Analysis of stock price fluctuations before earnings statements

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Abstract

The stock market is forward looking; economic indicators and important future events are factored into stock prices. According to the Efficient Market Hypothesis†, markets operate efficiently and stock prices instantly and stock prices instantly reflect all information available. However, inefficiencies in the stock market exist due to the behaviors and expectations of investors. Stock prices may rise or fall based on future expectations. The S&P500 Index, a general index of market performance, increased in price before the week of Brexit and the United States General Election**. In both cases, stock prices incorporated the expectation of future performance, in the events of a "Stay" Brexit vote and Hillary Clinton victory. We see that the market has predicted wrong, and immediate declines in the S&P500 occurred after. In this paper, I analyze the stock price change before earning statements to analyze how effectively the market predicts important events such as a company's earnings.

1 Introduction

Companies announce their earnings every quarter. Leading up to this event, financial analysts make predictions of what they think the earnings per

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† Read More: Nath, Trevir. "Investing Basics: What Is The Efficient Market Hypothesis, and What Are Its Shortcomings?" *NASDAQ.com*. 15 Oct. 2015.

**Yahoo Finance – S&P500 Historical Stock Data

share (EPS) will be. The consensus EPS (Earnings Per Share) is the average of the expectations. Market participants often use these predictions as benchmarks for how good or bad the company the company has performed in the previous quarter. Typically, higher EPS suggest that a company performed better, and higher (lower) EPS than estimates mean that a company outperformed (underperformed) their expectations. If the actual EPS comes in higher than the expected amount, this is generally good for the stock price. A company that is consistently meeting or beating its expectations signifies strong performance[†].

The time before a company's earnings statement represents the period of time where analysts make predictions of expected company EPS. A company's earnings for the quarter is unknown until the earnings release date – the quarterly report in which a company details their performance. The definition of earnings surprise is the relative difference between its consensus EPS forecast and actual Earnings per share**. Numerous papers have detailed the stock price fluctuations of what happens after a positive / negative earnings statement – about how markets react after information is released. In this paper, I focus on the stock price changes *before* the information is released. I mentioned before that stock prices are forward looking; therefore, expected future earnings, as well as other economic factors in the future, play an important role in a company's stock price.

We see this in the general stock price formula – a formula for calculating a company's expected stock price:

Stock Price = $Present\ Value\ of\ EPS\ (assuming\ no\ growth)\ -\ NPVGO$

Where NPVGO = Net Present Value of future growth opportunities for the company; Present Value is calculated by dividing future value by the time-discounted rate.

† Performance: "The NASDAQ Dozen: Positive Earnings Surprises." *NASDAQ.com*

If the market believes that future Earnings Per Share (data reported on earnings reports) is expected to be higher, then stock price for a company will increase if the market factors in the expectation or other information. Thus, higher expectations of future earnings result in higher stock prices. This makes sense, because higher expectations of earnings suggest that people believe that the company is performing better than expected. Stock price rises. On the other hand, lower expectations of earnings would result in lowering stock price.

In the 1990s, companies before an earnings report would often do everything possible in order to meet earnings expectations**. As accounting laws tightened, fewer companies have manipulated their earnings statements to match expectations. During these times, earnings surprises were rare. As accounting method became more highly regulated, earnings statements more closely reflected true performance.

In my paper, I will look at the effects of this "expectation" on stock market prices for a group of companies. I analyze whether increasing expectations and an increasing stock price correlates with positive earnings surprise. By comparing stock price changes between companies with positive and negative earnings surprises, I hope to analyze how well the market can "predict" such surprises, or price in the surprise, with corresponding increases or decreases in stock price before the surprise occurs.

2 Exploring the Data

The Data consist of observations of 429 companies in the S&P500 Index during Q2 earnings period ranging from June to October 2016. The data is

**Source: Kothari, S.P. "Stock Returns, Aggregate Earnings Surprises, and Behavioral Finance." *Journal of Financial Economics* (2006): 537-68. 30 Sept. 2005.

obtained from Historical Stock Data Website. I focused on companies from the S&P500. The Standard & Poor's 500 Index is the most commonly used benchmark for determining the state of the overall economy, and captures a wide market breadth of large-cap companies included in the index. Because company earnings reports occur in different dates, ranging from June to November in 2016Q2, this tends to average out the daily market trends of returns. Analyzing different returns at different dates makes our returns less influenced by market trends, for example – large returns of a group of companies in a few days because of a news report.

The Historical Stock Data contains data of daily stock prices of 440 of the 500 S&P companies. Data was omitted for 60 of the companies. Of the remaining 440, 10 companies were either acquired or merged with another company during the time period, and 1 (WFR) declared bankruptcy. From the remaining 429 companies, I extracted data from NASDAQ's website of the earnings report date and earnings surprise for 2016 Q2. I calculated relative surprises using the formula:

$$\text{Relative Surprise} = \frac{(Company\ Reported\ EPS\ -\ Consensus\ Expected\ EPS)}{Consensus\ Expected\ EPS}$$

In the second fiscal quarter (Q2) of 2016, we see that there is a wide range of earnings surprises.

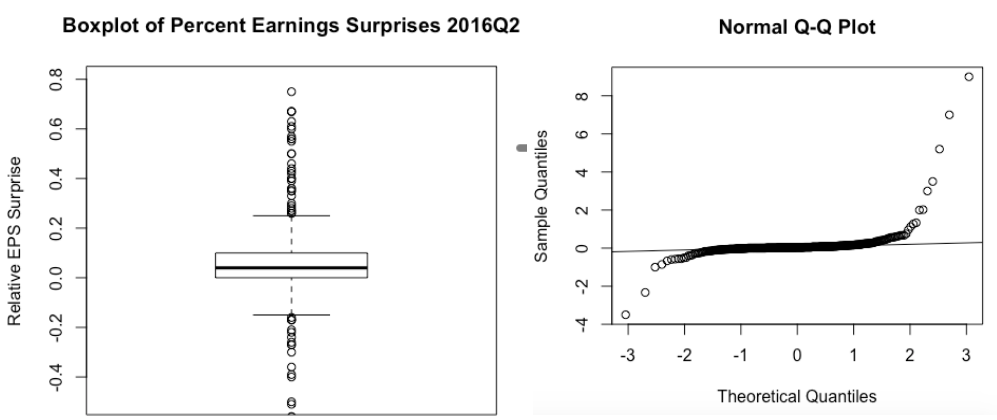


Figure 1: Box Plot and Normal QQ of Relative Earnings Surprises 2016Q2

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-3.5000  0.0000  0.0400  0.1193  0.1000  9.0000
```

We see that the median of earnings surprises is positive and the data looks to be skewed left. 305 out of 429 companies had a positive earnings surprise. Two standard deviations below the mean surprise would still be positive. The data suggests that earnings reported ended to have positive surprises in the quarter. The majority of the data follows a normal distribution, but we see that the data has fat tails and significant outliers. While the majority of the data falls between -20% and 30% surprise, our calculations are largely impacted by these outliers, which include a min of 350% and a max of 900% surprise.

To analyze the performance of companies before these surprises occur, I will begin by focusing on the returns of the company 7 days before their earnings report date. We obtained this data through looping. For each company, we found their earnings report date from NASDAQ. Next we matched this date with their stock price 1 day before the earnings date, as well as the stock price for 7 days before. For each company, we then calculated returned between these two dates and combined each company's data into one data set.

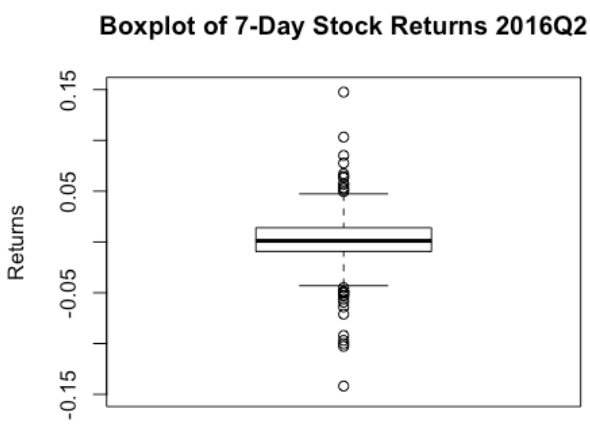
Returns in this date range differ for each company with different earnings dates. However, they represent an arbitrary time frame in which the future expectation is priced into the stock price itself. As a group, they represent the "average" or the "market" returns before the earnings quarter. Theoretically, future earnings should be factored into a stock price more than a week before an earnings report. However, for the scope of this paper, I will mainly focus within the 7-day period, where new information factors into expectations of a company's expected earnings. The consensus EPS for a company changes with various new information, and expectations for future performance changes as well. Investors

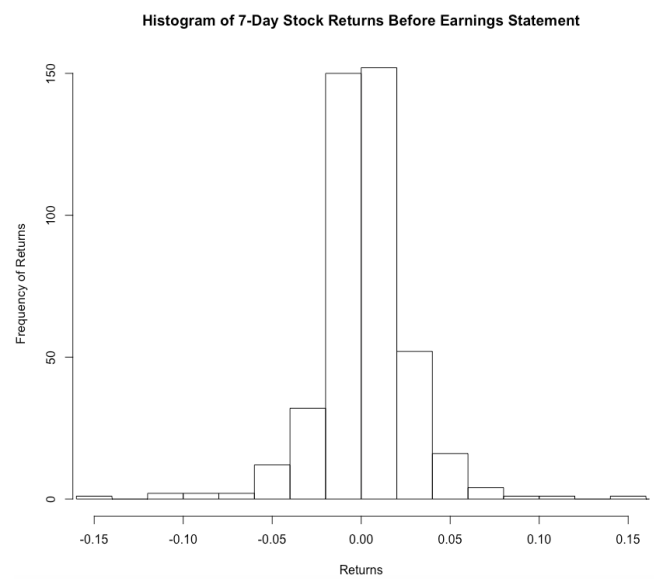
react to news of changing earnings expectations, and stock prices fluctuation to reflect the different forward outlook on companies.

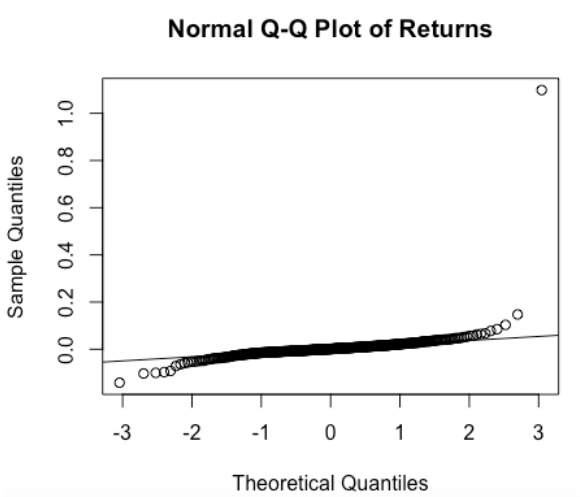
I calculate stock returns with the following formula

$$Returns = Log\left(\frac{Ending\ Stock\ Price}{Beginning\ Stock\ Price}\right)$$

Figure 2: Box Plot, Histogram, Normal QQ of 7-Day Returns 2016Q2








```
> mean(Returns8)
[1] 0.004269294
> var(Returns8)
[1] 0.003478886
```

```
    Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-0.141800 -0.009291  0.001083  0.004269  0.014000  1.099000
```

Looking at the data at the 429 companies, we see that the their total week returns before their earnings follows an approximately normal distribution. In addition, there appears to be fatter tails, they appear to be less significant than the outliers in earnings surprises. The majority of the companies had between -5% and 5% returns. We calculated the correlations between Earnings Surprises and 7-Day Returns to see if there is correlation between returns and Surprises as a whole.

```
> cor(Surprises, Returns8)
[1] -0.01178961
```

We found that there is close to 0 correlation, which suggests that on average, positive returns before an earnings date is uncorrelated with how positive or negative an earnings report may be. On average, market gains or losses for the week prior does not correlative with positive or negative earnings surprise. However, we believe that this initial analysis is flawed due to the large amounts of outliers, both in the positive and negative direction that may skew the data. We will now wrangle the data into different categories to analyze if there is a difference with earnings surprises for companies with different prior returns. I will look the returns for 7-Days and 1-Day before a company's earnings date.

Comparing Surprises vs. 7-Day Positive Returns

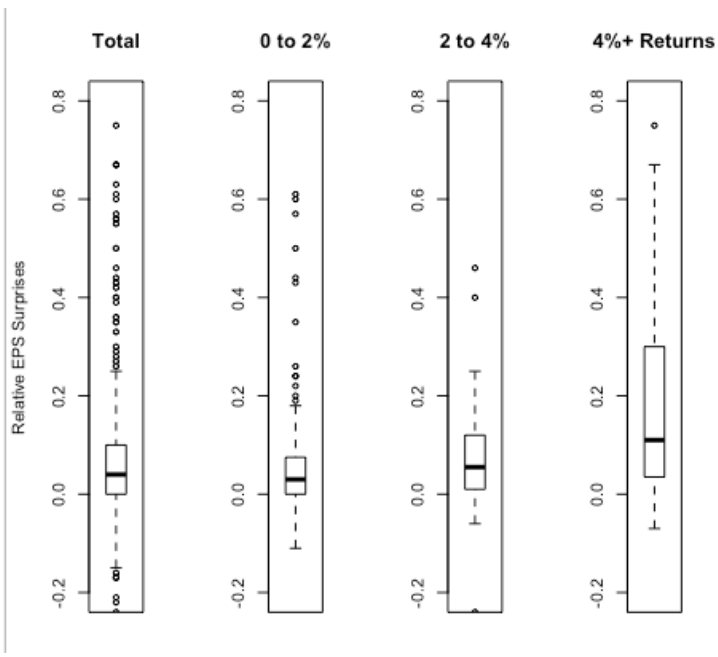
In our analysis of stock price fluctuations before earnings statements, we will first look at 7-day returns. As we noticed before, stock returns appear approximately normal. The 25th and 75th percentile are around -1% and 1.5%.

In our analysis, we will compare the relative earnings surprises of companies with different returns over the weeklong span before their earnings report date. We arbitrarily picked a length of time in which we believe market will factor in predictions for the quality of the earnings report. A quarterly earnings report is

very influential for investors, as it deals earnings in the past quarter, future company outlook, and other important notes. We split the companies into a few categories. First, we looked at the surprises for companies that had positive returns over the week and will compare it to the all the companies in the dataset.

We split the data into 7-day returns greater than 0% to 2%, 2% to 4%, and above 4%, and compared it to the relative surprises of the total 429 companies.

Figure 3: Comparison of EPS Surprise Distribution for Different 7-Day Positive Returns 2016Q2

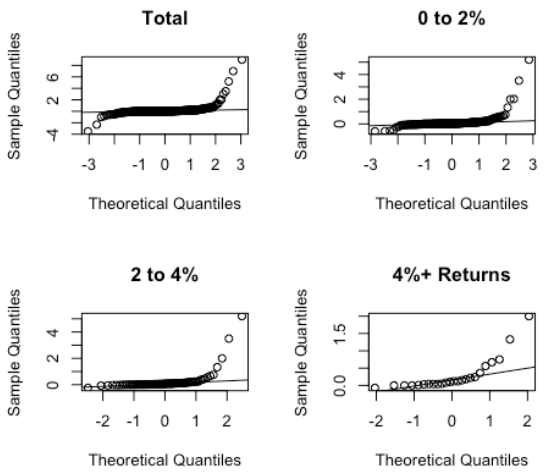



```
> summary(Total)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-3.5000  0.0000  0.0400  0.1193  0.1000  9.0000
> summary(Returns0to2)
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-0.60000  0.00000  0.03000  0.05711  0.07250  2.02000
> summary(Returns2to4)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
 -0.240   0.010   0.055   0.236   0.120   5.200
> summary(Returns4up)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-0.0700  0.0375  0.1100  0.2925  0.2700  2.0000
```

```
> cor(Joined$Q2EarningsSurprise.x, Joined$Returns7)
[1] -0.01178961
> cor(Positive0$Returns7, Returns0to2)
[1] -0.01947391
> cor(Positive1$Returns7, Returns2to4)
[1] -0.001260766
> cor(Positive2$Returns7, Returns4up)
[1] -0.03434869
```

We find that the median relative earnings surprises for companies with larger returns (4%+) in the prior week were higher than the relative surprises for the companies as a whole. In addition, while higher positive surprises in the total data set tended to be outliers, they were not so for companies with higher pre-week returns. However, there was still very low correlation between returns and earnings surprises for companies in each category.

Figure 4: Normal QQ Comparison of 7-Day Returns 2016Q2

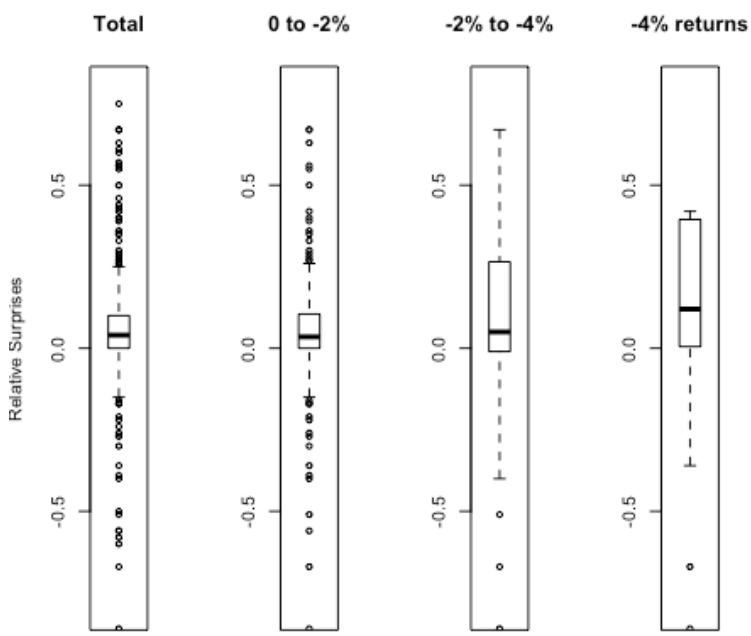


From the Normal Q-Q plots of the data, we see that there tended to be less negative outliers for the more positive 7-day returns, but positive earnings surprise outliers remained. Positive earnings surprises suggest that a company significantly outperformed their expected earnings per share. The data suggests that for companies with 7-Day higher returns, on average had higher median / mean earnings surprises. Very positive reports (above the normal) are present in each category of positive returns, but are larger positive returns of 2 and 4% had a higher top 25th percentile of earnings surprise. Therefore, the data suggests that there is higher probability distribution to higher relative surprises for companies with higher 7-day returns.

Comparing Surprises vs. 7-Day Negative Returns

Next, we will compare the earnings surprises for companies with negative returns for the week before their earnings date, to see if there is an association in the negative direction. Because there are fewer data in the higher negative returns, we divided the data into the categories, 0% to -1% returns, -1% to -2% Returns, and less than -2% Returns. Using similar calculations, we computed the following graphs:

Figure 5: Box Plot Comparison of Surprises – Different Negative 7-Day Returns 2016Q2

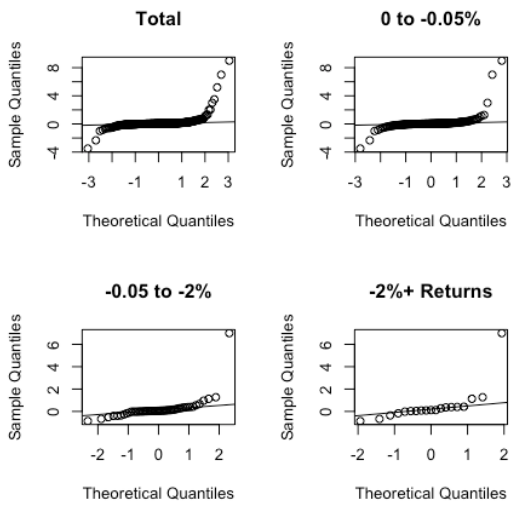



```
> cor(Joined$Q2EarningsSurprise.x, Joined$Returns7)
[1] -0.01178961
> cor(Negative0$Returns7, NegReturns0to2)
[1] -0.0504647
> cor(Negative1$Returns7, NegReturns2to4)
[1] -0.3071779
> cor(Negative2$Returns7, NegReturns4up)
[1] -0.2428688
```

We find that the median relative surprise is slightly higher for more negative returns. Negative returns for the week prior did not exhibit an association with earnings surprises for 2016Q2. This is surprising, because the data suggests two possibilities. Either the market in incorrect in their prediction – negative 7-Day returns -> not very negative earnings surprise, or that companies with low expected performance more were likely to outperform their expectations. There

was a stronger negative association between the Returns and Earnings Surprises for companies with higher negative returns before their earnings statement.

Figure 6: Normal QQ Comparison of Surprises for Different 7-Day Negative Returns 2016Q2



From normal QQ plots, we see that the amount of positive surprise skew for negative 7-day return companies is fewer than for companies with positive returns. In addition, there is a skew towards negative surprise outliers. However, company which negative returns on average did not exhibit negative earnings surprises. The surprises still followed a close normal approximation with fat tails, and even positive median and mean.

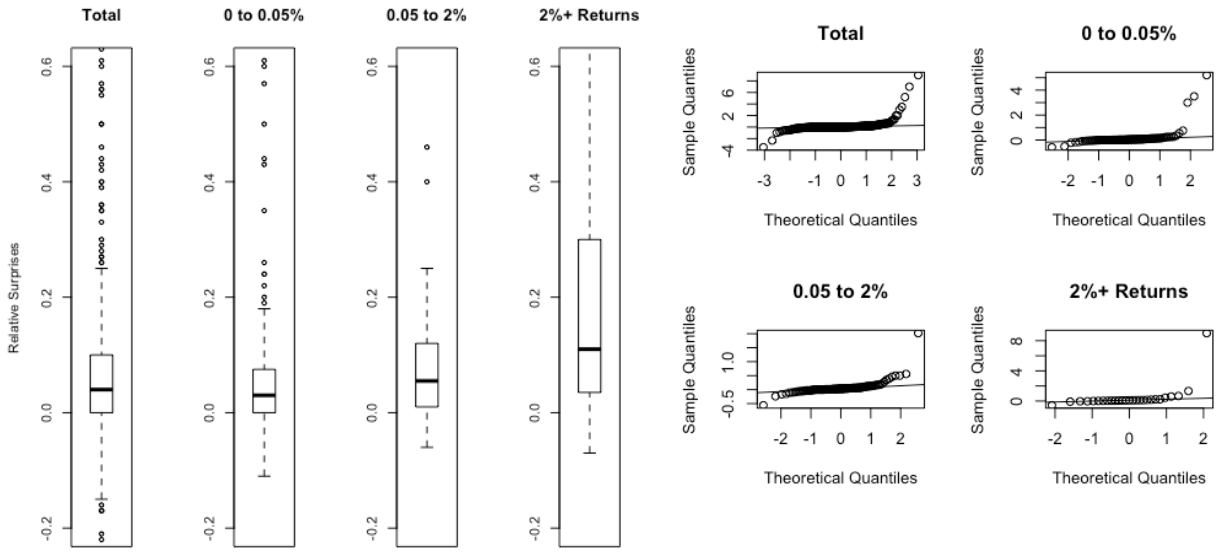
It is important to recognize that companies' earnings report details more than just Earnings Per Share. Quarterly reports often detail future outlook of a company and operations – which play a factor in stock price and company outlook as well.

Comparing Surprises vs. 1-Day Returns

Next, we performed analysis on companies with for their stock prices changes the day before the earnings date. For this analysis, we will see if there is correlation between earnings surprise as last day returns. We are analyzing how the market reacts to last day information to the market, forecasting future earnings, and changes. We want to analyze stock price changes for the day before a big event for a company.

As we expected, the Q2 Total Earnings Surprises did not change, because we are using the same time period earnings surprises. However, the 1-day returns for each company changed. 1-Day returns tend to have less spread than 7-day returns. For example a 4% change in stock in one day occurs less than a 4% change in stock price in 7 days, due to the effects of compounding returns. Therefore, we grouped the data by lower measurements of return. Only 7 companies in our data set displayed a >4% one day return before their earnings statement. Therefore, we split our positive returns by 0.05%, 2%, and >2%. Wrangling the data, we computed the following graphs:

Figure 7: Box Plot and QQ Plot Comparison of Surprises for Different 1-Day Positive Returns 2016Q2



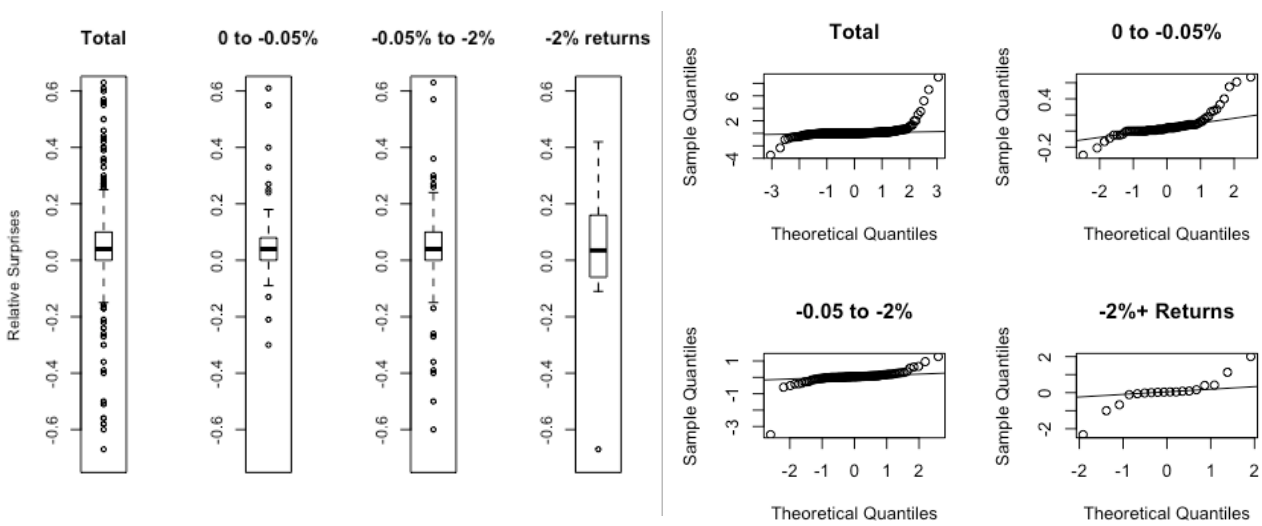
```
> summary(Total)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-3.5000  0.0000  0.0400  0.1193  0.1000  9.0000
> summary(Returns0to05)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-0.5800  0.0000  0.0400  0.1800  0.1125  5.2000
> summary(Returns05to2)
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-0.56000  0.00000  0.03000  0.06961  0.07000  2.02000
> summary(Returns2up)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-0.5600  0.0350  0.1000  0.4844  0.2000  9.0000
```

```
> cor(Joined2$Q2EarningsSurprise.x, Joined2$Return2)
[1] 0.0749035
> cor(Positive0$Return2, Returns0to05)
[1] 0.1926265
> cor(Positive1$Return2, Returns05to2)
[1] -0.08395058
> cor(Positive2$Return2, Returns2up)
[1] -0.02034887
```

From the graphs, we find similar results for 1-Day returns as we did for 7-Day returns. The returns were lower than return for 7 days, so we adjusted our splits to split up the data based on relative returns. Over 7-Days, companies may typically have higher or lower returns because of compounding.

In comparison to 7-Day returns (figure 3), a company's 1-Day returns had higher correlation with the relative earnings surprise. The correlation was still weak, and may be related to other factors in the market at the time. Continuing our analysis with negative returns:

Figure 8: Box Plot and QQ Plot Comparison of Surprises for Different 1-Day Negative Returns 2016Q2



```
> cor(Joined2$Q2EarningsSurprise.x, Joined2$Return2)
[1] 0.0749035
> cor(Negative0$Return2, NegReturns0to05)
[1] -0.1500122
> cor(Negative1$Return2, NegReturns05to2)
[1] 0.001140721
> cor(Negative2$Return2, NegReturns2up)
[1] -0.05453158
```

We found no relationship between the returns and relative earning surprises for companies with negative earnings. Relative surprises for each split of companies with the negative returns followed a similar distribution. Negative returns 1-Day before an earnings date showed little to no relations with the relative distribution of earnings surprises.

Discussion of Results

The market makes predictions of future events. We analyzed the data of 7-day and 1-day returns in order to find an association with their prediction (factored into their returns before the date) and the actual earnings report – whether the report ended up having positive or negative news of a company's earnings for the quarter.

In our results, we find that companies with Positive 7-day returns before their earnings date tended to have a high mean and median positive earnings surprise. In the data, we found many outliers, both in the returns as well as in the Relative Earnings Surprises. Correlation between returns and earnings surprises was very low in nearly all categories, which suggest that the accuracy of market predictions are random, and having a high return over the period does not associate with higher surprises. Therefore, the data suggest that market predictions are not a

good indicator or predictor of future earnings surprises. However, low Positive 1-Day returns tended to have higher correlations to positive surprises.

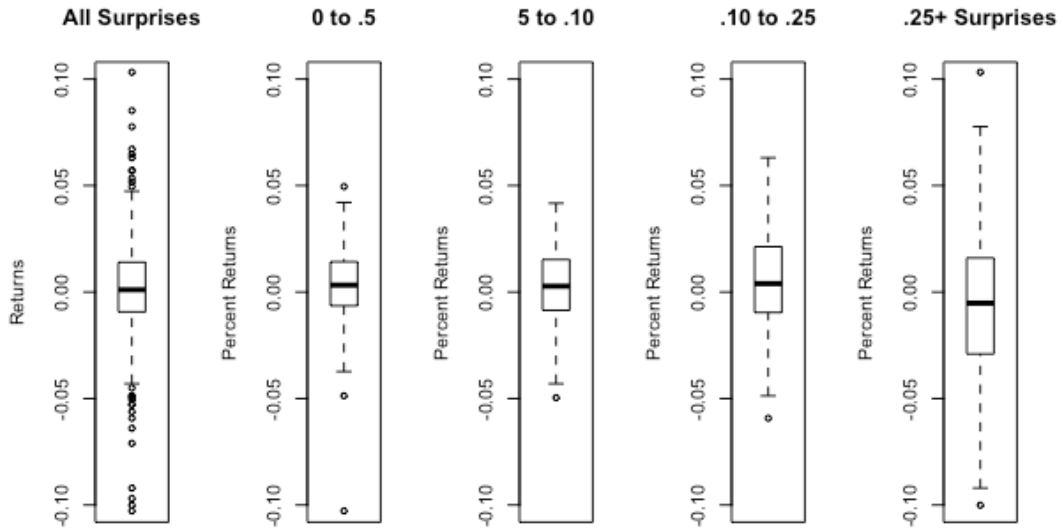
Our incentive for this research relates to the way the market makes predictions for big events. For example, the S&P500 companies had high returns before the Brexit vote, as well as the 2016 Presidential election (source). In the case of Brexit, the market factored in a high percentage of Brexit not occurring, believe it would be good for the market as a whole. For the 2016 Presidential election, S&P 500 had positive returns, factoring in a high probability to a Hillary Clinton Victory, which they believed would be beneficial for the market in continuing Barack Obama's economic growth policies (Will include Source). As we saw in both cases, the market predicted wrong, and the stock prices fell dramatically following the event. For our research, we focused on slightly less, but still significant news – company earnings reports. The market makes a prediction on earnings statements, and factors in the probability to the stock price. We must mention the difference between correlation and causation, so that we cannot make conclusions based on just one quarter of data. By analyzing surprises, we can make initial responses on how the market predicts important events such as earnings statements. It is important to recognize other factors that impact stock prices, including other news, company news, or other macro-economic occurrences. Therefore, when viewing the data, we cannot say that the market is accurate or inaccurate at making predictions, because the measurement of stock price has other factors in addition to the prediction of future news. The fact that there is data on earnings "Surprises" means that the market is constantly surprised by new information and data. With surprise in earnings and earnings reports, efficient markets incorporate the new information in the stock price and adjust for future predictions. There is more data out there on the effects of

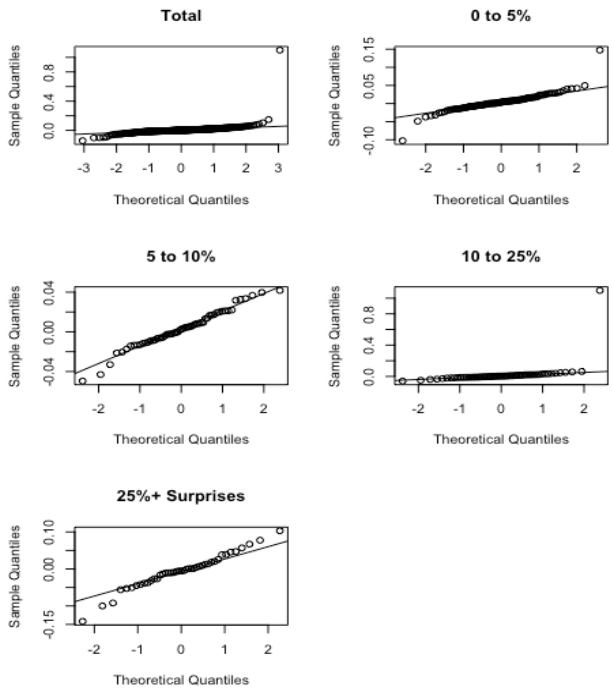
positive or negative earnings to stock prices AFTER the earnings statement, which involves discussions of market efficiency, behavior finance, and other long-term factors (source). In contract, our data focused the behavior of markets *before* an important event, and found in the 2016 Quarter 2 that stock price changes were more or less uncorrelated with results (surprises). If the stock price was solely based on future predictions, we could say that the market is rather inaccurate in making prediction on future events. More analysis on past earnings quarter is needed to make further or stronger statements on the accuracy of market predictions.

Additional Analysis

For further, instead of dividing by previous returns, we will split the companies into their earnings surprises and analyze the returns for 7-day prior. Instead of forward looking, we will use backward-looking analysis to find association with earnings surprise and previous returns. We are attempting to find if companies with positive or negative earnings surprises tended to have positive or negative earnings for the week prior.

Figure 9: Box Plot and QQ Plot Comparison of 7-Day Returns for Different Positive Surprises

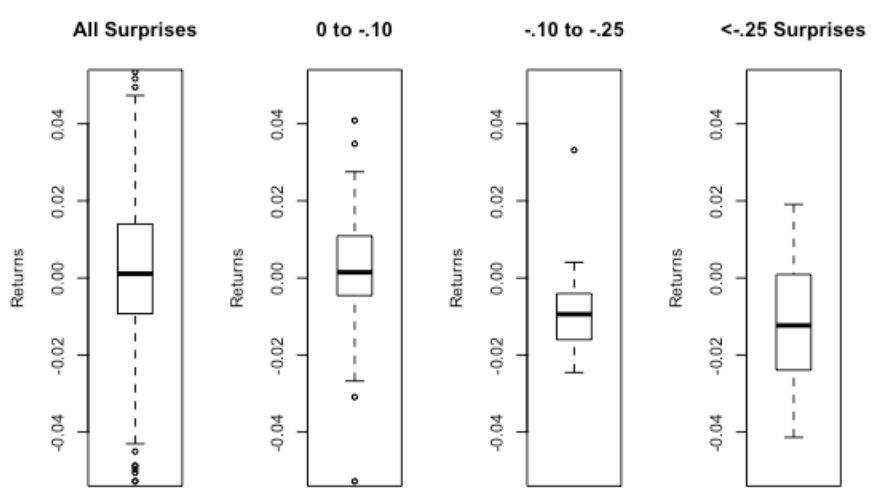


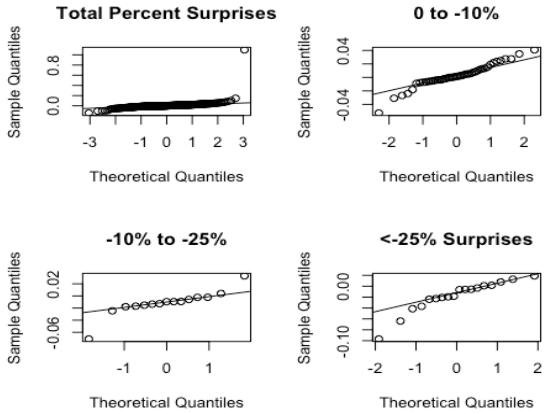



```
> cor(Positive1$Q2EarningsSurprise.x, Returns05)
[1] 0.04226515
> cor(Joined$Q2EarningsSurprise.x, Joined$Returns7)
[1] -0.01178961
> cor(Positive0$Q2EarningsSurprise.x, Returns0)
[1] -0.02337324
> cor(Positive1$Q2EarningsSurprise.x, Returns05)
[1] 0.04226515
> cor(Positive2$Q2EarningsSurprise.x, Returns1)
[1] -0.1099061
> cor(Positive3$Q2EarningsSurprise.x, Returns25)
[1] -0.05255949
```

The returns for each category of surprises all appear approximately normal, with low to insignificant correlation with their previous 7-day returns. We continue our analysis for negative surprises:

Figure 10: Box Plot and QQ Plot Comparison of 7-Day Returns for Different Positive Surprises






```
> cor(Joined2$Q2EarningsSurprise.x, Joined$Returns7)
[1] -0.01178961
> cor(Negative0$Q2EarningsSurprise.x, NegReturns0)
[1] -0.119327
> cor(Negative1$Q2EarningsSurprise.x, NegReturns1)
[1] -0.213518
> cor(Negative2$Q2EarningsSurprise.x, NegReturns2)
[1] -0.03224815
```

For the 7-Day returns of companies with negative earnings statements, we find the results more interesting. Companies that had large negative news, with lower than -10% and -25% surprise, tended to have lower median and mean returns. Companies that had released an earnings statement a -25% or lower surprise means that they significantly underperformed their expected earnings. These companies also displayed lower returns for the 7-days prior. This suggests that the market more accurately expect these companies to have large negative reports, and adjusted prices accordingly. In addition, when looking a the Normal QQ plots, strong negative outliers in 7-day prior are more present for companies with -25% or below earnings surprises. 75 percent of the returns were below 0%. As an investor, avoiding companies with these strong negative returns may increase their probably of avoiding negative news.

Conclusion

From our results, we have seen that there is low correlation between 7-day company returns and relative earnings surprise. Therefore, market returns before an earnings report does not give information, on average, of the relative positive or negative earnings surprise. The market's future expectations are not a good

indicator of true performance. The gains for losses in stock price returns before an event reflect the market pricing in new information. Expectations of future earnings are a portion of this information, but not all of it. There are other factors that may impact stock returns before earnings statements, such as macroeconomic trends or company news. In our analysis, we used 429 companies in order to average out these external effects. The spread of earnings reports over a few months also factors out analyst predictions – more positive earnings surprises may lead to higher analyst expectations for the same quarter.

Higher or lower stock price returns before an event suggest that the market may be pricing in the probably of the result. We found that this was the case for Brexit and the U.S. Election, based on S&P500 returns before an after the event. We found in our analysis of 2016 Quarter 2 that the returns are uncorrelated with the surprises. However, we found that for companies that had negative surprises, their prior returns tended to be negative as well.

The market may not have been accurate in predicting earnings statements for 2016 Q2, but they more accurately predicted when a company was to have strong negative earnings reports. Continuing our previous discussion of results, we believe that we require more data on more earnings quarters in order to make more significant conclusions. Finding data on performance is hard. Companies come and leave the S&P500 index often, leaving many companies without data or reports (in our case, 71 of them).

The market will continue to make predictions and forecasts on events - future elections, earnings reports, or other macro-economic influences. The day that Donald Trump takes office – and what he says that day – is another event that the market is factoring in to this day. Stock prices factor in market expectations,

and the accuracy of these expectations may be based on other factors in the general economy and company performance. The fact that there is earning surprise means that the market is not very accurate at forecasting EPS, and surprises reflect the inaccuracy in predictions. Analysts in the market will keep trying to predict, and the analysis of more future events, as well as how the market behaves before them, can give more information on the effects of predictions and stock price fluctuations before the event.

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