

TESTING THE EFFICIENT MARKETS HYPOTHESIS: A BEHAVIORAL APPROACH TO THE CURRENT ECONOMIC CRISIS

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Senior Honors Thesis

Spring 2009

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ACKNOWLEDGEMENTS: I would like to thank Professor Glenn Woroch for his time and insightful advice throughout all stages of this project. I would also like to thank Professor Adam Szeidl for his valuable guidance in developing the idea for this project and in helping to execute it. I am grateful to Radu Ciupagea for his many contributions to the research and development of ideas, and to Professor David Ahn for his aid in developing the statistical design and concluding this paper.

ABSTRACT

In 2008, as financial markets responded to the economic crisis fueled by the collapse of sub-prime mortgage-backed securities, it appeared that finance theories could not explain the vast fluctuations in stock prices. Explanations for the random nature of the stock market emerged from the field of behavioral finance, citing panic and other investor sentiments as the key factors driving the irrational state of the market.

The goal of this project is to test the Semi-Strong Form of the Efficient Markets Hypothesis on 30 component stocks of the S&P 500 Index and to determine which types of stocks are more price-sensitive to news announcements. The period of study is during the 2008 Economic Crisis, from 30 July 2008 to 28 January 2009. I first assess the relationship between price volatility and frequency of news items for each of the 30 stocks. In order to empirically test the claim that behavioral factors affect price sensitivity to new information, I calculate stocks' net return relative to the market over a six-month period prior to that of study. I then consider the relationship between the coefficients from the initial 30 regressions and each stock's performance relative to the market.

Behaviorally, stocks that outperformed the market may have inspired positive sentiments among investors, while stocks that under-performed may have induced panic. My hypothesis is that stocks that under-performed relative to the market are more sensitive to new information, i.e. there is a negative relationship between the measure of price sensitivity to news (the coefficients from the initial 30 regressions) and the stocks' performance relative to the market. Alternatively, panic drives the price sensitivity to new information more than the thrill of investing in a high-return stock does, or simpler yet, the downside hurts investors more than the upside helps them. Although not statistically significant, this paper finds a negative relationship between price sensitivity to news and performance relative to the market. After removing two outliers, however, the relationship becomes positive although still not statistically significant. This suggests that euphoria may have been a bigger factor than panic in driving price volatility over the period studied.

1. Introduction

In the fall of 2008, the credit crunch that had emerged the previous year developed into the greatest Wall Street panic since Black Tuesday. Many of the nation's largest investment banks collapsed, reopened for business as commercial banks, or became virtually nationalized as the government bought large shares of their stock. The channels of credit became severely constricted due to banks' heavy investments in sub-prime and other risky securities.

Many analysts believe that three factors mainly contributed to triggering the financial crisis: 1) the rapid rise and subsequent fall of housing prices; 2) a widespread decline in the standards of mortgage endorsements, and 3) general mismanagement of investment risks by firms financially engaged in mortgage-backed securities and other financial instruments.

The roots of the crisis extend back to the tech bubble of the 1990s. Following an abrupt decline in the stock market in 2000, the Federal Reserve drastically cut interest rates in order to limit the economic damage by making more credit available at a lower price. While the mortgage lending industry grew, those who had been previously denied a loan due to risk of default became approved. Borrowing became cheaper as more people became eligible to take out mortgage loans, placing upward pressure on the demand and consequently the price of homes. As the frequency of these sub-prime loans grew, so too did the complexity of financial instruments created to resell the mortgage-backed securities while attempting to hedge against risk. Investors felt the risk of these assets was properly managed because the rising housing prices served as collateral in the case of loan default.

However, in 2007, two hedge funds owned by Bear Stearns who had invested heavily in sub-prime securities collapsed. As the year went on, more banks that had made similar investments faced financial turmoil, while the rising number of foreclosures fueled a drop in

housing prices. Firms who had invested heavily in mortgage-backed securities faced tremendous losses as many borrowers defaulted once their adjustable-rate loans adjusted, causing the value of the underlying securities to drop dramatically. At the same time, falling housing prices meant the value of the collateral on the mortgage-backed assets was also diminishing. Banks and other financial institutions then began to experience large losses on their holdings of sub-prime and mortgage-backed securities. In March 2008 the government helped Bear Stearns to avoid bankruptcy by assuming \$30 billion in liabilities and arranging its sale to JPMorgan Chase. In September, Lehman Brothers declared bankruptcy as the government refused to step in as it had for Bear Stearns. Soon after, Merrill Lynch sold itself to Bank of America to avoid bankruptcy, and AIG received an \$85 billion bailout from the US government. These events sparked panic selling in the stock market, driving the yields on risky assets even higher relative to those on risk-free assets. As the stock market began to move randomly and irrationally, rational efficient market theory no longer seemed to apply. In particular, it appeared that the Efficient Markets Hypothesis had been disproved once and for all.

2. The Efficient Markets Hypothesis

The Efficient Market Hypothesis was developed in the 1960s in the Ph.D. dissertation of Eugene Fama at the University of Chicago Booth School of Business. Fama argued that in an active market including knowledgeable and able investors, securities will be fairly priced to reflect all available information. More precisely, the Efficient Market Hypothesis states that at any given time, a security's price fully incorporates all available information. The implications of the EMH are of great consequence. Most investors who trade securities do so under the assumption that the purchase price is lower than the security is worth to them, while the sale

price is greater than the security's value. However, if current prices fully incorporate all information, then trading securities in an attempt to outperform the market relies on luck rather than skill. Moreover, there are different kinds of information that affect asset prices; hence there are three versions of the Efficient Markets Hypothesis (hereafter EMH).

The Weak Form of the EMH states that prices incorporate only past information about the asset. An implication of this form of the EMH is that one cannot detect mis-priced assets and consistently outperform the market through technical analysis of past prices.

The Semi-Strong Form of the EMH asserts that stock prices reflect all publicly available information. This information includes past prices and returns as well as a company's financial statements, accounting practices, earnings and dividend announcements, and competitors' financial situation.

The Strong Form of the EMH states that the current price of a stock incorporates all existing information, both public and private. In this case, one should not expect to systematically outperform the market even if trading on insider information. According to this form of the EMH, the market anticipates future developments and asset prices adjust to incorporate this information.

Because it is often difficult to understand correctly the implications of the EMH, I present a few of the most common misinterpretations:

1. *Although the EMH claims investors cannot outperform the market, analysts such as Warren Buffet have done exactly that. Hence the EMH must be incorrect.* This interpretation is incorrect because the EMH implies that investors cannot *consistently* outperform the market; there will be times when, out of luck, an asset will outperform the market. Additionally, it is possible for one to consistently outperform the market by

chance. Suppose a fund manager has a 50% chance of beating the market next year. His probability of beating the market two years in a row is 25%; of beating the market eight years in a row, 4%. Consequently, out of 1000 fund managers, 4 will consistently outperform the market eight years in a row. Hence not only is it possible to outperform the market on occasion, it is possible to consistently outperform the market by luck.

2. *According to the weak form of the EMH, technical analysis is useless in predicting future stock returns. Yet financial analysts are not driven out of the market, so their services must be useful. Hence, the EMH must be incorrect.* This statement is incorrect because a financial analyst can put together a portfolio that matches the risk-tolerance of each client, whereas a random collection of stocks will most likely not cater to particular risk preferences. Secondly, financial analysis is essential to the efficiency of markets because it allows investors to take advantage of new information to identify mis-priced stocks. When there is competition among many investors, arbitrage opportunities vanish, i.e. stock prices adjust immediately to incorporate any new information, leading to market efficiency.
3. *The EMH must be incorrect because stock prices are constantly fluctuating randomly.* The fact that stock prices are constantly changing is evidence in support of the EMH, because new information appears almost continuously in the form of opinions, news stories, announcements, expectations, and even lack of news. The constant arrival of new information causes the continuous adjustment of prices, as the EMH claims.
4. *If the EMH holds, then all investors must be able to collect, analyze and interpret new information to correctly adjust stock prices. However, most investors are not trained financial experts. Therefore, the EMH must be false.* The EMH does not require that all

traders be informed. A relatively small core of experts is necessary to analyze new information and adjust stock prices correctly, after which other investors can trade on the new prices without having followed the underlying causes for the price change.

Project Overview

This paper's first goal is to test the validity of the Semi-Strong form of the EMH on 30 component stocks of the S&P 500. More specifically, is it the case that the magnitude of a stock's price change corresponds to the amount of publicly-available information available on that stock? For a six-month period from 30 July 2008 to 28 January 2009, I collect data on weekly price change and the number of news items per stock. The news items are collected from an archive database containing the most widely-read financial publications and serves as a proxy variable for the actual number of weekly news items from all sources per stock. According to the EMH, weeks where price volatility is high should also be weeks with a high number of news items, i.e. the relationship between price volatility and number of news items should be positive.

Secondly, I seek to determine if any behavioral factors contribute to the sensitivity of stock prices to new information. Does widespread buying or selling of a well-performing stock correspond to more information? In particular, does panic or euphoria contribute more to a stock's price sensitivity to new information? Does the price of a well-performing or under-performing stock change more when the stock is mentioned in the news? To answer these questions, I calculate each stock's net return over a six-month period prior to the study period, as well as the percentage difference between stock return and the market return. High-return stocks generally correspond to positive investor sentiment (euphoria), whereas low-return stocks correspond to negative investor response (panic). I test the relationship between price sensitivity (the coefficients from the first-step regression mentioned above) and return relative to market to

determine if panic, the thrill of winning, or neither of these factors affect the extent to which a stock's price is affected by new information. In this study I do not distinguish between "good" news and "bad" news.

3. Data

The period studied in this project is 30 July 2008 to 28 January 2009, over a total of 26 weeks. The 30 stocks that make up the sample data are part of the S&P 500 Index components. The sample size is 30 so that statistically significant results can be extended more generally to the universe of stocks with similar risk levels during this period (a sample size above 25 is considered large). I initially considered stocks within the banking industry, but there were little to no news items for each stock; hence my sample contains components of the S&P 500. Stocks in this index are mentioned in the news more frequently and on a regular basis. Because different risk levels may affect differently the price volatility of stocks that otherwise have the same number of news items, I narrow down the initial 500 components to 179 stocks with betas between 0.75 and 1.25. The beta statistic can be calculated as a function of the market return (R_m) and stock i 's individual return (R_i):

$$\beta_i = \frac{\text{cov} (R_i, R_m)}{\text{var} (R_m)}$$

Alternatively, beta can be estimated from the time series regression

$$R_i - R_f = \alpha_i + \beta_i *(R_m - R_f) + \varepsilon_i$$

where R_f is the risk-free return rate. Beta is used as an indicator of risk because it measures the extent to which increasing the holdings of an individual stock in the market portfolio will affect the variance of the portfolio's return.

In this study, the S&P 500 is representative of the market portfolio, and consequently its beta coefficient is 1. The 500 component betas are calculated by Google Finance as of 10 January 2009 and may have changed since then. From the 179 stocks within the specified beta range, 30 are selected randomly using a random number generator. The stocks in this sample and their respective beta coefficients are presented in Table 1.

When collecting the price and news data for each stock, I consider a Wednesday-to-Wednesday week to avoid holidays when prices are not announced. I construct the price volatility variable by calculating absolute percentage change in price between weekly open prices. More specifically, I record the open price on Wednesday in week i and in week $i + 1$, take the natural logarithm of each, and calculate the absolute value of $\ln(P_{i+1}) - \ln(P_i)$. The source for these prices is Google Finance.

To calculate the weekly number of news items per stock, I construct a proxy variable that contains the number of news items in a representative sample of news sources. Using the news archive database Factiva, I filter news stories from the most widely-read, mainstream financial publications by various factors for subject relevancy. Additionally, duplicate stories are identified and removed from the sample. News items are counted between Wednesday in week i and Wednesday in week $i + 1$, and stories on Wednesday in week $i + 1$ are counted toward the following week. I consider open prices which are available before most daily news announcements, so the price recorded for the latter Wednesday is unaffected by the news that occur after the open price is announced on that day. I verify that the study period does not include earnings reports for some stocks and not for others because this would affect the price of the former stocks but would not be included in the news variable. The sources and specifications

for news data are summarized in Figure 1. The price and news data per stock is presented in Tables 2-16.

Finally, I calculate each stock's net return over the period 1 January 2008- 30 July 2008 according to the formula

$$R_i = \frac{P_1 + D_1}{P_0} - 1,$$

where P_1 is the open price in July, D_1 is the sum of any dividends paid throughout the period, and P_0 is the open price in January. To quantify each stock's performance relative to the market during this period, I calculate the percentage difference between each stock's return (R_i) and the market return (R_m) according to the formula

$$\% \Delta = \frac{R_i - R_m}{R_i} * 100.$$

Net return and performance relative to market data for all stocks are presented in Table 17.

4. Models

For each of the 30 stocks, the price volatility variable discussed above is the dependent variable I am interested in studying, and the news variable is the independent variable I consider as a proxy for the universe of news items during the weekly periods of interest. To test whether the news variable is a significant predictor of volatility for each stock, I construct the OLS model

$$Y = \beta_1 X + \beta_2 X * X_2 + \beta_3 X * X_3 + \beta_4 X * X_4 + \dots + \beta_{30} X * X_{30} + \varepsilon, \quad (1.1)$$

where Y is the absolute percentage price change, X is the weekly number of news items, and X_2 - X_{30} are indicator variables for stocks 2-30 from Table 1 that are equal to 1 for stock i and 0 otherwise. The variables Y and X comprise the list of data for all 30 stocks. The correlation

coefficient on the number of news for stock i ($i \neq 1$) is given by $\beta_1 + \beta_i$. The correlation coefficient on the number of news for stock 1 (Agilent) is β_1 . However, due to the limitations of Excel software in calculating a regression with 29 interaction terms, I run the model

$$Y_i = \beta_{1i} X_i + \varepsilon_i \quad (1.2)$$

for each of the 30 stocks, where Y_i is the weekly price volatility for stock i and X_i is the weekly number of news for stock i . I test the alternative hypothesis that β_{1i} is nonzero (EMH holds) for all i against the null hypothesis that β_{1i} is zero (EMH does not hold). In models (1.1) and (1.2) I force the intercept to be zero because I am interested in evaluating the sensitivity of stock price to news and how much noise there is around the explanatory variable *during this period*. The correlation coefficients on the number of news resulting from this regression are the same as the ones resulting from equation (1.1).

For the second step of this project, I study the relationship between stock performance relative to the market and stock price sensitivity to news announcements. Specifically, I seek to determine whether stocks that have low performance relative to the market are more sensitive to news announcements than stocks that have high performance. To do so, I run the OLS regression

$$Y = \alpha + \beta_1 X + \varepsilon \quad (1.3)$$

where Y is the collection of betas from the 30 regressions modeled in equation (1.2) representing stock sensitivity to news announcements, and X measures the percentage difference between each stock's net return and the net return of the market, representing stock performance relative to the market. According to my hypothesis, β_1 should be negative, i.e. stocks that outperform the market are less price-sensitive to news announcements than stocks that under-perform the

market. As mentioned, the data comprising the dependent variable in this regression are the estimated coefficients on the independent variable in regression (1.2). Consequently, there is a high amount of “noise,” or errors (ϵ) in regression (1.3) resulting from its construction.

Econometric issues arising from this fact are discussed in the next section. The dependent and independent variables per stock for this model are summarized in Table 18.

5. Econometric and Validity Considerations

Due to limitations in data accessibility, certain aspects of the data collection and implementation may negatively affect the results and implications of this study. While the 30 sample stocks were selected randomly, they were selected from a general population of stocks from various industries. Consequently, the sample stocks were chosen from across various industries, introducing the issue of industry-specific effects. More specifically, because the sample stocks come from different industries, the number of news variable may not be a very accurate predictor of volatility. For example, two stocks from different industries that have similar price volatility and number of news may nonetheless have very different correlation coefficients on the number of news variable because one stock is part of an industry experiencing instability (such as the automotive industry during the period studied). Since the news variable is a proxy for the universe of information available at any given time for each stock, there may be some industry-specific factors that are not picked up by this proxy variable and therefore figure in the error term. Therefore, there may be high price volatility even at a lower frequency of news, i.e. there may be a lot of noise that is not explained by the news variable. As a result, the second-stage analysis of this project (model (1.3)) may not be meaningful because when we speak of an asset that has low price sensitivity to news announcements, we cannot be sure that the asset does

not exhibit high price volatility that is due to other factors not considered in the initial model (1.2). Another asset with similar volatility and return but from a different industry may not have as much noise, and the news coefficient may be a more accurate predictor of price volatility, i.e. its (1.2) correlation coefficient will be higher. Therefore, the data comprising the dependent variable in model (1.3) and the relationship between sensitivity to news and performance relative to market would look different had the sample originated in the same industry.

Another issue to be considered is the fact that the beta measures of risk used to narrow down the initial 500 components are calculated as of 10 January 2009. However, an asset's beta value may have changed over the course of the study period, moving from a risky asset (with a high beta) to one that was included in the sample. If this happened to half of the sample stocks, and the other half's betas did not change, then by omitting the risk variable I am not considering the effect that different risk levels may have on price sensitivity. It may be the case that regressions (1.2) may have more noise for risky stocks, which will have the same effect in model (1.3) as the industry omitted variable discussed above.

In order for this project to be feasible, a proxy variable representing all of the weekly news items per stock is necessary. While I attempt to construct a variable reflecting as many financial publications as possible, I clearly do not capture all of the weekly news stories per asset in the news items variable. Therefore, it is difficult to say whether noisy stocks with a low coefficient on the news variable are less sensitive to news announcements than they are to other factors that affect prices, or whether the news variable would explain more noise in the regression if it was expanded to include more data.

While the overall goal of this paper is to better understand the rational and behavioral factors affecting investors' behavior during this crisis, the study period itself complicates the

design of the project. The euphoric effect of a well-performing stock and the panic effect of an under-performing stock can be more easily quantified when considering momentum stocks. These types of stocks experience an upward (or downward) trend in prices over a short-run period. It is more likely that investors will act on impulse rather than based on calculated decisions when dealing with these stocks because it is very clear when the stocks are performing well and when they are not. An individual is more likely to know that his investments are in trouble if he sees the price of an asset continually falling over a period of time than by looking at the asset's return *relative to the market* over that same time period. Similarly, one may be more tempted to invest in a stock whose price has continued to grow over a given time period than one that has had a higher return *relative to the market* over the same period. If I were to consider momentum stocks in my sample, I could say with more confidence that model (1.3) reveals the presence of euphoria and panic in the market. This is because the model would then reflect the relationship between price sensitivity to news and the asset's total change in price from the beginning of the study period to the end, which would be high for upward momentum stocks and negative for downward momentum stocks. It is more likely that investors would react to stocks whose prices gained momentum over a period of time than stocks that have performed above or below the market, and therefore the relationship between the two variables mentioned above should be much stronger. However, because the study period occurs during a crisis, it is unlikely that any upward momentum stocks would exist among the 179 components of the S&P 500 with betas between 0.75 and 1.25. Additionally, randomization would most likely remove any such stocks from the sample. In that case I would only have downward momentum stocks in my sample and could therefore only consider the presence of panic in the market during the study period. By considering stocks that over or under-performed relative to the market, I could also

study the presence of euphoria in the market and determine whether it was weaker than the presence of panic during the study period.

The study period also poses challenges to the external validity of this study. Due to the fact that this crisis has been one of the most severe in recent U.S. history, it is difficult to extend the results of this paper to other periods. Such a deep crisis may possess certain characteristics particular to it that may not be present in less severe crises. Consequently, the same study conducted in 2000, for example, would likely reveal very different results. Additionally, I consider a certain class of stocks with similar risk levels, so the conclusions of this paper cannot be extended to the universe of stocks within the 30 July 2008- 28 January 2009 study period.

Finally, because the second stage regression of this project (model (1.3)) relies on the results of a previous regression (model (1.2)), the extra noise from the latter model means chances are higher that the results will not be statistically significant. Additionally, any econometric concerns with model (1.2) will also affect model (1.3). One way to remedy this without enriching the dataset is to weight the price sensitivity variables by significance level, giving more weight to those that are statistically significant than to those that are not. In this way, the fact that most coefficients are likely not different from zero is accounted for when establishing the relationship in model (1.3).

Nonetheless, the external validity concerns described above can be ignored because the project's main purpose is to explore whether rational or a combination of rational and irrational factors governed the behavior of the market *during the 2008 economic crisis*.

6. Results and Discussion

The estimated coefficients and corresponding p -values of model (1.2) are presented in Table 19. Among the 30 estimated coefficients on the news variable, 5 are statistically significant

at the 95% confidence level and 6 at the 90% confidence level. The stocks that are significant at 95% confidence are written in red in Table 18, and the additional stock that is significant at 90% confidence is written in blue. Because all statistically significant coefficients are positive, for these 6 stocks the data confirms the claims of the EMH with 90% confidence, i.e. there is less than a 10% chance that the positive relationship between price volatility and number of news is due to chance alone. The EMH states that a stock's price will adjust instantaneously to reflect any new information; therefore, a positive coefficient on the news variable indicates that as the number of news items increases, so does the price volatility because prices change *each time* a new announcement is made. Therefore, the more news items there are, the more prices will change to incorporate each announcement. A statistically significant negative coefficient (call it γ) on the number of news variable may not necessarily have provided evidence against the EMH even though it would imply that a one-unit increase in the number of news variable would lead to a γ drop in price volatility. It may be the case that "no news is bad news," i.e. perhaps investors are anticipating an announcement that the company is launching a new product. If there is no announcement, uncertainty about the firm's future and subsequent speculative trading will cause the price to be more volatile.

Additionally, it is difficult to establish causality between the two variables. It may be the case that as a stock's price becomes more unstable, the frequency of news stories on that stock increases as well, in which case the EMH does not hold regardless of the observed statistically significant results. However, this issue can be redressed by evaluating the content of the news stories; if they do not mention the stock's price on a consistent basis, it is likely that the relationship is as predicted by the EMH.

For the remaining 24 stocks in the sample, I fail to reject the null hypothesis that there is no relationship between the number of news and the price volatility of a stock, i.e. I fail to reject the claim that the EMH is false. Therefore, it may be the case that 24 of the 30 sample stocks' prices do not respond to new information (the coefficient on the news variable is zero), and that other factors affect prices. These factors could be the omitted variables discussed in Section 5, such as level of risk or industry-specific effects. It seems plausible that riskier stocks should experience greater price volatility because investors will likely engage in more frequent trading to avoid holding the stock for too long in case of a downturn. Nonetheless, these results are not evidence that the EMH is false; it may turn out that expanding the dataset to include a broader news variable will produce statistically significant results for these stocks in model (1.1). Additionally, the implications of the coefficient on the news variable are not affected by the fact that I do not consider whether the news are good or bad.

It may be the case that in weeks when there are many news announcements, the upward pressure on prices resulting from good news, although in greater magnitude, offsets the downward pressure on prices resulting from bad news in the same way that it does in weeks with fewer news items. Therefore, in weeks with few news items, the unit price change will be the same as in weeks with many news items, but this result will be a consequence of the design of the study rather than a failure of EMH. To illustrate, consider a week with 20 news items and starting price P for a certain asset A . Suppose for the first half of the week, there are 12 good news announcements, and for the second half of the week, there are 8 bad news announcements. During the first half of the week, the stock's price P grows to $P + 6$, and during the second half of the week, the bad news pushes the price $P + 6$ to $P - 1$. Now consider a week with 10 news items, 6 of them good and 4 of them bad. Starting with price P^* (which may be different from

P), during the first half of the week when there are good news, the price goes to $P^* + 3$, but then the bad news during the second half of the week pushes the price to $P^* - 1$. Then the unit change in price in both cases is -1 , despite the fact that the price changed more when there were more news items. However, the fact that I use *percentage* change as my measure of price volatility means that the volatility level will in fact be different in the two cases. Therefore, the EMH does not hold with the current data for these 24 stocks because if it did we would observe a significant positive (or negative) coefficient on the news variable.

Although the results of the second-stage regression (model **(1.3)**) are not statistically significant, they do take the form I suggest in my hypothesis. The coefficient on stock performance relative to market is -0.00001164 , which indicates that stocks that performed better than the market were less sensitive to news announcements than under-performing stocks during this period. The reported p -value for the estimated coefficient is 0.258809 , so there is less than a 25% chance that the observed nonzero coefficient is due to chance alone. While the confidence level for this coefficient is quite low, it is possible that by enriching the data in model **(1.2)** to obtain a greater number of statistically significant results, the confidence level in model **(1.3)** will increase because the noise will be reduced in the former regression (which in turn affects the noise in the latter regression). However, as shown in Figure 2, there are two outliers in the data that may be driving the negative relationship between the dependent and independent variables.

The outliers in the data are CA, Inc. and Big Lots. CA is an IT management software developer, and Big Lots is a Fortune 500 retail corporation whose department stores sell overstock and closeout merchandise. CA is the worst-performing stock in the sample with a price sensitivity coefficient of 0.000640258 , and Big Lots is the best-performing stock with a price sensitivity coefficient of -0.026435558 . It is plausible that CA's stock price fell so sharply during

the 6-month period from January-July 2008 because of the types of services it offers. Its main product, Enterprise IT Management, is aimed at governing and increasing the efficiency of firms' IT purchases. Investors during this period may have feared that demand for CA's products would fall sharply as the crisis deepened and affected more firms, causing them to cut costs wherever possible. When firms were simply trying to stay above the water it is unlikely that many were interested in spending money on services such as the ones offered by CA. Therefore, many of CA's shareholders likely sold their assets during this period, causing downward pressure on CA's stock price and thereby yielding the negative return seen in the data.

Similarly, Big Lots' success during this period is likely due to investor expectations about the company's future during the crisis. Because Big Lots stores offer lower-priced merchandise, demand for its products likely increased dramatically as more people affected by the crisis sought bargain buys. Not only did the number of items per lower-income household increase, the number of households buying from discount stores likely increased during the period of study. Investors who were aware of the imminent effects of the crisis bought up Big Lots shares during the January-July 2008 period, thereby pushing up its stock price and yielding the positive return seen in the data.

To evaluate how the relationship between performance relative to market and price sensitivity changes, I run model (1.3) without the two outliers. Figure 3 shows the results of this new regression: the relationship between performance relative to market and price sensitivity is now positive. The estimated coefficient from this new regression is 0.000007, with a reported p -value of 0.7181. Although not statistically significant, this suggests that stocks that performed better than the market were *more* sensitive to news announcements than under-performing stocks. It may be the case that euphoria had a greater impact on how investors respond to more

news announcements than panic during this period. More specifically, the increase in price resulting from increasing demand of an over-performing stock is greater in magnitude than the decrease in price resulting from decreasing demand of an under-performing stock as each is repeatedly mentioned in the news. However, it is unlikely that this is the case during the study period not only because the results are not statistically significant, but also because during an economic crisis the presence of panic in the market is much more pronounced than that of euphoria. Therefore, the results of this model are inconclusive, but it is very likely that with a richer dataset the negative relationship between price sensitivity and performance relative to market will be statistically significant.

7. Conclusion

The ultimate goal of this project is to expand the rational implications of the EMH to account for some of the basic behavioral factors affecting stock prices. Regardless of the statistical significance of its results, this project does not serve as a proof of the EMH or as a counter-example. It is possible that by enriching the datasets, it could be confirmed that the EMH applies to the data in this sample. However, any study of the EMH cannot be generalized to the market as a whole at any given time, because the EMH manifests itself differently in different circumstances. As discussed, riskier stocks will tend to experience greater price volatility at a given level of information than less risky stocks. During a crisis, investor expectations will affect stock prices differently than during a boom.

On the other hand, it is also difficult to disprove the EMH because many information components are tacit. Prices may change even when no news are announced, but this may be due to investor expectations about a firm's next move. Furthermore, it can be shown that factors

outside the category of new information can affect stock prices. These are the behavioral factors that affect each investor at the individual level and may have little to do with the qualitative information available on a stock. In this project I use the EMH as a vehicle for capturing the news sensitivity of stocks in order to determine if there is any difference in the way under-performing and over-performing stocks respond to new information.

I hypothesize that regardless of whether the news is good or bad, investors who hold poorly-performing stocks will become more panicked about their holdings the more their assets are mentioned in the news. This panicked state will induce sales of the asset, pushing the asset's price down. Investors holding well-performing stocks, on the other hand, will not respond as aggressively to the arrival of new information, and therefore prices will not move as much in response to an increase in the frequency of news.

The results of the first-stage regression in model (1.2) indicate that the EMH holds for 6 of the 30 sample stocks with 90% confidence. More specifically, for these 6 stocks there exists a positive relationship between number of news and price change that has less than 10% probability of existing by chance. It is possible that by enriching the news variable to capture more information relevant to each stock, model (1.2) would yield more statistically significant results.

Model (1.3) also yields inconclusive results- when including the data for all 30 stocks on price sensitivity and performance relative to market, the relationship between the two is negative, albeit not statistically significant. However, after removing the outliers, the relationship becomes positive yet still not statistically significant. It is likely that by reducing the noise in both models the relationship between price sensitivity and performance relative to market will become statistically significant. The sign of the estimated coefficient will probably be negative due to the

fact that the study period occurs during a crisis when panic affects investor sentiment more than euphoria.

While this project does not offer clear answers to the introduction questions, it does provide evidence that during the July 2008- January 2009 study period the EMH was deficient in explaining the price fluctuations of assets in the stock market. The second stage model of this project, if enhanced as described above, may provide evidence that the market is not completely rational, but that players can affect the stock market by bringing their own behavioral responses and idiosyncratic expectations to the trading floor.

Table 1: Sample Stocks and Corresponding Betas

Stock	Beta	Stock	Beta
1. Agilent (A)	1.24	16. General Dynamics (GD)	1.11
2. Aflac (AFL)	1.15	17. Health Care REIT (HCN)	1.05
3. Altera (ALTR)	1.22	18. Hewlett-Packard (HPQ)	1.03
4. Aon Corp. (AOC)	0.84	19. McDonalds (MCD)	0.79
5. Big Lots(BIG)	1.21	20. Marsh & McLennan (MMC)	0.82
6. Boston Scientific Corp (BSX)	0.98	21. Monsanto Company (MON)	0.98
7. CA, Inc. (CA)	0.97	22. Norfolk Southern Corp (NSC)	1.18
8. Cardinal Health (CAH)	1.05	23. Newell Rubbermaid (NWL)	1.14
9. Constellation Energy Group (CEG)	0.84	24. The Pepsi Bottling Group (PBG)	1.17
10. Comcast (CMCSA)	0.83	25. PerkinElmer (PKI)	1.12
11. Costco (COST)	0.85	26. PNC Financial Services (PNC)	0.95
12. Cintas Corporation (CTAS)	0.94	27. Sealed Air Corp (SEE)	1.15
13. Darden Restaurants (DRI)	1.1	28. Questar Corporation (STR)	0.88
14. Embarq Corporation (EQ)	1	29. Teco Energy (TE)	0.77
15. Fastenal Company (FAST)	0.92	30. US Bancorp (USB)	0.99

Figure 1: Factiva News Filter by Source and Subject

<i>Select Sources and Dow Jones Intelligent Indexing TM – Currently Selected</i>	
➤ Source	<u><i>Reuters News</i></u> or <u><i>The Wall Street Journal</i></u> or <u><i>The Wall Street Journal Online</i></u> or <u><i>The New York Times</i></u> or <u><i>Forbes</i></u> or <u><i>Forbes.com (U.S.)</i></u> or <u><i>Barron's</i></u> or <u><i>The Economist (UK)</i></u> or <u><i>Business Wire</i></u> or <u><i>BusinessWeek</i></u> or <u><i>BusinessWeek – Print and Online</i></u> or <u><i>Financial Times - Print and Online</i></u> or <u><i>Business Finance</i></u> or <u><i>Bloomberg Money</i></u> or <u><i>Bloomberg</i></u> or <u><i>CNBC- Business Center</i></u>
➤ Company	<u><i>McDonald's (example)</i></u>
➤ Subject	<u><i>Analysis</i></u> or <u><i>Commentary/Opinion</i></u> or <u><i>Corporate Digest</i></u> or <u><i>Dow Jones/Reuters Top Wire News</i></u> or <u><i>Economic Predictions/Forecasts</i></u> or <u><i>Personal Announcements</i></u> or <u><i>Press Release</i></u> or <u><i>Ranking</i></u> or <u><i>Routine Market/Financial News</i></u> or <u><i>Corporate/Industrial News</i></u>
➤ Industry	<u><i>All Industries</i></u>
➤ Region	<u><i>United States</i></u>
➤ Language	<u><i>English</i></u>
➤ Date Range	<u><i>Within the last year</i></u>

Table 2: Sample Stocks with Corresponding Price Volatility and Number of News Items Variables per Week

<u>Agilent</u>		<u>Week</u>	<u>AFLAC</u>	
Absolute % Price Change	# News		Absolute % Price Change	# News
0.009704776	5	30/7/08-6/8/08	0.026040351	0
0.024767364	0	6/8/08-13/8/08	0.003787542	0
0.042193325	5	13/8/08-20/8/08	0.021103203	0
0.016869592	7	20/8/08-27/8/08	0.006085773	0
0.009561133	4	27/8/08-3/9/08	0.055409856	0
0.061225239	4	3/9/08-10/9/08	0.011794873	0
0.054703622	1	10/9/08-17/9/08	0.026561058	0
0.005867031	7	17/9/08-24/9/08	0.07249309	0
0.053056646	6	24/9/08-1/10/08	0.077333203	0
0.172771689	7	1/10/08-8/10/08	0.248545781	1
0.009412797	3	8/10/08-15/10/08	0.001778964	0
0.072906771	3	15/10/08-22/10/08	0.064820481	0
0.061094657	7	22/10/08-29/10/08	0.035778532	2
0.129881109	6	29/10/08-5/11/08	0.162728113	0
0.164317797	2	5/11/08-12/11/08	0.096314658	0
0.084228259	7	12/11/08-19/11/08	0.102243418	0
0.047705522	4	19/11/08-26/11/08	0.089028898	0
0.04485566	6	26/11/08-3/12/08	0.040967863	0
0.045965538	4	3/12/08-10/12/08	0.067451852	0
0.107025795	4	10/12/08-17/12/08	0.02668619	1
0.037740328	4	17/12/08-24/12/08	0.028961503	1
0.044568319	0	24/12/08-31/12/08	0.035798006	0
0.179300913	1	31/12/08-7/1/09	0.009273637	2
0.030347156	2	7/1/09-14/1/09	0.141804844	0
0.022037979	2	14/1/09-21/1/09	0.112143294	0
0.00583092	5	21/1/09-28/1/09	0.328043461	8

Table 3: Sample Stocks with Corresponding Price Volatility and Number of News Items Variables per Week

<u>Altera</u>		<u>Week</u>	<u>Aon</u>	
Absolute % Price Change	# News		Absolute % Price Change	# News
0.041839658	2	30/7/08-6/8/08	0.040350038	1
0.030481003	1	6/8/08-13/8/08	0.001497487	0
0.018349139	2	13/8/08-20/8/08	0.004698855	1
0.02220862	0	20/8/08-27/8/08	0.022335526	5
0.028133135	2	27/8/08-3/9/08	0.011526901	2
0.074247335	2	3/9/08-10/9/08	0.02626953	0
0.016724443	2	10/9/08-17/9/08	0.01153566	0
0.015748357	0	17/9/08-24/9/08	0.012400899	0
0.013579258	2	24/9/08-1/10/08	0.031853325	0
0.205122895	1	1/10/08-8/10/08	0.108213585	0
0.054658413	4	8/10/08-15/10/08	0.245834963	3
0.047587081	4	15/10/08-22/10/08	0.059088916	2
0.05261362	2	22/10/08-29/10/08	0.020708014	1
0.033997609	3	29/10/08-5/11/08	0.1164513	2
0.147544308	2	5/11/08-12/11/08	0.063828042	0
0.032589442	2	12/11/08-19/11/08	0.037179003	0
0.031548358	1	19/11/08-26/11/08	0.037722305	0
0	1	26/11/08-3/12/08	0.002345767	1
0.050687698	7	3/12/08-10/12/08	0.010280464	0
0.11015604	2	10/12/08-17/12/08	0.01004564	0
0.04782035	0	17/12/08-24/12/08	0.04499267	0
0.061671821	0	24/12/08-31/12/08	0.038313801	0
0.031206536	1	31/12/08-7/1/09	0.068854005	0
0.1331174	0	7/1/09-14/1/09	0.031263564	1
0.009884759	2	14/1/09-21/1/09	0.00239063	0
0.12323264	5	21/1/09-28/1/09	0.035570132	0

Table 4: Sample Stocks with Corresponding Price Volatility and Number of News Items Variables per Week

<u>Big Lots</u>		<u>Week</u>	<u>Boston Scientific</u>	
Absolute % Price Change	# News		Absolute % Price Change	# News
0.108368037	0	30/7/08-6/8/08	0.058174721	2
0.009861129	1	6/8/08-13/8/08	0.0384959	0
0.02499001	0	13/8/08-20/8/08	0.033016435	4
0.059348759	1	20/8/08-27/8/08	0.025297792	0
0.019602065	2	27/8/08-3/9/08	0.021386954	2
0.086543875	0	3/9/08-10/9/08	0.027812679	1
0.083907959	1	10/9/08-17/9/08	0.021996814	2
0.026339246	2	17/9/08-24/9/08	0.017150277	3
0.072498042	0	24/9/08-1/10/08	0.071309028	1
0.165964958	0	1/10/08-8/10/08	0.15996465	1
0.034463607	0	8/10/08-15/10/08	0.066445099	7
0.010709607	0	15/10/08-22/10/08	0.070006003	3
0.003145363	0	22/10/08-29/10/08	0.103413095	2
0.0940001	0	29/10/08-5/11/08	0.135636827	1
0.369455988	0	5/11/08-12/11/08	0.12788485	1
0.07506598	0	12/11/08-19/11/08	0.062395816	0
0.009539023	0	19/11/08-26/11/08	0.231742057	0
0.013828002	0	26/11/08-3/12/08	0.068417	3
0.001874415	2	3/12/08-10/12/08	0.164693982	0
0.041499731	0	10/12/08-17/12/08	0.005457039	1
0.098574956	0	17/12/08-24/12/08	0.005427422	0
0.021353124	0	24/12/08-31/12/08	0	0
0.074610864	0	31/12/08-7/1/09	0.059111099	0
0.114113307	0	7/1/09-14/1/09	0.080999798	0
0.005115101	0	14/1/09-21/1/09	0.053848809	3
0.001456664	0	21/1/09-28/1/09	0.133531393	1

Table 5: Sample Stocks with Corresponding Price Volatility and Number of News Items Variables per Week

<u>CA, Inc.</u>		<u>Week</u>	<u>Cardinal Health</u>	
Absolute % Price Change	# News		Absolute % Price Change	# News
0.023458939	6	30/7/08-6/8/08	0.08122544	0
0.054321671	0	6/8/08-13/8/08	0.049428666	6
0.003739876	2	13/8/08-20/8/08	0.033882923	0
0.026051894	9	20/8/08-27/8/08	0.009772065	0
0.011428696	1	27/8/08-3/9/08	0.007067167	0
0.085634914	5	3/9/08-10/9/08	0.040912284	0
0.014315645	5	10/9/08-17/9/08	0.045803658	0
0.039369561	0	17/9/08-24/9/08	0.032829209	1
0.0329511	0	24/9/08-1/10/08	0.005305052	2
0.16251893	11	1/10/08-8/10/08	0.109734497	2
0.019002947	2	8/10/08-15/10/08	0.095766905	1
0.082443669	3	15/10/08-22/10/08	0.004280505	0
0.061237179	2	22/10/08-29/10/08	0.027370937	1
0.051905477	5	29/10/08-5/11/08	0.021550347	2
0.088704141	0	5/11/08-12/11/08	0.021031809	0
0.007653099	18	12/11/08-19/11/08	0.130204341	0
0.040501943	2	19/11/08-26/11/08	0.100876277	1
0.032144453	2	26/11/08-3/12/08	0.017160855	0
0.120862716	1	3/12/08-10/12/08	0.030975928	0
0.064788776	5	10/12/08-17/12/08	0.054214638	1
0.048897409	0	17/12/08-24/12/08	0.039692523	0
0.032135729	0	24/12/08-31/12/08	0.041754075	0
0.007063327	2	31/12/08-7/1/09	0.027279695	1
0.01253081	1	7/1/09-14/1/09	0.063500192	3
0.052332615	1	14/1/09-21/1/09	0.014668886	0
0.030719139	2	21/1/09-28/1/09	0.013934759	0

Table 6: Sample Stocks with Corresponding Price Volatility and Number of News Items Variables per Week

<u>Constellation Energy Group</u>		<u>Week</u>	<u>Comcast</u>	
Absolute % Price Change	# News		Absolute % Price Change	# News
0.02241462	0	30/7/08-6/8/08	0.089293036	14
0.177459184	1	6/8/08-13/8/08	0.01016175	3
0.000782656	1	13/8/08-20/8/08	0.00460618	1
0.04396144	2	20/8/08-27/8/08	0.022409901	5
0.011454534	1	27/8/08-3/9/08	0.00189036	2
0.09086351	2	3/9/08-10/9/08	0.009983444	6
0.676356663	2	10/9/08-17/9/08	0.04345326	7
0.154313932	30	17/9/08-24/9/08	0.02220071	4
0.064106868	7	24/9/08-1/10/08	0.001019888	4
0.044875506	4	1/10/08-8/10/08	0.179878061	3
0.010148409	3	8/10/08-15/10/08	0	4
0.029864851	7	15/10/08-22/10/08	0.086623189	3
0.041681297	4	22/10/08-29/10/08	0.084179694	7
0.01131376	8	29/10/08-5/11/08	0.079336742	9
0.01892801	7	5/11/08-12/11/08	0.127576599	7
0.018511256	1	12/11/08-19/11/08	0.003214403	4
0.005404295	2	19/11/08-26/11/08	0.005164634	7
0.21815601	1	26/11/08-3/12/08	0.006451635	3
0.104250021	12	3/12/08-10/12/08	0.053830266	2
0.056459358	5	10/12/08-17/12/08	0.008567984	4
0.147818787	12	17/12/08-24/12/08	0.037574865	1
0.038955641	0	24/12/08-31/12/08	0.038803366	0
0.005865119	0	31/12/08-7/1/09	0.040306208	2
0.064538521	4	7/1/09-14/1/09	0.114178103	5
0.005529968	3	14/1/09-21/1/09	0.066964904	3
0.005529968	4	21/1/09-28/1/09	0.068285908	8

Table 7: Sample Stocks with Corresponding Price Volatility and Number of News Items Variables per Week

<u>Costco Wholesale</u>		<u>Week</u>	<u>Cintas</u>	
Absolute % Price Change	# News		Absolute % Price Change	# News
0.038249525	0	30/7/08-6/8/08	0.028877909	0
0.046994125	2	6/8/08-13/8/08	0.021455734	1
0.015118917	1	13/8/08-20/8/08	0.014161277	0
0.000753864	0	20/8/08-27/8/08	0.000653808	0
0.009748859	0	27/8/08-3/9/08	0.017171975	0
0.026801781	3	3/9/08-10/9/08	0.007361211	0
0.01272226	0	10/9/08-17/9/08	0.049154529	1
0.058639838	1	17/9/08-24/9/08	0.147242799	1
0.001249219	2	24/9/08-1/10/08	0.005997548	0
0.169899037	1	1/10/08-8/10/08	0.130603724	0
0.05809419	3	8/10/08-15/10/08	0.119346758	0
0.043023146	3	15/10/08-22/10/08	0.028105974	0
0.040398702	1	22/10/08-29/10/08	0.049679844	0
0.039487042	2	29/10/08-5/11/08	0.086826092	0
0.073141118	3	5/11/08-12/11/08	0.127203544	1
0.087653294	1	12/11/08-19/11/08	0.010591856	1
0.060826052	1	19/11/08-26/11/08	0.008211725	0
0.013178092	1	26/11/08-3/12/08	0.018902453	0
0.075826611	5	3/12/08-10/12/08	0.108476476	1
0.003221225	5	10/12/08-17/12/08	0.010742097	0
0.014721612	0	17/12/08-24/12/08	0.162030211	4
0.01396454	0	24/12/08-31/12/08	0.0635492	1
0.003913899	0	31/12/08-7/1/09	0.051489782	0
0.053359411	3	7/1/09-14/1/09	0.046697788	2
0.02280195	0	14/1/09-21/1/09	0.011803416	0
0.01699401	0	21/1/09-28/1/09	0.049752971	0

Table 8: Sample Stocks with Corresponding Price Volatility and Number of News Items Variables per Week

Darden Restaurants		<u>Week</u>	<u>Embarq</u>	
Absolute % Price Change	# News		Absolute % Price Change	# News
0.063734709	1	30/7/08-6/8/08	0.081818466	2
0.019340762	0	6/8/08-13/8/08	0.012903405	0
0.076364036	0	13/8/08-20/8/08	0.008788506	1
0.133140556	4	20/8/08-27/8/08	0.007058364	3
0.03347307	4	27/8/08-3/9/08	0.020481385	0
0.002017486	0	3/9/08-10/9/08	0.019186263	1
0.017351119	3	10/9/08-17/9/08	0.091915175	1
0.050892936	2	17/9/08-24/9/08	0.013541007	1
0.015080068	0	24/9/08-1/10/08	0.029121204	0
0.164391394	1	1/10/08-8/10/08	0.115784296	2
0.09564343	0	8/10/08-15/10/08	0.010561521	0
0.062402094	0	15/10/08-22/10/08	0.062249999	1
0.053092087	0	22/10/08-29/10/08	0.045006075	11
0.14795871	0	29/10/08-5/11/08	0.057417582	2
0.227701394	0	5/11/08-12/11/08	0.159155843	1
0.084229734	0	12/11/08-19/11/08	0.072064366	0
0.014652277	0	19/11/08-26/11/08	0.019738547	0
0.040969585	0	26/11/08-3/12/08	0.005215136	0
0.22996791	0	3/12/08-10/12/08	0.027258382	0
0.0622787	0	10/12/08-17/12/08	0.020131691	0
0.207060749	4	17/12/08-24/12/08	0.059826825	0
0.003933493	0	24/12/08-31/12/08	0.04692072	0
0.008174917	0	31/12/08-7/1/09	0.051728361	0
0.12984666	1	7/1/09-14/1/09	0.039904142	0
0.044928224	1	14/1/09-21/1/09	0.015363033	1
0.174066668	2	21/1/09-28/1/09	0.082082064	1

Table 9: Sample Stocks with Corresponding Price Volatility and Number of News Items Variables per Week

<u>Fastenal</u>		<u>Week</u>	<u>General Dynamics</u>	
Absolute % Price Change	# News		Absolute % Price Change	# News
0.023832475	0	30/7/08-6/8/08	0.004644485	3
0.039609138	0	6/8/08-13/8/08	0.027744803	0
0.001781649	0	13/8/08-20/8/08	0.008946435	6
0.00296238	0	20/8/08-27/8/08	0.00184232	1
0.030682018	0	27/8/08-3/9/08	0.000759013	1
0.027538519	0	3/9/08-10/9/08	0.081959422	2
0.023898196	0	10/9/08-17/9/08	0.005899722	1
0.040594954	0	17/9/08-24/9/08	0.063765644	0
0.069925688	0	24/9/08-1/10/08	0.081568004	2
0.304251951	1	1/10/08-8/10/08	0.136605577	2
0.044643068	1	8/10/08-15/10/08	0.041318928	0
0.047672956	0	15/10/08-22/10/08	0.084398704	3
0.008788851	0	22/10/08-29/10/08	0.035649415	4
0.083381609	0	29/10/08-5/11/08	0.075051733	2
0.142230395	0	5/11/08-12/11/08	0.073679284	0
0.010202683	0	12/11/08-19/11/08	0.091306547	3
0.073144803	0	19/11/08-26/11/08	0.082377638	0
0.14542884	0	26/11/08-3/12/08	0.00650541	0
0.130337321	0	3/12/08-10/12/08	0.11111898	3
0.06245793	0	10/12/08-17/12/08	0.027364669	3
0.023523491	1	17/12/08-24/12/08	0.035740537	3
0.009296813	0	24/12/08-31/12/08	0.034858003	0
0.060519261	0	31/12/08-7/1/09	0.068910462	0
0.098546656	0	7/1/09-14/1/09	0.10761568	3
0.01048745	1	14/1/09-21/1/09	0.034357375	2
0.053760332	1	21/1/09-28/1/09	0.11947023	1

Table 10: Sample Stocks with Corresponding Price Volatility and Number of News Items Variables per Week

<u>Health Care REIT</u>		<u>Week</u>	<u>Hewlett-Packard</u>	
Absolute % Price Change	# News		Absolute % Price Change	# News
0.039338206	1	30/7/08-6/8/08	0.006497166	6
0.011680102	0	6/8/08-13/8/08	0.022304116	7
0.011484311	0	13/8/08-20/8/08	0.017403237	14
0.00235202	1	20/8/08-27/8/08	0.036010438	20
0.011511199	1	27/8/08-3/9/08	0.018170519	10
0.079929555	1	3/9/08-10/9/08	0.008044396	14
0.004612168	0	10/9/08-17/9/08	0.030496019	20
0.038367615	0	17/9/08-24/9/08	0.013746648	18
0.056543177	0	24/9/08-1/10/08	0.017182553	15
0.106904624	0	1/10/08-8/10/08	0.200863281	18
0.045915384	1	8/10/08-15/10/08	0.042007732	9
0.043485112	1	15/10/08-22/10/08	0.05265746	12
0.007901505	0	22/10/08-29/10/08	0.064681287	8
0.004190926	3	29/10/08-5/11/08	0.078767898	15
0.190065216	0	5/11/08-12/11/08	0.163342083	18
0.003925973	1	12/11/08-19/11/08	0.031204734	33
0.070503066	0	19/11/08-26/11/08	0.005107417	29
0.109891719	0	26/11/08-3/12/08	0.002700677	10
0.087738914	0	3/12/08-10/12/08	0.024340768	18
0.016660441	0	10/12/08-17/12/08	0.055886833	14
0.020506883	0	17/12/08-24/12/08	0.043645352	7
0.045947582	0	24/12/08-31/12/08	0.045861419	6
0.027112717	0	31/12/08-7/1/09	0.062218455	8
0.085225049	1	7/1/09-14/1/09	0.079804393	12
0.000274537	0	14/1/09-21/1/09	0.038173669	10
0.073029001	2	21/1/09-28/1/09	0.064575092	16

Table 11: Sample Stocks with Corresponding Price Volatility and Number of News Items Variables per Week

<u>McDonald's</u>		<u>Week</u>	<u>Marsh & McLennan Companies</u>	
Absolute % Price Change	# News		Absolute % Price Change	# News
0.030342631	3	30/7/08-6/8/08	0.06403876	2
0.033519141	9	6/8/08-13/8/08	0.034503506	5
0.021635269	2	13/8/08-20/8/08	0.030801592	0
0.000798531	4	20/8/08-27/8/08	0.009532961	4
0.008590571	3	27/8/08-3/9/08	0.010382349	3
0.003952262	5	3/9/08-10/9/08	0.011514053	5
0.007701413	15	10/9/08-17/9/08	0.002478316	3
0.029715383	3	17/9/08-24/9/08	0.006800644	1
0.013314046	9	24/9/08-1/10/08	0.033200669	2
0.138634758	6	1/10/08-8/10/08	0.109615841	0
0.031783902	2	8/10/08-15/10/08	0.028475523	3
0.00326857	3	15/10/08-22/10/08	0.030817364	3
0.026124227	11	22/10/08-29/10/08	0.065315934	4
0.015770434	4	29/10/08-5/11/08	0.030484699	1
0.037372631	9	5/11/08-12/11/08	0.150213309	2
0.015045958	5	12/11/08-19/11/08	0.002966732	1
0.010544285	7	19/11/08-26/11/08	0.010975205	1
0.019570096	4	26/11/08-3/12/08	0.003771218	1
0.059172671	13	3/12/08-10/12/08	0.019056086	1
0.038920487	3	10/12/08-17/12/08	0.058728595	1
0.022287744	3	17/12/08-24/12/08	0.005235614	0
0.006673745	1	24/12/08-31/12/08	0.031858054	1
0.004693704	3	31/12/08-7/1/09	0.040686392	0
0.056807035	9	7/1/09-14/1/09	0.097346426	1
0.009099556	4	14/1/09-21/1/09	0.007149271	1
0.029233897	13	21/1/09-28/1/09	0.080636532	1

Table 12: Sample Stocks with Corresponding Price Volatility and Number of News Items Variables per Week

<u>Monsanto Company</u>		<u>Week</u>	<u>Norfolk Southern Corporation</u>	
Absolute % Price Change	# News		Absolute % Price Change	# News
0.088358053	1	30/7/08-6/8/08	0.00751421	1
0.040881472	3	6/8/08-13/8/08	0.072381913	0
0.028061832	1	13/8/08-20/8/08	0.000878349	1
0.012328274	5	20/8/08-27/8/08	0.032137646	0
0.068986751	3	27/8/08-3/9/08	0.011267323	0
0.08343749	3	3/9/08-10/9/08	0.084042857	1
0.114529014	2	10/9/08-17/9/08	0.051979486	1
0.012645524	1	17/9/08-24/9/08	0.007432768	0
0.13418438	0	24/9/08-1/10/08	0.022635643	2
0.380456362	4	1/10/08-8/10/08	0.224976732	1
0.22766141	8	8/10/08-15/10/08	0.052496698	1
0.039525174	0	15/10/08-22/10/08	0.008926191	1
0.009938271	0	22/10/08-29/10/08	0.062592438	0
0.103912289	1	29/10/08-5/11/08	0.033133524	1
0.115313262	0	5/11/08-12/11/08	0.112145481	0
0.121234949	0	12/11/08-19/11/08	0.07150719	0
0.005219075	0	19/11/08-26/11/08	0.052924573	2
0.024404983	0	26/11/08-3/12/08	0.014855961	0
0.161781712	0	3/12/08-10/12/08	0.011691067	0
0.122960595	2	10/12/08-17/12/08	0.040233457	0
0.101527143	3	17/12/08-24/12/08	0.032577624	0
0.030902989	0	24/12/08-31/12/08	0.035646456	0
0.146774713	2	31/12/08-7/1/09	0.080093214	0
0.045436185	8	7/1/09-14/1/09	0.171951272	2
0.000261917	1	14/1/09-21/1/09	0.152073504	1
0.049195483	1	21/1/09-28/1/09	0.098352779	1

Table 13: Sample Stocks with Corresponding Price Volatility and Number of News Items Variables per Week

<u>Newell Rubbermaid</u>		<u>Week</u>	<u>The Pepsi Bottling Group</u>	
Absolute % Price Change	# News		Absolute % Price Change	# News
0.034094211	1	30/7/08-6/8/08	0.03970745	1
0.069067357	0	6/8/08-13/8/08	0.063625696	0
0.042061031	0	13/8/08-20/8/08	0.028114966	0
0.025889631	0	20/8/08-27/8/08	0.017256392	3
0.068992871	0	27/8/08-3/9/08	0.072082519	0
0.047300961	0	3/9/08-10/9/08	0.002220461	2
0.026171599	1	10/9/08-17/9/08	0.014470212	2
0.102475001	0	17/9/08-24/9/08	0.051918099	0
0.038001118	0	24/9/08-1/10/08	0.038221213	4
0.188679756	1	1/10/08-8/10/08	0.163363643	7
0.06847301	0	8/10/08-15/10/08	0.053307394	1
0.047434366	0	15/10/08-22/10/08	0.00297556	3
0.043253818	0	22/10/08-29/10/08	0.066896912	2
0.039777971	3	29/10/08-5/11/08	0.066471109	1
0.109547542	0	5/11/08-12/11/08	0.110199005	4
0.105619549	1	12/11/08-19/11/08	0.053222225	2
0.050475521	0	19/11/08-26/11/08	0.193618833	2
0.110795312	0	26/11/08-3/12/08	0.012700503	2
0.067582664	0	3/12/08-10/12/08	0.066264795	1
0.083976473	0	10/12/08-17/12/08	0.08977284	0
0.225211804	6	17/12/08-24/12/08	0.101600241	0
0.023530497	1	24/12/08-31/12/08	0.027486843	0
0.050281661	0	31/12/08-7/1/09	0.041598918	0
0.102160513	0	7/1/09-14/1/09	0.109366023	0
0.089046557	1	14/1/09-21/1/09	0.035436779	3
0.037697211	0	21/1/09-28/1/09	0.046975368	0

Table 14: Sample Stocks with Corresponding Price Volatility and Number of News Items Variables per Week

<u>PerkinElmer</u>		<u>Week</u>	<u>PNC Financial Services</u>	
Absolute % Price Change	# News		Absolute % Price Change	# News
0.001732802	0	30/7/08-6/8/08	0.022513208	1
0.006901339	2	6/8/08-13/8/08	0.045116233	0
0.001376463	0	13/8/08-20/8/08	0.015405963	1
0.022989518	0	20/8/08-27/8/08	0.004487883	0
0.004219416	1	27/8/08-3/9/08	0.054804385	0
0.080715449	0	3/9/08-10/9/08	0.020305967	0
0.053116741	0	10/9/08-17/9/08	0.046887847	0
0.041639951	0	17/9/08-24/9/08	0.022215656	1
0.050099216	0	24/9/08-1/10/08	0.020883211	1
0.077786625	0	1/10/08-8/10/08	0.106843096	0
0.042882854	1	8/10/08-15/10/08	0.087551042	3
0.076322268	2	15/10/08-22/10/08	0.060412094	4
0.182715723	6	22/10/08-29/10/08	0.105687316	20
0.128046241	1	29/10/08-5/11/08	0.103005167	4
0.092037705	1	5/11/08-12/11/08	0.112491281	3
0.036600077	1	12/11/08-19/11/08	0.149551895	5
0.004133457	1	19/11/08-26/11/08	0.076525643	1
0.046435837	1	26/11/08-3/12/08	0.19133364	2
0.027398974	1	3/12/08-10/12/08	0.225039287	1
0.23295125	2	10/12/08-17/12/08	0.085978852	2
0.01143741	0	17/12/08-24/12/08	0.097479714	2
0.028724575	0	24/12/08-31/12/08	0.052305296	2
0.087694204	3	31/12/08-7/1/09	0.039170881	2
0.042529937	0	7/1/09-14/1/09	0.074331611	2
0.030857988	4	14/1/09-21/1/09	0.601115993	3
0.010413145	2	21/1/09-28/1/09	0.380820094	5

Table 15: Sample Stocks with Corresponding Price Volatility and Number of News Items Variables per Week

<u>Questar</u>		<u>Week</u>	<u>Sealed Air</u>	
Absolute % Price Change	# News		Absolute % Price Change	# News
0.06437529	0	30/7/08-6/8/08	0.080931597	2
0.013957949	1	6/8/08-13/8/08	0.025872963	0
0.039541893	0	13/8/08-20/8/08	0.019672766	0
0.048724892	0	20/8/08-27/8/08	0.025284695	0
0.079949463	1	27/8/08-3/9/08	0.058520665	0
0.134282035	0	3/9/08-10/9/08	0.010612344	2
0.038971855	0	10/9/08-17/9/08	0.045758245	0
0.015903572	0	17/9/08-24/9/08	0.035413537	0
0.101379589	0	24/9/08-1/10/08	0.031648211	0
0.393172161	0	1/10/08-8/10/08	0.097379384	1
0.042736698	1	8/10/08-15/10/08	0.092775324	0
0.122750926	1	15/10/08-22/10/08	0.131489836	0
0.020718973	1	22/10/08-29/10/08	0.142291455	1
0.156043016	1	29/10/08-5/11/08	0.038099846	2
0.110014779	1	5/11/08-12/11/08	0.101344706	0
0.043588786	0	12/11/08-19/11/08	0.012845392	0
0.040251	1	19/11/08-26/11/08	0.078510464	1
0.043737754	0	26/11/08-3/12/08	0.000686577	0
0.074033123	0	3/12/08-10/12/08	0.039062205	0
0.061330331	0	10/12/08-17/12/08	0.013298068	1
0.054219765	1	17/12/08-24/12/08	0.035426048	0
0.045333541	0	24/12/08-31/12/08	0.016506565	1
0.117748837	1	31/12/08-7/1/09	0.048595251	1
0.102173625	1	7/1/09-14/1/09	0.075558516	0
0.003947174	0	14/1/09-21/1/09	0.065894263	1
0.099808166	0	21/1/09-28/1/09	0.082572899	3

Table 16: Sample Stocks with Corresponding Price Volatility and Number of News Items Variables per Week

<u>Teco Energy</u>		<u>Week</u>	<u>US Bancorp</u>	
Absolute % Price Change	# News		Absolute % Price Change	# News
0.131408016	4	30/7/08-6/8/08	0.035216044	1
0.029405405	1	6/8/08-13/8/08	0.041152737	2
0.037041272	2	13/8/08-20/8/08	0.025122741	3
0.018692133	0	20/8/08-27/8/08	0.03040154	0
0.013986242	1	27/8/08-3/9/08	0.055365282	1
0.078723156	0	3/9/08-10/9/08	0.003430535	5
0.039831027	0	10/9/08-17/9/08	0.077516269	7
0.008505519	1	17/9/08-24/9/08	0.001157073	1
0.059188871	0	24/9/08-1/10/08	0.025715703	2
0.143298355	1	1/10/08-8/10/08	0.16193833	3
0.010316967	1	8/10/08-15/10/08	0.030379602	3
0.03458558	0	15/10/08-22/10/08	0.048790164	7
0.045682683	0	22/10/08-29/10/08	0.032571839	3
0.159578102	2	29/10/08-5/11/08	0.03502366	6
0.055479152	0	5/11/08-12/11/08	0.193817761	2
0.028938189	0	12/11/08-19/11/08	0.026409302	3
0.059506451	0	19/11/08-26/11/08	0.02672143	9
0.076928495	0	26/11/08-3/12/08	0	1
0.028585749	0	3/12/08-10/12/08	0.138619437	5
0.062882582	0	10/12/08-17/12/08	0.103681385	9
0.071458964	0	17/12/08-24/12/08	0.072818249	2
0.022989518	0	24/12/08-31/12/08	0.00335149	1
0.055660847	0	31/12/08-7/1/09	0.016870919	0
0.058189293	1	7/1/09-14/1/09	0.090769251	1
0.01188469	0	14/1/09-21/1/09	0.272428715	1
0.07245967	0	21/1/09-28/1/09	0.084179694	9

Table 17: Per stock net return and performance relative to market

<u>Stock</u>	<u>Dividends Paid</u>	<u>Net Return</u>	<u>% Difference Between R_i and R_m</u>
S&P 500	0	-0.13030239	0
A	0	-0.044450504	65.88665488
AFL	0.48	0.008163919	106.265364
ALTR	0.09	0.04	130.6978253
AOC	0.45	-0.031322262	75.96186685
BIG	0	0.933166771	816.154762
BSX	0	0.040343348	130.9613262
CA	0.08	-0.989356061	-659.2769872
CAH	0.26	-0.103460329	20.59982246
CEG	0.956	-0.194693038	-49.41632153
CMCSA	0.126	0.03420765	126.2525116
COST	0.305	0.001364354	101.0470675
CTAS	0.46	-0.197969543	-51.93086098
DRI	0.56	0.136477313	204.7389177
EQ	1.376	-0.023374519	82.0613275
FAST	0.25	0.070201643	153.8759443
GD	0.99	-0.052732394	59.53075458
HCN	2.02	-0.001566697	98.79764523
HPQ	0.16	-0.134310618	-3.076097069
MCD	0.75	-0.048083389	63.09861316
MMC	0.6	0.006792453	105.2128384
MON	0.59	0.097945448	175.1678062
NSC	0.9	0.27186427	308.6410464
NWL	0.42	-0.342338865	-162.7264665
PBG	0.31	-0.289888211	-122.4734412
PKI	0.21	0.07751938	159.4919095
PNC	1.95	-0.107922455	17.17538335
SEE	0.24	-0.171304348	-31.46677356
STR	0.246	0.310270671	338.1158711
TE	0.395	0.279239766	314.3013386
USB	0.85	-0.104435357	19.85154148

Table 18: Model (1.3) price sensitivity and performance relative to market variables per stock

<u>Stock</u>	<u>Coefficient on News Variable (Dependent Variable)</u>	<u>% Difference to Market Return (Independent Variable)</u>
A	-0.000626384	65.88665488
AFL	0.029037743	106.265364
ALTR	0.001658141	130.6978253
AOC	0.01406662	75.96186685
BIG	-0.026435558	816.154762
BSX	-0.005806584	130.9613262
CA	0.000640258	-659.2769872
CAH	0.004209394	20.59982246
CEG	0.001862084	-49.41632153
CMCSA	0.004535803	126.2525116
COST	0.005422214	101.0470675
CTAS	0.028348547	-51.93086098
DRI	0.00999756	204.7389177
EQ	0.001776781	82.0613275
FAST	0.033388823	153.8759443
GD	0.000517155	59.53075458
HCN	-0.008774843	98.79764523
HPQ	0.000368977	-3.076097069
MCD	0.001479504	63.09861316
MMC	-0.003118276	105.2128384
MON	0.010912691	175.1678062
NSC	0.021206191	308.6410464
NWL	0.019906857	-162.7264665
PBG	0.005406674	-122.4734412
PKI	0.017699204	159.4919095
PNC	0.006058101	17.17538335
SEE	0.00574088	-31.46677356
STR	-0.002308826	338.1158711
TE	0.018722586	314.3013386
USB	0.001101454	19.85154148

Table 19: Model (1.2) estimated coefficients and corresponding p -values per stock

<u>Stock</u>	<u>Coefficient</u>	<u>p-value</u>
A	-0.000626384	0.895547297
AFL	0.029037743	0.000891081
ALTR	0.001658141	0.78880372
AOC	0.01406662	0.094005122
BIG	-0.026435558	0.24024375
BSX	-0.005806584	0.417096618
CA	0.000640258	0.732780659
CAH	0.004209394	0.418135599
CEG	0.001862084	0.681137816
CMCSA	0.004535803	0.146986538
COST	0.005422214	0.268209745
CTAS	0.028348547	0.006812332
DRI	0.00999756	0.337769914
EQ	0.001776781	0.618048853
FAST	0.033388823	0.309681045
GD	0.000517155	0.92246954
HCN	-0.008774843	0.469095115
HPQ	0.000368977	0.795347369
MCD	0.001479504	0.309122794
MMC	-0.003118276	0.545162483
MON	0.010912691	0.134819263
NSC	0.021206191	0.187868158
NWL	0.019906857	0.004885154
PBG	0.005406674	0.32240528
PKI	0.017699204	0.018470115
PNC	0.006058101	0.371121825
SEE	0.00574088	0.531574786
STR	-0.002308826	0.940442567
TE	0.018722586	0.02208849
USB	0.001101454	0.816009758

Figure 2: Model (1.3) Data Scatterplot and Trendline

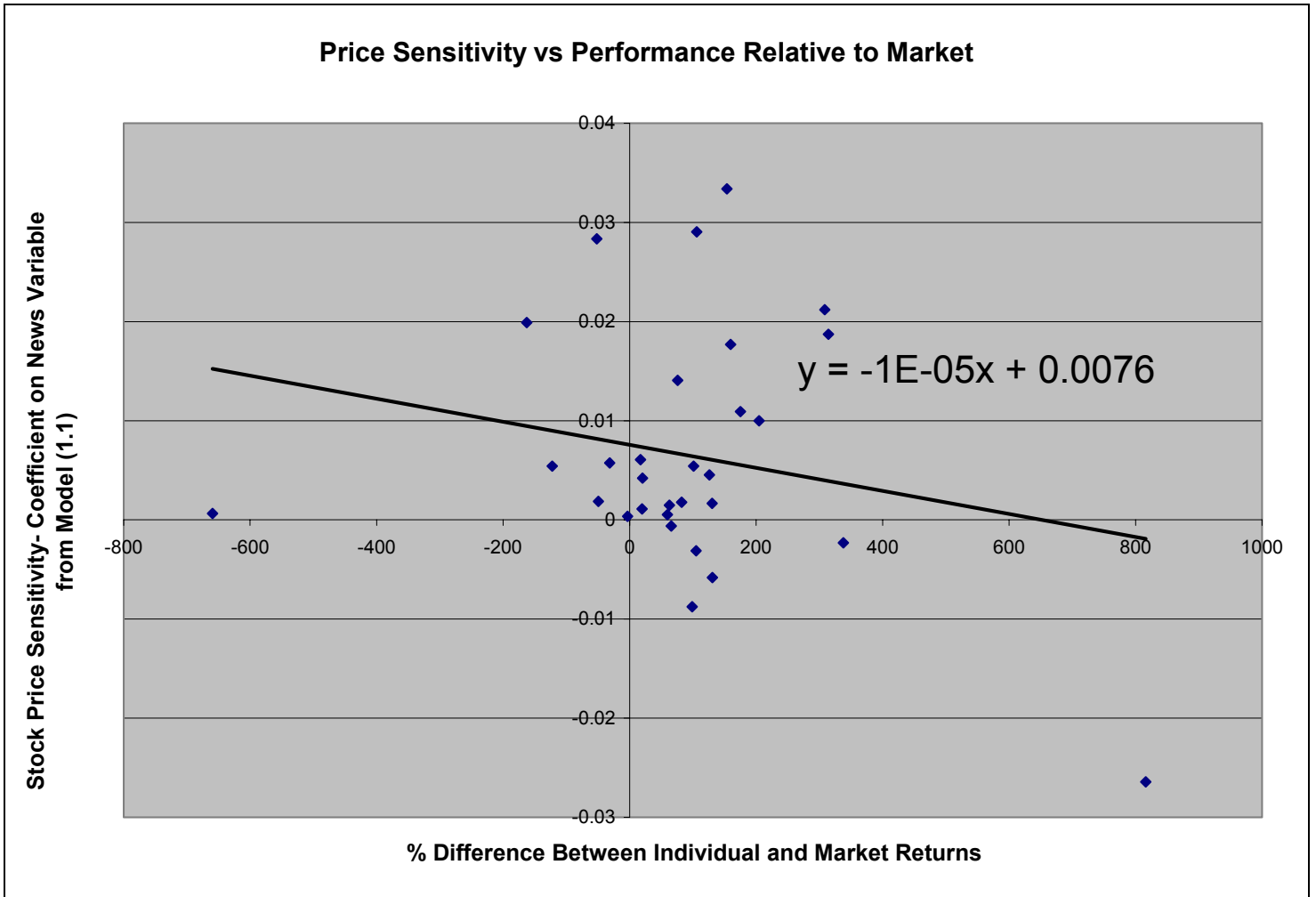
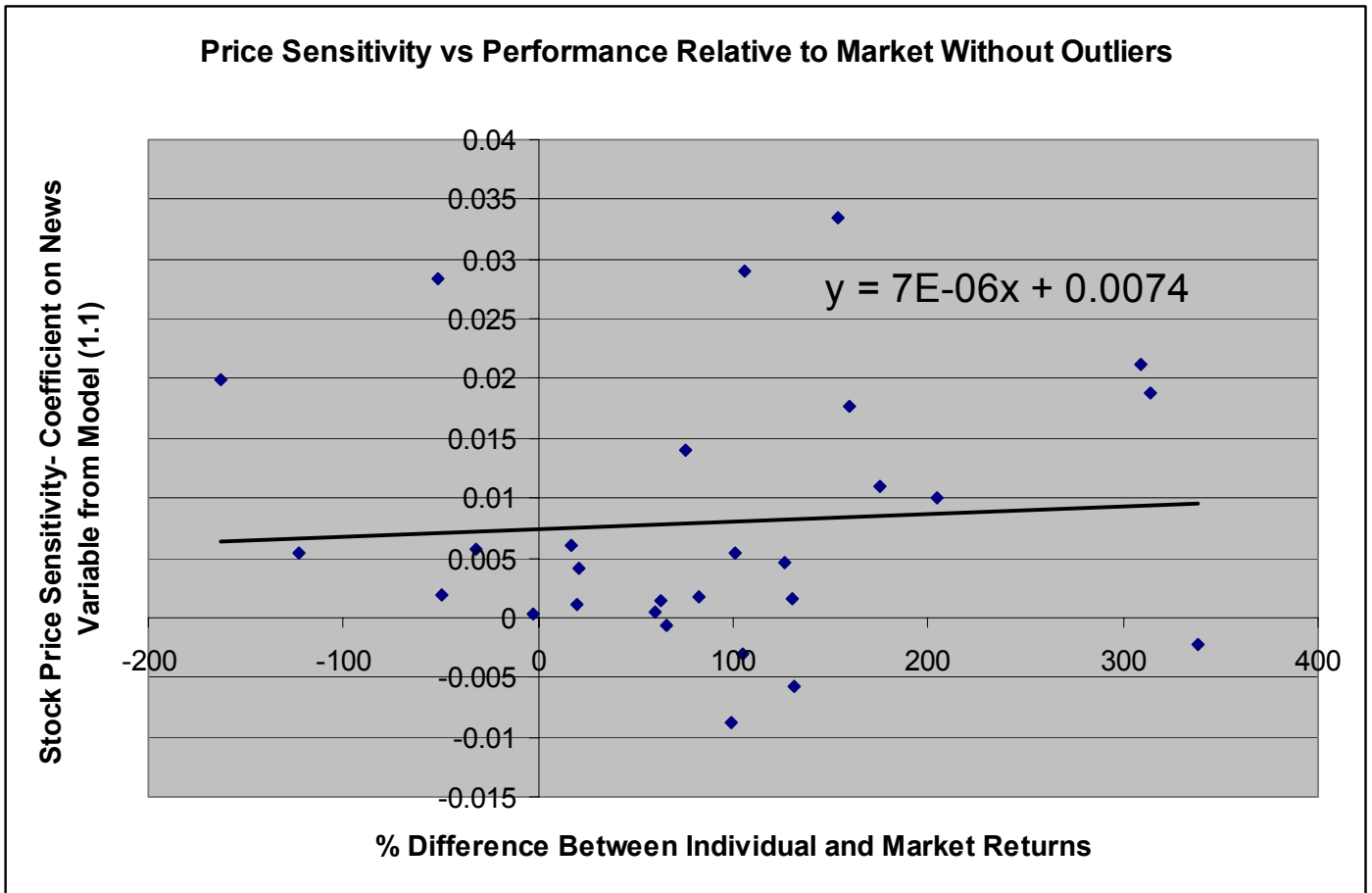


Figure 3: Model (1.3) Data Scatterplot and Trendline without Outliers



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