A Study of Market Efficiency in the Period Preceding Earnings Announcements
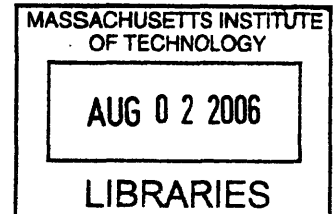
by

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ABSTRACT

The Efficient Market Hypothesis, which has been one of the fundamental propositions of finance for over 30 years, implies that an investor, whether he is an amateur or a professional trader, cannot consistently beat the market. In this study, we examine if this theory holds in the period preceding an earnings announcement, by testing whether there is a relationship between stock returns before and after an earnings announcement.

We find that there exists a negative correlation between pre-earnings returns and post-earnings returns for small capitalization stocks that could be explained by investor irrationality. This relationship is statistically significant for pre-earnings returns calculated up to a 10 day period preceding an earnings announcement and strongest over a 3 day period.

We also tested to see if there was a correlation between the earnings results in the last quarter and the movements in stock price prior to this quarter's earnings announcement, and did not observe any statistically significant outcomes.

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TABLE OF CONTENTS

1. Introduction

There is a large body of research addressing the post-earnings announcement drift. A study by Jegadeesh and Titman (1993) for example examines the inefficiencies that arise in the market in the days after earnings announcements and shows that it is possible to predict future stock returns[1] using current stock returns. This observation results from investors over-reacting or under-reacting to the profit figures released quarterly and is one of the many empirical findings inconsistent with the efficient market theory.

In the US, earnings announcements make public the amount of profit earned each quarter. Many investors use this information to adjust their expectations about a company's performance and to decide whether to invest in the firm's stock. The reaction to an earnings announcement can be evaluated by comparing the level of the actual earnings to the value previously expected by market participants. If the difference is positive, than the stock will have positive returns after the announcement, and vice versa. Therefore, what really matters is not the absolute value of the earnings but rather the difference between actual earnings and expected earnings. Although many studies like that of Jegadeesh and Titman (1993) have been done on how stock prices react after this event, a great deal of information on how prices move prior to the earnings announcement is still not available.

Investors are sometimes irrational in the way they make decisions which might lead to inefficiencies in the market. In this study, we test whether the market is efficient in the days preceding an earnings announcement. In order to do so, we plan to observe movements in the stock prices of 300 companies and develop a model through which we could predict future stock prices and determine whether we can achieve consistent abnormal returns in the market.

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[1] Stock return is the percentage change in share price over a defined period of time

2. <u>Background</u>

The Efficient Market Hypothesis has been one of the fundamental propositions of finance for over 30 years. Fama (1970) defined an efficient financial market as one in which security prices always fully reflect the available information. This theory implies that an investor, whether he is an amateur or a professional trader, cannot consistently beat the market. The efficient market theory is based on the idea that we should not be able to identify a predictable pattern in stock prices. Prices should be as likely to go up as they are to go down regardless of past performance. Indeed, suppose that the market could predict with great confidence, for example, that a week from now, the price of Microsoft will double. What would happen? Everyone would want to buy shares of Microsoft today and this would lead to an immediate price increase. Therefore the forecast of a favorable future performance would in fact cause an immediate price jump. Because of this, there would be no change in the Microsoft shares in a week, given that the price has already been adjusted today for this "good news". More generally, any time there is positive news about a company, its stock price will immediately adjust to the fair level. As such, we can only expect to earn on a stock its ordinary rate of return, which is nothing more than the return necessary to compensate us for the risk of the shares.

There are many empirical findings which demonstrate that the efficient market hypothesis generally holds, nonetheless, we find exceptions to the rule. Particularly, many studies examine the inefficiencies that arise in the market in the days around earnings announcements. Researchers have mostly focused on the post earnings announcement drift which is explained by theories in behavioral finance. Indeed, investors sometimes tend to be overly conservative leading to under-reaction to earnings announcement. Thus it takes them

longer to adjust their expectations and the stock price drifts in a predictable manner. Bernard (1992) found empirical evidence of this phenomenon by showing that stocks that have high earnings surprises also have higher earnings in the period after the announcement.

In his study, Bernard also finds evidence that stocks with high earnings surprises might also earn abnormal returns in the days prior to the announcement. Assuming that these returns aren't observed as new information is made public and incorporated into the stock price; these findings might be inconsistent with the efficient market hypothesis. Indeed, if investors behave in an irrational manner in the days preceding earnings announcements, then we might be able to predict future movements in stock prices. People tend to overestimate their abilities in predicting the market. Despite all evidence to the contrary, they believe that they are smarter than everyone else and can make better investing decisions. If investors were to bet on their ability to predict earnings and increased their buying/selling of shares in the days prior to an earnings announcement, then we might see a negative correlation between pre-earnings announcement returns and post-earnings announcement returns. Indeed, suppose investors **irrationally** believe that a company will have very good earnings this quarter (they have a "gut" feeling), and they start buying shares of the stock. The price of the shares will then go up in the days before the announcement and the stock will be overvalued since this increase in price was not caused by the release of any real information. Instead, the price was raised by market pressures coming from the increased demand. The earnings should be lower than predicted since expectations had been hiked up by irrational beliefs. Returns after the event would then be negative.

In this study, our objective is to test whether the market is efficient in the days preceding an earnings announcement. More specifically, we want to analyze if investors behave in the irrational manner described above. In order to do so, we plan to observe movements in stock

prices of US companies and develop a model with which we can determine whether or not there exist a negative correlation between pre-earnings announcement returns and post-earnings announcement returns.

We also want to examine which "irrationalities" might lead investors to make forecasting errors. More specifically, a series of experiments by Kahneman and Tversky (1973) indicate that people give too much weight to recent experiences and tend to make forecasts that are too extreme given the uncertainty inherent in their information. This suggests that maybe investors place a lot of weight on a firm's actual earnings from last quarter when making their forecast for this quarter's earnings. If this were the case, then they would buy stock from firms that did very well in the last quarter, thus raising the price of these shares right before the earnings release in this quarter. In order to examine this possibility, we will test the correlation between the returns after last quarter's earnings announcement with the returns before this quarter's announcement. In an attempt to determine if size and visibility of a company would influence our results, we also conducted all of our research on two separate groups: large capitalization firms and small capitalization firms.

3. <u>Methods</u>

We completed the research in multiple stages. We first gathered and sorted information on various stocks into an excel spreadsheet, and then performed the appropriate analysis on this data.

3.1. Data Collection

A substantial portion of the time dedicated to this study was spent collecting and organizing the information necessary to calculate the returns around earnings announcements. The first step was to obtain a list of stocks along with their market capitalization[2]. In this study, we used market cap as a proxy for the size and visibility of a firm since it is generally true that larger and better known companies have a higher value of equity. From the New York Stock Exchange's website (_www.nyse.com_), we downloaded into excel a complete list of all the stocks listed on the exchange, as well as their total market cap as of October 31st, 2005. This list of over 3600 companies was sorted by size, with equity values ranging from close to zero to over 450 billion.

From there, two groups of stocks were chosen: small cap and large cap. The problem with very small companies is that there isn't a substantial amount of information available on them. As such, we couldn't find data on stocks with a market cap under $300 million. Therefore, the "small cap" group was comprised of 150 stocks with equity values between $300 and $800 million. The "large cap" group was comprised of 150 stocks with equity values over $15 billion.

For each of the companies in the two groups, the date and time of their earnings announcements then had to be determined. For the purpose of this study, we only needed

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[2] Market capitalization, often abbreviated to market cap, refers to the total value of a firm's equity. It is measured by multiplying the total number of shares outstanding by the price of those shares

earnings information for two consecutive quarters during 2004. The year 2004 was chosen because it was the most recent period of time for which pricing data was available. The information needed was found on _www.earnings.com_. On this website, we looked up each stock individually. We were provided with the exact day of the earnings releases and also whether these announcements were made Before the Market Opened (BMO) or After the Market Closed (AMC). Knowing if an event was BMO or AMC was crucial since it indicated more accurately the time of the announcement. When information for one company could not be found, we eliminated it from the group and randomly selected another stock with similar market cap to replace it. Choices that had earnings releases during the middle of the day (not BMO or AMC) were also eliminated, since the price of shares was only given at market close.

Finally, in order to gather stock prices for all the companies in the two groups, we took advantage of the resources on the Wharton Research Data Services (WRDS) website at _http://wrds.wharton.upenn.edu/_. WRDS is a web interface that provides access to a number of databases in the field of finance. More specifically, we used the database CRSP (Center for Research in Security Prices) in order to find the desired stock prices. By inputting the list of stock tickers for the 300 companies into the database, we were able to download into excel the closing price on each day of 2004 for all of the stocks in the two groups.

3.2. Model

Once all the data had been gathered, we created an excel model that allowed us to calculate the returns around the companies' earnings announcements. Returns were calculated as the percentage change in share price over a period of time. The model was created in such a way that the number of days over which the returns were computed could be changed. If the earnings release was made for example before the market opened on July 9th, then the post-earnings return was calculated as the change in share price between the closing price on July 8th and the closing price on July 9th. Also, some adjustments had to be made in order to account for the time of day of the announcement. Any announcement made after the market closed on a particular day was considered to be the same as an announcement made before the market opened on the following day.

One key assumption in this analysis is that the change in share price in the day following the announcement is in large part due to the earnings news released. The post-earnings announcement return was thus calculated over a 1 day period given that the more time passes after the announcement; the less the movements in share price are attributable to this event. The pre-earnings announcement returns were calculated over 1 day, 2 day, 3 day, 5 day, 10 day, 15 day, 20 day and 30 day periods, in order to see how the results obtained varied as the time to the earnings release increased.

3.3. Analysis

3.3.1. Pre-announcement return vs. Post-announcement return

We did a regression of the post-announcement returns on the pre-announcement returns (for all the different time periods listed in section 2.2) to test whether there was a linear relationship between these 2 variables. In order to determine if the results were statistically significant, we also computed a t-Stat for the coefficients and calculated the R-Square of the regression.

3.3.2. Last quarter earnings vs. Pre-announcement return

We wanted to determine whether last quarter's earnings influenced people's decision to buy/sell shares of a firm before this quarter's earnings announcement. In order to do so, we did a regression of the pre-announcement returns (for all the different time periods listed in section 2.2) before this quarter's earnings release on the post-announcement returns after the last quarter earnings release to test whether there was a linear relationship between these 2 variables. In order to determine if the results were statistically significant, we also computed a t-Stat for the coefficients and calculated the R-Square of the regression.

4. <u>Results</u>

4.1. Pre-announcement return vs. Post-announcement return

The regression of the post-announcement returns over the pre-announcement returns showed a statistically significant linear relationship for the small capitalization stocks but not for the large capitalization stocks

4.1.1. Small capitalization stocks

The results for small capitalization stocks shown in Table 1 and Table 2 indicate a statistically significant[3] correlation between returns before an earnings announcement and those after the event. Indeed, returns calculated up to 10 days before the earnings release, seem to have a negative correlation with the outcome of the earnings announcement. This relationship is only significant for the time right before the announcement, as we find regression lines with slopes around zero for returns calculated over a period equal to or greater than 15 days.

Table 1: Regression Results for Small Cap Stocks

| | Pre-Announcement Returns Calculated over a Period of | | | | | | | |
| | 1 Day | | 2 Days | | 3 Days | | 5 Days | |
	Coefficient	t Stat	Coefficient	t Stat	Coefficient	t Stat	Coefficient	t Stat
Intercept	0.00	0.69	0.01	0.97	0.00	0.61	0.00	0.70
Slope	-0.63	-2.36	-0.67	-3.38	-0.56	-3.45	-0.33	-2.48

| | Pre-Announcement Returns Calculated over a Period of | | | | | | | |
| | 10 Days | | 15 Days | | 20 Days | | 30 Days | |
	Coefficient	t Stat	Coefficient	t Stat	Coefficient	t Stat	Coefficient	t Stat
Intercept	0.00	0.04	0.00	0.27	0.00	0.68	0.00	0.48
Slope	-0.25	-2.50	-0.01	-0.12	0.00	-0.01	0.00	1.29

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[3] Any coefficient with t-Stat above 2 is considered statistically significant

From Table 2, we can see that the observed correlation is strongest for pre-earnings returns calculated over a 3 day period. Indeed, although the R-Square is small, it still indicates that 7.7% of the variation in the returns after the earnings event can be explained by the returns before the announcement.

Table 2: Correlation Results for Small Cap Stocks

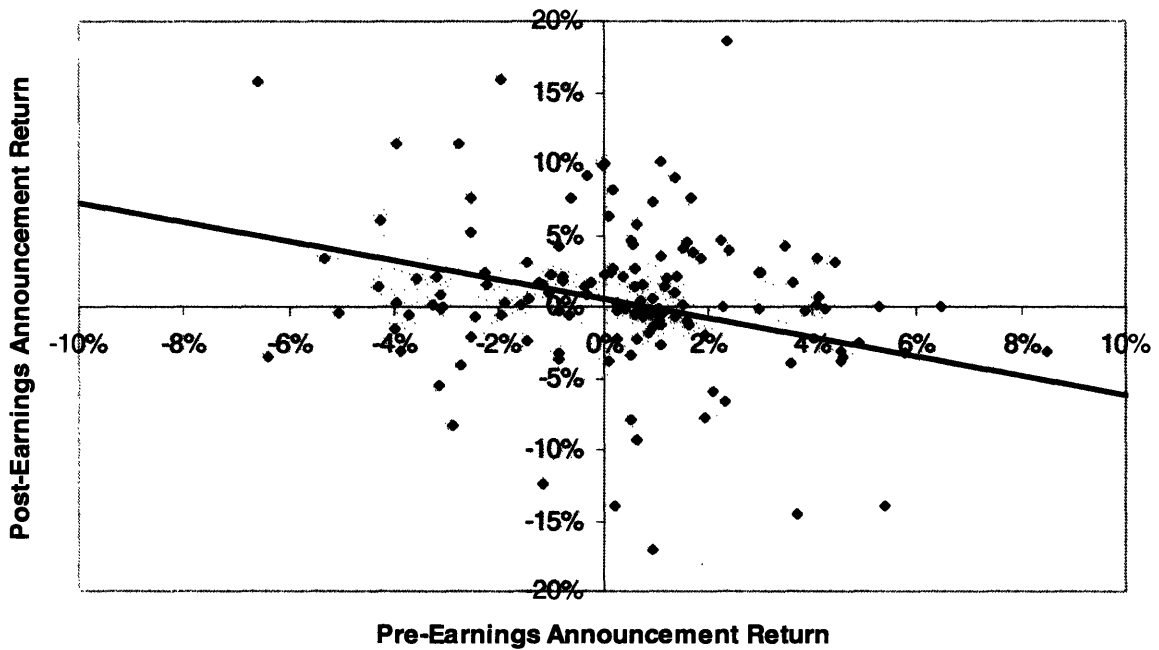|	Correlation	R-Square
1 Day	-0.20	3.8%
2 Days	-0.27	7.4%
3 Days	-0.28	7.7%
5 Days	-0.20	4.2%
10 Days	-0.21	4.3%

Graph 1: Pre-announcement return vs. Post-announcement return graphs

For Pre-Earnings Returns Calculated over a Period of 1 Days
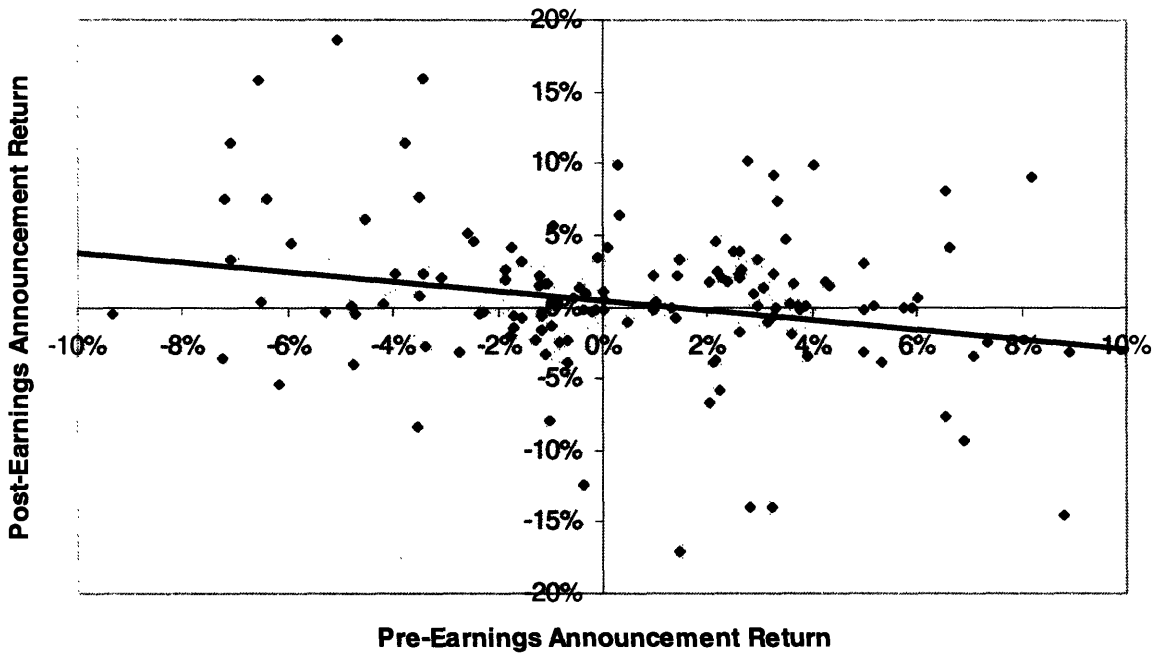
Pre-Earnings Announcement Return

For Pre-Earnings Returns Calculated over a Period of 2 Days

Pre-Earnings Announcement Return

For Pre-Earnings Returns Calculated over a Period of 3 Days

Pre-Earnings Announcement Return

For Pre-Earnings Returns Calculated over a Period of 10 Days

Pre-Earnings Announcement Return
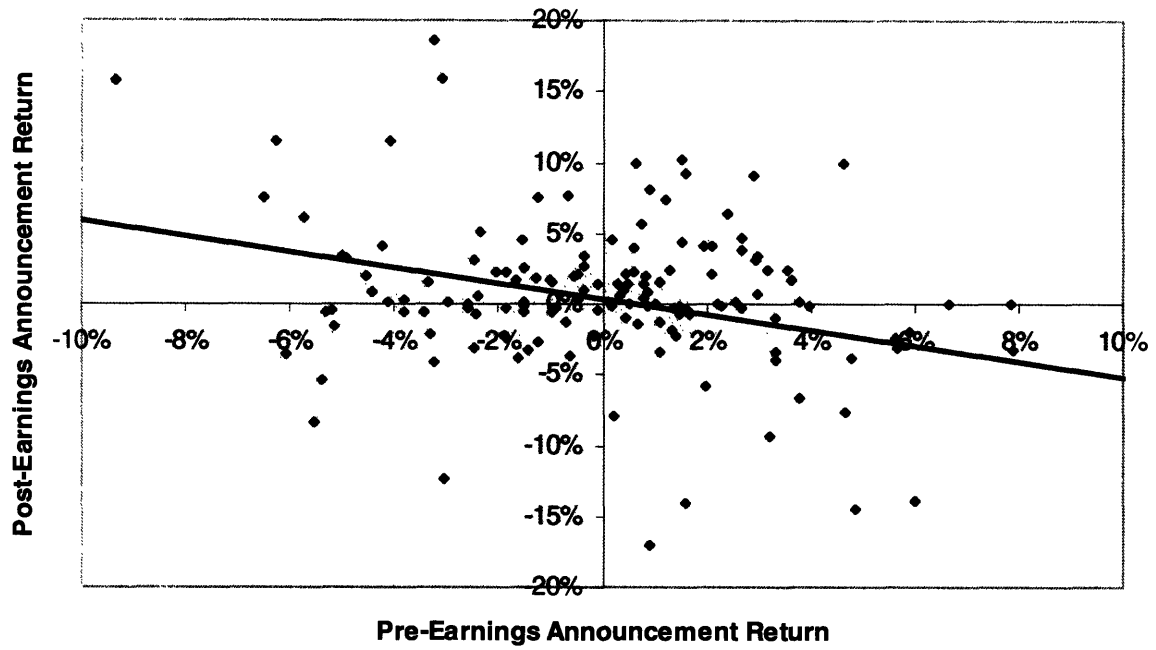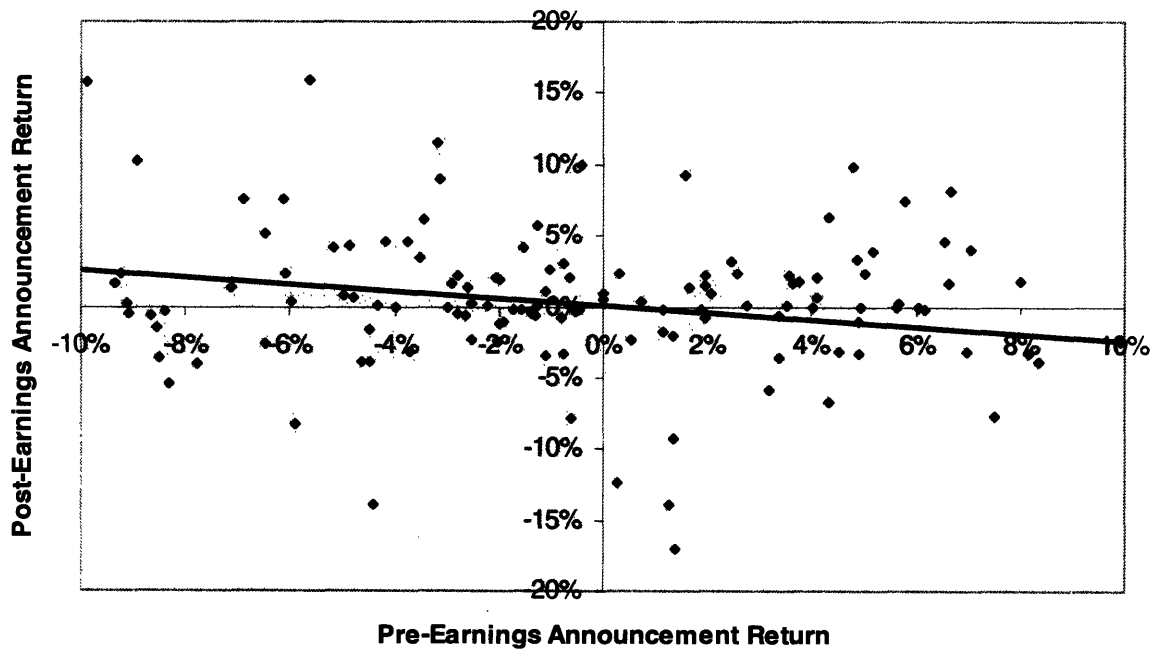
4.1.2. Large capitalization stocks

The results for large capitalization stocks, shown in Table 3 and Table 4, indicate that there is

no statistically significant relationship between returns before an earnings announcement and

those after the announcement. Indeed, none of the regression coefficients have a t-Stat above 2,

and the R-Square for the different periods are all below 1%.

Table 3: Regression Results for Large Cap Stocks

| | Pre-Announcement Returns Calculated over a Period of | | | | | | | |
| | 1 Day | | 2 Days | | 3 Days | | 30 Days | |
	Coefficient	t Stat	Coefficient	t Stat	Coefficient	t Stat	Coefficient	t Stat
Intercept	0.00	-0.54	0.00	-0.50	0.00	-0.51	0.00	-0.17
Slope	0.17	0.72	0.08	0.45	0.04	0.24	-0.07	-1.54

Table 4: Correlation Results for Large Cap Stocks

	Correlation	R-Square
1 Day	0.07	0.5%
2 Days	0.04	0.2%
3 Days	0.02	0.1%

4.2. Last quarter earnings vs. Pre-announcement return

The regression of this quarter's pre-announcement returns over last quarter's post-announcement returns suggests that there isn't a statistically significant relationship between these two variables in both the small cap and large cap categories.

4.2.1. Small capitalization stocks

As shown in Table 5 and Table 6, there does not seem to be a correlation between the earnings results in the last quarter and the movements in stock price prior to this quarter's earnings announcement. Indeed, none of the regression coefficients have a t-Stat above 2, and the R-Squares for the different periods are all below 1.5%.

Table 5: Regression Results for Small Cap Stocks

	Pre-Announcement Returns Calculated over a Period of							
	Day 1		Day 2		Day 3		30 Days	
	Coefficient	t Stat	Coefficient	t Stat	Coefficient	t Stat	Coefficient	t Stat
Intercept	0.00	2.66	0.00	1.69	0.00	0.30	0.00	-0.35
Slope	0.04	1.33	-0.03	-0.92	-0.06	-1.29	-0.24	-1.33

Table 6: Correlation Results for Small Cap Stocks

	Correlation	R-Square
1 Day	0.11	1.3%
2 Days	-0.08	0.6%
3 Days	-0.11	1.2%

4.2.2. Large capitalization stocks

From Table 7 and Table 8, there does not seem to be a strong correlation between the two regression variables. For pre-announcement returns calculated over a 1 day period before the earnings release, we do get statistically significant results. Nonetheless, this 1 day period is the only interval for which our coefficients are statistically significant and for which the R-Square is relatively large (6.1%). For the rest of the periods, we find no statistically significant relationship worth mentioning; suggesting that the correlation between the earnings results in the last quarter and the pre-earnings returns in this quarter is not strong.

Table 7: Regression Results for Large Cap Stocks

| | Pre-Announcement Returns Calculated over a Period of | | | | | | | |
| | 1 Day | | 2 Days | | 3 Days | | 30 Days | |
	Coefficient	t Stat	Coefficient	t Stat	Coefficient	t Stat	Coefficient	t Stat
Intercept	0.00	1.56	0.00	1.03	0.00	1.18	0.01	1.53
Slope	0.19	2.52	0.13	1.28	0.08	0.84	0.40	1.02

Table 8: Correlation Results for Large Cap Stocks

	Correlation	R-Square
1 Day	0.25	6.1%
2 Days	0.13	1.6%
3 Days	0.08	0.7%

5. Discussion

This study has led to a few interesting results on the behavior of investors around earnings announcements. As shown in Table 1, it seems that investors do behave in an irrational way in the days before an earnings event. Indeed, the fact that we see a negative correlation between pre-earnings returns and post-earnings returns for small capitalization stocks suggests that shareholders essentially "bet" on the outcome of the announcements.

However, the strategies developed seem to be based on behavioral patterns present in a majority of shareholders. In fact, if these bets were made in a purely speculative way, than we wouldn't observe the same results. For example, imagine that there are 1000 market participants in the economy. If all of these investors form their expectations in an independent manner and base their strategies on different rationales, then there would be about 500 people who think earnings will be positive and 500 who have the opposite view. This should be the case, because at any given time, share prices reflect all available information. Any "hunch" someone feels in theory should cancel out when we aggregate all the different expectations in the market. This is why the market inefficiency we observe in the days preceding earnings announcements seems to come from an irrationality common to many investors.

By testing for a correlation between post-earnings returns in the last quarter with pre-earnings returns in this quarter, we tried to determine if this common irrationality was that investors expected stocks with positive/negative earnings surprises in the previous quarter to have positive/negative earnings surprises in this quarter. Our findings show that such a correlation seems unlikely and that investors realize that we cannot predict future earnings outcomes using past earnings outcomes. This said, we should then ask ourselves why we would

observe this market inefficiency. First of all, we will assume that our observations do not arise from inefficiency in the period after the earnings event. As described in the background section of this report, there have been many studies that have analyzed patterns of stock movements in the period after earnings announcements and our results do not seem to fit with these findings. As such, we believe that the correlation observed comes from inefficiency in the period before the earnings event.

Future studies would have to be made to explore the exact reasons why such a pattern in stock prices would arise; however, we can make a few suggestions as to why investors might behave the way that they do. Indeed, the field of behavioral finance has contributed many findings on the psychology of decision making. There seem to be many "irrationalities" that characterize the way market participants make decisions. Two anomalies that might explain the behavior of investors before the announcement would be "Forecasting Errors" and "Overconfidence". "Forecasting Errors" refers the evidence that people give too much weight to recent experience compared to prior beliefs. In our case, that would mean that investors might for example believe a stock is doing very well because within the last month the stock price has been climbing, or because, last week, they read something positive in the news about the company. They would then make forecasts that are too extreme and the shares of the company would be overvalued right before the earnings release. After the earnings event, people would readjust their expectations and the price of the stock would go down. The second anomaly, which is "Overconfidence", refers to the fact that people tend to underestimate the imprecision of their forecast and overestimate their abilities. Because of this, investors might be placing a lot of importance on their "gut feelings" and make irrational decisions before an announcement. In any

case, further research would have to be done to test if these two anomalies indeed explain our findings.

Another question left to answer is why we observe statistically significant results for small cap stocks and not large cap stocks. We could suggest the following reason, although it is merely speculative. Large cap stocks are generally more visible in the economy and are followed by a greater number of people. Indeed, an important source of information for market participants is the research done by analysts. Large cap stocks are covered by a substantial amount of analysts (at least a few for each big investment bank) whereas this is not the case for smaller, less important companies. These analysts regularly publish a complete report on the company, which includes details varying from the health of the industry in which the firm is competing to a stock price target[4]. Aside from these research reports, there are also many places online that provide a list of data, such as historical stock prices or past earnings. This information is also usually more complete for large cap stocks. Therefore, when there are more analysts doing research on a stock, as well as more information readily accessible, it is less likely that a group of investors will make irrational, "gut feeling" decisions about buying or selling this stock.

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[4] A price target is the analyst's suggestion of what the share price ought to be

6. Conclusion

The Efficient Market Hypothesis generally holds, nonetheless our study puts forth another small instance where this theory breaks down. Indeed, it seems that investors behave in an irrational way in the days before an earnings announcement, leading to small cap stocks being overvalued or undervalued during this period. We have also shown that this anomaly, that characterizes the way market participants make decisions, is not related to last quarter's earnings. Therefore, the next step in our research would be to further explore the reasons why investors might make forecasts that are too extreme and maybe uncover a behavioral interpretation to our results.

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