# The Uncertainty Influence on Earnings Announcement Returns

GUSTAV KÖLBY[a] & JOHAN WIDÉN[b]

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**ABSTRACT**

We present evidence that market uncertainty influences the magnitude of the stock return response to earnings announcements. In this paper, we find that investors react more strongly to good news when released in a market of high uncertainty, compared with the same news in a market of low uncertainty. Further, we find that a reversal of the returns occurs within 45 trading days. We relate our findings to behavioural theories, using contrast effects and sentiment models as possible explanations. The previously observed market uncertainty inversely biases the perception of the earnings announcement, and investors mistakenly perceive the good news as better than it actually is, leading to an overreaction that is reflected in the market price.

**Key Words:** Market Uncertainty, VIX, Unexpected Earnings, Contrast Effects, Earnings Announcements

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[a] 23265@student.hhs.se [b] 23281@student.hhs.se

# I. Introduction

This thesis tests how investors behave when facing similar earnings announcements, in different states of the market. Earnings announcements are of great importance, as they play a key role in the communication between corporations and investors and contribute to the stock price performance of companies.

In recent years, the literature on how investors react when facing different kinds of information has increased. Meanwhile, there is limited knowledge about the relation between the behaviour of investors and the macroeconomic environment. However, one study of interest investigates how the *prevailing level* of the market, in terms of aggregated price to earnings, affects how investors react to good and bad news. Another area of interest is how investors react to earnings news, after being exposed to *shocks* in the macroeconomic environment. These studies reveal whether investors behave rationally or irrationally. Irrational behaviour often leads to under- or overreactions to news, and to mispricing that can be seen in stock price movements. Mispricing is of high interest as they leave room for investors to take advantage of this temporary market inefficiency.

One psychological setting that has not been prominent within the Finance literature, is the theory of contrast effects. This theory dates far back in time. The first evidence of contrast effects originates from how the same water temperature could be perceived differently, depending on what temperature one was previously exposed to. Contrast effects have since then been studied in many different settings. For example, contrast effects have been studied in the setting of men's perception of female beauty. Very recently, the concept of contrast effects was used in the setting of financial markets, where Hartzmark and Shue find that the return of a company at the date of their announcement, is negatively related to the earnings announcements of large firms in the preceding day. Thus, the previously observed announcements inversely bias the perception of a firm's announcement (Hartzmark & Shue, 2018).

The present study aims to investigate how market uncertainty affects earnings announcement returns, using VIX as a proxy for the prevailing level of the market uncertainty. Hereafter, high market uncertainty (high VIX) is also referred to as a bad state, and low market uncertainty (low VIX) is also referred to as a good state.

We find that investors react more strongly to good news, when released in a bad state of the market compared to the same news announced in a good state of the market. Specifically, during periods of high market uncertainty, the abnormal return from positive earnings announcements is larger than in periods of low market uncertainty. Further, we conclude that this stock price effect, reverses within a period of 45 days after the initial event. We support our findings using behavioural theory, in particular the investor sentiment model developed by Barberis et al., together with the theory of contrast effects (Barberis, Shleifer, & Vishny, 1998). Firstly, in the investor sentiment model, investors believe to be in either of two regimes, a trending or a reverting regime. If investors believe to be in the trending regime, the prevailing state of the market serves as an indication of the state of the current regime. News in the opposite direction of what can be expected in the trending regime, comes as a shock to investors which intensifies their reactions. Secondly, in the theory of contrast effects, an event is judged based on its relation to the previously observed case. When good news is announced in a bad market, the news is in contrast to investors' previous observations. The contrast of the new event to the previous environment makes investors perceive the good news as better than it actually is, leading to an overreaction that is reflected in the market price. Thus, their previous observations *inversely* bias their perception of the news.

Further, the present study considers an alternative justification based on rational models. In these models, investors adapt their perception of the current state of the market from past information. Thus, a preceding high market uncertainty, causes investors to believe that the current state of the market is bad. If good news arrives, their perception of the current state of the market changes and the probabilities of expected future earnings shift to a more optimistic case, increasing the market price, assuming that there is no major discount rate effect. However, our findings suggest that investors' reactions are more in line with behavioural theory, due to the observed reversal effect as well as the fact that we do not find evidence of other effects predicted by the rational model. The reversal effect indicates a behavioural bias, because a rational reaction is expected to prevail over time, whereas a behavioural bias should correct itself over time, given that markets are efficient in the long run.

# II. Literature Overview

### *A. Overview*

The effect of the prevailing level of the market environment on market participants' behaviour and market returns is an area of the literature that has gained interest in recent years. The results, interpretations and conclusions vary among the studies depending on how test variables are constructed, e.g. how the market environment is defined, or what theories and models that are applied.

Conrad et al. were early to study investors' responses to earnings announcements in different market settings (Conrad, Cornell, & Landsman, 2002). They define the different states of the market with the prevailing level of price to earnings (P/E) in the overall market, where high P/E implies a good market and low P/E implies a bad market. By studying the response to good and bad earnings announcements in different markets, they find that market participants react more strongly to bad news than to good news in good markets (high P/E).

While the price level of the market captures the overall pricing situation, another definition of the market environment that is prominent in existing literature is VIX (CBOE Volatility Index). VIX has previously been shown to be a good proxy for the overall market uncertainty. Studies of VIX during large macro shocks such as the Cuban missile crisis, 9/11 and the 2008 financial crisis, show large increases in VIX (see Figure 8). These events imply that VIX is a measure that covers global events as well as pure economic events.

Williams and Bird et al. examine the role of shocks to market uncertainty in shaping the return responses to firm-specific earnings news (Bird, Krishna, & Danny, 2014; Williams, 2015). To define market uncertainty, they use the change in VIX over the announcement period in order to capture shocks to market uncertainty. Following an increase in market uncertainty, Williams finds that investors put more emphasis on bad news than on goods news. Further, after a decrease in market uncertainty, investors place equal weight on good and bad news.

Bird et al. partly confirm Williams' study on investors' reactions to unexpected news during changes in market uncertainty. They find that in times of low market uncertainty, investors are optimistically biased and react stronger to good news. However, in times of high market uncertainty, investors have a pessimistic view and react stronger to bad news. Similar to Williams, Bird et al. study market uncertainty as the change in VIX over the event window, i.e. two consecutive days. These results are contrary to Conrad et al., as Bird et al. and Williams find that negative responses are more pronounced in *bad times*, whereas Conrad et al. find that negative responses are more pronounced in *good times*.

The relation between market participants' behaviour and the market environment through the VIX component is also studied by Deshpande and Svetina (Deshpande & Svetina, 2014). They investigate the relation between firm-specific last year earnings, expected earnings and actual earnings on the stock return for a small number of local firms and how this relation is affected by the daily level of VIX. However, they narrow their focus to solely negative earnings surprises and for a small sample of local companies, as they aim to explore the role of the local newspaper. They find that the response to negative earnings surprises is impacted by the level of market uncertainty. In periods of high VIX, the market response to negative earnings surprises is stronger. However, in periods of low VIX the impact is insignificant.

Agapova and Madura, also study the effect of market uncertainty on investors' responses (Agapova & Madura, 2016). However, they shift the focus from earnings announcements to earnings guidance. They use two different measures of VIX in their definition of market uncertainty, for which they get different results. Firstly, they find that the response to negative earnings guidance is *more negative* in times of high market uncertainty, defined by the two-day change in VIX. Secondly, they find that the response to neutral earnings guidance is *more positive* in high market uncertainty, when using the five-day average level of VIX. Thus, the results when using the level of VIX and the change in VIX are in opposite directions.

### *B. Explanations*

Existing literature can be divided into two main strands depending on how previous studies explain their findings, either by behavioural theories or by rational models.

Conrad et al. offer two potential explanations to their findings, using both rational and behavioural theories through regime-shifting models (Conrad et al., 2002). Firstly, the rational interpretation of their results stems from a rational expectations equilibrium model developed by Veronesi (Veronesi, 1999). In the model, investors are uncertain about the overall state of the market. Because investors cannot observe the current state of the market directly, they must infer it from past market performance. If the prior market performance has been good, investors believe that the market is in a good state and vice versa. During a good state, further good news has little impact on investors, since it is expected. However, bad news in a good state makes investors change their perception of the current state of the market, and causes investors to infer a higher probability that the market is in a bad state. This leads to lower expectations of future dividends, resulting in lower market prices. Bad news also increases the uncertainty about the *true* state of the market, as investors first believed that the market was in a good state. When investors perceive two different indications of the current state of the market, they have difficulties to determine the true state of the market, which increases their uncertainty. During increased uncertainty, risk-averse investors require a higher expected rate of return to hold stocks and the market discount rate increases. This further lowers the present value of future cash flows and the market price. In the model, the discount rate effect is stronger than the probability effect. Consequently, the negative effect of an increased discount rate outweighs the positive effect of the changed probabilities when good news is announced in a bad market.

Secondly, the behavioural theory used by Conrad et al. stems from a model of investor sentiment, developed by Barberis et al. (Barberis, Shleifer, & Vishny, 1998). In the model, the investor believes that the pattern of a firm's earnings can be in either of two different regimes. In the first regime, earnings are reverting to the mean. Thus, a positive announcement is followed by a negative announcement and vice versa. In the second regime, earnings trend and thus, announcements of a specific sign are likely to be followed by announcements of the same sign. The transition probabilities between the two regimes are fixed in the investor's mind and the firm is more likely to stay in a given regime, rather than to switch to the other. In their interpretation, Conrad et al. relate the prevailing state, defined with P/E, to the trending regime and the level of P/E as the sign of the trending regime, high P/E implying a trending regime with expected positive announcements. Thus, in high P/E and a good market, the market response to good news is relatively small as the news is expected when investors believe to be in the trending regime. However, bad news comes as more of a surprise and generates large negative returns, as it implies that the market shifts to the other regime.

Williams supports his findings, that are contradictory to Conrad et al., with behavioural theories, and in particular the "Knightian uncertainty", or ambiguity theory (Williams, 2015; Knight, 1921). The ambiguity theory separates between ambiguity and risk. Risk is when an investor is aware of the probabilities but not of the *payoffs,* whereas ambiguity is when there is uncertainty about the *probabilities* of the payoffs. During high market uncertainty, investors have difficulties understanding the new environment and to collapse the potential distributions to a unique probability distribution. Therefore, ambiguity prevails during high market uncertainty. The ambiguity theory implies that when being exposed to ambiguity, one is not aware of the probabilities. Investors therefore take a more conservative approach by choosing the worst-case distribution. Williams explains his findings as under high market uncertainty (or ambiguity), investors take a more conservative approach when the bad news is expected to be persistent and thus react stronger to bad news. Agapova and Madura also use the ambiguity theory to explain their results (Agapova & Madura, 2016).

As seen above, there are both rational and behavioural explanations for investors' reactions to earnings news within the existing literature. One behavioural setting that is not as prominent within Finance, is the theory of contrast effects. Contrast effects have historically been studied in other settings than financial markets and are more commonly detailed in the Psychology literature.

### *C. Contrast Effects*

Contrast effects were first noted by John Locke during the seventeenth century, who observed how the same water temperature could be perceived differently, depending on what temperature one was previously exposed to (Locke, 1690). Wilhelm Wundt, a psychologist in the nineteenth century, related contrast effects to the fundamental theory of perception and psychology (Wundt, 1862). Contrast effects have since then been studied in many different settings. Kenrick and Gutierres study contrast effects in the setting of men's perception of female beauty. They let men rank a photo of a woman and found that men who were frequently exposed to attractive women through a TV show, rated the target female as significantly less attractive than the control group (Kenrick & Gutierres, 1980). Other settings that study contrast effects include the judgement of crimes, and the evaluation of essays. Pepitone and DiNubile find that the judgements of crimes depend on the preceding case that was judged (Pepitone & DiNubile, 1976). Daly and Dickson-Markman find contrast effects in the evaluation of essays, that the grading is impacted by the quality of the preceding essay (Daly & Dickson-Markman, 1982).

A contrast effect is when the value of a previously observed signal inversely biases the perception of the next signal. Contrast effects can further be divided into two cases, perception bias and expectation bias. With perception bias, investors perform a biased assessment of the next case *after* seeing the next case. Investors perceive a case as different than it is. Expectation bias occurs when a previous case causes investors to hold mistaken beliefs about the quality of a future event *before* the future event is observable. Expectation bias leads to mistaken predictions about future outcomes that can be corrected once the outcome is realised, whereas the perception bias leads to mistaken perceptions, that prevail after the event has occurred.

Hartzmark and Shue take the concept of contrast effects from Psychology literature and apply it on a new setting, the setting of financial markets (Hartzmark & Shue, 2018). They study how the announcement return (the stock return after the release of a quarterly report) for a company is affected by the announced earnings of other large firms in the previous trading day. The findings are that the return of a company at the date of their announcement, is negatively related to the earnings announcements of large firms in the preceding day. Therefore, if a group of large firms announced positive earnings in the day prior to the announcement of a specific company, then a positive announcement results in a lower stock market return compared to if the announcements of the large firms were negative in the day prior to the company's announcement. They explain their results with contrast effects, because the announcements of other firms' earnings prior to the announcement of the company's earnings have a significant impact on the perception of the specific company's announcement. In other words, other firms' positive earnings surprises prior to the announcement, make the specific company's earnings surprise to be perceived as less impressive, and hence the market reaction is lower. This implies that the market reacts to the relative content of news instead of the absolute content. After the announcement, they find that a reversal effect occurs within 50 trading days, i.e. the stock price adjusts to the absolute content of the earnings announcement, which further supports the behavioural theory, and more precisely the theory of contrast effects.

### *D. Motivation*

The aim of this study is to further investigate investors' reactions to earnings announcements in relation to the prevailing level of the market, and more precisely investigate if investors react differently to the same news in different environments. As uncertainty has shown to affect the behaviour of individuals, it is highly interesting to further study how this behaviour is reflected in stock prices. In studying this association, we use VIX as a proxy for the level of the market. As described above, VIX has been shown to be high in uncertain times and after specific events, such as 9/11 and the 2008 financial crisis. These events imply that VIX is a good indication of the state of the market.

This paper contributes to the literature in several ways. Firstly, by using VIX as a proxy for the market state, we extend existing literature that uses VIX, including Williams, Bird et al., Agapova and Madura and Deshpande and Svetina. Secondly, we believe that our measure of the level of market uncertainty will add potential explanations to the field. Existing literature that studies the impact of VIX on earnings announcement returns uses the *change* in VIX over the announcement period to define the market state. However, we use the prevailing 10-day level of the VIX, and thus we study this relation in another perspective. We believe that the long-term level is interpreted differently by investors compared to sudden shocks, and therefore we expect different results that are more in line with the literature that has used the long-term market level (defined with other measures than VIX). Lastly, we want to further discuss the interpretations of the results. As the literature that uses the prevailing level of the market has not used theories that can be directly applied to explaining their findings, we deepen the interpretation by incorporating new theories. In explaining our results, we consider explanations from four models and two strands of literature, i.e. the rational expectations equilibrium model from Veronesi, and behavioural interpretations from the ambiguity theory and the investor sentiment model (Barberis et al., 1998; Veronesi, 1999; Williams, 2015). Finally, we also continue the work on contrast effects by Hartzmark and Shue and apply it on another setting within financial markets (Hartzmark & Shue, 2018).

# III. Data & Sample Selection

This study is based on 59 759 observations of quarterly earnings announcements from U.S. companies during the years 2000 to 2018. This data sample roughly represents four reports per year from 830 companies, over 18 years.

Further, the explanatory variables used in the regressions are standardised to a mean of 0 and a standard deviation of 1, to enable comparisons between the variables. To reduce the influence of outliers, observations in the 1st and 99th percentile for Market Uncertainty and Unexpected Earnings are excluded.

## *A. Main Variables*

*Market Uncertainty* $_t$ or *VIX* $_t$ is the variable capturing market uncertainty. It is estimated by The Chicago Board Options Exchange Volatility Index (VIX). The index measures the expectation of the 30-day volatility for the S&P 500 index. The variable used is the average VIX for the 10 trading days preceding the earnings announcement. Since VIX measures the short-term volatility (30 days), we use 10 days to define the prevailing market uncertainty. This variable is intended to measure the general level of market uncertainty and to capture investors' perception of the near future.

*Unexpected Earnings* $_{i,\,t}$ or *UE* $_{i,\,t}$ is how a company, i, for every quarter, t, performs in terms of EBIT (Earnings before Interest and Taxes) relative to the consensus estimate for the same period. The consensus is estimated by the mean of the forecasts of EBIT sent in to The Institutional Brokers' Estimate System (I/B/E/S) by financial analysts covering a company. If the consensus consists of less than three forecasts from financial analysts, it is excluded.

EBIT is used because it is a key operational metric commonly used by both financial analysts and investors.

$$\text{UE}_{\text{i, t}} = \frac{\text{Actual EBIT}_{\text{i, t}} - \text{EBIT consensus}_{\text{i, t}}}{\text{Absolute value of }\left(\text{Actual EBIT}_{\text{i, t}}\right)}$$

The event day, t+0, is the first day that the stock market has a chance to react to the release of the quarterly report. More precisely the event day is the same as the release day of the quarterly report, if the release time is before 4 pm. If the release time is after 4 pm, the event day is the day after the release of the report, as the stock market closes at 4 pm.

*Good News* $_{i, t}$ is a dummy variable equal to one if the Unexpected Earnings variable is greater than zero, meaning that the actual earnings are higher than the consensus, i.e. good news. If the Unexpected Earnings variable is less than zero, in cases where the actual earnings are less than the consensus i.e. bad news, the *Good News* $_{i, t}$ dummy variable is equal to zero.

*Cumulative Abnormal Return* $_{i, t, d}$ or *CAR* $_{i, t, d}$ is the dependent variable and the abnormal return of a stock for the number of days, d, after the event day. The start day for the calculation of the abnormal return is one day before the event day for our main regressions in the initial tests. The abnormal return is calculated as the individual stock's actual return subtracted with the expected return estimated by the Capital Asset Pricing Model (CAPM). The beta, β, is estimated for every stock and day on a rolling basis. The rolling window is two years. The risk-free rate, $R_f$, is estimated by the US treasury 10-year Bond on a monthly basis, retrieved from The Center for Research in Security Prices (CRSP). The market return is estimated by the return of the Standard & Poor's 500 index (S&P 500). Stock prices and the S&P 500 index data are also retrieved from CRSP.

$$CAR_{i, t, d} = R_{i, t, d} - E(R_{i, t, d})$$
$$E(R_{i, t, d}) = R_{f;t,d} + \beta_{i, t, d}[R_{M;t,d} - R_{f;t}]$$
$$CAR_{i, t, d} = R_{i, t, d} - \beta_{i, t, d}R_{M;t,d} + R_{f;t,d}(\beta_{i, t, d} - 1)$$

*Continuous interaction variable between Unexpected Earnings & Market Uncertainty* $_{i, t}$ or *c.UE*c.VIX* $_{i, t}$ is the main test variable. The variable captures the effect between Unexpected Earnings and Market Uncertainty.

### *B. Additional Variables for Robustness Checks*

*Volume* $_{i, t}$ is the abnormal amount traded on the event day for every company, i, and quarter, t. To be more specific, *Volume* $_{i, t}$ is the traded amount on the release day minus the trailing 20-day average, divided by the trailing 20-day average. This variable is indented to capture liquidity for a traded security. High liquidity means that it is easy for market actors to buy and sell at prices they deem to be correct.

*BidAskSpread* $_{i, t}$ is the difference between the close ask and the close bid price. This variable also captures the liquidity in the traded security, i.e. if the difference between bid and ask prices is small, it is easy for investors to enter and exit a given security. In contrast, if the difference is big, an investor might choose not to sell (buy) a security that the investor otherwise would want to sell (buy), meaning that the return of the stock during the event day does not perfectly reflect investors' views.

*Size* $_{i,\,t}$ is the market capitalisation of a studied company on the date of the quarterly report announcement. This variable is intended to capture the effect of how big a company is and further how many investors that are closely following the earnings development of the company. The *Size* variable is expressed in billion USD.

*StdEst* $_{i,\,t}$ is the standard deviation of the estimates from analysts covering a company, making up the consensus before the release of the quarterly report. This variable is intended to capture the accuracy of the consensus. More specifically, low standard deviation serves as a proxy for agreement among analysts and thus a more accurate estimate of the future earnings of a company.

*NumEst* $_{i,\,t}$ is the number of estimates in the consensus for every company and quarter. This variable is also intended to reflect the accuracy of the consensus. A consensus consisting of many estimates is likely to be a more accurate estimate of the actual earnings than a consensus based on few estimates. As stated before, we entirely exclude observations that are based on a consensus of less than three estimates.

### *C. Summary Statistics*

In this section we present summary statistics over our explanatory variables and our dependent variable.

In Table 1 we present descriptive statistics over our explanatory variables. The mean of the Unexpected Earnings variable is close to zero, meaning that on average the earnings reports are close to the consensus before the release of the report. Further, the $25^{th}$ and $75^{th}$ percentile corresponds to -6.7 and 11.7 percent, respectively. This implies that the first quartile consists of earnings announcements that miss the consensus with 6.7 percent or more. The third quartile consist of earnings announcements that beats the consensus with 11.7 percent or more, when the earnings surprises are scaled to the absolute value of the actual EBIT number. Taken together, this shows that even though the Unexpected Earnings are on average close to zero there are a lot of variation in companies' reported results versus the expectations.

The VIX variable in our data sample is on average 16.2 percent. It is hard to say what a normal VIX level is but very high levels of VIX corresponds to an uncertain market. For example, the sample's highest VIX observation is 80.9 percent and as seen in Figure 8 that corresponds to the peak of the 2008 financial crisis.

**Table 1**
**Descriptive Statistics over Explanatory Variables**

Table 1 shows the count, mean, 25th, 50th and 75th percentile, minimum, maximum and the standard deviation for the explanatory variables. Note that the Unexpected Earnings variable is scaled to the actual earnings, and that the Size variable is expressed in billion USD.

| | Count | Mean | p25 | p50 | p75 | Min | Max | Std |
|---|---|---|---|---|---|---|---|---|
| UE | 59 759 | -0.0085 | -0.0671 | 0.0224 | 0.1167 | -3.7733 | 2.4388 | 0.4529 |
| VIX | 59 759 | 0.1618 | 0.1290 | 0.1454 | 0.1759 | 0.0936 | 0.8086 | 0.0591 |
| Volume | 59 759 | 2.1259 | 0.5446 | 1.3248 | 2.6868 | -0.9911 | 156.2378 | 3.2922 |
| BidAskSpread[1] | 59 759 | 0.0294 | 0.0100 | 0.0100 | 0.0300 | -0.5800 | 6.9900 | 0.0931 |
| Size | 59 759 | 10.1307 | 0.7482 | 2.3047 | 7.4401 | 0.0032 | 811.6639 | 29.2865 |
| StdEst | 59 759 | 21.5516 | 1.3400 | 3.8500 | 12.4900 | 0.0000 | 1.40e+04 | 111.6614 |
| NumEst | 59 759 | 6.9427 | 4.0000 | 5.0000 | 9.0000 | 3.0000 | 40.0000 | 4.7296 |

Table 2 shows that the first day reaction to quarterly earnings reports is on average zero. This is consistent with the data of Unexpected Earnings from Table 1, where this variable is also close to zero on average. Interestingly, there seem to be cases for which the return reaction for the quarterly earnings report release is large. As the 25th and 75th percentile corresponds to an abnormal return of -3.8 and 3.9 percent, respectively.

**Table 2**
**Cumulative Abnormal First Day Return**

Table 2 shows the count, mean, 25th, 50th and 75th percentile and the standard deviation for first day returns after the release of a quarterly report.

| | Count | Mean | p25 | p50 | p75 | Std |
|---|---|---|---|---|---|---|
| Cumulative Abnormal Return 1 Day | 59 759 | -0.0009 | -0.0382 | -0.0002 | 0.0386 | 0.0819 |

[1] NASDAQ uses the inside quotations as the closing bid and ask. The inside quotation is the highest bid and lowest ask.

Table 3 sorts the Cumulative Abnormal Return for the first day into quartiles for Unexpected Earnings and Market Uncertainty represented by VIX. The 1st quartile, q1, represents the subgroup with the lowest values and the 4th quartile, q4, represents the subgroup with the highest values. Noteworthy is that for the four quartiles, Cumulative Abnormal Return increases with Unexpected Earnings. However, in the four quartiles of VIX, the results are mixed. For the two highest quartiles of Unexpected Earnings, Cumulative Abnormal Return increases in general with VIX, but for the two lowest Unexpected Earnings quartiles there seems to be no clear visual relationship. This indicative result is repeated with our regressions in the next section.

**Table 3**
**Cumulative Abnormal First Day Return Sorted by Quartiles**

Table 3 shows the Cumulative Abnormal Return after the release of a quarterly report for the return window [-1; +1]. The returns are sorted in four quartiles of Unexpected Earnings and four quartiles of our market uncertainty variable VIX.

| | | Quartiles of VIX | | | |
|---|---|---|---|---|---|
| | | q1 | q2 | q3 | q4 |
| Quartiles of UE | q1 | -0.0312 | -0.0302 | -0.0279 | -0.0341 |
| | q2 | -0.0104 | -0.0084 | -0.0086 | -0.0070 |
| | q3 | 0.0095 | 0.0108 | 0.0133 | 0.0123 |
| | q4 | 0.0231 | 0.0248 | 0.0265 | 0.0293 |

Table 4 sorts the Cumulative Abnormal Return, for the return windows t-1 to t+1 and up to t-1 to t+45, by Market Uncertainty quartiles. For all of the return windows the 4th Market Uncertainty quartile exhibits higher Cumulative Abnormal Return than the 1st Market Uncertainty quartile, also in line with our results in the Section V.

**Table 4**
**Cumulative Abnormal Return Sorted by VIX Quartiles**

Table 4 shows the Cumulative Abnormal Return after the release of a quarterly report for the return windows [-1; +1] up to [-1; +45]. The returns are sorted in four quartiles of Market Uncertainty. The 1st quartile, q1, is the subgroup with the lowest Market Uncertainty and the 4th quartile, q4, is the subgroup with the highest Market Uncertainty.

| | | Return Window | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | [-1;+1] | [-1;+2] | [-1;+3] | [-1;+4] | [-1;+5] | [-1;+10] | [-1;+15] | [-1;+20] | [-1;+25] | [-1;+30] | [-1;+35] | [-1;+40] | [-1;+45] |
| | q1 | -0.0019 | -0.0022 | -0.0030 | -0.0037 | -0.0042 | -0.0044 | -0.0032 | -0.0009 | 0.0008 | 0.0022 | 0.0010 | -0.0007 | -0.0030 |
| Quartiles | q2 | -0.0009 | -0.0016 | -0.0017 | -0.0016 | -0.0017 | -0.0010 | 0.0004 | -0.0002 | -0.0015 | -0.0043 | -0.0049 | -0.0066 | -0.0092 |
| of VIX | q3 | 0.0007 | 0.0008 | 0.0016 | 0.0021 | 0.0021 | 0.0028 | 0.0022 | 0.0009 | 0.0000 | 0.0009 | 0.0003 | -0.0013 | -0.0047 |
| | q4 | -0.0004 | 0.0003 | 0.0010 | 0.0013 | 0.0019 | 0.0035 | 0.0026 | 0.0021 | 0.0031 | 0.0043 | 0.0052 | 0.0069 | 0.0093 |
| | Total | -0.0009 | -0.0012 | -0.0013 | -0.0014 | -0.0016 | -0.0012 | -0.0004 | -0.0000 | 0.0001 | -0.0000 | -0.0008 | -0.0021 | -0.0043 |

# IV. Methodology and Research Design

### *A. Theory*

Three regressions are used to investigate market uncertainty's effect on how earnings announcement news is received by the market. Regression 1 and Regression 2 are our baseline regressions, testing similar associations. Previous literature suggests that both negative and positive effects of Market Uncertainty on abnormal return can be present in our test setting. Going forward, four theories are considered when analysing the results; (i) the ambiguity theory, (ii) the investor sentiment model, (iii) the rational expectations equilibrium model and (iv) the theory of contrast effects (Barberis et al., 1998; Hartzmark & Shue, 2018; Veronesi, 1999; Williams, 2015). The following is a short overview of these four theories in our test setting, (previously described in Section II). Table 5 provides a summary of the theories and the predicted return responses.

i. The ambiguity theory, suggests that in an uncertain market setting, investors take a more conservative approach and the response to bad news is stronger, compared to in a less uncertain market. Thus, the response to bad news during high Market Uncertainty should be more negative.

ii. The investor sentiment model implies that investors perceive the state of the market as being in either of two regimes. One is a regime during which announcement surprises consistently are of the same sign, and the other regime contains reverting announcement surprises. Applying this model to the present study, the prevailing state of the market, defined as Market Uncertainty, can be perceived as being the state of the trending regime. To be more specific, in high Market Uncertainty, i.e. a bad state, investors expect to receive bad news, and in low Market Uncertainty, i.e. a good state, investors expect to receive good news. News announcements in the opposite direction to what investors expect, lead to strong return responses, and thus the abnormal return becomes more positive for good news and less negative for bad news, with higher Market Uncertainty.

iii. The rational expectations equilibrium model offers an explanation based on variations in discount rates and in probabilities of expected future cash flows. In low Market Uncertainty, investors expect to receive good news as they believe that the current state of the market is good. Bad news then causes investors to shift their expectations of the state of the market, and the stock price decreases due to lower expected future cash flows and a higher discount rate. In the opposite situation, in high Market Uncertainty and when good news is announced, the effect is not as distinct. The positive change in expected future cash flows is outweighed by the negative effect of the increased discount rate from investors' mistaken beliefs about the true state of the economy. Therefore, the abnormal return for good news decreases with higher Market Uncertainty and the abnormal return for bad news increases with higher Market Uncertainty.

iv. In the theory of contrast effects, investors determine the magnitude of new events, using the previously observed market as a reference. If the previous state has been good, investors find good news to be less impressive and vice versa. Therefore, if the news is not in contrast to the prevailing market, the reaction is modest. However, if the news is in contrast to the previously observed state, i.e. if in a bad state, good news is reported or vice versa, investors overreact due to the perceived contrast. Thus, the theory predicts more negative returns if bad news is reported in good states, and more positive returns if good news is reported in a bad state.

Lastly, a major distinction between the literature with these different results should be mentioned. The literature that finds a positive association between Market Uncertainty and abnormal return for bad news, and motivates this with the ambiguity theory, studies the *change* in market uncertainty. Whereas the literature that finds a negative association, and motivates this with the rational expectations equilibrium model and the investor sentiment model, studies a *fixed* state of the market. This implies that we can expect the rational expectations equilibrium model and the investor sentiment model from previous literature to be more applicable to our case, as we use the prevailing level of VIX and not the change in VIX. Meanwhile, contrast effects have not been studied in this setting before.

**Table 5**
**Predicted Announcement Returns for The Different Theories**

Table 5 shows the predicted announcement returns of positive Unexpected Earnings and Negative Unexpected Earnings in High and Low Market Uncertainty for each of the four theories.

| | | |
|---|---|---|
| **Ambiguity Theory** | *The ambiguity theory predicts that investors are more conservative under high market uncertainty* | |
| | Negative Unexpected Earnings | Positive Unexpected Earnings |
| High Market Uncertainty | More Negative | Less Positive |
| Low Market Uncertainty | Less Negative | More Positive |
| **Investor Sentiment Model** | *A regime shifting model, where news in the opposite direction of the current regime pronounce the reactions* | |
| | Negative Unexpected Earnings | Positive Unexpected Earnings |
| High Market Uncertainty | Less Negative | More Positive |
| Low Market Uncertainty | More Negative | Less Positive |
| **The Rational Expectations Equilibrium Model** | *A regime shifting model. Shifts in regimes affect market prices through changes in probabilities and discount rates* | |
| | Negative Unexpected Earnings | Positive Unexpected Earnings |
| High Market Uncertainty | Less Negative | Less Positive |
| Low Market Uncertainty | More Negative | More Positive |
| **Contrast Effects** | *News that is in contrast to the previously observed environment generates larger reactions* | |
| | Negative Unexpected Earnings | Positive Unexpected Earnings |
| High Market Uncertainty | Less Negative | More Positive |
| Low Market Uncertainty | More Negative | Less Positive |

### *B. Regression Overview*

The following regressions are used to test the above mentioned theories. Regression 1 and Regression 2 are used for our baseline results, and Regression 3 is used for our robustness checks. The initial effect of earnings announcements is studied with the time window t-1 to t+1.

**Regression 1**

Baseline regression with continuous interaction variable:

$$CAR_{i,\,t,\,d} = \beta_0 + \beta_1 UE_{i,t} + \beta_2 VIX_t + \beta_3\, c.UE * c.VIX_{i,t} + \varepsilon$$

Regression 1 is used to test the effect of Market Uncertainty and Unexpected Earnings on the Cumulative Abnormal Return. The regression is used for the whole data sample, but also for two subgroups; only negative Unexpected Earnings and only positive Unexpected Earnings. Further, it is also used to check for potential reversal effects by rerunning it for different return windows for the Cumulative Abnormal Return. Consequently, any significant reversal effects would imply that the association can be more related to behavioural theory than to rational theory. This is because a behavioural bias is expected to correct itself over time, compared with a rational reaction that is expected to prevail over time and not reverse, as it should be incorporated in the fundamental market price, if markets are efficient in the long-term.

**Regression 2**

Baseline regression with dummy interaction variable:

$$CAR_{i,\,t,\,d} = \beta_0 + \beta_1 \text{Good News}_{\,i,t} + \beta_2 VIX_t + \beta_3\, \text{Good News} * c.VIX_{i,t} + \varepsilon$$

In Regression 2 we decompose Regression 1 to separate between positive and negative Unexpected Earnings. We define the variable *Good News* $_{i,t}$ as positive Unexpected Earnings, i.e. the announced earnings are higher than what the market expected (the dummy variable takes on the value of one). Further, when the announced earnings are below the market consensus, the variable takes on the value zero and the earnings announcement is considered to be bad news.

**Regression 3**

Regression for robustness checks of the continuous interaction variable:

$$CAR_{i,\,t,\,d} = \beta_0 + \beta_1 UE_{i,t} + \beta_2 VIX_t + \beta_3\, c.UE * c.VIX_{i,t} + \beta_4 Volume_{i,t} + \beta_5 BidAskSpread_{i,t} + \beta_6 Size_{i,t} + \beta_7 StdEst_{i,t} + \beta_8 NumEst_{i,t} + \varepsilon$$

Regression 3 is used to test the robustness of our results. Extra variables used for control are selected because it is plausible that they have some explanatory power in terms of mainly: (i) The liquidity of the studied firms' traded securities, i.e. if a stock is illiquid, the market price might not represent investors' views. (ii) The accuracy of the consensus that we use to estimate the Unexpected Earnings of the companies, i.e. if the accuracy of the consensus is low, it might not be an estimate that is representable for the companies expected earnings before the release of the quarterly earnings report, resulting in a deceptive Unexpected Earnings.

### *C. Predicted Associations for Baseline Regressions*

The effect of Market Uncertainty on the magnitude of the stock return response to Unexpected Earnings announcements is tested with the baseline regressions (Regression 1 and Regression 2). The dependent variable is the Cumulative Abnormal Return, for which the start date is t-1. The relevant variable in our baseline regressions, is the interaction variable between Market Uncertainty and Unexpected Earnings. In Regression 1, the coefficient $\beta_3$ is our main coefficient of interest and in Regression 2, our main coefficients of interest are the stand-alone Market Uncertainty variable and the dummy interaction variable, represented by the coefficients $\beta_2$ and $\beta_3$.

Below is a prediction of what the above described theories would look like in our baseline regressions. This is put forward to enable a comparison between previous theories and the results from our data sample. Table 6 provides a summary of the estimated coefficients for each theory.

i. The ambiguity theory predicts that when investors believe that Market Uncertainty is high, investors shift their expectations to be more conservative. Thus, the aggregated effect from Unexpected Earnings on Cumulative Abnormal Return from increased Market Uncertainty should be significantly negative in Regression 1, for a reasonable range of Unexpected

Earnings[2]. Further for Regression 2, $\beta_2$ representing the unconditional effect of Market Uncertainty should be significantly negative and for good news the combined effect from $\beta_2$ and $\beta_3$ should also be significantly negative.

ii. In the investor sentiment model, investors expect the current regime to continue. Thus, from a sentiment perspective, a stronger return response is expected when this expectation is not fulfilled. This means that if the results are consistent with the sentiment theory the aggregated effect from Unexpected Earnings on Cumulative Abnormal Return from increased Market Uncertainty should be significantly positive in Regression 1. Further, for Regression 2, $\beta_2$ representing the unconditional effect of Market Uncertainty should be significantly positive and for good news the combined effect from $\beta_2$ and $\beta_3$ should also be significantly positive.

iii. According to the rational expectations equilibrium model, negative Unexpected Earnings in low Market Uncertainty would lead to greater negative abnormal returns, and positive Unexpected Earnings in high Market Uncertainty would lead to less positive abnormal returns. Thus, in Regression 1, $\beta_3$ should be significantly negative, and the aggregated effect from Market Uncertainty on Unexpected Earnings and Cumulative Abnormal Return should intersect around Unexpected Earnings of 0. In Regression 2, $\beta_2$ representing the unconditional effect of Market Uncertainty should be significantly positive, since investors react stronger to negative signals in good times. For good news the combined effect from $\beta_2$ and $\beta_3$ should be significantly negative, since investors tend to react less to positive signals in bad times.

iv. The theory of contrast effects predicts that when Market Uncertainty is high, positive Unexpected Earnings should yield higher returns, and when Market Uncertainty is low, negative Unexpected Earnings should yield lower returns. Thus, in Regression 1, the aggregated effect from Unexpected Earnings on Cumulative Abnormal Return from increased Market Uncertainty should be significantly positive. Further, for Regression 2, $\beta_2$ representing the unconditional effect of Market Uncertainty should be significantly positive and for good news the combined effect from $\beta_2$ and $\beta_3$ should also be significantly positive.

[2] A significant continuous interaction variable will lead to an intersection in Regression 1. Our predictions for the ambiguity theory, the investor sentiment model and the contrast effects theory assume that the intersection is at extreme values of Unexpected Earnings, and that the predictions are valid for all reasonable values of Unexpected Earnings.

**Table 6**
**Predicted Associations for Baseline Regressions**

Table 6 shows the Predicted Associations for our Baseline Regressions according to models used in the existing literature.

| | Regression 1 | Regression 2 | |
|---|---|---|---|
| **Coefficients** | $\beta_3$ | Unconditional effect $\beta_2$ *Good News = 0, (bad news)* | Combined effect of $\beta_2$ and $\beta_3$ *Good News = 1, (good news)* |
| Ambiguity Theory | Negative (-) | Negative (-) | Negative (-) |
| Investor Sentiment Model | Positive (+) | Positive (+) | Positive (+) |
| Rational Expectations Equilibrium Model | Negative (-) | Positive (+) | Negative (-) |
| Theory of Contrast Effects | Positive (+) | Positive (+) | Positive (+) |

# V. Results

### *A. Baseline Results*

The results from Regression 1 for the period t-1 to t+1 are presented in column 2, Table 7. For this return window (t-1 to t+1), $\beta_3$ is significantly positive. A significantly positive continuous interaction variable between Market Uncertainty and Unexpected Earnings ($\beta_3$ ) of 0.18 percent with standardised values is estimated. For example, if VIX increases with one standard deviation it can be estimated that the Cumulative Abnormal Return for the period t-1 to t+1 will increase with 0.33 percent (0.14 percent from the Market Uncertainty variable alone and 0.18 percent from the interaction variable), given fixed Unexpected Earnings of one.

The stand-alone Unexpected Earnings variable for the return window t-1 to t+1 is estimated to be 1.56 percent. This implies that a one standard deviation increase of Unexpected Earnings corresponds to a 1.75 percent increase in Cumulative Abnormal Return (1.56 percent from the Unexpected Earnings variable alone and 0.18 percent from the interaction variable), given fixed Market Uncertainty of one. The large increase in abnormal return from the stand-alone Unexpected Earnings ($\beta_1$) variable is intuitive because beating the market expectations with one standard deviation is likely to signal good earnings ability.

The re-run of Regression 1 for different return windows is shown in Table 7. It becomes evident that the results shown in column 2 persist up to 10 days. Indicating that the initial effect prevails the days after the event and does not reverse immediately.

Column 1 shows that the Market Uncertainty variable affects how the market reacts to Unexpected Earnings on the announcement day (t+0). Further, column 3 to 5 show that the interaction variable is significant at the 1 percent level up to day 4 after the announcement day. In column 6, representing the period t-1 to t+5, the interaction variable is significant at the 5 percent level.

The coefficient of the interaction variable, $\beta_3$, is estimated to be in the interval of 0.14 percent to 0.19 percent for the return windows t-1 to t+0 and up to t-1 to t+10. This means that the interaction variable with Unexpected Earnings and VIX is estimated to contribute with 0.14 to 0.19 percent higher abnormal returns given a one standard deviation increase. Meaning, similar Unexpected Earnings reports lead to different abnormal returns depending on the level of Market Uncertainty.

Note that the relationship from the combined effect of VIX from Regression 1, higher VIX resulting in higher abnormal return, is only estimated to hold for a limited range of Unexpected Earnings. For very negative Unexpected Earnings the described relationship is not estimated to hold because the interaction term's (with VIX and UE) magnitude becomes larger than the unconditional effect of VIX. For example, (in the return window t-1 to t+1) if Unexpected Earnings is equal to -2 and VIX is equal to +1, the predicted value of Regression 1 is -3.44 percent. In comparison, when Unexpected Earnings is equal to -2 and VIX is equal to +0.5 the predicted value is -3.33 percent. Showing that higher VIX results in a *lower* abnormal return, for very negative Unexpected Earnings.

**Table 7**
**Baseline Results for Different Return Windows – Regression 1**

Table 7 shows how Unexpected Earnings announcements and Market Uncertainty affect the Cumulative Abnormal Return for firms over the time period [-1; +1] up to [-1; +10], from close to close. The explanatory variables are standardised to a mean of 0 and a standard deviation of 1. *UE* is the unexpected earnings measured as (Actual EBIT – EBIT consensus)/Abs (Actual EBIT)). *VIX* represents the level of market uncertainty measured by the expectation of the 30-day volatility for the S&P 500 index. *Interaction Variable UE & VIX* is the continuous interaction variable of the two variables, capturing the influence of Market Uncertainty on Unexpected Earnings' effect on a firm's Cumulative Abnormal Returns. The standard errors are robust and reported in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent level, respectively.

Regression 1:

$$CAR_{i,\,t,\,d} = \beta_0 + \beta_1 UE_{i,t} + \beta_2 VIX + \beta_3\, c.UE * c.VIX_{i,t} + \varepsilon$$

| VARIABLES | Cumulative Abnormal Return | | | | | | |
|---|---|---|---|---|---|---|---|
| Column: | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Return Window: | [-1;0] (Event day) | [-1;+1] | [-1;+2] | [-1;+3] | [-1;+4] | [-1;+5] | [-1;+10] |
| Standardized values of UE | 0.01454*** | 0.01563*** | 0.01596*** | 0.01616*** | 0.01631*** | 0.01645*** | 0.01687*** |
| | (4.1623e-04) | (4.5863e-04) | (4.7699e-04) | (4.9712e-04) | (5.1280e-04) | (5.2383e-04) | (5.7701e-04) |
| Standardized values of VIX | 0.00076** | 0.00144*** | 0.00153*** | 0.00200*** | 0.00241*** | 0.00255*** | 0.00259*** |
| | (3.4879e-04) | (3.9304e-04) | (4.1857e-04) | (4.3706e-04) | (4.6117e-04) | (4.7082e-04) | (5.1069e-04) |
| Interaction Variable UE & VIX | 0.00137*** | 0.00183*** | 0.00192*** | 0.00182*** | 0.00188*** | 0.00157** | 0.00149** |
| | (4.5718e-04) | (5.4566e-04) | (5.5518e-04) | (5.9261e-04) | (6.4071e-04) | (6.7072e-04) | (7.1845e-04) |
| Constant | -0.00088*** | -0.00090*** | -0.00116*** | -0.00128*** | -0.00141*** | -0.00159*** | -0.00116*** |
| | (3.0124e-04) | (3.2890e-04) | (3.4691e-04) | (3.5923e-04) | (3.7115e-04) | (3.8120e-04) | (4.2272e-04) |
| Observations | 59 759 | 59 759 | 59 759 | 59 759 | 59 759 | 59 759 | 59 759 |
| R-squared | 3.7% | 3.6% | 3.4% | 3.3% | 3.1% | 3.0% | 2.6% |

To further study the difference in return reactions between negative and positive Unexpected Earnings, Regression 1 is rerun for two subgroups; only negative Unexpected Earnings and only positive Unexpected Earnings. Table 8 presents the results for the two subgroups for the return window t-1 to t+1.

For positive Unexpected Earnings the results are similar to the findings for the whole data sample presented in Table 7. The second column in Table 8 shows a significantly positive interaction variable between Unexpected Earnings and Market Uncertainty for the subsample consisting of only positive Unexpected Earnings. The coefficient of 0.31 percent for good earnings news suggests that a one standard deviation increase of Unexpected Earnings corresponds to a 1.40 percent increase in Cumulative Abnormal Return (1.09 percent from the Unexpected Earnings variable alone and 0.31 percent from the interaction variable), given a fixed Market Uncertainty of one.

The first column in Table 8 shows the results for the subsample consisting of only negative Unexpected Earnings. For this subsample the interaction variable between Unexpected Earnings and Market Uncertainty is not significantly different from zero. This suggests that for negative Unexpected Earnings, Market Uncertainty does not affect the magnitude of the return reaction from Unexpected Earnings. Further, the stand-alone VIX coefficient is not significantly different from zero. This means that for this subgroup the general Market Uncertainty is not estimated to have an impact on the Cumulative Abnormal Return from Unexpected Earnings. This adds further understanding to the above results for the whole sample, where the relationship from the combined effect of VIX from Regression 1; higher VIX resulting in higher abnormal return, is not estimated to hold for very negative Unexpected Earnings. From Table 8 it seems that the relationship from Regression 1 only holds for positive Unexpected Earnings.

The effect from the interaction variable is larger for the subsample consisting of only positive Unexpected Earnings (0.31 percent), compared to the whole sample consisting of both positive and negative Unexpected Earnings (0.18 percent). This is likely due to the fact that the whole sample includes negative Unexpected Earnings that are insignificant, which reduces the magnitude of the interaction variable for the whole sample.

For both subgroups the stand-alone Unexpected Earnings coefficients are significantly positive. The coefficients are estimated to 0.68 and 1.09 percent for negative and positive Unexpected Earnings, respectively, implying that the Cumulative Abnormal Return decreases with negative Unexpected Earnings and increases with positive Unexpected Earnings.

**Table 8**
**Data sample Split in to Negative and Positive Unexpected Earnings – Regression 1**

Table 8 shows how Unexpected Earnings announcements and Market Uncertainty affect the Cumulative Abnormal Return for firms over the time period [-1; +1], from close to close, for the subsamples of only negative Unexpected Earnings (left column) and only positive Unexpected Earnings (right column). The explanatory variables are standardised, to a mean of 0 and a standard deviation of 1. *UE* is the unexpected earnings measured as (Actual EBIT – EBIT consensus)/Abs (Actual EBIT)). *VIX* represents the level of market uncertainty measured by the expectation of the 30-day volatility for the S&P 500 index. *Interaction Variable UE & VIX* is the continuous interaction variable of the two variables, capturing the influence of Market Uncertainty on Unexpected Earnings' effect on a firm's Cumulative Abnormal Returns. The standard errors are robust and reported in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent level, respectively.

Regression 1:

$$CAR_{i,\,t,\,d} = \beta_0 + \beta_1 UE_{i,t} + \beta_2 VIX + \beta_3\, c.UE * c.VIX_{i,t} + \varepsilon$$

| VARIABLES | Cumulative Abnormal Return | |
|---|---|---|
| Return Window | [-1;+1] | |
| Subsample | UE < 0 | UE > 0 |
| Standardized values of UE | 0.00675*** | 0.01088*** |
| | (5.8912e-04) | (9.3692e-04) |
| Standardized values of VIX | 0.00040 | 0.00134** |
| | (6.5791e-04) | (5.9799e-04) |
| Interaction Variable UE & VIX | 0.00063 | 0.00309** |
| | (6.2346e-04) | (1.2571e-03) |
| Constant | -0.01935*** | 0.01039*** |
| | (5.6154e-04) | (4.9886e-04) |
| Observations | 24 711 | 35 029 |
| R-squared | 0.9% | 0.8% |

The results from Regression 2 for the period t-1 to t+1 are presented in Table 9. Similar to the findings from Regression 1, positive Unexpected Earnings yield higher abnormal return in all states of the market. In this regression good news is estimated to have an on average 3.8 percent higher abnormal return than bad news, if the VIX effect is discarded. The variables of interest in this regression are the stand-alone Market Uncertainty variable and the Good News dummy interaction variable, represented by the coefficients $\beta_2$ and $\beta_3$. Regression 2 confirms the results from Regression 1 for earnings announcements that are considered to be good news, as $\beta_3$ is estimated to contribute positively with 0.20 percent. More precisely, if the standardised value of Market Uncertainty is equal to 1, a positive earnings announcement is estimated to have a Cumulative Abnormal Return for the period t-1 to t+1 of 1.7 percent (i.e. 3.8 percent from the good news itself and 0.20 percent from the interaction variable between Good News and Market Uncertainty, plus the negative constant of 2.3 percent). The unconditional effect from Market Uncertainty is discarded for positive Unexpected Earnings because the coefficient $\beta_2$ that represents the unconditional effect is not significantly different from zero. Further, these results are in line with the results presented in Table 8 and is again implying that the relationship that we find for the whole sample in Regression 1, is only significant for good news (positive Unexpected Earnings) and not for bad news (negative Unexpected Earnings).

**Table 9**
**Baseline Results – Regression 2**

Table 9 shows how Unexpected Earnings announcements and Market Uncertainty affect the Cumulative Abnormal Return for firms, with a dummy variable for good news, over the time period [-1; +1], from close to close. *Good News* is a dummy variable equal to 1 if the company announces positive Unexpected Earnings, and equal to 0 if the Unexpected Earnings are negative (i.e. the consensus of the estimated earnings is higher than the actual earnings). *VIX* represents the level of market uncertainty measured by the expectation of the 30-day volatility for the S&P 500 index. This explanatory variable is standardised, to a mean of 0 and a standard deviation of 1. *Interaction VIX & Good News* is the interaction variable of the two variables, capturing the influence of Market Uncertainty and positive Unexpected Earnings on a firm's Cumulative Abnormal Returns. The standard errors are robust and reported in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent level, respectively.

Regression 2:

$$CAR_{i,\,t,\,d} = \beta_0 + \beta_1 \text{Good News}_{\,i,t} + \beta_2 VIX_t + \beta_3 \text{ Good News} * c.VIX_{i,t} + \varepsilon$$

| VARIABLES | Cumulative Abnormal Return [-1;+1] |
|---|---|
| Good News | 0.03843***<br>(6.6446e-04) |
| Standardized values of VIX | 0.00015<br>(6.1110e-04) |
| Interaction VIX & Good News | 0.00201***<br>(5.0946e-04) |
| Constant | -0.02346***<br>(5.1327e-04) |
| Observations | 59 740 |
| R-squared | 5.4% |

Taken together, Regression 1 and Regression 2 indicate that the baseline results support the two behavioural theories, contrast effects and the investor sentiment model, in our test setting. This is because the results are in line with the predicted associations for the theory of contrast effects and the investor sentiment model for positive Unexpected Earnings. With respect to the ambiguity theory, the results do not support this theory as an explanation, since the aggregated effect from Unexpected Earnings on Cumulative Abnormal Return from increased Market Uncertainty is not significantly negative in Regression 1 and the coefficients of interest in Regression 2 are not significantly negative. Further, the rational expectations equilibrium model finds limited support from Regression 1 because the coefficient of interest $\beta_3$ is not significantly negative. The baseline results in Regression 2 are also in contrast to the rational theory because none of the coefficients are in line with the predicted rational results, since the coefficient for the unconditional effect is insignificant and the combined effect is significantly positive.

In summary, the two regressions show evidence in line with a behavioural explanation for positive Unexpected Earnings announcements (i.e. the actual earnings surpass the expected consensus earnings). This is not the case for negative Unexpected Earnings, for which we find very limited significant relationships.

### *B. Interpretation and Visualisation of Baseline Results*

As mentioned above, this study finds evidence of a more positive reaction to Unexpected Earnings during periods of high Market Uncertainty. Figure 1 visualises the results from Regression 1 (for the whole data sample) and shows that these results only persist for a limited range of Unexpected Earnings. When studying the combined effect of VIX from Regression 1 the additional positive effect of Market Uncertainty, persists down to Unexpected Earnings values of -0.79 standard deviations. Meaning that quarterly earnings reports that do not miss the consensus expectation with more than 0.79 standard deviations, relative to the sample, are predicted to have a greater positive return during high Market Uncertainty. For Unexpected Earnings more negative than -0.79 standard deviations, the relationship is not estimated to hold because the interaction term's (with VIX and UE) magnitude becomes larger than the unconditional effect of VIX and the combined relationship is the reversed.

Values of Unexpected Earnings that are below the intersection do not support the investor sentiment model, the rational expectations equilibrium model or the theory of contrast effects. However, the results below the intersection point partly support the ambiguity theory because for these cases increased Market Uncertainty leads to more negative Cumulative Abnormal Return.

**Figure 1**

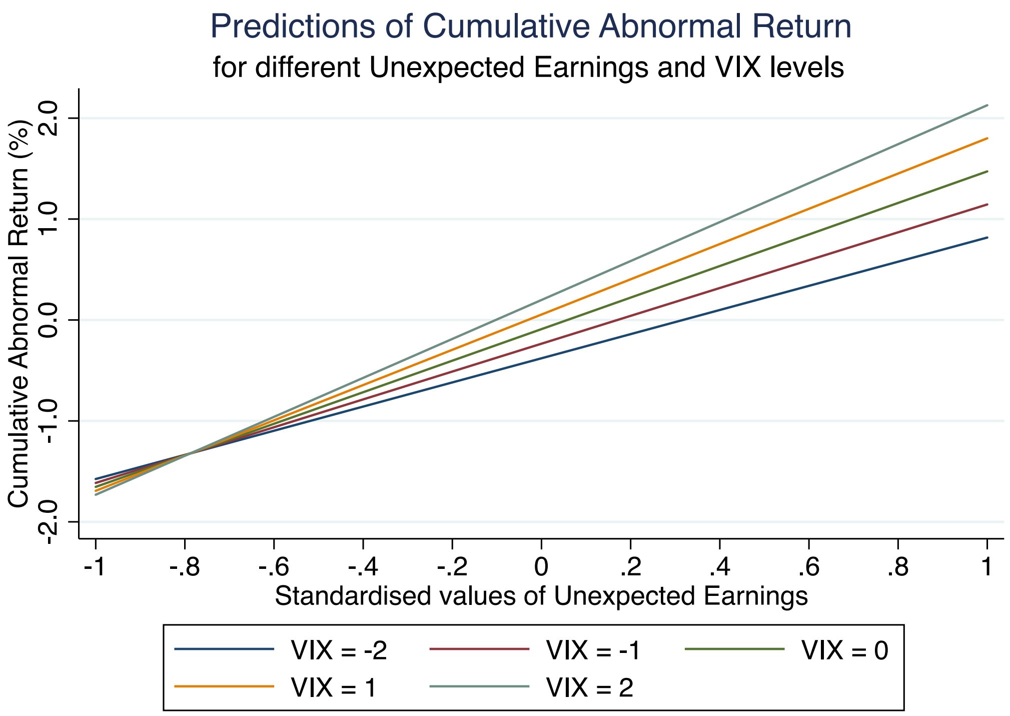


Figure 1 shows the predicted relation between Cumulative Abnormal Return for Unexpected Earnings announcements and Market Uncertainty from Regression 1. The effect on announcing firms for the time period [-1; +1], from close to close is depicted on the y-axis. The standardised values of Unexpected Earnings are shown on the x-axis. The different lines represent the predicted standardised VIX effect on Cumulative Abnormal Return.

The dummy regression (Regression 2) tells a similar but slightly different story compared with the results from the whole data sample from Regression 1. Figure 2 shows that there is a positive association between Market Uncertainty and Cumulative Abnormal Return for good news. However, this association seems not to hold for bad news, as the line representing bad news is flat.

**Figure 2**

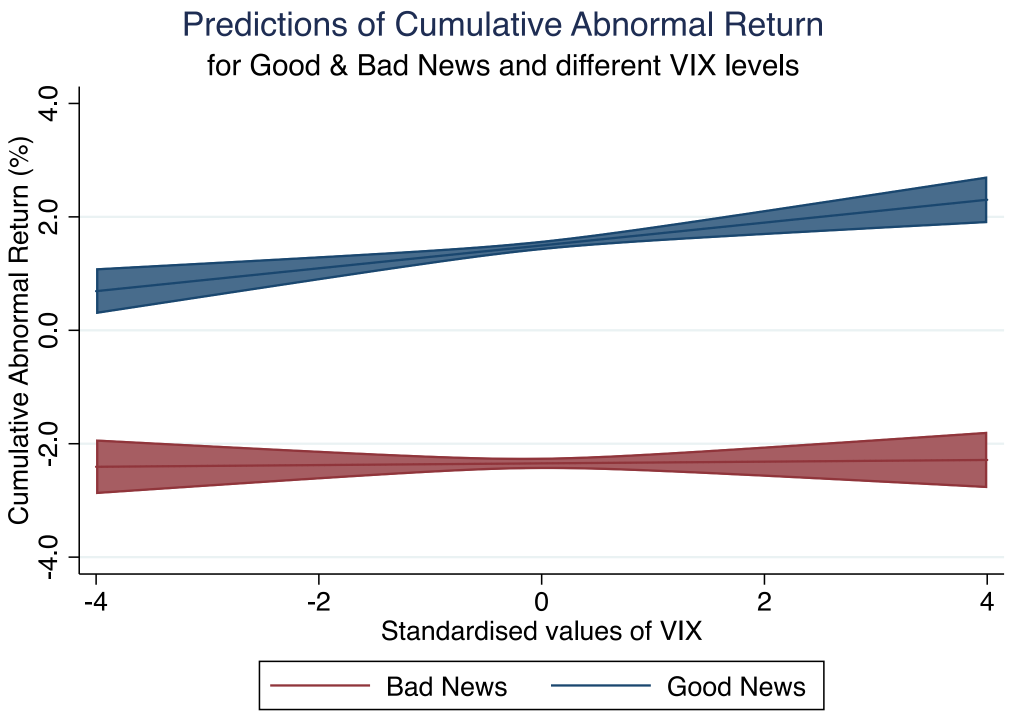


Figure 2 shows the predicted relation between return reactions for Unexpected Earnings announcements and Market Uncertainty from Regression 2, with 95 percent confidence intervals. The Cumulative Abnormal Return for announcing firms for the time period [-1; +1], from close to close, is depicted on the y-axis. The standardised value of VIX is showed on the x-axis. The different lines represent the predicted effect on Cumulative Abnormal Returns from Good (upward sloping line, Good News = 1) and Bad (flat line, Good News = 0) earnings news, in different Market Uncertainty settings.

It becomes evident when comparing the two different graphs from Figure 1 (representing the whole sample for Regression 1) and Figure 2 (representing Regression 2), that the association that seems to exist for negative Unexpected Earnings for the whole sample in Regression 1, is not found in Regression 2. For this regression negative Unexpected Earnings (bad news) has no association with the general Market Uncertainty.

Taken together, from the results from Regression 1 and from Figure 1, it is evident that an association between Market Uncertainty and Cumulative Abnormal Return exists, but as shown with Regression 2 and from Figure 2, it seems only to exist for positive Unexpected Earnings announcements.

# VI. Further Interpretation of the Results

## *A. Long Run Reversals*

As shown in the previous section, we find indications of a behavioural bias in the studied data sample. If this is a mispricing that occurs due to a behavioural bias, it can be expected that this bias will be corrected over time, and that the prices in the long run should converge to its fundamental values. To test for a reversal effect, we rerun Regression 1 for different return windows. This is done by studying a return window that starts after the initial reaction period (t-1 to t+1). By looking solely on a post-event window, a reversal effect should manifest itself by having an association that is in the opposite direction of the results from our baseline regression. To be more specific, the interaction variable should change from being positively associated with the Cumulative Abnormal Return to being negatively associated. Further, if the behavioural bias is due to a perception bias, the mispricing should occur first when the event occurs. Thus, the mispricing should exist *after* the event. Compared to an expectation bias, where the mispricing occurs *before* the event and is corrected when the information is released.

Table 10 shows Regression 1 for different return windows and shows evidence of a significant reversal effect within 45 trading days. The first column shows our baseline regression presented in the previous section. Column 2 and 3 show our baseline results replicated for longer time horizons. The two columns show that Market Uncertainty affects the Unexpected Earnings' effect on Cumulative Abnormal Return up to 20 trading days after the event, but the effect becomes insignificantly different from zero 30 trading days after the announcement.

In column 4 and 5 we show that a reversal effect is evident in the data. Column 4 shows that the interaction variable for the return window t+2 to t+45 switches sign and becomes significantly negative. Interestingly, the reversal coefficient of -0.184 percent is roughly the same size as the initial effect, for the return window t-1 to t+1, of 0.183 percent. Column 5 shows the return window t-1 to t+45 and again shows that the interaction variable is not significantly different from zero. Also, when looking at the return window after 45 trading days, t+46 to t+75, no further reversal is evident in the data, indicating that the observed reversal effect occurs in the time window of approximately t+2 to t+45 in our data sample.

In conclusion, these results indicate that our initial findings are due to behavioural biases such as a perception bias that reverses within 45 trading days after the release of the quarterly report and that no association can be found in the long run.

**Table 10**
**Long Run Reversals**

Table 10 shows how Unexpected Earnings announcements and Market Uncertainty affect the Cumulative Abnormal Return for announcing firms for the return windows [-1; +1], [-1; +20], [-1; +30], [+2; +45], [-1; +45] and [+46; +75]. The explanatory variables are standardised, to a mean of 0 and a standard deviation of 1. *UE* is the unexpected earnings measured as (Actual EBIT – EBIT consensus) / Abs (Actual EBIT)). *VIX* represents the level of market uncertainty measured by the expectation of the 30-day volatility for the S&P 500 index. *Interaction Variable UE & VIX* is the continuous interaction variable of the two variables, capturing the influence of Market Uncertainty on Unexpected Earnings' effect on a firm's abnormal returns. The standard errors are robust and reported in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent level, respectively.

Regression 1:

$$CAR_{i,\,t,\,d} = \beta_0 + \beta_1 UE_{i,t} + \beta_2 VIX_t + \beta_3\, c.UE * c.VIX_{i,t} + \varepsilon$$

| VARIABLES | Cumulative Abnormal Return for: | | | | | |
|---|---|---|---|---|---|---|
| Column | (1) | (2) | (3) | (4) | (5) | (6) |
| Return Window: | [-1;+1] | [-1;+20] | [-1;+30] | [+2;+45] | [-1;+45] | [+46;+75] |
| Standardised values of UE | 0.01563*** | 0.01851*** | 0.01902*** | 0.00408*** | 0.02020*** | 0.00126* |
| | (4.5863e-04) | (6.6839e-04) | (7.3667e-04) | (7.3244e-04) | (8.7064e-04) | (7.0333e-04) |
| Standardised values of VIX | 0.00144*** | 0.00078 | 0.00085 | 0.00233*** | 0.00350*** | 0.00745*** |
| | (3.9304e-04) | (6.0181e-04) | (6.5858e-04) | (6.4037e-04) | (7.3468e-04) | (6.2597e-04) |
| Interaction Variable UE & VIX | 0.00183*** | 0.00185** | 0.00118 | -0.00184* | 0.00009 | -0.00137 |
| | (5.4566e-04) | (8.5544e-04) | (9.2734e-04) | (9.6932e-04) | (1.0790e-03) | (9.4261e-04) |
| Constant | -0.00090*** | -0.00001 | -0.00003 | -0.00323*** | -0.00430*** | -0.00707*** |
| | (3.2890e-04) | (5.0083e-04) | (5.7137e-04) | (5.6787e-04) | (6.6436e-04) | (5.5590e-04) |
| Observations | 59 759 | 59 759 | 59 759 | 59 759 | 59 759 | 59 759 |
| R-squared | 3.6% | 2.2% | 1.8% | 0.1% | 1.6% | 0.3% |

### *B. Trading Strategy*

From our long run reversal results, one important implication is that we can potentially predict a reversal of the returns during the reversal window t+2 to t+45, in period t, for firms with positive Unexpected Earnings. Our results predict that positive Unexpected Earnings in combination with a *high* VIX level at time t will reverse more compared to positive Unexpected Earnings in combination with a *low* VIX level, as seen in Table 10. To be more specific, during the time period t+2 to t+45, the interaction variable is estimated to contribute to higher Cumulative Abnormal Return for low VIX (i.e. negative standardised VIX) and the interaction variable is estimated to contribute to lower Cumulative Abnormal Return for high VIX observations (i.e. positive standardised VIX). This leaves room to test if it is possible to exploit these results and achieve abnormal returns. To test this, we construct a trading strategy that exploits the difference in the reversal between the high VIX and the low VIX observations.

In the trading strategy we choose to only look at positive Unexpected Earnings, as our results are insignificant for negative Unexpected Earnings. Further, we focus on positive Unexpected Earnings above the $75^{th}$ percentile ($4^{th}$ quartile), because the reversal effect is more pronounced in this subsample, as seen in Table 10. The returns of high Unexpected Earnings are predicted to increase the most during the initial event and to have the largest reversal effect after the event.

The trading strategy is constructed as follows: Since our regression suggests that positive Unexpected Earnings in combination with a *high* VIX level will reverse more, we hold short positions for companies that report Unexpected Earnings above the $75^{th}$ percentile during a period when the VIX level is above the $75^{th}$ percentile, for the reversal window t+2 to t+45. In contrast, we hold long positions for companies that report positive Unexpected Earnings above the $75^{th}$ percentile during a period when the VIX level is below the $25^{th}$ percentile, for the reversal window t+2 to t+45.

To best match our regression results, both the long and short portfolios are equally weighted. Further, we assume that we can invest without any trading costs and that we can borrow at the risk-free rate. We also assume that we can earn the risk-free rate during days when no companies match the above selection criteria. This means that on days when our criteria only meet one leg (long or short), we invest the other leg in the risk-free rate and on days when no investment criteria are met we stay out of the market.

For our sample period, year 2000 to 2018, the Long & Short Reversal strategy actively participates in the stock market 3 140 days of 4 653 possible trading days. However, the result from the above described trading strategy is poor. One dollar invested in the beginning of the period would develop to c. 0.79 dollar, this can be compared with the market index[3] where one dollar invested resulted in c. 2.15 dollar at the end of the sample period.

**Figure 3**

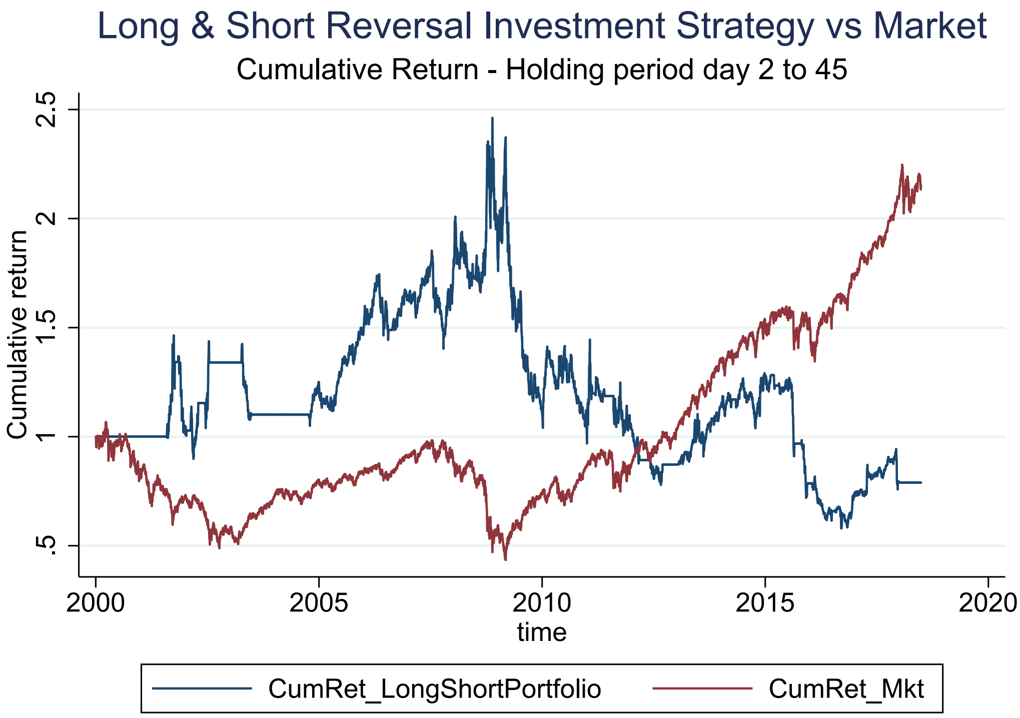


Figure 3 shows how one dollar invested according to the Long & Short Reversal investment strategy would develop compared to one dollar invested in the market index. Long position: Companies reporting positive (q4) Unexpected Earnings during low (q1) VIX periods. Short position: Companies reporting positive (q4) Unexpected Earnings during high (q4) VIX periods. The positions are held during the reversal window that is [+2; +45] after the release of the quarterly report. One dollar invested, at the beginning of the sample period, according to the Long & Short Reversal investment strategy would develop to c. 0.79 dollar at the end of the sample period. One dollar invested in the market index would develop to c. 2.15 dollar at the end of the sample period.

Further, we can conclude that the short leg of the trading strategy largely contributes to the poor result. One potential explanation to this can be that companies that report good results, will continue to perform well which outweighs the reversal effect. Therefore, another trading strategy can be constructed that excludes the short investments, i.e. only holds long positions when companies report Unexpected Earnings above the 75$^{th}$ percentile during a period when

[3] Market index is calculated as the value-weighted return on all NYSE, AMEX, and NASDAQ stocks from CRSP.

the VIX level is below the 25th percentile, for the reversal window t+2 to t+45. The long position will exploit a positive return from the interaction variable during the reversal window, as VIX in the 25th percentile is negative. This strategy results in fewer days during which stock positions are held, 1 867 days compared to 3 140 days of the Long & Short Reversal strategy and to 4 653 possible trading days. This can be seen below in Figure 4, since the return is flat over long periods for the Long Only Reversal investment strategy, meaning that no stock positions are held.

The cumulative return for this strategy over the studied sample period is positive. One dollar invested in the beginning of year 2000 developed to c. 2.13 dollar in the end of 2018. However, the cumulative return for this trading strategy is still less than the cumulative return of the market index. This means that the strategy has very limited practical economic implications, since investing in a broad index is likely to make an investor better off.

**Figure 4**

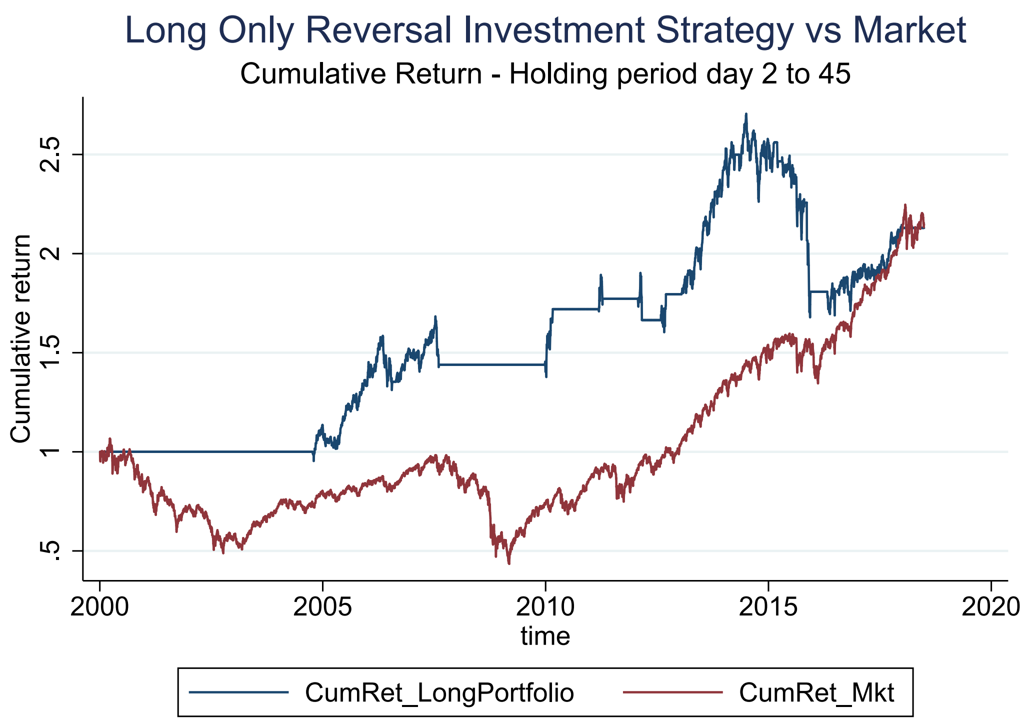


Figure 4 shows how one dollar invested according to the Long Only Reversal investment strategy would develop compared to one dollar invested in the market index. Long position: Companies reporting positive (q4) Unexpected Earnings during low (q1) VIX periods. Positions are held during the reversal window [+2; +45] after the release of the quarterly report. One dollar invested, at the beginning of the sample period, according to the Long Only Reversal investment strategy developed to c. 2.13 dollar at the end of the sample period. One dollar invested in the market index developed to c. 2.15 dollar at the end of the sample period.

Additional insights can be drawn by looking at the return of the Long Only Reversal investment strategy compared to the Fama-French & Momentum factors (Carhart, 1997; Fama & French, 1993). Table 11 shows the results from the regression:

**Four-factor model - Regression**

$$\text{Portfolio Return}_t = \text{Alpha}_t + \beta_1 \text{MktRf}_t + \beta_2 \text{SMB}_t + \beta_3 \text{HML}_t + \beta_4 \text{UMD}_t + \varepsilon$$

From Table 11 it can be concluded that the return for the Long Only Reversal strategy can be explained by the Market factor and the Small Minus Big factor. The High Minus Low and the Momentum factor, do not contribute to explain the return of the portfolio as these two factors are not significantly different from zero.

The Market factor coefficient of 0.97 is close to 1. This is expected since we use all price data available for American stocks in our data sample. Further, we do not make any selection criteria for firm-specific factors (or industry factors), other than the Unexpected Earnings in our trading strategy, leaving us with a broad representation of the whole market. Thus, the market coefficient should be close to 1.

The other significantly positive coefficient is Small Minus Big of 0.72. This means that the return of the trading strategy can also be explained by a high exposure to firms with a small market capitalisation. This is intuitive, because it is also likely that small firms are overrepresented in our subsample with Unexpected Earnings above the $75^{th}$ percentile, as the firms may be less mature and have a larger tendency to surprise analysts, compared to larger firms that are followed more closely by analysts and are in a more mature stage.

Because of the high explanatory power of the Market and the Small Minus Big factor, the Alpha of the portfolio is estimated to be -0.009 percent, however it is not significantly different from zero. This implies that the return from the portfolio can be explained by commonly known risk factors and that the portfolio does not exhibit an “edge” over the market.

**Table 11**
**Long Only Reversal investment strategy**

Table 11 shows the relation between the return from the Long Only Reversal investment strategy in relation to a Momentum factor and the three Fama-French factors; Excess return of the market, Small Minus Big and High Minus Low. The table shows the regression results for the Long Only Reversal investment strategy over the time period [+2; +45], from close to close. The return from the Long Only Reversal investment strategy can be explained by two factors; Excess return of the market and Small Minus Big. This means that the Alpha of the portfolio is not significantly different from zero. The standard errors are robust and reported in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent level, respectively.

Regression:

$$\text{Portfolio Return}_t = \text{Alpha}_t + \beta_1 \text{MktRf}_t + \beta_2 \text{SMB}_t + \beta_3 \text{HML}_t + \beta_4 \text{UMD}_t + \varepsilon$$

| VARIABLES | Portfolio Long Only Strategy<br>[+2;+45] |
|---|---|
| MktRf | 0.97261***<br>(3.0006e-02) |
| SMB | 0.72457***<br>(3.7948e-02) |
| HML | 0.05078<br>(4.9534e-02) |
| UMD | -0.00435<br>(3.7160e-02) |
| Alpha | -0.00009<br>(1.6439e-04) |
| Observations | 1 867 |
| R-squared | 61.4% |

In conclusion, in our data sample we find evidence of a reversal effect since we find a significantly negative association between our two main variables of interest, Market Uncertainty and Unexpected Earnings, for the time period t+2 to t+45. However, these statistical results seem to have limited economic implications, since a trading strategy derived from these results does not beat the general market. One explanation for this can be that the average values of Unexpected Earnings and VIX in the 1$^{st}$ and 4$^{th}$ quartiles are not extreme enough to make the trading strategy effective. By dividing our data sample into more subgroups and only using the highest and lowest groups, it could potentially increase the profitability of the trading strategy. Though, this action will lead to fewer possible trades as the selection criteria narrows. In other words, the significant reversal regression cannot easily be translated into a trading strategy, and the statistical effect seems to be too small to be exploited in an economic meaningful way.

# VII. Robustness Checks

In Regression 3 we control for two factors that can potentially affect our results from Regression 1 and Regression 2. These two factors are: liquidity and accuracy.

The rationale behind controlling for liquidity is two-fold. Firstly, if illiquidity affects investors so that they cannot easily trade a security, the security price might not reflect investors' views and the mispricing might not be due to Market Uncertainty, but due to illiquidity. Secondly, if a security is illiquid, it is likely to spike the volatility for that individual stock meaning that the reactions that we try to study are magnified and unreliable when drawing conclusions. We also control for the accuracy of the predicted earnings. i.e. the consensus. The rationale behind controlling for accuracy is that low accuracy leads to an irrelevant Unexpected Earnings measure. If any of these factors actually affect the results, the variables will take away explanatory power from our interaction variable.

Table 12 shows that the coefficient of our interaction variable is approximately the same as in the baseline regressions, and that all three explanatory variables remain significantly different from zero, with the same type of association (positive) as in our original regressions, when including control variables. Further, the variables that are used to explain accuracy have limited significance. In column 1, the only accuracy variable that is significantly different from zero is Size, and when all control variables are included (column 3) none of the accuracy variables are significantly different from zero. However, from this regression we cannot conclude that the accuracy of the reported consensus has no effect on the Cumulative Abnormal Return. It is possible that our three chosen accuracy variables (Size, StdEst and NumEst) do not reflect accuracy in a meaningful way and that there are other variables that can serve as better proxies for accuracy.

Further, the two variables used to explain liquidity are estimated to have a significant effect on the Cumulative Abnormal Return both in the stand-alone regression (column 2) and when all control variables are included (column 3). It is likely that one of the liquidity variables, Volume or BidAskSpread, explains the same variation as the Size variable and due to multicollinearity causes the Size variable to become insignificantly different from zero in column 3.

Taken together, our results are unaffected when including variables for liquidity and accuracy.

**Table 12**
**Robustness Check with Control Variables – Regression 3**

Table 12 shows how Unexpected Earnings announcements and Market Uncertainty affect the Cumulative Abnormal Return for announcing firms for the time period [-1; +1], from close to close. The explanatory variables are standardised, to a mean of 0 and a standard deviation of 1. *UE* is the unexpected earning measured as (Actual EBIT – EBIT consensus) /Abs (Actual EBIT)). *VIX* represents the level of market uncertainty measured by the expectation of the 30-day volatility for the S&P 500 index. *Interaction Variable UE & VIX* is the continuous interaction variable of the two variables, capturing the influence of Market Uncertainty on Unexpected Earnings' effect on a firm's abnormal returns. *Volume* is the abnormal volume. *BidAskSpread* is the difference between the close ask and close bid prices. *Size* is the market capitalisation of the firm. *StdEst* is the standard deviation of the analysts' estimates included in the reported consensus. *NumEst* is the number of analyst estimates in the consensus. The standard errors are robust and reported in parentheses. *, ** and *** indicate significance at the 10, 5 and 1 percent level, respectively.

Regression 3:

$$CAR_{i,t,d} = \beta_0 + \beta_1 UE_{i,t} + \beta_2 VIX_t + \beta_3\, c.UE * c.VIX_{i,t} + \beta_4 Volume_{i,t} + \beta_5 BidAskSpread_{i,t} + \beta_6 Size_{i,t} + \beta_7 StdEst_{i,t} + \beta_9 NumEst_{i,t} + \varepsilon$$

| VARIABLES | Cumulative Abnormal Return | | |
|---|---|---|---|
| | | [-1; +1] | |
| | (1) | (2) | (3) |
| Standardised values of UE | 0.01563*** | 0.01565*** | 0.01563*** |
| | (4.5933e-04) | (4.4706e-04) | (4.4790e-04) |
| Standardised values of VIX | 0.00138*** | 0.00079** | 0.00084** |
| | (3.9784e-04) | (3.9763e-04) | (3.9925e-04) |
| Interaction Variable UE & VIX | 0.00182*** | 0.00177*** | 0.00177*** |
| | (5.4591e-04) | (5.3775e-04) | (5.3781e-04) |
| Standardised values of Volume | - | -0.01110*** | -0.01114*** |
| | | (1.6257e-03) | (1.6401e-03) |
| Standardised values of BidAskSpread | - | 0.00230*** | 0.00231*** |
| | | (4.1852e-04) | (4.1999e-04) |
| Standardised values of Size | 0.00083*** | - | -0.00010 |
| | (2.5481e-04) | | (2.7853e-04) |
| Standardised values of StdEst | -0.00016 | - | -0.00031 |
| | (2.8906e-04) | | (3.1478e-04) |
| Standardised values of NumEst | -0.00041 | - | 0.00036 |
| | (3.4439e-04) | | (3.5885e-04) |
| Constant | -0.00090*** | -0.00091*** | -0.00091*** |
| | (3.2890e-04) | (3.2561e-04) | (3.2561e-04) |
| Observations | 59 759 | 59 759 | 59 759 |
| R-squared | 3.6% | 5.5% | 5.5% |

# VIII. Implications

First of all, in this paper we find that there is a significantly positive relation between market uncertainty and how earnings news affect returns. Further, when separating between good and bad news, we find that this association is only significant for good news.

For the interpretation of our results, we develop two potential explanations based on two strands of literature. Firstly, we consider an explanation using rational models. Secondly, we use behavioural theory as a possible explanation.

### *A. Rational Models*

As described in Section V, our regressions imply that the rational expectations equilibrium model does not fit as an explanation to our results (Veronesi, 1999). However, with some adjustments to the model, it can potentially explain our findings. In the model, investors are uncertain about the overall state of the market. Because investors cannot observe the current state of the market directly, they must infer it from past market performance. If the prior state of the market has been bad, i.e. high market uncertainty, investors believe that the market is in a bad state. Positive earnings announcements then have two implications for investors according to the model. Firstly, the new information implies that the market is in a better state than what the investors initially thought. This shifts the probabilities towards a more optimistic outlook and increases the value of expected future dividends, thus increasing the market price. Secondly, good news increases investors' uncertainty about the *true* state of the market, as the new information is contrary to their initial believes about the market. Risk-averse investors then require a higher expected rate of return to hold stocks in this new environment. This makes the market discount rate to increase, thus lowering the present value of future cash flows and the market price. In order for this theory to hold for our results, the effect from the shift in probabilities must be greater than the effect from the change in discount rates, in order for the cumulative effect to be positive on the market price. As described before, this is not the case in the model developed by Veronesi, and the original model does not suit as a plausible explanation. However, the described modification could be discussed as a rational justification of the results. There are some further fallacies in the application of the rational model by Veronesi to our case. Firstly, it was developed to cover market-wide effects and not firm-specific cases, therefore it is not directly applicable to our case. Secondly, as we can see a reversal effect within 45 trading days that is of equal size as the initial effect, the results are more in favour of behavioural theory. This is because if the return is based on rational grounds and incorporated in the fundamental market price, it should persist going forward. Whereas a reversal effect implies that it is an overreaction (or underreaction), that the market corrects afterwards.

### *B. Behavioural Models*

As mentioned throughout this paper, our findings seem to be more in line with behavioural theory. Our results are consistent with two behavioural theories, the investor sentiment model and the theory of contrast effects (Barberis et al., 1998; Hartzmark & Shue, 2018). As our results imply that during a bad market state, defined with high market uncertainty, the abnormal returns of good news are more positive, the investor sentiment model can partly be applied to explain our findings. Because investors that are exposed to a specific market state expect the trend to continue in future events as well, the good news appear as a chock when the prior environment is an uncertain market, leading to investors' reaction being greater than if announced in a market of low uncertainty. Though, the literature focuses on firm-specific conditions and on firm-specific earnings over a longer time horizon, and is therefore not directly applicable to our case, as we combine firm-specific data with a market-wide factor. However, complementing this theory with the theory of contrast effects can add depth to the interpretation. Our results can be explained by contrast effects since, when good news is announced in a bad state, investors perceive the news as being better than it actually is, as it is in contrast to the prevailing market. In a bad market, investors do not expect good news and therefore overreacts to the announced information. This results in the abnormal returns from the event being larger, than during low market uncertainty. Thus, the prevailing market inversely biases investors' perception of the new information. The results can further be explained with a concept within the theory of contrast effects; the perception bias. As the bias occurs at the event and persists afterwards, and we find a significant reversal effect during 2 to 45 days after the event. This indicates that the behavioural bias can be explained with the perception bias of contrast effects, as investors perceive the event as better than it actually is and that the market corrects the abnormal return created from this reaction within 45 trading days.

In addition, this explanation can also be related to the Prospect Theory and reference points of Kahneman and Tversky (Kahneman & Tversky, 1979). The prevailing level of the market contributes to the reference point of investors. Thus, a bad state of the market leads investors to adjust their reference point negatively. When the reference point of investors is lower, the same amount of gain will be perceived as much greater than during status quo.

To conclude, more pronounced stock returns to good news during high market uncertainty can be explained with investors perceiving a positive event, as better than it actually is due to the reference point that the market uncertainty creates, and thus overreacts to the event. The correction of the reaction happens after the event as the return reverses within 45 days.

### *C. Relation to Existing Literature*

Our results are consistent with Conrad et al., who use both the rational expectations equilibrium model and the investor sentiment model as possible explanations to their findings. However, they also mention the fallacies that the behavioural model is based on firm-specific conditions, and that the rational model is based on market-wide effects. In this paper, the application of the theory of contrast effects, complements the results in the study by Conrad et al.

Further, our results may be perceived as contrary to Bird et al. and Williams' as they find that when the market uncertainty increases, investors put more emphasis on bad news than on good news and thus react more strongly to negative earnings announcements. However, as they study the *change* in market uncertainty over the period of the event, our study differs significantly from theirs. They define the market environment as the change in market uncertainty over the announcement period, and their measure includes limited information about the preceding state of the market. In this paper, we study how the prevailing level of market uncertainty impacts investors' perception of news and thus how investors make decisions when being exposed to an uncertain market rather than to shocks in the market.

Finally, this paper continues the study by Hartzmark and Shue of contrast effects in financial markets, and consistent with their suggestions of future research, we can find evidence of contrast effects depending on the macroeconomic environment. Also, in line with Hartzmark and Shue, we find that the mispricing induced by the contrast effect reverses within 45 trading days.

### *D. Exploiting the Mispricing – A Trading Strategy*

As we find evidence of a mispricing and due to the fact that we observe a reversal effect within 45 days after the event, investors can potentially exploit this mispricing. As described in Section VI, we test this by constructing a trading strategy based on positive Unexpected Earnings. Even though we find significant evidence of this effect, it is too small to have any economic implications and it is not possible to successfully execute a trading strategy from our results.

# IX. Summary

In this paper, we study how earnings announcements and the prevailing level of the market affect stock returns, using VIX as a proxy for the level of the market.

We find that there is a significantly positive relation between the state of the market and how earnings news affects announcement returns. This association seems only to hold for good news. Thus, the announcement return of good news in bad states is larger compared to the return of the same news in good states. Further, we conclude that a reversal effect of the return occurs within a 45-day period after the event. Lastly, we construct a trading strategy to exploit the mispricing after these events, however we find that the significant reversal effect cannot easily be translated into a trading strategy and that the statistical effect seems to be too small to be exploited in an economic meaningful way.

We find two possible explanations to our results. Firstly, we use rational models to motivate an alternative explanation to our results. Investors form their beliefs about the true state of the market from past information. Thus, when investors believe the market to be in a bad state, and positive news arrives, their beliefs of the true state of the market change. This causes the probabilities of future expected earnings to shift to a more positive case, increasing the market price. Secondly, to explain our findings, we use two behavioural theories, the investor sentiment model developed by Barberis et al., and the theory of contrast effects. In the investor sentiment model, investors believe to be in either of two regimes, a trending or a reverting regime. In the trending regime, the prevailing market serves as an indication of the state of the current regime. News in the opposite direction of what can be expected in the trending regime, comes as a shock to investors which intensifies their reactions. Further, according to the theory of contrast effects, an event is judged based on its relation to the previously observed case. When good news is announced in a bad market, the news is in contrast to investors' previous observations. The contrast of the new event to the previous environment, makes investors perceive the good news as better than it actually is, leading to an overreaction that is reflected in the market price. Thus, their previous observations inversely bias their perception of the news. Finally, we conclude that the behavioural theories fit better into our results, as there are fallacies in the application of the rational model to our case and the fact that we observe a reversal effect, speaks largely in favour of the behavioural explanation.

# X. Future Research & Limitations

### *A. Suggestions for Future Research*

Existing literature, this paper included, seems to be divided into two different cases. One where the abnormal returns are negatively associated with the state of the market, as in our case, and one where the abnormal returns are positively associated with the state of the market. The difference in the results seems to depend on the definition of the market state, prevailing market conditions, as in our case, versus shocks to the market state. As these relatively similar approaches in defining the market give such different results, we believe this is an interesting area for future research. To study how investors behave when being exposed to a specific environment for a period of time, versus when being exposed to shocks in the market environment.

In the aspect of contrast effects, it is interesting that we find limited evidence of contrast effects for bad news. In the theoretical setting, a contrast should be perceived due to the observed difference and not depend on the initial state, i.e. both from warm to cold water and from cold to warm water as in the original findings by John Locke. Thus, to study if investors are optimistically biased in the concept of contrast effects when interpreting earnings announcements is an interesting area for future research.

Furthermore, we believe that this area of literature can grow and add to existing literature by using other measures that represent the state of the market in explaining the relation between macroeconomic factors and market returns. Potential factors that can be used include the current yield spread and GDP growth.

Finally, contrast effects in the financial setting is an interesting area that can be studied further in different situations. For example, an area that can be of interest, is in investment evaluations to see if investors reject good investment opportunities due to their previously observed cases, especially within the trending venture capital industry.

### *B. Limitations*

In our study, there are some limitations that should be pointed out. Firstly, in order to draw any conclusions on stock reactions, the data set should be representable for the overall stock market. This raises the question if our data sample represents the stock market in general. This is likely not to be the case, as our data sample is over 18 years for U.S. stocks only. Thus, conclusions from our findings should be made with caution for other stock markets and periods.

Secondly, our measure of the market environment is an object for discussion. One of the most important variables that we use in this paper to draw our conclusions, is the definition of the current state of the market. This raises the question, if VIX is a good proxy for the state of the overall market and most importantly, if it actually captures investors' perception of the current state of the market. Further, the time period of 10 days, during which we measure market uncertainty can both be too short or too long, to be a good representation of a specific market environment, and to influence investors.

Thirdly, the other important variable that we use, is Unexpected Earnings. It is based on EBIT, and it can be examined whether Unexpected Earnings of EBIT is the most accurate way to study investors' responses to earnings announcements, or if any other metric would capture the effect in a better way.

Lastly, in this study we estimate how investors behave during different states of the market. However, it is possible that our results can be explained with differences in the behaviour of *financial analysts* rather than of *investors*, and that their estimates of expected earnings that are sent in to I/B/E/S, and thus their accuracy, differs with the level of the market. This would imply that the pronounced abnormal returns of good news in high Market Uncertainty would be because analysts generally lower their estimates in bad times so that the market expectations are lower, and not because investors overreact to good news in bad times.

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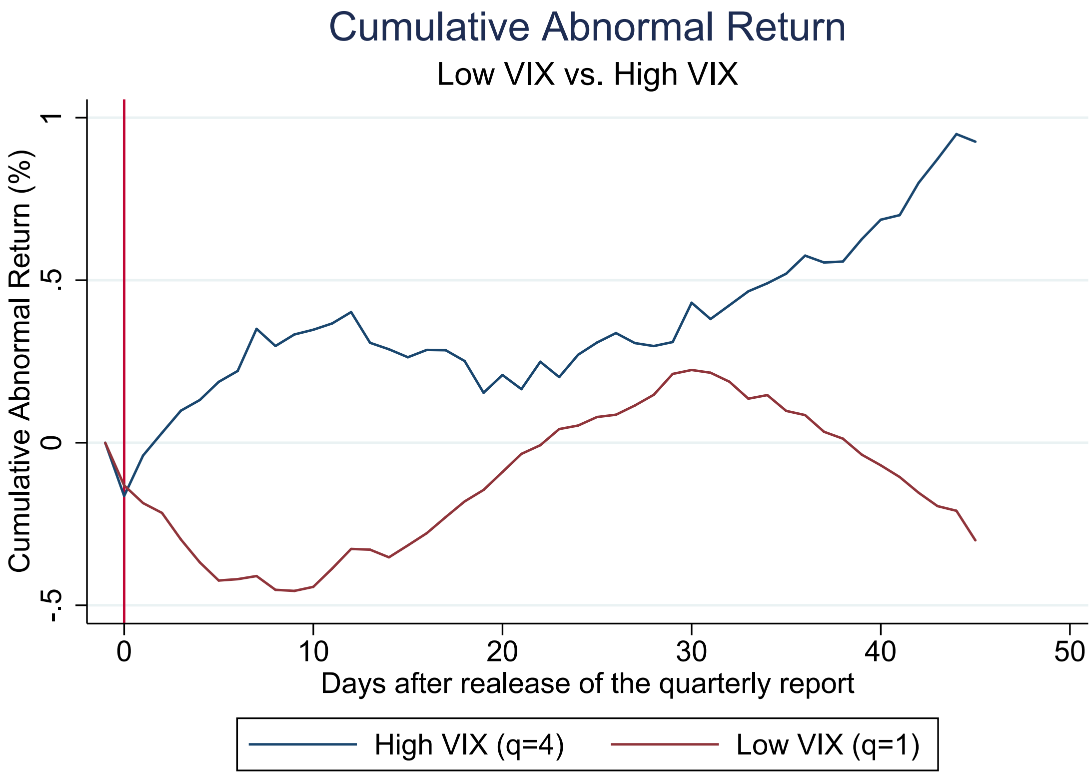
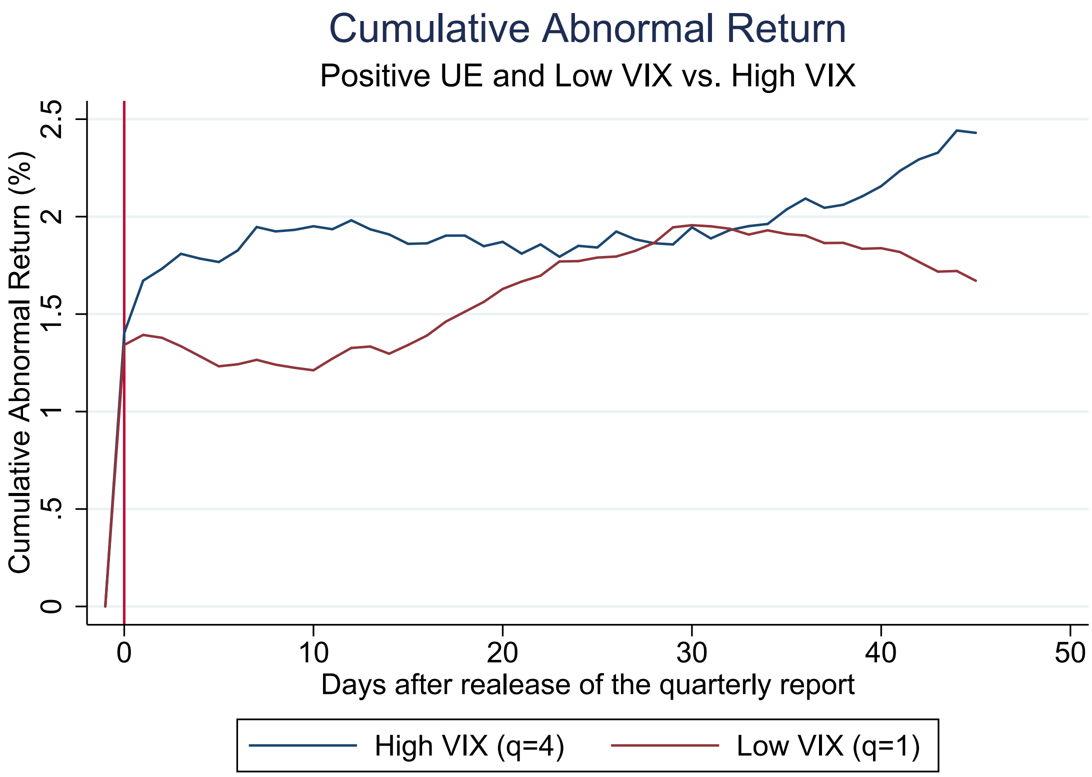
# XII. Appendix

**Figure 5**



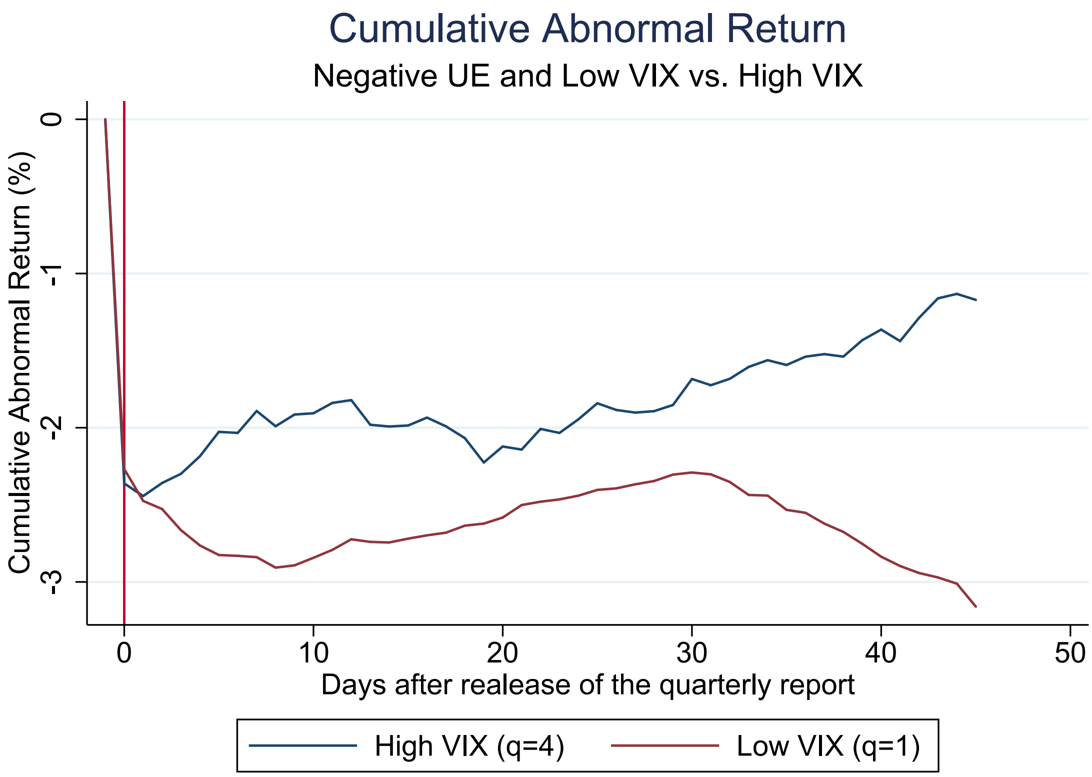

This graph shows the Cumulative Abnormal Return for the 1st quartile of VIX (below the 25th percentile) and the 4th quartile of VIX (above the 75th percentile) up to 45 trading days after the earnings announcement. As shown in Table 2, the first day return is slightly negative on average. Also see Table 13.

**Figure 6**




This graph shows the Cumulative Abnormal Return for the 1st quartile of VIX (below the 25th percentile) and the 4th quartile of VIX (above the 75th percentile) up to 45 trading days after the earnings announcement for positive Unexpected Earnings. As expected, earnings announcements that is above the expected consensus yield, on average, a positive return. Further, the earnings announcements that are released during high Market Uncertainty yield, on average, a higher return response during the first days, compared to similar earnings announcements during low Market Uncertainty. This difference in returns has a tendency to reverse over time. Also see Table 14.

**Figure 7**




This graph shows the Cumulative Abnormal Return for the 1st quartile of VIX (below the 25th percentile) and the 4th quartile of VIX (above the 75th percentile) up to 45 trading days after the earnings announcement for negative Unexpected Earnings. The difference in returns between the high and low Market Uncertainty group is not as pronounced as for positive Unexpected Earnings for the first day. However, a clear difference in return is evident in the succeeding days. Also see Table 15.

**Table 13**
**Cumulative Abnormal Return for Different VIX Levels**

This table shows Cumulative Abnormal Return for the 1st and 4th Market Uncertainty quartiles for the return windows [-1; +1] to [-1; +45]. The table also show the difference and the corresponding p-value in Cumulative Abnormal Return for these subgroups of Market Uncertainty. The mean Unexpected Earnings for the two different subgroups are also presented.

| | Return Window: | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | [-1;+1] | [-1;+2] | [-1;+3] | [-1;+4] | [-1;+5] | [-1;+10] | [-1;+15] | [-1;+20] | [-1;+25] | [-1;+30] | [-1;+35] | [-1;+40] | [-1;+45] |
| **Cumulative Abnormal Return** | | | | | | | | | | | | | |
| Low VIX, q=1 | -0.0019 | -0.0022 | -0.0030 | -0.0037 | -0.0042 | -0.0044 | -0.0032 | -0.0009 | 0.0008 | 0.0022 | 0.0010 | -0.0007 | -0.0030 |
| High VIX, q=4 | -0.0004 | 0.0003 | 0.0010 | 0.0013 | 0.0019 | 0.0035 | 0.0026 | 0.0021 | 0.0031 | 0.0043 | 0.0052 | 0.0069 | 0.0093 |
| diff (q=1 - q=4) | -0.0015 | -0.0025 | -0.004 | -0.005 | -0.0061 | -0.0079 | -0.0058 | -0.003 | -0.0023 | -0.0021 | 0,0000 | -0.0076 | -0.0123 |
| p | 0.2638 | 0.0741 | 0.0056 | 0.0007 | 0.0001 | 0,0000 | 0.0013 | 0.1208 | 0.2655 | 0.3343 | 0.0623 | 0.0015 | 0.0000 |
| **Unexpected Earnings** | | | | | | | | | | | | | |
| Low VIX, q=1 | 0.0027 | | | | | | | | | | | | |
| High VIX, q=4 | -0.0271 | | | | | | | | | | | | |
| p | 0.0000 | | | | | | | | | | | | |
| Count (Low VIX) | 22 720 | | | | | | | | | | | | |
| Count (High VIX) | 5 517 | | | | | | | | | | | | |

**Table 14**
**Cumulative Abnormal Return for Different VIX Levels – Positive Unexpected Earnings**

This table shows Cumulative Abnormal Return for the 1st and 4th Market Uncertainty quartiles for the return windows [-1; +1] to [-1; +45] for positive Unexpected Earnings only. The table also shows the difference and the corresponding p-value in Cumulative Abnormal Return for these subgroups of Market Uncertainty. The mean Unexpected Earnings for the two different subgroups are also presented.

| | Return Window: | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | [-1;+1] | [-1;+2] | [-1;+3] | [-1;+4] | [-1;+5] | [-1;+10] | [-1;+15] | [-1;+20] | [-1;+25] | [-1;+30] | [-1;+35] | [-1;+40] | [-1;+45] |
| **Cumulative Abnormal Return** | | | | | | | | | | | | | |
| Low VIX, q=1 | 0.0139 | 0.0138 | 0.0134 | 0.0128 | 0.0123 | 0.0121 | 0.0134 | 0.0163 | 0.0179 | 0.0196 | 0.0191 | 0.0184 | 0.0167 |
| High VIX, q=4 | 0.0167 | 0.0173 | 0.0181 | 0.0178 | 0.0177 | 0.0195 | 0.0186 | 0.0187 | 0.0184 | 0.0195 | 0.0204 | 0.0216 | 0.0243 |
| diff (q=1 - q=4) | -0.0028 | -0.0035 | -0.0047 | -0.0050 | -0.0054 | -0.0074 | -0.0052 | -0.0024 | -0.0005 | 0.0001 | 0.0000 | -0.0032 | -0.0076 |
| p | 0.0840 | 0.0354 | 0.0066 | 0.0057 | 0.0041 | 0.0003 | 0.0191 | 0.3046 | 0.8384 | 0.9669 | 0.6567 | 0.2824 | 0.0154 |
| **Unexpected Earnings** | | | | | | | | | | | | | |
| Low VIX, q=1 | 0.2038 | | | | | | | | | | | | |
| High VIX, q=4 | 0.1505 | | | | | | | | | | | | |
| p | 0.0000 | | | | | | | | | | | | |
| Count (Low VIX) | 13 447 | | | | | | | | | | | | |
| Count (High VIX) | 3 218 | | | | | | | | | | | | |

**Table 15**
**Cumulative Abnormal Return for Different VIX Levels – Negative Unexpected Earnings**

This table shows Cumulative Abnormal Return for the 1st and 4th Market Uncertainty quartiles for the return windows [-1; +1] to [-1; +45] for negative Unexpected Earnings only. The table also shows the difference and the corresponding p-value in Cumulative Abnormal Return for these subgroups of Market Uncertainty. The mean Unexpected Earnings for the two different subgroups are also presented.

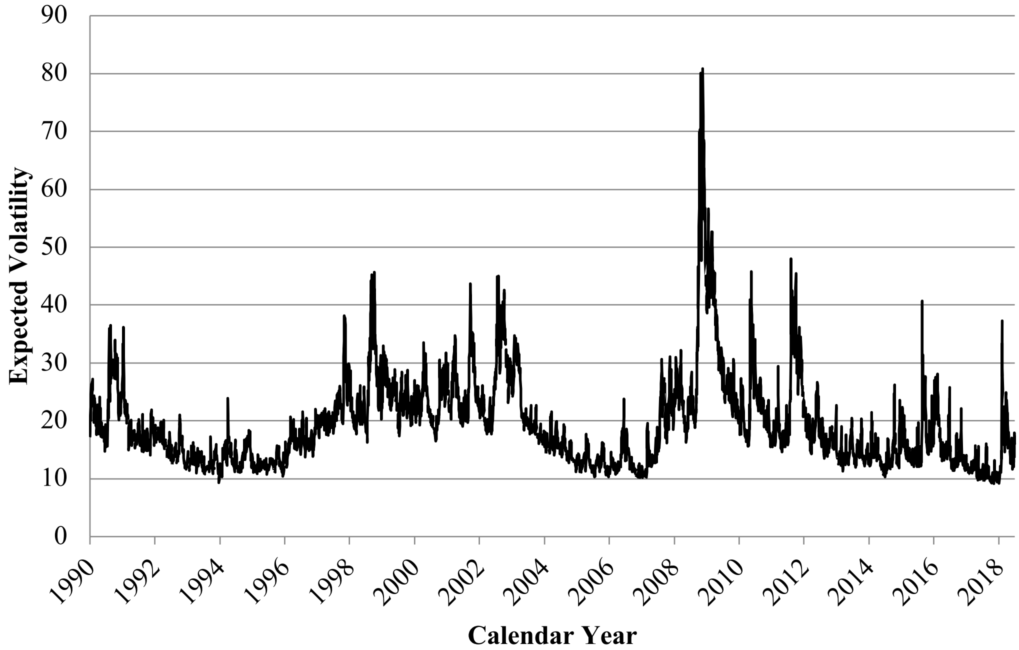
| | Return Window: | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | [-1;+1] | [-1;+2] | [-1;+3] | [-1;+4] | [-1;+5] | [-1;+10] | [-1;+15] | [-1;+20] | [-1;+25] | [-1;+30] | [-1;+35] | [-1;+40] | [-1;+45] |
| **Cumulative Abnormal Return** | | | | | | | | | | | | | |
| Low VIX, q=1 | -0.0247 | -0.0253 | -0.0266 | -0.0276 | -0.0283 | -0.0284 | -0.0272 | -0.0258 | -0.0240 | -0.0229 | -0.0253 | -0.0284 | -0.0316 |
| High VIX, q=4 | -0.0244 | -0.0236 | -0.0230 | -0.0219 | -0.0203 | -0.0191 | -0.0199 | -0.0212 | -0.0184 | -0.0168 | -0.0159 | -0.0136 | -0.0117 |
| diff (q=1 - q=4) | -0.0003 | -0.0017 | -0.0037 | -0.0058 | -0.0080 | -0.0094 | -0.0073 | -0.0046 | -0.0056 | -0.0061 | 0.0000 | -0.0147 | -0.0199 |
| p | 0.8797 | 0.4452 | 0.1118 | 0.0156 | 0.0012 | 0.0006 | 0.0130 | 0.1445 | 0.0955 | 0.0820 | 0.0106 | 0.0001 | 0.0000 |
| **Unexpected Earnings** | | | | | | | | | | | | | |
| Low VIX, q=1 | -0.2891 | | | | | | | | | | | | |
| High VIX, q=4 | -0.2764 | | | | | | | | | | | | |
| p | 0.2679 | | | | | | | | | | | | |
| Count (Low VIX) | 9 269 | | | | | | | | | | | | |
| Count (High VIX) | 2 294 | | | | | | | | | | | | |

**Table 16**
**Correlation Matrix of Explanatory Variables**

This table shows the correlation between our explanatory variables. Note that *, ** and *** indicate significance at the 5, 1 and 0.1 percent levels, respectively.

| | UE | VIX | Volume | BidAskSpread | Size | StdEst | NumEst |
|---|---|---|---|---|---|---|---|
| UE | 1.0000 | | | | | | |
| VIX | -0.0191*** | 1.0000 | | | | | |
| Volume | 0.0040 | -0.0541*** | 1.0000 | | | | |
| BidAskSpread | 0.0021 | 0.0229*** | -0.0090* | 1.0000 | | | |
| Size | 0.0181*** | 0.0097* | -0.0669*** | 0.0091* | 1.0000 | | |
| StdEst | -0.0187*** | 0.0094* | -0.0479*** | -0.0121** | 0.4328*** | 1.0000 | |
| NumEst | 0.0432*** | -0.1304*** | 0.0426*** | -0.0389*** | 0.2930*** | 0.0605*** | 1.0000 |

**Figure 8**
**Time Series of VIX**




This graph shows the Chicago Board Options Exchange Volatility Index (VIX), for the period 1990 to 2018. The index measures the expectation of the 30-day volatility for the S&P 500 index.