School of Business and Economics

The Impact of Trade Policy on Financial Markets

Evidence from the U.S. – China Trade War

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Foreword and Acknowledgements

The seeds of this thesis were planted over fourteen months ago, at the very start of the U.S. - China trade war. My journey towards attaining a master's degree has taken me across many different areas of economics, but none more exciting than the area of finance. One of the unique aspects of finance is its application of knowledge from other areas of discipline. The interaction between asset prices and economic variables such as interest rates, inflation and oil price was of particular interest to me. It was no accident that I chose to study the interaction between two of the world's largest economies and its impact on financial markets, any more than writing this foreword was an accident.

I began my research in earnest in January of 2019, completing this project five months and over ninety pages later. This thesis is considerably longer than I had originally planned, but I have finally overcome the temptation to include "just one more observation", and have put my pen to rest. Of course, the trade dispute has evolved rapidly while I have been writing, and it continues to do so even as this thesis approaches its final stage. My objective was to leave no stone unturned, and provide broad coverage. However, there are many subjects that I do not touch upon, and many others that I can only mention in passing.

Abstract

The objective of this thesis was to assess the impact of the U.S. – China trade war on financial markets. By utilizing event study methodology, research has analyzed the reactions of various financial data to tariffs and trade-related announcements. The results suggest a significant impact of both positive and negative trade-related news on stocks, debt securities and stock market volatility. The study goes into detail on how the reactions differ across different major indices, market sectors, capitalizations and U.S. treasury yields.

"The Impact of Trade Policy on Financial Markets: Evidence from the U.S.–China Trade War"

Keywords: event study, trade war, tariff, trade, policy, stocks, bonds, debt, yields, volatility

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1. Introduction

1. 1 Background

"The supreme art of war is to subdue the enemy without fighting".

− Sun Tzu, The Art of War

Written some twenty-five hundred years ago, The Art of War remains one of the most influential books on war and peace. The ancient Chinese military leader Sun Tzu recognized war as a legitimate tool of statecraft, one not confined solely to the battlefield. Sun Tzu's view on war touched upon the political, diplomatic and psychological aspects as much as the physical. War, trade, politics and international relations were seen as tools and all part of the same "game".

Throughout history, countries have used economic tools such as sanctions and tariffs in order to pursue their strategic interests around the world. 2018 has seen an escalation of trade tensions and economic disputes between some of the world's leading economic countries. In an effort to lower U.S. trade deficit (CNBC, 2018), protect domestic industries from the competition abroad (CNBC, 2018), and penalize foreign countries for various political reasons (NY Times, 2018), the U.S. President Donald J. Trump announced that the U.S. would impose tariffs on billions of dollars' worth of goods coming into their country, causing countries to implement retaliatory measures of their own. Countries like Turkey and China accusing the U.S. of waging *"economic war"* (NBC, 2018) and starting *"the biggest trade war in history"* (CNN Business, 2018) is an exclamation mark to everything that had led to this point. An article published in the New York Post stated the following:

"Tariffs and fiscal and monetary policies can have diplomatic uses, too — and today, with the American economy booming, the Trump administration is finally swinging the big stick of tariffs and sanctions as a non-lethal substitute for diplomatic or even military action" (New York Post, 2018).

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Economic warfare is defined by The Oxford English Dictionary as: *"an economic strategy based on the use of measures (e.g. blockade) of which the primary effect is to weaken the economy of another state"* (OED, 2010). *"Trade war"* is defined as: *"A situation in which countries try to damage each other's trade, typically by the imposition of tariffs or quota restrictions."* (OED, 2010).

Trade is a crucial element of international economics and allows goods to be shared worldwide. Countries are constantly trading back and forth between each other, shaping the global economic environment and global financial markets.

"In the past two decades the world has witnessed great financial markets integration due to an overall globalized economic environment" (Cakan et al., 2015).

The fundamental reality of international trade is that one country's trade surplus is another country's deficit. A trade deficit occurs when a country's imports exceed its exports, implying that consumers buy more foreign goods than domestic products. This is often referred to as an unfavorable balance of trade. A trade surplus occurs when a country's exports exceed its imports. International trade can be influenced through various governmental policies whose purpose is to influence the flow of goods entering and leaving a country. As such, governments may impose various protectionary measures such as limits on the quantity of allowable imports in order to try to lower their country's trade deficit and help protect domestic industries from competition abroad (Dunn & Mutti, 2004). One such protectionary measure is a tariff. A tariff, as defined in the Merrier-Webster Dictionary, is *"a tax on goods coming into or leaving a country"*. A broader definition of a tariff is found in the Oxford Dictionary of Economics:

"A scale of charges. In economics a tariff was originally a schedule of taxes on imports; it now refers to the actual import duties. An ad valorem tariff is set as a percentage of the price of the goods imported. A specific tariff is set in money terms per physical unit of good imported, and does not depend on its price. A non-discriminatory tariff taxes imports from all countries equally; tariff preferences mean that similar imports from different countries are taxed at different rates" (Black, Hashimzade & Myles, 2009).

The money collected through a tariff is called a duty, and the revenue raised by the duty goes to the country's government. However, whether a country gains from imposing a tariff depends upon whether its trading partners retaliate and impose tariffs of their own, in which case a trade war that leaves all countries worse off is a likely outcome, such as the world experienced during the 1930s (Dunn & Mutti, 2004).

The benefits of tariffs are said to be uneven. On one hand, they are considered to be "pro-producer", as the benefits associated with tariffs on imported goods is that domestic producers experience less competition from abroad and are able to produce more, thus gaining market power. On the other hand, they are said to be "anti-consumer", as companies have stated that increased tariffs hurt their businesses and lead to increased consumer prices. As such, the benefits of restrictive trade policies and trade barriers are not clear-cut and each particular case must be studied separately. Furthermore, *"The mere fact that a policy reduces imports does not make it a trade barrier, however, it must discriminate against imports relative to domestic alternatives. Higher gasoline taxes would reduce imports of gasoline, but would equally discourage consumption of domestic gasoline and would therefore not be a trade barrier"* (Dunn & Mutti, 2004).

There is a large degree of speculation on whether trade deficits are a cause for concern. John Maynard Keynes is regarded as one of the greatest economists of the 20th century. Keynes argued that trade deficits raise a country's unemployment levels, harm its economy and cause international economic instability (Milberg, 2002; Lavoie, 2014; Irwin, 1996). While many modern day economists argue that trade deficits are unproblematic, some still believe otherwise. A recent article published by Wall Street Journal titled *"The Case of Free Trade is Weaker Than You Think"* written by Larry Summers (2016) shares Keynes' classic view on trade deficits, perhaps indicating that Keynes' views still hold strong to this day.

On November 2, 2018 The U.S. Census Bureau published a trade report (Census.gov, 2018) stating that the trade deficit with China reached an all-time high despite the tariffs on billions of dollars' worth of Chinese products imposed throughout the year (Reuters, 2018). The increased import relative to the export despite billions of dollars in taxes implies that producers may be looking to try to get ahead of any future restrictions. Thus, tariffs may have the opposite of the intended effect, as far as lowering the trade deficit is concerned. The news

came concurrently with The U.S. Treasury Department's projection that the Federal Government is on the cusp of issuing more debt that it did during the financial meltdown of 2008 (Bloomberg, 2018). The so-called trade war between two of the world's largest economies has caused disruptions within the supply chains and economies of both countries, spreading uncertainty among companies and businesses.

As of this writing, tariffs imposed on imported steel and aluminum have caused the largest U.S. producer of nails, Mid Continent Steel and Wire, to lay off 150 of its 500 employees with the CEO of the company claiming that they are *"on the brink of extinction"* (CNN Business, 2018). Jagemann Stamping President Ralph Hardt claimed that his company is still recovering from the 2002 tariffs imposed by George W. Bush and fears that *"the Trump tariffs could be a repeat, if not worse"* (Washington Post, 2018). In a formal letter addressed to the Office of U.S. Trade Representative, Apple expressed its concern that the proposed future taxes on imported goods will increase the cost of its U.S. operations, divert resources and disadvantage the company compared to foreign competitors (CNBC, 2018). On September 8, 2018 The U.S. President Donald J. Trump addressed Apple's concerns about the tariffs, stating that the company should move its production to the U.S (Washington Post, 2018). In addition to Apple being threatened by U.S. trade policies, the question is: what is China planning to do to retaliate against Apple in the Chinese market?

1. 2 Research Question

Systematic risk factors and macroeconomic news' impact on asset returns and volatility remains a subject of research to this day, perhaps due to the ever-changing dynamics of the financial markets. Indeed, the evidence presented by Goldberg & Leonard (2003) suggests that markets are always changing, even when no news is present, indicating the presence of sentimental effects and their influence on trade patterns. Economic effects such as disruption of trade may influence the public and their investment behavior. In order to better understand the market fluctuations and people's behavior amidst the current trade dispute and during times of restrictive trade policies in general, the research topic of this thesis is:

"The Impact of Trade Policy on Financial Markets: Evidence From The US–China Trade war"

Specifically, the study shall measure the impact of tariffs and trade-related news on financial markets by analyzing volatility and returns across different financial data. The research question is:

"How does the trade war between the U.S. and China impact the countries' financial markets?"

2. Theoretical Framework

This study is based on several strands of literature. The theoretical foundation will be covered in this chapter, starting with the efficient markets hypothesis followed by the behavioral finance theory, two fundamental and influential theories of asset pricing.

2.1 Efficient Markets Hypothesis

The efficient markets hypothesis (from now on EMH) introduced by Eugene Fama (1970) states that in an efficient market, the prices of financial assets reflect all available information, making it impossible to beat the market i.e. earn excess return consistently. EMH argues that in an efficient market, no arbitrage opportunities exist, and that opportunities for extraordinary gain do not persist. Fama (1970) divided this hypothesis into three forms: the weak form, the semi-strong form, and the strong form of market efficiency. Each form implies that information at different levels is embedded in the stock price.

Strong form efficiency implies that all public and private information is accounted for in the price of a stock, thus making it impossible to beat the market even when using privileged information not available to the public.

Semi-strong efficiency implies that all public information such as earnings and news reports is instantly incorporated into the price, making it impossible to beat the market using publicly available information. Investment strategies such as utilizing publicly available financial information and news reports in order to "get an edge" on the market and to predict future prices are thus rendered ineffective.

Weak form efficiency implies that historic prices cannot be used in order to predict future prices. Investment strategies such as using technical analysis (looking at past prices in order to predict future prices) are thus rendered ineffective. Historical data on securities and assets are publicly available, and historical patterns that might have predicted the future have already been exploited.

The underlying assumption of this hypothesis is that news travels instantly and that future prices are independent of past prices, making it impossible to predict price movements. In finance literature, the relationship between current and future prices is referred to as a "random walk". Thus, since the price of an asset reflects all available information, the price changes only when new information becomes available, and the information is reflected in asset prices without delay. The event study methodology used in this research is based on EMH, as it tests the semi-strong form of the efficient market hypothesis and estimates the impact of an event by looking at price fluctuations around the designated event period (Bodie, 2009).

Throughout history, there have been numerous examples of investors earning excess returns using both insider and publicly available information. As such, the EMH has been subject to criticism, with most of it being aimed towards the assumptions of strong and semi-strong forms of market efficiency (Fabozzi, Jones & Johnson, 2002). Despite the criticism, the EMH continues to serve as a useful benchmark for researchers, central bankers and regulators alike (Fakhry, 2016).

John C. Bogle, the founder of one of the most famous mutual fund companies Vanguard, had this to say about the concept of market efficiency:

"The active money manager puts forth this argument. "I'm smarter than the others in the market. I can discover undervalued stocks, and when the market discovers them and they rise in price I'll sell them. Then I'll discover other undervalued stocks and repeat the process all over again. I know that the stock market is highly efficient, but through my intelligence, my expert analysts, my computer programs, and my trading strategies, I can spot temporary inefficiencies and capture them, over and over again". Some fund managers have actually succeeded in this task. But they are precious few in number—over the past 36 years, just three funds out of 355 have consistently distinguished themselves. Nonetheless,

hope springs eternal among money managers, and they strive for excellence. Of course, they believe in themselves (this field has few shrinking violets!), but they also have a vested financial interest in persuading investors that if they have done well in the past they will continue to do so in the future. And if they haven't done well in the past, well, better days are always ahead (Bogle, 2009)*"*

Bogle mentions money managers persuading investors that if they have done well in the past, then they will continue to do so in the future. The concept of overconfidence and belief may influence our decisions or judgments in both helpful and detrimental ways, and ties into the next section of this thesis: the field of behavioral finance.

2.2 Behavioral Finance

"Behavioral finance closely combines individual behavior and market phenomena and uses knowledge taken from both the psychological field and financial theory (Fromlet, 2001)".

Behavioral finance studies the effect of investor sentiment on financial decisions. Unlike EMH, which is predicated on the belief that investors are (on an aggregate level) rational and not influenced by cognitive and emotional factors, behavioral finance seeks to explain market inefficiency and market abnormalities through the concepts of human irrationality and psychology. Behavioral finance argues that financial markets are not as objective and efficiently priced as some theories assume and seeks to explain investment behaviors such as investors holding on to stocks that are crashing or selling stocks that are

rising. Studies argue that negative investor sentiment such as bad mood and anxiety have a negative effect on investment decisions, causing investors to deviate from rational investment behavior. Research suggests strong linkage between emotions and financial market decision-making (Birau, 2011).

"What is important in market fluctuations are not the events themselves, but the human reactions to those events." (Lee et al., 2002, p. 2277).

Investor sentiment and the tendency to overreact to certain events may be explained through the overreaction hypothesis, which states that investors may deviate from their fundamental investment principles due to errors in investors' forecasts (De Bondt, 2000). Behavioral finance suggests that investors misinterpret information on the following three grounds:

irrational behavior, systematic patterns of behavior, and limits to arbitrage in financial markets (Goedhart et al., 2005). An irrational investment decision may happen if an investor makes an inaccurate assessment of publicly available information (Goedhart et al., 2005). Putting too much emphasis on recent news is an example of irrational behavior. Systematic patterns of behavior can be patterns of overreaction, overconfidence and overrepresentation (Goedhart et al., 2005). For example, overconfidence in one's own ability as a competent investor can influence investment behavior. The third theory on investor misinterpretation is related to limits to arbitrage in financial markets. This occurs when investors expect the same future outcome as the current or a previous outcome (Goedhart et al., 2005). Investing in a stock without a thorough analysis due to a belief that a company that does well in one quarter will do well in the next is an example of this.

If negative sentiment can influence investment decisions, it is reasonable to believe that feelings of anxiety and fear in connection with trade war can influence investment behavior and thus influence asset pricing. Depending on how investors interpret information, trade war-related news may cause a market sell-off and a downwards trend in price, as investors exercise a risk averse behavior in light of trade war news. Conversely, news of a potential trade deal or truce may trigger an optimistic investor response, driving up the stock prices and causing markets to rise continuously over time.

3 Methodology

The objective of this study is to scientifically demonstrate that the movements in financial markets around the event periods are related to trade-war-related information and not due to random market, industry factors or random fluctuation in stock prices.

3.1 Event Study

Event study methodology can be utilized in order to examine the research problem. Originally introduced during the late 1960s by Ball and Brown (1968) and Fama et al. (1969), this methodology has grown in popularity and is now considered to be an important part of financial literature (Kothrai & Warner, 2008). This methodology has enabled financial economists and researchers to verify the validity of the semi-strong form of the efficient markets hypothesis. As mentioned previously, market efficiency deals with whether prices really reflect the information that is in the marketplace. In particular, the

semi-strong form of EMH argues that asset prices already fully reflect all publicly available information, thus making it impossible to earn "abnormal" or excess returns consistently using fundamental or technical analysis.

The empirical process used to calculate abnormal return and determine whether there has been a violation of the EMH varies from study to study. Common among them is the fact that they are used to measure movements of financial instruments within a predefined event window in order to make inferences on the impact of those particular events. Researchers have looked at investors' mood as well as the effects of weather, terrorist attacks and even airplane crashes on financial markets' return and volatility. Chang et al (2006) looked at the effects of weather on investment behavior. The research concluded that cloud cover and temperature had a significant effect on stock returns, with investors investing more when the temperature is high and cloud coverage is low. Ashton et al. (2003) looked at the effects of sports on the London Stock Exchange, with their research concluding that the performance of the national football (soccer) team of England had a significant effect on investment behavior. Chance and Ferris (1987) have looked at the impact of airplane crashes on financial markets, concluding that the stock of the company involved in a crash declined significantly, but only for that particular company and not for the airplane industry as a whole. Various research on the impact of terrorist attacks on financial markets suggest a linkage between abnormal stock market returns and terrorism attacks, with the abnormal returns lingering on the event day and on the days that follow. Furthermore, there seems to be a correlation between the number of casualties and stock market volatility.

3.2 Procedure

In this section, the framework for defining various models and estimating their parameters will be defined. When conducting an event study, the time of the event is defined as "time period zero" or "day zero" and the objective is to gauge the impact of a particular event on a particular financial variable on that day. Furthermore, it is common practice to examine the days before and after the event in order to determine whether there is any anticipation of the event or whether the abnormal returns are persistent after the event. If the markets are informationally efficient, then there should not be any pattern of abnormal returns and they should not persist on subsequent days. If the difference between the abnormal return and the normal return is statistically significant, then one may start to question the validity of the semi-strong form of the efficient market hypothesis with respect to that particular effect, as the

market is not quickly incorporating that information into the pricing of that financial asset.
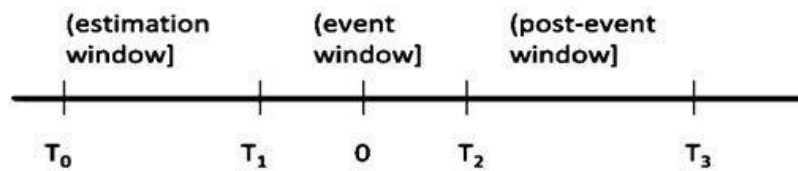
Figure 1: Event Study Timeline

Figure 1 illustrates the event study timeline. The notation of the timeline is as follows:

The event day is defined at T = 0,

Event window: T = T1 + 1 to T2

Estimation window: T = T0 + 1 to T1

Post event window: T = T2+ 1 to T3

Length of the estimation window: L1 = T1 - T0

Length of the event window: L2 = T2 - T1

Length of post event window: L3 = T3 - T2

MacKinlay's (1997) event methodology framework can be used in order to test the EMH. A brief summary of this framework is presented in the following seven steps:

1. Event definition
2. Selection criteria
3. Normal and abnormal returns
4. Estimation procedure
5. Testing procedure
6. Empirical results
7. Interpretation and conclusions

1. Defining the events of interest and the event window.

First, the task is to define the event of interest. For example, the event of interest could be a stock split, a merger or an earnings announcement. Once established, a general event window is defined, which serves as the timeframe over which asset prices are examined. The event window must be long enough to capture the impact of the event. The length of the

event window is set depending on whether the objective is to investigate short- or long-run effects. Long-run estimation windows can cover weeks, months, or even years when using monthly data. Shorter windows have the benefit of added precision. The research must try to pinpoint the date and time at which the information was received and consider any information leakage prior to the event. The research event timeline for this study is defined in chapter five of this thesis. The event window is defined in chapter six.

2. Defining the selection criteria

The second step is to select the financial variables (usually stock returns) and to determine their availability. During this stage, the research must note any potential biases which may be introduced through the selection, as well as to summarize some characteristics of the data (e.g., industry representation, firm market capitalization etc.). The choice of financial variables for this particular study is covered in section four of this thesis.

3. Normal and abnormal returns

This section is about understanding what needs to be measured in order to conduct an event study. Normal return is defined as the expected return without the event taking place. Determining the normal return can be accomplished through the use of statistical or economic models. The two common statistical models used in event studies are the market model and the constant-mean-return model. For the statistical models, it is conventional to assume that asset returns are jointly multivariate normal and independently and identically distributed through time. This assumption is sufficient for the models to be correctly specified.

Alternatively, various economic models such as the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT) can be utilized. Economic models are statistical models with economic restrictions. The complexity associated with the application and estimation of sophisticated economic models has to be seen in relation to their added benefits. It is argued that the added precision of these more complex methods is rather small or even negligible (Brown & Warner, 1980; Binder, 1998; Cam, 2007). Some researchers even argue against the use of CAPM in event studies due to some of its restrictions (MacKinlay, 1997). The variance of the abnormal returns is frequently not reduced by choosing a more sophisticated model (MacKinlay et al. 1998). The two most common models for measuring normal returns; the market model and the constant-mean-return model shall be presented.

The market model or *"the OLS model"* (Brown and Warner, 1985) used in event methodology is based on a regression technique with a slope and an intercept, where the data is regressed on market data. The market model assumes a linear relationship between the asset return and the market return. This model is estimated using data from the estimation window, which should not overlap with the event window and should act as a separate set of data.

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

The equation above is the market model. Where R_{it} is the period t return of asset i. R_{mt} is the return of the market portfolio or the benchmark on period t. u_{it} is the error term, which is a random variable with finite variance and an expect value of zero. It is assumed that u_{it} is uncorrelated with the market return R_{mt} and firm return R_{it} with $i \neq j$ not autocorrelated and homoscedastic. The regression coefficient β_i is a measure of the sensitivity of R_{it} on the reference market.

$$\hat{R}_{i\tau} = \frac{1}{EST} \sum_{i=1}^{i} R_{i\tau}$$

The equation above is the constant-mean-return model, where $R_{i\tau}$ is the estimated normal return for security i for period τ and EST is the length of the estimation window (MacKinlay, 1997). The constant-mean-return model assumes that the mean return of a security is constant through time. Brown and Warner (1980, 1985) found that results based on this model often yield results similar to those of the more sophisticated models.

In addition to estimating normal returns, one is interested in finding the abnormal returns (from now on AR) or excess returns associated with the event, which is the difference between the actual return and what the model predicts. There are several models that can calculate AR, some examples are the mean-adjusted returns model (MAR), the market-adjusted returns model (MKAR) and the risk-adjusted returns model (RAR). The mean-adjusted abnormal returns are defined by:

$$AR_{it} = R_{it} - E(R_{it})$$

Where AR_{it} is the excess or abnormal return for market or stock i during time or period t. R_{it} is the observed return for market i during period t.

$E(R_{it})$ is the average return for market i during time t.

The distribution of AR under H0, or under the null of no abnormal performance for firm i on period t during the event window is:

$$AR_{it} \sim N(0, \sigma^2(AR_{it}))$$

Where $\sigma^2(AR_{it})$ is the variance of the abnormal returns.

4. Estimation procedure

In the fourth step, the estimation window is defined, which is the period used to calculate normal return. Normal return is defined as the expected return without the event taking place. It is common to use the period prior to the event window for the estimation window. In his example, MacKinlay (1997) utilizes a 250 day trading day period prior to the event window as the estimation window in order to calculate normal return. Armitage (1995) insists that estimation periods should consist of anything from 100 to 300 days for daily observations and 24 to 60 months when the analysis is conducted on a monthly basis
It is common to exclude the event period from the estimation period in order to prevent the event from influencing normal return, also referred to as "event contamination".

5. Testing procedure

The fifth step in the framework is to define the null hypothesis and to test the abnormal returns. In event studies, the null hypothesis is that there is no abnormal return:

$$H_0: AR = 0 \text{ and } CAR = 0$$
$$H_1: AR \neq 0 \text{ and } CAR \neq 0$$

Abnormal returns can be tested individually for each event and each stock or aggregated across events or stocks in order to calculate the overall abnormal effect. Often, the objective is to compute the overall inference of all the events, as one stock's abnormal return in one period might not provide any useful information. Aggregation of abnormal returns can be accomplished through a number of different methods, such as by calculating the cumulative abnormal returns (CAR), average abnormal returns (AAR) or cumulative average abnormal returns (CAAR). CAR is aggregating the single-day ARs across time. AAR aggregation is

accomplished by aggregating and averaging single-day ARs across stocks or events. CAAR is a combination of both, and is done by averaging and aggregating ARs across both time and stocks or events.

For individual ARs, their significance can be tested using a procedure outlined by Brooks (2014):

$$S\hat{A}R_{it} = \frac{\hat{A}R_{it}}{[\hat{\sigma}^2(AR_{it})]^{1/2}} \sim N(0,1)$$

SAR_{it} stands for standardized abnormal return, which is the test statistic for each firm i and for each event day t. The procedure is a t-test where the abnormal return is divided by its corresponding standard error, which will asymptotically follow a standard normal distribution.

Cumulative abnormal returns are computed by summing abnormal returns over several periods, for example from time T_1 to T_2:

$$C\hat{A}R(T_1, T_2) = \sum_{t=T_1}^{T_2} \hat{A}R_t$$

The variance of CAR is the number of observations in the event window plus 1, multiplied by the daily abnormal return variance calculated previously:

$$\hat{\sigma}^2(CAR_i(T_1, T_2)) = (T_2 - T_1 + 1)\hat{\sigma}^2(\hat{A}R_{it})$$

In other words it is the sum of the individual daily variances over the days in T_1 to T_2 inclusive.

The H0 cumulative AR distribution is:

$$CAR_i(\tau_1, \tau_2) \sim N(0, \sigma_i^2(\tau_1, \tau_2))$$

The test statistic for CARs is similar the to test statistic for individual ARs, where the now "cumulative" abnormal return is divided by its corresponding standard error, which will also asymptotically follow a standard normal distribution.

For average abnormal returns, for N firms or N events:

$$\hat{AR}_t = \frac{1}{N} \sum_{i=1}^{N} \hat{AR}_{it}$$

The abnormal returns are added together and divided by N number of firms, stocks, or events. More often than not, the objective of an event study is to determine whether the return averaged across all firms or events is statistically different from zero, rather than for any specific individual date or stock.

Lastly, for cumulative average abnormal returns (CAAR), the cumulative abnormal returns (CARs) are summed and averaged. As previously, when testing the significance of the result, the abnormal return is divided by its corresponding standard error, in this case the CAAR.

The procedure for testing the significance of the aggregated abnormal returns is similar to the procedure used for testing individual ARs covered previously. The difference lies in replacing individual abnormal return with cumulative abnormal return. This procedure is also described by Stock & Watson (2007), using slightly different and perhaps simpler notation:

$$t = \frac{\overline{Y} - \mu}{SE(\overline{Y})}$$

Where Y bar is the average AR / CAR / CAAR, μ is the expected AR / CAR / CAAR, SE is the standard error of AR / CAR / CAAR. The expected AR is zero (no abnormal return).

6. Empirical results
The sixth step is to present the empirical results and to gauge their importance. In addition, a presentation of diagnostics can be helpful. The study should note whether the results are heavily influenced by one or two stocks.

7. Interpretation and conclusions
The empirical results should hopefully lead to useful insights about how events affect security prices. If the impact (or lack thereof) of the event on security prices is unclear, including additional analysis to distinguish between competing explanations should be

considered.

3.3 Criticism

"MacKinlay (1997) argues that conducting event studies initially appears difficult but is in fact easy; my view is that exactly the reverse is true: in principle, event studies are simple to understand and to conduct, but to do so in a rigorous manner requires a great deal of thought. There is a bewildering array of approaches that can be deployed, and at first blush it is not at all clear which of them is appropriate or optimal." (Brooks, 2014)

The event study methodology is not without its criticism. For one, Brooks (2014) stated the difficulties of conducting an event study due to *"a bewildering array of approaches that can be deployed".* Indeed, the approach is left up to one's discretion, as the event study methodology does not provide a one-size-fits-all answer to every problem. The event study literature presents broad, general guidelines, and may leave researchers confused. The procedures outlined in this thesis are a tiny fraction of the total, but were covered in detail due to their direct relevance to this particular study.

One of the main issues concerning event studies occurs when other events take place within the time frame of the event study analysis, making an interpretation of results difficult or inaccurate. In order to mitigate this problem, one has to attempt to make the estimation window as narrow as possible and attempt to exclude non-related circumstances.

A number of further issues can arise within the context of conducting an event study. These include the role of sampling interval, event date uncertainty, robustness, and some additional biases (MacKinlay, 1997).

The choice of sampling interval refers to the frequency of stock return data used in an event study. Research shows that there is a substantial payoff to using shorter intervals when available, such as using daily stock returns over monthly, quarterly or annual data.

Event date uncertainty refers to event date identification and the difficulties associated with it. One cannot be certain that the market was informed of the event prior to the close of the market. A common way of handling this problem is expanding the event window to two days (day 0 and day +1).

Robustness refers to the assumption of normality, that the returns are jointly normal and temporally independently and identically distributed. This is generally not a problem for event studies due to quick convergence to asymptotic distribution.

Lastly, a number of possible biases can arise. Nonsynchronous trading can introduce a bias. For example, "closing prices" are prices at which the last transaction occurred during the trading day. In general, these closing prices do not occur at the same time each day, and by calling them "daily prices", one is assuming that they are equally spaced at 24-hour intervals. Computing cumulative abnormal returns can introduce an upward bias, which arises from the observation to observation rebalancing of equal weights implicit in the calculation of the aggregate cumulative abnormal return combined with the use of transaction prices which can represent both the bid and the offer side of the market.

4. Dataset

This study has utilized various financial data in order to examine the research problem., including major stock market indices such as the S&P 500 and the Chinese SSE as well as market sector indices that summarize the performance of stocks grouped by specific market sectors and market capitalization indices which track the performance of stocks grouped by company size. This allows the research to distinguish between different market segments and categories from a larger whole in order to make inferences on how the trade war affects each specific market segment and category. In addition, the study has analyzed the impact of trade war on U.S. stock market volatility and on the U.S. debt market.

A stock market index is a list of publicly traded companies and allows investors to track or invest in a specific market with ease and without having to research and aggregate the individual, underlying stocks, giving investors a single number to summarize its performance. Investing in a well-diversified index fund may limit exposure to macro-economic, firm or industry specific risks, as they spread risk broadly across different stocks. Indices are often used as benchmarks by active investors (investors who pick individual stocks) to track their own portfolio returns to see if they are out- or under-performing a particular market. Investors who do not try to "out-think" or out-perform a market are referred to as passive investors and tend to buy and hold index funds consisting of many different stocks. Passive investors tend to argue that almost no active investors can beat the overall markets consistently, a mindset described in the Efficient Markets Hypothesis section of this thesis.

A list of financial variables used for the analysis are now presented, starting with major indices. All data are daily historical data.

4.1 Major Indices

S&P 500

The S&P 500 is a U.S. stock market index based on the market capitalizations of 500 leading companies listed on the New York Stock Exchange, NASDAQ and Cboe BZX Exchange and captures approximately 80% coverage of available market capitalization. The S&P committee selects the companies in the S&P 500 so that they are representative of the industries in the United States economy. The S&P 500 differs from the Dow Jones Industrial Average and the NASDAQ Composite index because of its diversity and is often used as a barometer for general risk trends and volatility (more on this in the volatility section of this chapter).

NASDAQ Composite

The NASDAQ Composite is comprised of over 4000 stocks being traded on the U.S. NASDAQ Stock Exchange. It differs from the S&P 500 in that the vast majority of the stocks are within the technology segment of the economy. The NASDAQ Composite index is therefore considered a good proxy for the technology segment of financial markets.

Dow Jones Industrial Average

The Dow Jones Industrial Average is the oldest of the major U.S. stock market indices and consisted of strictly industrial companies, thereby earning its name. Today, it is comprised of 30 large-cap companies which represent a wide array of American business, from technology to manufacturing, domestic to international, and everything in-between. The companies included represent a huge portion of the U.S. economy, acting as a proxy for all other enterprises.

SSE Composite Index

The SSE Composite Index is a stock market index of all stocks that are traded at the Shanghai Stock Exchange.

Historical data on all major indices were obtained from the "Yahoo! Finance" website.

4.2 Market Sector Indices

Market Sector Indices summarize the performance of stocks grouped by specific market sectors and industries. The S&P 500 Sector Indices were obtained from S&P's official website, standardandpoors.com. The S&P 500 was chosen due to its diversity. The Index is broken down into eleven sub-indices according to the Global Industry Classification Standard (GICS) sectors. These eleven sectors are Consumer Discretionary, Consumer Staples, Energy, Financials, Health Care, Industrials, Information Technology, Materials, Communication Services, Utilities, and Real Estate. The information presented was gathered from the official S&P website.

Communication Services

The communication services sector includes satellite companies, cable companies, wireless operators and Internet service providers whose objective is to make communication on a global scale possible. This sector includes companies such as AT&T and Verizon. As of January 25, 2019, the total value of all communication services stocks in the United States came to $4.42 trillion, or 10.33% of the market.

Consumer Discretionary

The consumer discretionary sector is a sector of the economy that produces goods and services that are considered nonessential, whose demand rises and falls based on income and general economic conditions. Consumer discretionary goods include apparel, entertainment and leisure, automobiles and luxurious diamond engagement rings. Examples of consumer discretionary stocks include Apple, Amazon, and Starbucks. As of January 25, 2019, the total value of all consumer discretionary stocks in the United States came to $4.54 trillion, or about 10.11% of the market.

Consumer Staples

The consumer staples sector consists of businesses that sell the necessities of life; products like toothpaste and packaged food. The consumer staples sector includes companies such as Procter & Gamble and Kroger. As of January 25, 2019, the total value of all consumer staples stocks in the United States came to $2.95 trillion, or about 7.18% of the market.

Energy

The energy sector consists of businesses that source, drill, extract, and refine raw commodities

such as oil and gas. Major energy stocks include Exxon Mobil and Chevron. As of January 25, 2019, the total value of all energy stocks in the United States came to $3.36 trillion, or about 5.51% of the market.

Financials

The financial sector consists of banks, insurance companies, real estate investment trusts, credit card issuers, and other money-focal enterprises that keep the economy flowing. As of January 25, 2019, the total value of all financial stocks in the United States came to $6.89 trillion, or about 13.63% of the market. JP Morgan Chase, Goldman Sachs, and Bank of America are some examples of financial stocks.

Health Care

The health care sector consists of drug companies, medical supply companies, and other scientific-based operations that are concerned with improving public health. As of January 25, 2019, the total value of all health care stocks in the United States came to $5.25 trillion, or about 15.21% of the market. Examples of health care stocks are Johnson & Johnson and Pfizer.

Industrials

The industrial sector comprises railroads and airlines to military weapons and industrial conglomerates. Major industrial stocks include Lockheed Martin , CSX and the aerospace colossus Boeing. As of January 25, 2019, the total value of all industrial stocks in the United States came to $3.80 trillion, or about 9.33% of the market.

Information Technology

The information technology (IT) sector is a sector of the economy that produces hardware, software, computer equipment, and IT services. Microprocessors, printers, operating systems and cell phone handsets are examples of products that have turned IT into a giant part of global economies. Top IT stocks include Microsoft and IBM. As of January 29, 2018, the total value of all information technology stocks in the United States came to $7.10 trillion, or about 19.85% of the market.

Materials

The materials sector supplies the other sectors with the raw materials they need to conduct their operations. These materials include metals, paper, chemicals, wood, and industrial ore. As of January 25, 2019, the total value of all materials stocks in the United States came to $1.77

trillion, or about 2.71% of the market. Major materials stocks include Dow Dupont, Ecolab, and International Paper.

Real Estate

The real estate sector includes all Real Estate Investment Trusts with the exception of Mortgage, which is housed under the financial sector. The sector also includes companies that manage and develop properties. As of January 25, 2019, the total value of all real estate stocks in the United States came to $1.17 trillion, or 2.96% of the market. The real estate industry includes stocks such as American Tower, Simon Property Group and Prologis.

Utilities

The utilities sector of the economy is home to companies involved with the delivery of electricity, natural gas, water and power. Utilities sector includes companies like Exelon and Dominion Resources. As of January 25, 2019, the total value of all utilities stocks in the United States came to $1.27 trillion, or about 3.18% of the market.

4.3 Market Capitalization Indices

Market capitalization (market cap) is used in order to rank the size of companies. Market cap is the market value of a publicly traded company's outstanding shares and is equal to the share price multiplied by the number of shares outstanding. Capitalization could be used as an indicator of public opinion of a company's net worth. It is important to note that market cap reflects only the equity value of a company, as opposed to sales or total asset figures. This study has utilized the FTSE Russell U.S. Equity Indexes obtained from the official FTSE website, ftserussell.com. The following is a list of all the market cap indices included in this study, ranging from the smallest microcap index to the largest Russell 3000 index.

Russell Microcap

The Russell Microcap Index measures the performance of the microcap segment of the U.S. equity market and makes up less than 3% of the U.S. equity market.

Russell 2000

The Russell 2000 Index measures the performance of smaller businesses and is comprised of 2000 small-capitalization companies. The index represents approximately 8% of the total market capitalization.

Russell 2500

The Russell 2500 Index combines a portion of small cap stocks with midcap stocks, forming a "SMID" (small/mid) cap segment of stocks.

Russell Midcap

The companies making up the Index are medium sized companies, comprised of 800 publicly traded U.S. companies with market caps of between $2 and $10 billion.

Russell Top 50 Mega Cap

The Russell Top 50 Index holds only 50 stocks, but due to the size of the mega cap companies, it still represents a large proportion of all U.S. equities.

Russell 1000

The Russell 1000 Index is comprised of 1,000 largest U.S. public companies, representing some 92% of the U.S. stock market value.

Russell 3000

The Russell 3000 lists the largest 3000 U.S. publicly traded companies and represents nearly 98% of the investable U.S. stock market, making it an accurate representation of the overall stock market performance.

4.4 Debt Securities

A debt security is a loan contract. By issuing a loan, a company or government borrows money from investors who in return are paid interest on the money loaned. Companies and governments issue such loans in order to fund new projects or ongoing expenses. In general, debt securities are considered less risky than stocks because the holders must be paid before any profits are distributed to shareholders.

The U.S. Federal Government issues the following fixed income securities: treasury bonds, treasury bills, and treasury notes. They differ with respect to the interest they pay and their time to maturity. Maturity refers to how long a debt security in question is outstanding. Treasury yields refer to how much an investor is being paid from their investments as a percentage of the holdings value. For bonds, a bond yield equals annual coupon payment divided by bond price.

When money goes into debt securities, it drives their price up. With bonds, prices and yields move in the opposite direction. When prices rise, yields fall. In other words, higher demand

suppresses yields. Under normal conditions, longer term bonds pay investors higher interest rates, as they tie up their money for a longer period of time. In general, investors demand higher yields for longer-term bonds.

The shape of the yield curve changes along with demand and may provide insight into investor sentiment and general economic conditions. If the yield curve is inverted, as it is during the time of this writing (CNBC, 2019), some long-term bonds pay investors less than short-term bonds. On May 23 2019, the one month was yielding more than the ten year. Investors have bought long-term bonds to the point of the yield being no more attractive than that of the short-term bonds. This may be interpreted as an indication of investors believing that there is a risk in the near-term that outweighs the risk of long-term, a sign of troubled times ahead. Treasury yields are regarded as an indicator of investor sentiment, economic conditions and coming recessions. *"The bond market is flashing its biggest recession sign since before the financial crisis"*(CNBC, 2019)

During periods of fear and uncertainty, many investors sell risky assets and invest money in safer investments such as debt securities. However, debt securities become less and less attractive as the yields become suppressed. The concept of human rationality dictates that if the yields are perceived as being too low (unattractive), investors will refrain from investing into debt.

The 5, 10, and 30 year treasury yields were obtained from the "Yahoo! Finance" website and are used for the analysis.The objective of the analysis is to determine whether the trade war has an impact on the U.S. debt market. The results may also provide insight into investor sentiment.

4.5 Volatility

"The VIX Index is recognized as the world's premier gauge of U.S. equity market volatility ... widely reported by financial media and closely followed by a variety of market participants as a daily market indicator." (cboe.com, 2019)

"Volatility measures the frequency and magnitude of price movements, both up and down, that a financial instrument experiences over a certain period of time. The more dramatic the price swings in that instrument, the higher the level of volatility." (cboe.com, 2019)

The Chicago Board Options Exchange (CBOE) Volatility Index (VIX), commonly referred to as the "fear index" or the "fear gauge", is a measure of the stock market's expectation of volatility, computed from options-based theory and current options-market data. VIX measures the implied volatility of S&P 500 Index options. The more volatile the stocks and options are, the higher the VIX price. Investors cannot trade the VIX itself, but can trade derivatives contracts based on the index, which may leave investors financially exposed to volatility.

The objective of the analysis is to determine whether the events analyzed in this study have a significant impact on stock market volatility. Historical data of the VIX Volatility Index were obtained from the "Yahoo! Finance" website.

5. Event Timeline

This chapter presents the events examined in this study.

March 1, 2018
The Trump administration announced steep tariffs on steel and aluminum.
"Stocks tumble off Trump tariff announcement" (CNBC, 2018).

March 22, 2018
U.S. imposes a 25 percent tariff on all steel imports and a 10 percent tariff on all aluminum imports from China, claiming that this is the first of many (CNBC,2018).

April 2, 2018
China imposes tariffs ranging from 15 to 25 percent on 128 products worth $3 billion in retaliation to the U.S. steel and aluminum tariffs (CNBC, 2018).

April 16, 2018
"U.S. ban on sales to China's ZTE opens fresh front as tensions escalate" (Reuters, 2018).
The US Commerce Department banned American firms from selling parts, software, and components to China's ZTE Corp, a multinational telecommunications equipment and system company.

June 15, 2018

The U.S. announces tariffs on $50 billion of imports from China, with Trump threatening more if China retaliates (CNBC, 2018).

July 6, 2018

U.S. and China exchange $34 billion in tariffs (CNBC, 2018). The U.S. imposes tariffs on $34 billion worth of Chinese goods. China immediately retaliates with tariffs on its $34 billion list of goods issued the month before.

July 11, 2018

The USTR released a list of $200 billion of Chinese goods it plans to impose an extra 10 percent tariffs on (CNBC, 2018).

July 31, 2018

"The U.S. and China are trying to restart trade talks aimed at averting a full-blown trade war between the world's two largest economies." (Bloomberg, 2018)

August 23, 2018

The U.S. implements 25 percent tariffs on 279 goods originating from China, worth $16 billion. China implements retaliatory 25 percent tariffs on 333 goods originating from the US, also worth $16 billion (CNBC, 2018)..

September 17, 2018

"Trade war fears have been rattling markets for a while. On Sep 17, the Trump administration announced that it would impose 10% tariffs on $200 billion worth of Chinese goods, which would rise to 25% by year end. In retaliation, China said too announced 10% tariffs on 5,000 U.S. products worth $60 billion. However, 10% tariffs were seen as a relief compared to a harsher 25% tariffs, as feared by analysts. This somewhat helped markets since a rally in industrial stocks followed. (NASDAQ, 2018)

September 24, 2018

U.S. and China implement third round of tariffs (CNBC, 2018). The U.S. implements tariffs on US$200 billion worth of Chinese goods, bringing the total amount to $250 billion. China responds to U.S. tariffs by implementing tariffs on $60 billion worth of US goods.

October 30 / 31, 2018

October 30: U.S. President Donald Trump said he will make a *"a great deal"* with China, and that he *"would like to make a deal now, but that China is not ready."* (CNBC, 2018).

October 31 (Day +1): U.S. President Donald Trump has not *"set in stone"* any decisions on escalating tariffs on Chinese goods and may withdraw some duties if there are promising policy discussions with China (Reuters, 2018).

November 19, 2018

"US – China trade conflict is worsening" (Washington Post, 2018). Mike Pence says the U.S. is ready to continue its Trade War against China by doubling tariffs on Chinese goods.

November 28 / 29, 2018

Wall Street closed sharply higher on Tuesday after comments from a top U.S. economic adviser raised hopes for a solution to the ongoing trade war with China" (Yahoo Finance).

"The U.S. and China, looking to defuse tensions and boost markets, are exploring a trade deal in which Washington would hold off on further tariffs through the spring in exchange for new talks looking at big changes in Chinese economic policy "(Wall Street Journal)

December 3, 2018

"Dow jumps more than 250 points on US-China trade truce" (CNBC, 2018).

Trade Truce – President Trump and President Xi agree to pause the trade war.

December 4, 2018

"US stocks fall as investors question US - China trade truce" (Fox Business, 2018).

President Trump says he is a "Tariff Man".

December 7, 2018

"Dow drops 200 points on trade war fears, slowing growth" (CNBC, 2018).

President Trump and President Xi are unlikely to meet.

December 14 / 17, 2018

December 14 (day 0): *"Markets closed mostly lower on Thursday, with stocks moving in and out of positive territory, as investors continued to worry over the lack of clarity and progress in U.S.-China trade talks."* (NASDAQ, 2018)

"On Dec 14, National Bureau of Statistics of China reported that industrial output grew 5.4%

year over year in November, its slowest pace in almost three years. Chinese retail sales rose 8.1% year over year in November, marking the weakest growth since 2003. Most economists think lingering trade related conflicts with the United States are the primary reason for slow pace of Chinese economic growth." (NASDAQ, 2018)

December 17 (day +1): *"Wall Street collapsed on Friday following investors' concerns of an impending global economic slowdown. A series of weaker-than-expected economic reports from China and European Union raised eyebrows of several market participants. All three major stock indexes closed in the red. For the week also, these indexes ended in negative territory."* (NASDAQ, 2018)

December 21, 2019

"White House advisor Peter Navarro says 'China is trying to steal our future' — Comments knock stocks" (CNBC, 2018). Peter Navarro, President Trump's trade adviser said that it is highly unlikely that the United States and China will arrive at an agreement during the 90-day ceasefire period agreed by both sides.

January 7 / 8, 2019

"Positive Developments on Trade War Front ... During January 7-8, high level delegations of both the United States and China are scheduled to meet to discuss a possible trade deal. President Trump also tweeted that he is hopeful of a possible solution to the trade tussle" (NASDAQ, 2019).

January 18, 2019

"US markets leap (again) on China trade war rumors" (CNN Business, 2019).

"Markets gathered steam on Friday after Bloomberg News reported that China has offered to go on a "six-year buying spree" to boost imports from America. The goal would be to zero out China's massive trade surplus with the United States by 2024, the report said." (CNN Business, 2019).

February 7, 2019

U.S. stock markets closed lower as arrest of Chinese tech-behemoth Huawei's CFO in Canada significantly dented investors' hope of a solution to trade-related concerns.

"The development sent fear into financial markets across the globe, driving the Dow down more than 700 points at one point..." (CNBC, 2019)

"The markets fear that trade talks between the U.S. and China could collapse, resulting in an

escalation of a costly trade war that would slow global growth.” (CNBC, 2019)

February 12, 2019

President Trump said trade discussions with China *“are going well”* and that China *“wants to make a deal very badly”*. In addition, Trump said that he would consider delaying a March 2 deadline to reach a trade deal with China, saying the United States might not impose higher tariffs on Chinese goods if talks with Beijing were going well (NY Times, 2019).

February 15, 2019

“Dow soars more than 400 points on trade optimism” (CNBC, 2019)

February 25, 2019

“Shanghai stocks just had their best day in more than three years after comments from the leaders of China and the United States brought investors piling back into the market .... Some of the encouragement came from US President Donald Trump, who announced that he'll delay a major tariff hike on Chinese exports in order to give the two countries more time to reach a trade deal. Trump tweeted that trade negotiators had made "substantial progress" and that he will meet Chinese President Xi Jinping "to conclude an agreement" if the talks continue to advance.” (CNN, 2019)

April 1, 2019

“The Chinese government said it will extend a suspension of retaliatory tariffs on U.S. autos and include the opioid fentanyl in a list of controlled substances, two steps that could generate a positive atmosphere for trade negotiations.” (Bloomberg, 2019)

May 7, 2019

After a series of positive trade-related news, the U.S. Trade Representative told reporters that the U.S. will increase the duty rates on billions of dollars worth of Chinese goods such as electrical equipment, building materials, machinery, car parts and furniture from 10% to 25% due to Chinese negotiators pulling back on their promises and *“breaking the deal”*.
“Dow drops 470 points on growing trade-war threat, biggest decline since early January“ (CNBC, 2019)
“Fear of intensifying trade war ricochets through economy” (NY Times, 2019)
“Trade war fears are crushing stocks, and sell-off could keep going if there is no deal by Friday“ (CNBC, 2019)

May 10 / 13, 2019

May 10 (Day 0): The U.S. has increased tariffs on $200bn of Chinese goods from 10% to 25%, with Beijing vowing to retaliate. President Trump said there is *"no need to rush"* in trade talks with China.

"U.S. - China trade deal: higher tariffs come into effect as talks continue. Damaging trade war could destabilise the already slowing global economy." (The Guardian, 2019)

May 13 (Day +1): China says new import tariffs on $60 Billion worth of U.S. goods to take effect June 1, while threatening to *"weaponize"* their U.S. debt (CNBC, 2019).

"China says it will never surrender to foreign pressure amid trade dispute" (CNBC, 2019)

6. Analysis

This chapter outlines the procedures used to conduct the analysis. The seven-point structure of this chapter follows the same step by step approach described by MacKinlay (1997) in chapter three of this thesis.

1. Defining the events of interest and the event window.

The events chosen for the study are presented in chapter five. Drawing inspiration from MacKinlay, each announcement or development is assigned to one of two categories: positive or negative (good news or bad news). Each announcement category is analyzed separately. Of the 28 announcements, 10 are good news and 18 are bad news. As of this writing, the trade dispute between U.S. and China has lasted approximately 14 months. The study has chosen to identify and include as many observations as possible, recognizing that different issues arise when observations are within close proximity of each other. The following paragraph explains how the study has dealt with these issues.

The analysis was conducted using two separate event windows due to close proximity of some of the events. The first event window is 10 days before and 10 days after the event. Using event study notation, the first event window ranges from day -10 to day +10 (21 days total), with day 0 being the event day. The second event window is the event day itself and the two days following the event, or day 0 to day +2 (3 days total). This is due to issues related to clustering (event windows overlapping each other) when aggregating abnormal returns across events. Clustering may produce inaccurate results, as the abnormal post-event

returns of one event feed into the abnormal pre-event of another and vice versa. In other words, the abnormal returns of sample stocks are potentially correlated when aggregated across events. This issue is eliminated when using the 3-day event window, ensuring increased precision and robustness of the results. The 21-day event window, although perhaps unreliable when aggregating abnormal returns across events, could still provide valuable insight into pre- and post-event abnormal returns when looking at each index and event separately without aggregation. Results are presented in chapter eight of this thesis. The research has taken into account the time difference between the U.S. and China when analyzing the SSE.

2. Defining the selection criteria

All data are daily historical data. Research shows that there is a substantial payoff to using daily stock return over weekly or monthly data (MacKinlay, 1997). The financial data examined in this study have all been outlined and covered in chapter four of this thesis. Instead, this section will touch upon potential biases introduced into the analysis through the selection criteria.

When conducting U.S. sector analysis, the study recognizes that while the S&P 500 is considered the most diverse of the major indices, capturing approximately 80% of available market capitalization, it is mainly a large-cap index comprised of the 500 leading, most traded companies and perhaps not entirely representative of the equity market as a whole. However, this may also be considered a strength, as the most traded securities are likely the most affected, and less traded securities may create noise in research findings. Market cap analysis will reveal whether there are any substantial differences in how different market caps are affected. If the results are similar for all market caps, then this potential bias is of less importance.

3. Defining normal and abnormal returns

As outlined in detail in chapter three, normal return is defined as the expected return without the event taking place and abnormal return is defined as excess return associated with the event, which is the difference between the actual return and what the model predicts.

4. Estimation procedure

This study has utilized the constant-mean-return model described in chapter three for the estimation of normal return. The objective of the research is to analyze financial markets as

a whole, and not firm specific reactions. The constant-mean-return model uses the historical mean of the data which allows for market indices to be analyzed. This is contrary to the market model, where firm specific data is regressed on market data and assumes a linear relationship between the asset return and the market return. As a side note, Brown and Warner (1980) found that the constant-mean-return model outperforms many more complicated approaches because of the estimation error that comes with the latter (Brooks, 2014).

This study has used a 250 day trading day period prior to the event window as the estimation window in order to calculate normal return, which is identical to the length used by MacKinlay (1997) in his example. Normal return was measured using the following formula:

$$\hat{R}_{i\tau} = \frac{1}{250} \sum_{-250}^{-1} R_{i\tau}$$

Where $R_{i\tau}$ is the estimated normal return for security i for period τ and 250 is the length of the estimation window. The event period was excluded from the estimation period in order to prevent the event from influencing normal return (event contamination), as is common practice with event studies.

The mean-adjusted abnormal returns were measured by taking the actual return and subtracting the normal return:

$$AR_{it} = R_{it} - E\left(R_{it}\right)$$

Where AR_{it} is the excess or abnormal return for market or stock i during time or period t.
R_{it} is the observed return for market i during period t.
$E(R_{it})$ is the average return for market i during time t.

5. Testing procedure
The fifth step in the framework is to define the null hypothesis and to aggregate and test the abnormal returns. The null hypothesis is that there is no abnormal return:

$$H_0: AR = 0 \text{ and } CAR = 0$$
$$H_1: AR \neq 0 \text{ and } CAR \neq 0$$

Abnormal returns were aggregated using the CAR, AAR and CAAR procedures outlined in chapter three of this thesis. The significance of the results was tested using a procedure described by Brooks (2014) and Stock & Watson (2007). The procedure is a t-test where the abnormal return is divided by its corresponding standard error, which will asymptotically follow a standard normal distribution:

$$t = \frac{\overline{Y} - \mu}{SE(\overline{Y})}$$

Where Y bar is the average AR / CAR / CAAR, μ is the expected AR / CAR / CAAR), SE is the standard error of AR / CAR / CAAR. The expected AR is zero (no abnormal return). A five percent level of significance was chosen as a threshold for rejection of the null hypothesis.

6. Empirical results

The empirical results are presented in chapter seven.

7. Interpretation and conclusions

Empirical results are interpreted and discussed in chapter eight. The conclusion is found in chapter nine of this thesis.

7. Results

The results of the analysis presented in this chapter are structured according to the five categories of financial data used in this study: major indices, sectors, market caps, debt securities and volatility.

The first table of each section shows unaggregated abnormal and cumulative abnormal returns. AR for day 0 and day +1 along with cumulative abnormal returns for days 0 to 2 and 0 to 5 estimated separately for each index and each date using a 250 day estimation window and a 21-day event window. Dates are listed chronologically. In order to distinguish between positive and negative developments easier, blue color indicates positive developments and grey color indicates negative developments.

To recap, AR for day zero is the abnormal return on the day of the event. AR +1 is the abnormal return on the day following the event. CAR 0-2 is the summed total of abnormal returns for the day of the event and the two subsequent days. For example, an AR of one percent on day zero, plus AR of one percent on the following day, plus AR of minus one percent on the second day following the event will result in a CAR 0-2 equal one percent. CAR 0-2 and CAR 0-5 are calculated in order to determine whether the abnormal returns are persistent over longer periods of time.

Next are the average abnormal and cumulative average abnormal returns. The average abnormal returns (AARs) are aggregated across all events using a 250 day estimation window and a 3-day event window (day 0, day +1 and day +2) and show the average reactions to the events. An AAR of a negative one percent for negative developments multiplied by the total number of negative developments included in the study equals an eighteen percent aggregated total loss as a result of the events. The aggregated results of the 3-day window do not have issues related to clustering and are considered reliable. CAAR 0-2 for the 3-day window were tested for their significance in order to assess whether abnormal returns are persistent over time. A graphical representation of the reactions are included.

The estimation is repeated for the 21-day event window (day -10 to day +10). As mentioned previously, the study was conducted using two separate event windows due to reasons outlined in the analysis chapter six of this thesis. The previous CAAR 0-2 test conducted using the 3-day event window is enough to tell whether the abnormal returns are persistent over time. Thus, the aggregated CAARs of the 21-day event window were not tested.

All results are percentages and refer to abnormal and cumulative abnormal returns, not actual stock returns. Results are discussed in chapter eight of this thesis.

7. 1 Major Indices

Table 1: Results for every major index analyzed separately for each date

March 1	S&P 500	NASDAQ C	D&J Ind	China SSE
AR DAY 0	-1.388 %	-1.354 %	-1.760 %	-0.589 %
AR DAY 1	0.459 %	0.996 %	-0.355 %	0.074 %
CAR 0-2	0.122 %	0.566 %	-0.819 %	0.484 %
CAR 0-5	0.643 %	1.659 %	-0.936 %	1.015 %
March 22	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	-2.611 %	-2.562 %	-3.055 %	-3.458 %
AR DAY 1	-2.182 %	-2.558 %	-1.865 %	-0.612 %
CAR 0-2	-2.176 %	-2.013 %	-2.191 %	-3.030 %
CAR 0-5	-3.031 %	-4.513 %	-2.832 %	-2.977 %
April 2	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	-2.322 %	-2.873 %	-2.000 %	-0.844 %
AR DAY 1	1.191 %	0.932 %	1.555 %	-0.177 %
CAR 0-2	-0.044 %	-0.597 %	0.435 %	-0.794 %
CAR 0-5	-1.432 %	-2.203 %	-0.979 %	0.528 %
April 16	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	0.759 %	0.618 %	0.805 %	-1.403 %
AR DAY 1	1.012 %	1.651 %	0.801 %	0.815 %
CAR 0-2	1.805 %	2.385 %	1.386 %	0.265 %
CAR 0-5	0.233 %	-0.160 %	-0.025 %	0.684 %
June 15	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	-0.146 %	-0.268 %	-0.393 %	-3.837 %
AR DAY 1	-0.257 %	-0.071 %	-0.467 %	0.283 %
CAR 0-2	-0.850 %	-0.696 %	-2.071 %	-4.922 %
CAR 0-5	-1.262 %	-1.359 %	-2.721 %	-5.983 %
July 6	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	0.790 %	1.237 %	0.350 %	2.482 %
AR DAY 1	0.823 %	0.780 %	1.242 %	0.485 %
CAR 0-2	1.905 %	1.958 %	2.109 %	1.228 %
CAR 0-5	2.007 %	2.522 %	2.332 %	2.649 %
July 11	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	-0.756 %	-0.627 %	-0.933 %	-1.730 %
AR DAY 1	0.827 %	1.304 %	0.855 %	2.182 %
CAR 0-2	0.134 %	0.626 %	0.251 %	0.271 %
CAR 0-5	0.511 %	0.758 %	0.818 %	-1.147 %
July 31	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	0.436 %	0.461 %	0.372 %	0.314 %
AR DAY 1	-0.155 %	0.377 %	-0.376 %	-1.761 %
CAR 0-2	0.722 %	1.983 %	-0.089 %	-3.409 %
CAR 0-5	1.668 %	2.760 %	0.935 %	-2.825 %
August 23	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	-0.235 %	-0.231 %	-0.365 %	0.439 %
AR DAY 1	0.552 %	0.758 %	0.451 %	0.247 %
CAR 0-2	1.015 %	1.333 %	1.020 %	2.625 %
CAR 0-5	0.968 %	1.921 %	0.578 %	1.272 %
Sept 17	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	-0.620 %	-1.531 %	-0.418 %	1.888 %
AR DAY 1	0.474 %	0.667 %	0.644 %	1.227 %
CAR 0-2	-0.082 %	-1.034 %	0.766 %	3.145 %
CAR 0-5	0.126 %	-0.774 %	1.167 %	6.213 %
Oct 30	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	1.527 %	1.526 %	1.719 %	1.461 %
AR DAY 1	1.052 %	1.953 %	0.933 %	0.250 %
CAR 0-2	3.602 %	5.176 %	3.669 %	4.489 %
CAR 0-5	4.068 %	4.267 %	4.569 %	3.521 %

Sept 24	S&P 500	NASDAQ C	D&J Ind	China SSE
AR DAY 0	-0.410 %	-0.011 %	-0.743 %	-0.494 %
AR DAY 1	-0.189 %	0.088 %	-0.326 %	1.011 %
CAR 0-2	-0.987 %	-0.227 %	-1.537 %	0.072 %
CAR 0-5	-0.523 %	0.090 %	-0.722 %	-2.219 %
Nov 19	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	-1.700 %	-3.107 %	-1.601 %	-2.051 %
AR DAY 1	-1.854 %	-1.751 %	-2.262 %	0.318 %
CAR 0-2	-3.273 %	-3.977 %	-3.898 %	-1.857 %
CAR 0-5	-2.130 %	-2.505 %	-2.839 %	-4.254 %
Nov 28	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	2.256 %	2.884 %	2.441 %	1.146 %
AR DAY 1	-0.234 %	-0.277 %	-0.133 %	-1.226 %
CAR 0-2	2.820 %	3.372 %	3.068 %	0.826 %
CAR 0-5	0.419 %	1.345 %	0.654 %	3.482 %
Dec 3	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	1.074 %	1.474 %	1.104 %	2.644 %
AR DAY 1	-3.304 %	-3.907 %	-3.161 %	0.522 %
CAR 0-2	-2.396 %	-2.046 %	-2.391 %	2.662 %
CAR 0-5	-4.658 %	-4.333 %	-4.783 %	0.479 %
Dec 4	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	-3.307 %	-3.907 %	-3.165 %	-0.509 %
AR DAY 1	-0.169 %	0.387 %	-0.338 %	-1.600 %
CAR 0-2	-5.852 %	-6.643 %	-5.789 %	-1.983 %
CAR 0-5	-5.221 %	-4.895 %	-5.286 %	-1.830 %
Dec 7	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	-2.360 %	-3.100 %	-2.269 %	-0.714 %
AR DAY 1	0.175 %	0.727 %	0.136 %	0.475 %
CAR 0-2	-2.222 %	-2.218 %	-2.355 %	0.179 %
CAR 0-5	-3.630 %	-3.973 %	-3.481 %	0.340 %
Dec 14	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	-1.941 %	-2.310 %	-2.055 %	-1.437 %
AR DAY 1	-2.113 %	-2.323 %	-2.143 %	0.268 %
CAR 0-2	-4.060 %	-4.212 %	-3.862 %	-1.888 %
CAR 0-5	-9.324 %	-11.167 %	-9.242 %	-3.945 %
Dec 21	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	-2.082 %	-3.052 %	-1.831 %	0.525 %
AR DAY 1	-2.750 %	-2.250 %	-2.956 %	-0.783 %
CAR 0-2	0.006 %	0.357 %	0.074 %	-0.420 %
CAR 0-5	1.575 %	1.545 %	2.009 %	-1.453 %
Jan 7	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	0.736 %	1.278 %	0.452 %	-0.152 %
AR DAY 1	1.002 %	1.102 %	1.116 %	0.816 %
CAR 0-2	2.185 %	3.278 %	1.987 %	0.411 %
CAR 0-5	2.207 %	2.630 %	2.217 %	2.123 %
Jan 18	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	1.367 %	1.075 %	1.428 %	0.684 %
AR DAY 1	-1.368 %	-1.878 %	-1.171 %	-1.060 %
CAR 0-2	0.276 %	-0.674 %	1.014 %	-0.198 %
CAR 0-5	0.644 %	0.334 %	0.994 %	0.801 %
February 7	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	-0.933 %	-1.184 %	-0.868 %	1.483 %
AR DAY 1	0.074 %	0.137 %	-0.246 %	0.806 %
CAR 0-2	-0.781 %	-0.913 %	-1.321 %	4.243 %
CAR 0-5	0.556 %	0.707 %	0.225 %	5.848 %
Feb 12	**S&P 500**	**NASDAQ C**	**D&J Ind**	**China SSE**
AR DAY 0	1.283 %	1.444 %	1.478 %	1.957 %
AR DAY 1	0.304 %	0.072 %	0.462 %	0.083 %
CAR 0-2	1.323 %	1.598 %	1.534 %	0.790 %
CAR 0-5	2.738 %	2.412 %	3.542 %	4.085 %

Feb 15	S&P 500	NASDAQ C	D&J Ind	China SSE
AR DAY 0	1.086 %	0.609 %	1.733 %	2.770 %
AR DAY 1	0.154 %	0.191 %	0.035 %	0.169 %
CAR 0-2	1.422 %	0.829 %	2.014 %	3.263 %
CAR 0-5	1.843 %	1.694 %	2.553 %	10.625 %
Feb 25	S&P 500	NASDAQ C	D&J Ind	China SSE
AR DAY 0	0.129 %	0.360 %	0.233 %	5.555 %
AR DAY 1	-0.073 %	-0.066 %	-0.128 %	-0.564 %
CAR 0-2	0.009 %	0.366 %	-0.172 %	5.513 %
CAR 0-5	0.043 %	0.679 %	-0.804 %	8.295 %
April 1	S&P 500	NASDAQ C	D&J Ind	China SSE
AR DAY 0	1.113 %	1.233 %	1.227 %	2.578 %
AR DAY 1	-0.035 %	0.205 %	-0.340 %	0.239 %
CAR 0-2	1.255 %	1.987 %	0.999 %	4.088 %
CAR 0-5	1.919 %	2.583 %	1.355 %	4.918 %
May 7	S&P 500	NASDAQ C	D&J Ind	China SSE
AR DAY 0	-1.700 %	-2.024 %	-1.842 %	-6.020 %
AR DAY 1	-0.196 %	-0.298 %	-0.027 %	0.670 %
CAR 0-2	-2.234 %	-2.776 %	-2.441 %	-6.484 %
CAR 0-5	-3.612 %	-5.150 %	-3.700 %	-6.179 %
May 13	S&P 500	NASDAQ C	D&J Ind	China SSE
AR DAY 0	-2.474 %	-3.509 %	-2.436 %	-1.235 %
AR DAY 1	0.767 %	1.097 %	0.787 %	-0.715 %
CAR 0-2	-1.156 %	-1.324 %	-1.224 %	-0.078 %
CAR 0-5	-1.626 %	-2.987 %	-1.184 %	-2.482 %

Table 2: Aggregated Average ARs and CARs for major indices using a 3-day event window, negative developments, Results are percentages.

Day	S&P 500		NASDAQ C		D&J Ind		China SSE	
	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
0	-1.30	-1.30	-1.66	-1.66	-1.37	-1.37	-1.13	-1.13
1	-0.19	-1.49	0.02	-1.64	-0.25	-1.62	0.31	-0.82
2	0.45	-1.04	0.56	-1.08	0.42	-1.19	0.27	-0.56

Table 3: Aggregated Average ARs and CARs for major indices using a 3-day event window, positive developments, Results are percentages.

Day	S&P 500		NASDAQ C		D&J Ind		China SSE	
	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
0	1.10	1.10	1.23	1.23	1.22	1.22	1.90	1.90
1	-0.27	0.84	-0.22	1.01	-0.28	0.94	-0.25	1.64
2	0.29	1.12	0.58	1.59	0.22	1.16	0.20	1.84

All AARs for day 0 and CAAR 0-2 were found significant at a 0.05 level of significance.
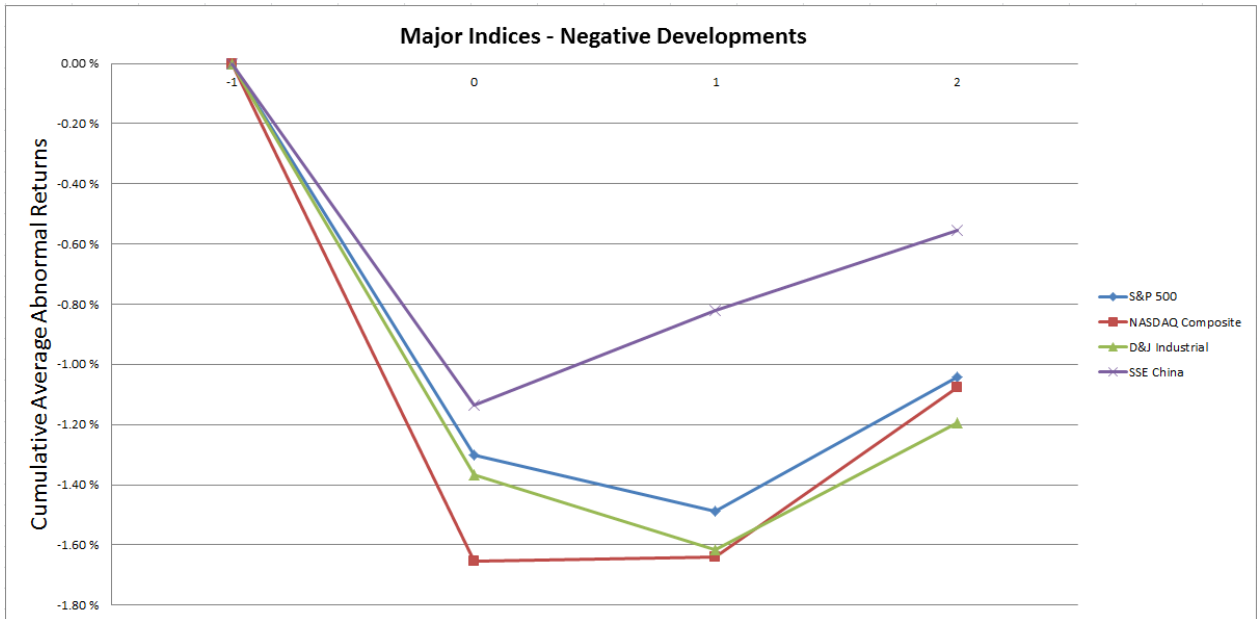
Figure 2: CAARs for major indices using a 3-day event window, negative developments
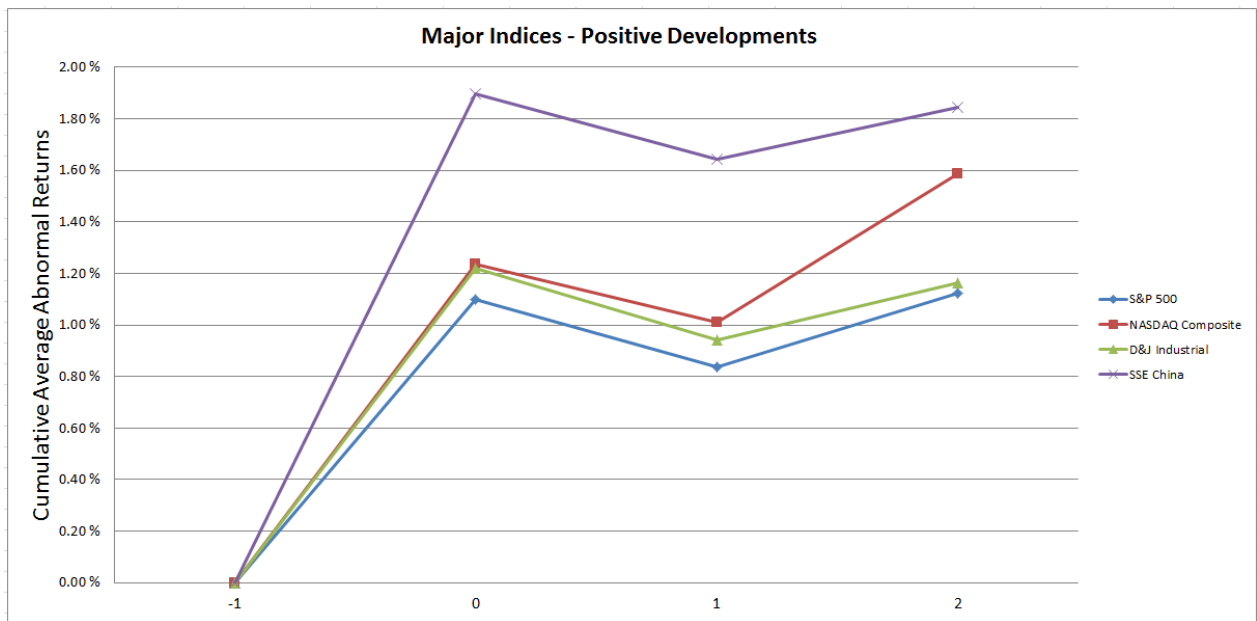
Figure 3: CAARs for major indices using a 3-day event window, positive developments

Table 4: Aggregated Average ARs and CARs for major indices using a 21-day event window, negative developments, Results are percentages.

Event Day	S&P 500		NASDAQ C		D&J Ind		China SSE	
	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
-10	-0.14	-0.14	-0.21	-0.21	-0.23	-0.23	-0.27	-0.27
-9	0.07	-0.07	0.01	-0.19	0.11	-0.12	0.26	-0.01
-8	0.15	0.07	0.22	0.02	0.07	-0.05	-0.10	-0.11
-7	-0.15	-0.08	-0.27	-0.25	-0.09	-0.13	-0.59	-0.70
-6	-0.16	-0.23	-0.11	-0.36	-0.17	-0.31	0.03	-0.67
-5	-0.40	-0.64	-0.69	-1.05	-0.37	-0.67	-0.37	-1.03
-4	0.36	-0.28	0.45	-0.60	0.38	-0.30	-0.06	-1.09
-3	-0.06	-0.34	-0.06	-0.65	-0.04	-0.34	0.00	-1.09
-2	-0.06	-0.40	-0.03	-0.68	0.01	-0.32	0.02	-1.07
-1	-0.01	-0.42	-0.01	-0.69	-0.06	-0.38	0.32	-0.74
0	-1.30	-1.72	-1.66	-2.35	-1.37	-1.74	-1.13	-1.88
1	-0.19	-1.90	0.02	-2.33	-0.25	-1.99	0.31	-1.56
2	0.45	-1.46	0.56	-1.77	0.42	-1.57	0.27	-1.30
3	0.02	-1.44	-0.01	-1.78	0.07	-1.50	-0.15	-1.45
4	-0.33	-1.76	-0.43	-2.21	-0.36	-1.86	-0.14	-1.59
5	-0.05	-1.40	-0.17	-1.69	0.00	-1.49	-0.04	-0.89
6	-0.16	-1.56	-0.18	-1.87	-0.10	-1.59	0.07	-0.82
7	0.06	-1.50	0.11	-1.77	0.02	-1.57	-0.55	-1.37
8	0.01	-1.48	-0.19	-1.96	0.06	-1.51	0.25	-1.11
9	-0.10	-1.58	-0.16	-2.12	-0.11	-1.62	-0.25	-1.37
10	-0.30	-1.89	-0.49	-2.61	-0.21	-1.83	0.54	-0.82

Table 5: Aggregated Average ARs and CARs for major indices using a 21-day event window, positive developments. Results are percentages.

| Event Day	S&P 500		NASDAQ C		D&J Ind		China SSE	
	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
-10	0.47	0.47	0.51	0.51	0.41	0.41	0.47	0.47
-9	-0.14	0.33	-0.24	0.27	-0.18	0.23	-0.22	0.25
-8	-0.21	0.12	-0.02	0.26	-0.36	-0.13	0.50	0.75
-7	0.69	0.81	0.75	1.01	0.74	0.61	0.76	1.50
-6	-0.38	0.43	-0.48	0.52	-0.37	0.24	-0.49	1.02
-5	0.10	0.53	0.10	0.62	0.13	0.37	0.40	1.42
-4	-0.06	0.47	-0.21	0.41	-0.03	0.34	0.04	1.46
-3	0.44	0.90	0.60	1.01	0.52	0.86	0.27	1.74
-2	-0.30	0.60	-0.47	0.55	-0.23	0.62	-0.13	1.60
-1	0.51	1.11	0.44	0.98	0.44	1.06	0.91	2.51
0	1.10	2.21	1.23	2.22	1.22	2.28	1.90	4.41
1	-0.27	1.95	-0.22	2.00	-0.28	2.01	-0.25	4.16
2	0.29	2.23	0.58	2.57	0.22	2.23	0.20	4.36
3	-0.02	2.21	-0.17	2.40	0.10	2.33	0.44	4.80
4	0.05	2.26	0.05	2.46	-0.01	2.32	0.33	5.13
5	-0.06	2.20	-0.03	2.42	-0.13	2.19	0.94	6.06
6	0.00	2.20	0.02	2.44	-0.02	2.17	-0.20	5.87
7	0.18	2.38	0.28	2.72	0.24	2.40	0.29	6.15
8	-0.30	2.08	-0.38	2.34	-0.41	1.99	0.95	7.11
9	-0.15	1.92	-0.28	2.06	-0.15	1.84	-0.14	6.96
10	0.06	1.99	0.15	2.21	-0.03	1.81	0.64	7.60
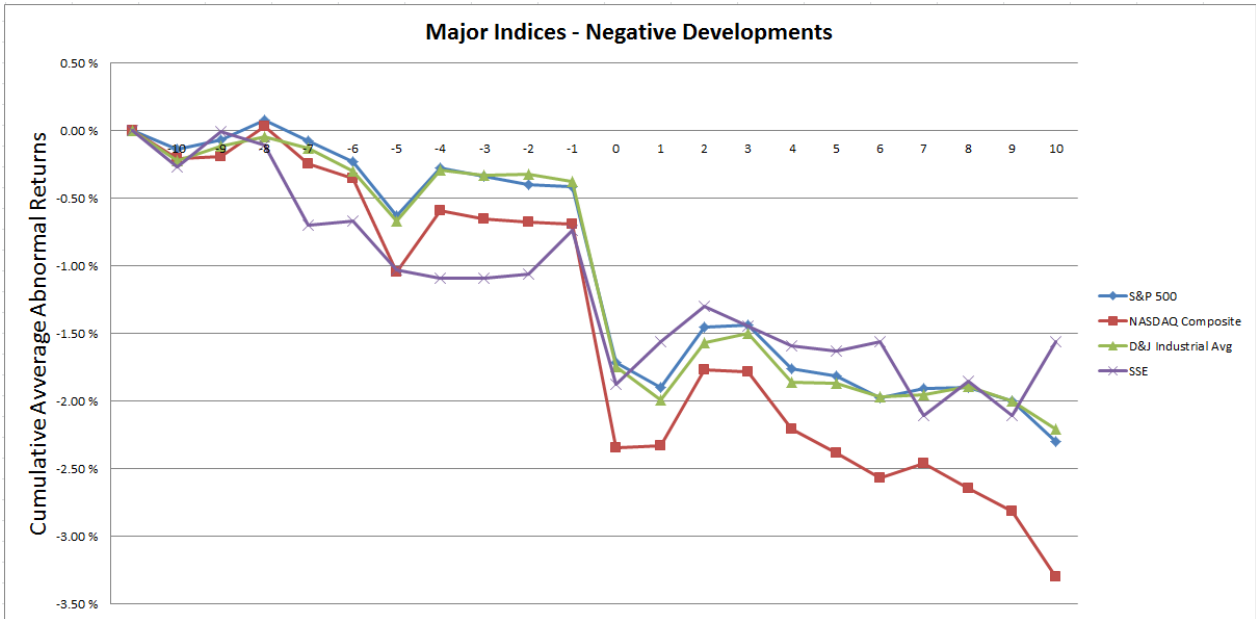
Figure 4: CAARs for major indices using a 21-day event window, negative developments
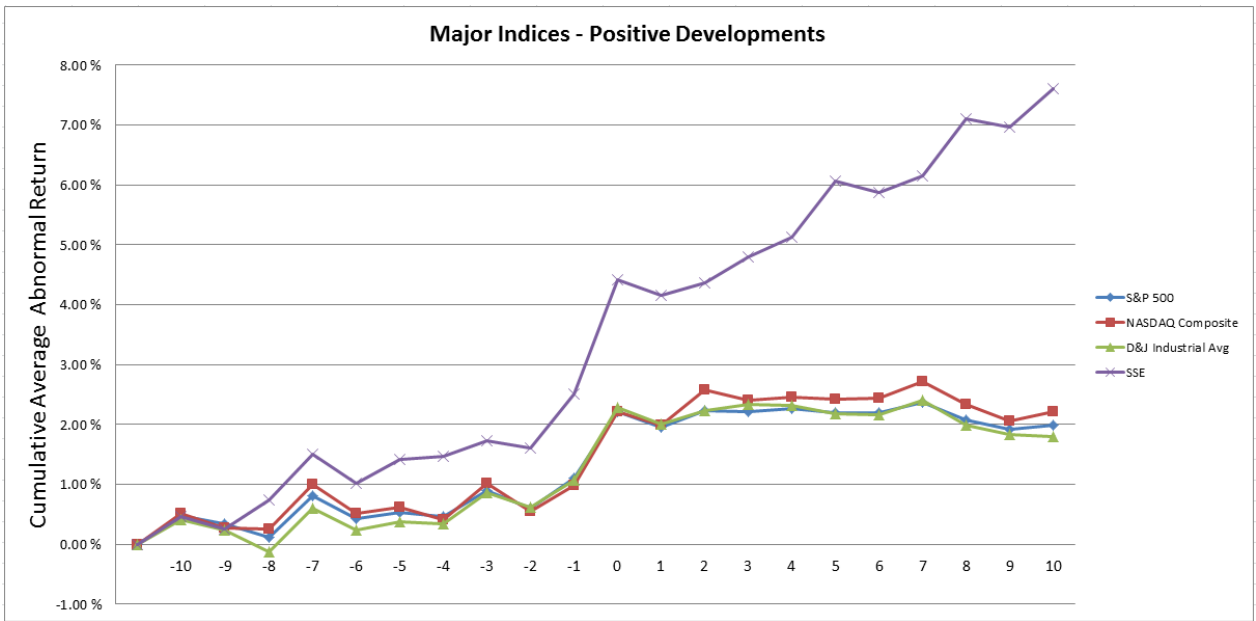
Figure 5: CAARs for major indices using a 21-day event window, negative developments

7. 2 Sectors

Table 6: Results for every sector analyzed separately for each date

March 1	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	-0.265 %	-1.100 %	-0.290 %	-0.149 %	-1.888 %	-1.817 %	-1.990 %	-1.817 %	-1.097 %	-0.513 %	0.031 %
AR DAY 1	0.896 %	0.025 %	0.825 %	0.418 %	0.257 %	0.864 %	-0.124 %	0.864 %	-0.260 %	-0.344 %	-0.234 %
CAR 0-2	1.659 %	-0.025 %	1.474 %	1.341 %	-0.332 %	-0.119 %	-0.966 %	-0.119 %	-0.062 %	0.503 %	1.762 %
CAR 0-5	2.539 %	0.109 %	1.609 %	0.549 %	0.004 %	0.830 %	-0.138 %	0.830 %	0.630 %	2.077 %	0.453 %
March 22	**Comm Serv**	**Cons Disc**	**Cons Staples**	**Energy**	**Financials**	**Health Care**	**Industrials**	**IT**	**Materials**	**Real Estate**	**Utilities**
AR DAY 0	-1.047 %	-2.228 %	-0.805 %	-2.059 %	-3.859 %	-2.971 %	-3.398 %	-2.853 %	-3.075 %	-0.379 %	0.485 %
AR DAY 1	-0.101 %	-2.056 %	-1.256 %	-0.600 %	-3.124 %	-2.155 %	-1.466 %	-2.895 %	-2.022 %	-1.535 %	-1.384 %
CAR 0-2	-1.077 %	-1.499 %	-0.728 %	-0.901 %	-3.881 %	-3.148 %	-2.655 %	-1.926 %	-3.194 %	-0.563 %	2.096 %
CAR 0-5	-1.825 %	-3.505 %	1.395 %	-1.659 %	-4.676 %	-3.421 %	-3.099 %	-4.550 %	-3.801 %	1.397 %	2.033 %
April 2	**Comm Serv**	**Cons Disc**	**Cons Staples**	**Energy**	**Financials**	**Health Care**	**Industrials**	**IT**	**Materials**	**Real Estate**	**Utilities**
AR DAY 0	-1.441 %	-2.955 %	-2.482 %	-2.010 %	-2.239 %	-2.159 %	-2.153 %	-2.644 %	-2.248 %	-1.263 %	-0.756 %
AR DAY 1	0.776 %	1.168 %	1.357 %	2.119 %	1.288 %	1.442 %	1.310 %	0.876 %	1.377 %	0.311 %	0.343 %
CAR 0-2	0.626 %	-0.071 %	0.384 %	-0.022 %	0.058 %	0.604 %	-0.484 %	-0.511 %	-0.281 %	0.251 %	-0.204 %
CAR 0-5	-0.006 %	-1.353 %	-0.443 %	0.398 %	-1.412 %	-1.128 %	-2.794 %	-2.284 %	-0.511 %	-0.713 %	-0.019 %
April 16	**Comm Serv**	**Cons Disc**	**Cons Staples**	**Energy**	**Financials**	**Health Care**	**Industrials**	**IT**	**Materials**	**Real Estate**	**Utilities**
AR DAY 0	1.497 %	0.677 %	1.072 %	1.007 %	0.393 %	0.756 %	0.938 %	0.605 %	1.325 %	0.423 %	1.367 %
AR DAY 1	0.122 %	1.785 %	0.237 %	0.394 %	-0.153 %	0.774 %	0.779 %	1.884 %	1.071 %	1.326 %	1.037 %
CAR 0-2	**1.193 %**	2.888 %	0.451 %	2.934 %	-0.205 %	1.529 %	2.674 %	2.149 %	3.073 %	1.541 %	2.011 %
CAR 0-5	0.879 %	1.530 %	-4.403 %	3.170 %	1.015 %	0.435 %	1.725 %	-1.228 %	0.947 %	-0.860 %	1.123 %
June 15	**Comm Serv**	**Cons Disc**	**Cons Staples**	**Energy**	**Financials**	**Health Care**	**Industrials**	**IT**	**Materials**	**Real Estate**	**Utilities**
AR DAY 0	1.187 %	0.166 %	1.356 %	-2.193 %	-0.082 %	0.250 %	-0.241 %	-0.560 %	-0.665 %	-0.139 %	0.722 %
AR DAY 1	-1.968 %	-0.264 %	-1.446 %	1.051 %	-0.126 %	-1.021 %	-0.415 %	0.150 %	-0.285 %	-0.105 %	0.363 %
CAR 0-2	0.644 %	-0.314 %	0.470 %	-1.480 %	-0.593 %	-0.561 %	-2.850 %	-1.227 %	-2.818 %	-0.153 %	2.155 %
CAR 0-5	0.771 %	-0.895 %	1.733 %	-1.021 %	-1.767 %	-0.561 %	-3.831 %	-2.419 %	-2.941 %	2.387 %	3.262 %
July 6	**Comm Serv**	**Cons Disc**	**Cons Staples**	**Energy**	**Financials**	**Health Care**	**Industrials**	**IT**	**Materials**	**Real Estate**	**Utilities**
AR DAY 0	0.361 %	0.708 %	0.328 %	0.584 %	0.455 %	1.401 %	0.357 %	1.108 %	0.436 %	0.394 %	0.730 %
AR DAY 1	-0.133 %	1.065 %	-0.442 %	1.385 %	2.255 %	0.614 %	1.763 %	0.690 %	0.900 %	-0.923 %	-3.180 %
CAR 0-2	1.353 %	1.896 %	1.153 %	2.628 %	2.303 %	2.391 %	2.446 %	1.906 %	2.129 %	-0.064 %	-1.482 %
CAR 0-5	0.069 %	2.285 %	1.385 %	0.972 %	1.382 %	2.861 %	2.439 %	2.774 %	0.540 %	-0.477 %	-0.480 %
July 11	**Comm Serv**	**Cons Disc**	**Cons Staples**	**Energy**	**Financials**	**Health Care**	**Industrials**	**IT**	**Materials**	**Real Estate**	**Utilities**
AR DAY 0	-1.055 %	-0.314 %	-0.337 %	-2.238 %	-0.560 %	-0.827 %	-1.645 %	-0.612 %	-1.725 %	-0.347 %	0.854 %
AR DAY 1	0.508 %	0.585 %	-0.092 %	0.132 %	0.152 %	1.116 %	1.099 %	1.679 %	0.202 %	0.214 %	0.073 %
CAR 0-2	-1.305 %	0.436 %	0.208 %	-1.617 %	-0.909 %	0.487 %	0.029 %	0.942 %	-1.555 %	-0.426 %	0.977 %
CAR 0-5	-1.584 %	0.389 %	-0.125 %	-3.348 %	2.440 %	0.324 %	1.038 %	0.997 %	-1.109 %	-2.137 %	0.220 %

July 31	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	-0.762 %	0.348 %	0.468 %	-0.385 %	-0.722 %	0.966 %	2.066 %	0.186 %	0.862 %	1.873 %	1.063 %
AR DAY 1	-0.058 %	-0.536 %	-0.871 %	-1.407 %	-0.044 %	0.006 %	-1.322 %	0.852 %	-1.011 %	0.680 %	-0.841 %
CAR 0-2	-0.632 %	0.346 %	0.687 %	-2.379 %	-0.769 %	1.278 %	0.559 %	2.286 %	-0.901 %	2.007 %	0.769 %
CAR 0-5	0.662 %	1.517 %	1.374 %	-1.942 %	0.607 %	1.913 %	1.380 %	3.239 %	0.255 %	2.867 %	1.710 %
August 23	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	-0.094 %	-0.283 %	-0.211 %	-0.617 %	-0.581 %	-0.161 %	-0.392 %	0.071 %	-0.743 %	-0.228 %	-0.013 %
AR DAY 1	0.635 %	0.484 %	-0.173 %	0.702 %	0.231 %	0.389 %	0.379 %	0.978 %	1.165 %	0.611 %	0.434 %
CAR 0-2	0.901 %	0.790 %	-0.322 %	0.728 %	0.919 %	0.571 %	1.154 %	1.894 %	1.836 %	0.279 %	-0.218 %
CAR 0-5	-0.641 %	1.192 %	-0.826 %	0.315 %	-0.173 %	1.027 %	0.217 %	2.486 %	0.967 %	0.736 %	0.385 %
Sept 17	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	0.147 %	-1.388 %	0.354 %	0.103 %	-0.413 %	-0.386 %	-0.014 %	-1.517 %	0.281 %	0.472 %	0.298 %
AR DAY 1	-0.056 %	1.149 %	-0.436 %	0.634 %	0.360 %	0.474 %	0.848 %	0.517 %	0.020 %	-0.617 %	-0.219 %
CAR 0-2	-1.281 %	-0.322 %	-0.229 %	1.056 %	1.633 %	-0.078 %	0.750 %	-1.217 %	1.384 %	-1.084 %	-2.076 %
CAR 0-5	0.296 %	-0.851 %	-0.323 %	2.992 %	0.836 %	1.034 %	-0.267 %	-0.428 %	0.707 %	-2.393 %	-2.417 %
Sept 24	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	0.205 %	-0.683 %	-1.523 %	1.423 %	-1.117 %	0.101 %	-1.364 %	0.201 %	-1.444 %	-1.937 %	-0.903 %
AR DAY 1	0.092 %	0.477 %	-0.633 %	0.533 %	-0.435 %	-0.341 %	-0.369 %	-0.157 %	-0.499 %	-0.131 %	-1.247 %
CAR 0-2	0.655 %	-0.123 %	-2.111 %	0.923 %	-2.888 %	-0.095 %	-1.919 %	-0.477 %	-3.001 %	-3.256 %	-3.209 %
CAR 0-5	0.953 %	-0.239 %	-2.158 %	2.059 %	-4.065 %	1.075 %	-1.035 %	0.641 %	-3.630 %	-2.510 %	-1.075 %
Oct 30	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	2.435 %	1.150 %	1.951 %	2.262 %	1.602 %	1.049 %	1.972 %	1.114 %	2.265 %	1.663 %	0.309 %
AR DAY 1	2.048 %	1.549 %	-0.875 %	0.559 %	1.422 %	0.140 %	0.798 %	2.316 %	1.373 %	-1.363 %	-1.131 %
CAR 0-2	4.598 %	4.832 %	1.547 %	3.612 %	3.472 %	2.435 %	4.482 %	4.573 %	6.640 %	0.759 %	-1.337 %
CAR 0-5	3.983 %	5.388 %	3.009 %	5.359 %	5.428 %	2.971 %	5.778 %	2.971 %	8.316 %	2.084 %	0.321 %
Nov 19	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	-2.655 %	-2.814 %	-0.208 %	-0.082 %	-0.042 %	-1.327 %	-1.586 %	-3.897 %	-1.383 %	0.365 %	0.520 %
AR DAY 1	-1.297 %	-2.237 %	-1.719 %	-3.330 %	-2.111 %	-1.024 %	-2.127 %	-2.201 %	-1.844 %	-1.354 %	-0.502 %
CAR 0-2	**-2.989 %**	-4.099 %	-2.768 %	-1.861 %	-2.098 %	-2.909 %	-3.026 %	-5.508 %	-2.363 %	-1.114 %	-1.466 %
CAR 0-5	-1.776 %	-1.925 %	-1.523 %	-3.851 %	-0.876 %	-0.942 %	-2.683 %	-4.036 %	-3.456 %	-0.678 %	0.076 %
Nov 28	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	2.105 %	3.177 %	0.962 %	1.723 %	1.806 %	2.378 %	2.376 %	3.348 %	1.496 %	0.855 %	-0.107 %
AR DAY 1	0.365 %	-0.476 %	0.120 %	0.579 %	-0.795 %	0.255 %	0.039 %	-0.992 %	0.724 %	0.108 %	-0.077 %
CAR 0-2	2.909 %	3.398 %	1.923 %	2.054 %	1.683 %	3.691 %	3.493 %	3.378 %	2.686 %	1.954 %	1.337 %
CAR 0-5	0.839 %	2.090 %	0.178 %	-0.398 %	-3.719 %	1.348 %	-0.318 %	1.684 %	0.037 %	3.639 %	2.359 %

Dec 3	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	0.090 %	2.145 %	-0.092 %	2.263 %	0.486 %	0.384 %	1.167 %	2.044 %	1.762 %	0.349 %	0.878 %
AR DAY 1	-3.179 %	-4.025 %	-1.653 %	-2.914 %	-4.492 %	-2.371 %	-4.440 %	-3.973 %	-3.093 %	-1.283 %	0.150 %
CAR 0-2	**-2.045 %**	-1.276 %	-1.703 %	-2.412 %	-5.380 %	-2.345 %	-3.813 %	-1.730 %	-2.652 %	1.680 %	1.031 %
CAR 0-5	-3.161 %	-4.319 %	-2.155 %	-4.574 %	-9.610 %	-4.404 %	-6.779 %	-3.951 %	-5.160 %	-0.086 %	2.090 %
Dec 4	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	-3.185 %	-4.025 %	-1.654 %	-2.920 %	-4.494 %	-2.375 %	-4.444 %	-3.972 %	-3.099 %	-1.290 %	0.139 %
AR DAY 1	1.038 %	0.604 %	0.039 %	-1.769 %	-1.377 %	-0.363 %	-0.544 %	0.201 %	-1.328 %	2.607 %	-0.008 %
CAR 0-2	-4.190 %	-6.573 %	-2.920 %	-5.286 %	-7.708 %	-5.332 %	-7.629 %	-7.408 %	-6.922 %	-0.155 %	0.562 %
CAR 0-5	-2.457 %	-5.456 %	-2.239 %	-6.546 %	-9.658 %	-4.011 %	-7.422 %	-5.241 %	-5.982 %	-2.406 %	0.565 %
Dec 7	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	-2.031 %	-3.133 %	-1.298 %	-0.586 %	-1.828 %	-2.046 %	-2.621 %	-3.606 %	-2.481 %	-1.466 %	0.434 %
AR DAY 1	0.765 %	0.117 %	0.019 %	-1.619 %	-1.389 %	-4.610 %	0.280 %	1.405 %	0.332 %	-0.441 %	0.294 %
CAR 0-2	-1.098 %	-2.987 %	-0.436 %	-2.151 %	-4.212 %	-2.584 %	-2.918 %	-2.125 %	-2.484 %	-1.769 %	1.033 %
CAR 0-5	-1.431 %	-4.420 %	-1.844 %	-3.801 %	-5.316 %	0.282 %	-3.965 %	-3.679 %	-3.356 %	-3.185 %	1.067 %
Dec 14	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	-1.009 %	-2.036 %	-1.936 %	-2.394 %	-1.026 %	-3.441 %	-1.427 %	-2.545 %	-0.767 %	-0.199 %	-0.248 %
AR DAY 1	-1.899 %	-2.907 %	-2.314 %	-1.866 %	-0.973 %	-2.186 %	-1.727 %	-2.273 %	-1.757 %	-3.759 %	-3.310 %
CAR 0-2	-2.276 %	-3.957 %	-5.430 %	-6.626 %	-2.475 %	-6.484 %	-2.567 %	-3.964 %	-1.932 %	-3.030 %	-4.213 %
CAR 0-5	-8.708 %	-11.221 %	-9.245 %	-11.741 %	-6.462 %	-10.647 %	-8.231 %	-10.964 %	-5.383 %	-6.812 %	-4.900 %
Dec 21	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	-3.078 %	1.419 %	-1.074 %	-0.984 %	-1.916 %	-1.447 %	-1.897 %	-3.038 %	-0.887 %	-1.610	-0.736 %
AR DAY 1	-2.016 %	3.026 %	-2.898 %	-4.032 %	-2.314 %	-2.541 %	-3.144 %	-2.769 %	-2.631 %	-3.809 %	-4.387 %
CAR 0-2	0.205 %	-2.619 %	-1.145 %	1.105 %	0.373 %	0.435 %	-0.303 %	0.063 %	1.061 %	-2.167 %	-3.598 %
CAR 0-5	1.000 %	-2.045 %	0.319 %	1.496 %	2.706 %	2.896 %	1.803 %	1.521 %	3.362 %	-1.473 %	-2.533 %
Jan 7	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	0.804 %	2.348 %	-0.248 %	3.879 %	0.301 %	0.403 %	0.742 %	0.875 %	0.413 %	0.774 %	-0.749 %
AR DAY 1	1.615 %	1.152 %	0.995 %	3.666 %	0.072 %	0.936 %	1.472 %	0.916 %	1.099 %	1.754 %	1.214 %
CAR 0-2	2.384 %	3.981 %	-0.174 %	1.376 %	0.961 %	1.651 %	2.910 %	3.039 %	1.682 %	2.107 %	-0.225 %
CAR 0-5	2.176 %	3.073 %	0.339 %	0.919 %	2.191 %	1.103 %	4.404 %	2.494 %	1.657 %	3.564 %	-1.632 %
Jan 18	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	0.567 %	1.321 %	1.249 %	2.026 %	1.783 %	1.193 %	1.956 %	1.532 %	1.722 %	0.308 %	0.088 %
AR DAY 1	-1.925 %	-1.764 %	-0.932 %	-2.122 %	-1.004 %	-0.701 %	-2.000 %	-1.731 %	-1.282 %	-0.158 %	0.113 %
CAR 0-2	-1.059 %	-0.187 %	1.528 %	-0.996 %	0.901 %	0.636 %	0.229 %	0.264 %	-0.113 %	0.240 %	1.244 %
CAR 0-5	-1.030 %	0.759 %	0.589 %	0.076 %	1.964 %	-1.164 %	1.337 %	1.365 %	1.431 %	2.757 %	-0.165 %

Feb 7	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	-1.032 %	-0.894 %	-0.062 %	-2.136 %	-0.916 %	-1.099 %	-0.683 %	-1.447 %	-1.362 %	0.733 %	1.242 %
AR DAY 1	0.347 %	-0.520 %	0.538 %	-0.395 %	-0.517 %	0.145 %	0.131 %	0.531 %	-0.016 %	0.029 %	0.434 %
CAR 0-2	-1.312 %	-1.248 %	0.694 %	-2.062 %	-1.156 %	-1.123 %	0.014 %	-0.939 %	-1.156 %	0.922 %	1.527 %
CAR 0-5	-0.071 %	0.546 %	0.625 %	0.850 %	-0.469 %	0.630 %	1.710 %	0.603 %	0.752 %	1.150 %	1.051 %
Feb 12	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	1.145 %	1.626 %	0.880 %	1.287 %	1.582 %	1.304 %	1.571 %	1.341 %	2.262 %	-0.764 %	0.156 %
AR DAY 1	-0.091 %	0.613 %	0.258 %	1.306 %	0.238 %	0.213 %	0.656 %	0.127 %	0.141 %	0.626 %	-0.307 %
CAR 0-2	1.277 %	1.783 %	-0.044 %	2.950 %	0.685 %	1.770 %	1.741 %	1.590 %	1.922 %	0.247 %	-0.424 %
CAR 0-5	1.950 %	2.873 %	1.365 %	5.369 %	3.551 %	2.759 %	3.563 %	2.483 %	5.685 %	0.062 %	0.844 %
Feb 15	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	0.404 %	0.508 %	0.969 %	1.617 %	2.035 %	1.427 %	1.356 %	0.786 %	1.406 %	0.473 %	0.311 %
AR DAY 1	0.306 %	0.469 %	0.500 %	0.337 %	0.251 %	-0.283 %	-0.048 %	0.014 %	0.624 %	0.039 %	0.530 %
CAR 0-2	0.639 %	1.097 %	1.398 %	2.398 %	2.909 %	0.980 %	1.817 %	0.921 %	3.779 %	-0.206 %	1.249 %
CAR 0-5	1.137 %	1.131 %	0.895 %	1.369 %	2.771 %	1.038 %	2.568 %	2.741 %	4.601 %	-0.418 %	1.795 %
Feb 25	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	0.081 %	-0.317 %	-0.519 %	0.172 %	0.464 %	0.088 %	0.427 %	0.492 %	0.703 %	-0.881 %	-0.701 %
AR DAY 1	0.120 %	0.141 %	0.037 %	-0.251 %	-0.196 %	-0.345 %	-0.276 %	0.193 %	-0.543 %	-0.255 %	-0.206 %
CAR 0-2	-0.188 %	-0.218 %	-0.567 %	0.328 %	0.687 %	-0.776 %	0.565 %	0.585 %	0.096 %	-1.587 %	-0.768 %
CAR 0-5	0.598 %	0.012 %	-0.446 %	1.422 %	0.520 %	-1.095 %	-0.105 %	0.581 %	-0.669 %	-1.149 %	0.003 %
April 1	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	1.404 %	1.116 %	-0.251 %	1.347 %	2.386 %	0.101 %	2.034 %	1.330 %	1.481 %	-0.343 %	-0.790 %
AR DAY 1	0.398 %	-0.077 %	-0.889 %	-0.712 %	-0.014 %	-0.306 %	-0.079 %	0.238 %	0.395 %	0.779 %	0.031 %
CAR 0-2	2.129 %	1.693 %	-1.810 %	-0.341 %	2.686 %	-0.396 %	1.672 %	2.332 %	3.188 %	0.254 %	-0.989 %
CAR 0-5	2.553 %	3.263 %	-0.854 %	2.651 %	3.497 %	-0.135 %	2.079 %	2.569 %	4.168 %	0.002 %	-1.343 %
May 7	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	-1.436 %	-1.523 %	-1.079 %	-0.608 %	-1.712 %	-2.000 %	-2.101 %	-2.202 %	-1.842 %	-1.847 %	-0.374 %
AR DAY 1	-0.429 %	-0.106 %	-0.225 %	-0.042 %	-0.292 %	0.087 %	-0.028 %	-0.230 %	-0.108 %	-0.016 %	-1.426 %
CAR 0-2	-2.123 %	-2.115 %	-1.525 %	-0.561 %	-2.088 %	-2.092 %	-2.314 %	-3.149 %	-2.730 %	-1.602 %	-1.908 %
CAR 0-5	-4.432 %	-4.346 %	-1.021 %	-0.565 %	-3.686 %	-3.603 %	-3.862 %	-5.280 %	-2.860 %	-0.254 %	-0.032 %
May 13	Comm Serv	Cons Disc	Cons Staples	Energy	Financials	Health Care	Industrials	IT	Materials	Real Estate	Utilities
AR DAY 0	-2.623 %	-3.051 %	-0.904 %	-1.549 %	-2.916 %	-1.789 %	-2.903 %	-3.835 %	-2.196 %	-0.020 %	1.053 %
AR DAY 1	0.167 %	0.821 %	0.319 %	1.171 %	0.808 %	0.371 %	1.036 %	1.537 %	0.827 %	0.277 %	-0.871 %
CAR 0-2	-0.443 %	-1.499 %	0.136 %	0.159 %	-2.587 %	-1.185 %	-1.768 %	-1.302 %	-1.602 %	0.840 %	-0.007 %
CAR 0-5	-1.351 %	-2.185 %	0.279 %	-0.081 %	-1.955 %	-0.703 %	-2.288 %	-3.057 %	-2.213 %	-0.555 %	1.170 %

Table 7: Aggregated Average ARs and CARs for sectors using a 3-day event window, negative developments, Results are percentages.

Day	Comm Serv		Cons Disc		Cons Stap		Energy		Financials		Health Care		Industrials		IT		Materials		Real Estate		Utilities	
	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
0	-0.97	-0.97	-1.53	-1.53	-0.60	-0.60	-0.97	-0.97	-1.38	-1.38	-1.22	-1.22	-1.53	-1.53	-1.81	-1.81	-1.28	-1.28	-0.49	-0.49	0.27	0.27
1	-0.14	-1.12	-0.10	-1.63	-0.46	-1.06	-0.28	-1.25	-0.42	-1.79	-0.17	-1.39	-0.13	-1.66	0.04	-1.77	-0.27	-1.55	-0.43	-0.92	-0.77	-0.50
2	0.51	-0.60	0.66	-0.97	0.36	-0.70	0.60	-0.65	0.35	-1.44	0.32	-1.07	0.42	-1.24	0.49	-1.27	0.40	-1.15	0.30	-0.61	0.04	-0.46

Table 8: Aggregated Average ARs and CARs for sectors using a 3-day event window, positive developments, Results are percentages.

Day	Comm Serv		Cons Disc		Cons Stap		Energy		Financials		Health Care		Industrials		IT		Materials		Real Estate		Utilities	
	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
0	0.83	0.83	1.34	1.34	0.54	0.54	1.37	1.37	1.17	1.17	0.93	0.93	1.57	1.57	1.30	1.30	1.44	1.44	0.43	0.43	0.05	0.05
1	-0.04	0.79	-0.30	1.05	-0.33	0.21	-0.37	1.00	-0.46	0.72	-0.25	0.68	-0.52	1.05	-0.20	1.10	-0.16	1.28	0.09	0.52	-0.05	-0.01
2	0.21	1.00	0.50	1.54	0.07	0.28	-0.09	0.91	0.07	0.78	0.21	0.89	0.32	1.37	0.62	1.72	0.35	1.63	0.22	0.75	0.20	0.19

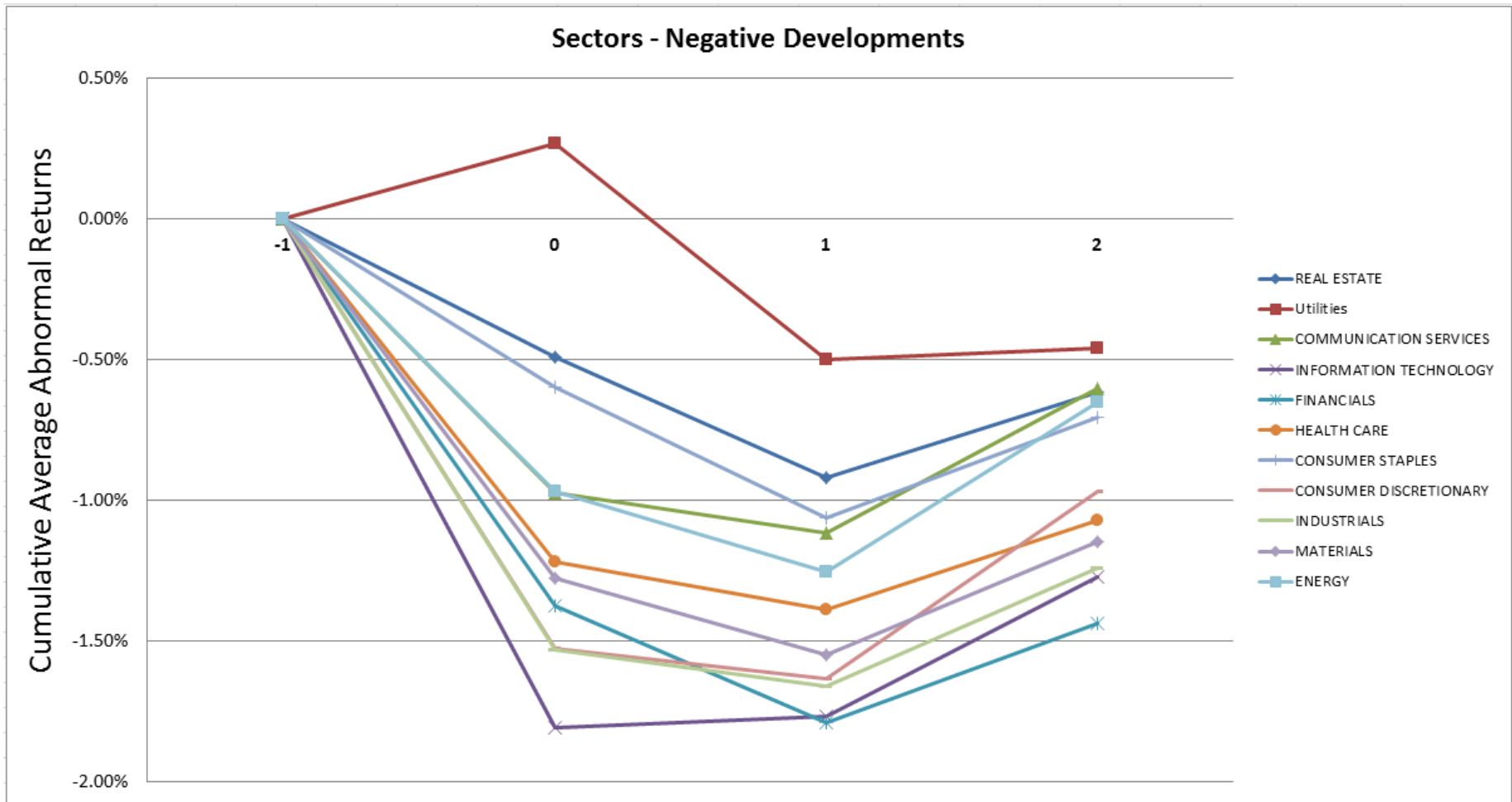All AARs for day 0 and CAAR 0-2 were found significant at a 0.05 level of significance.

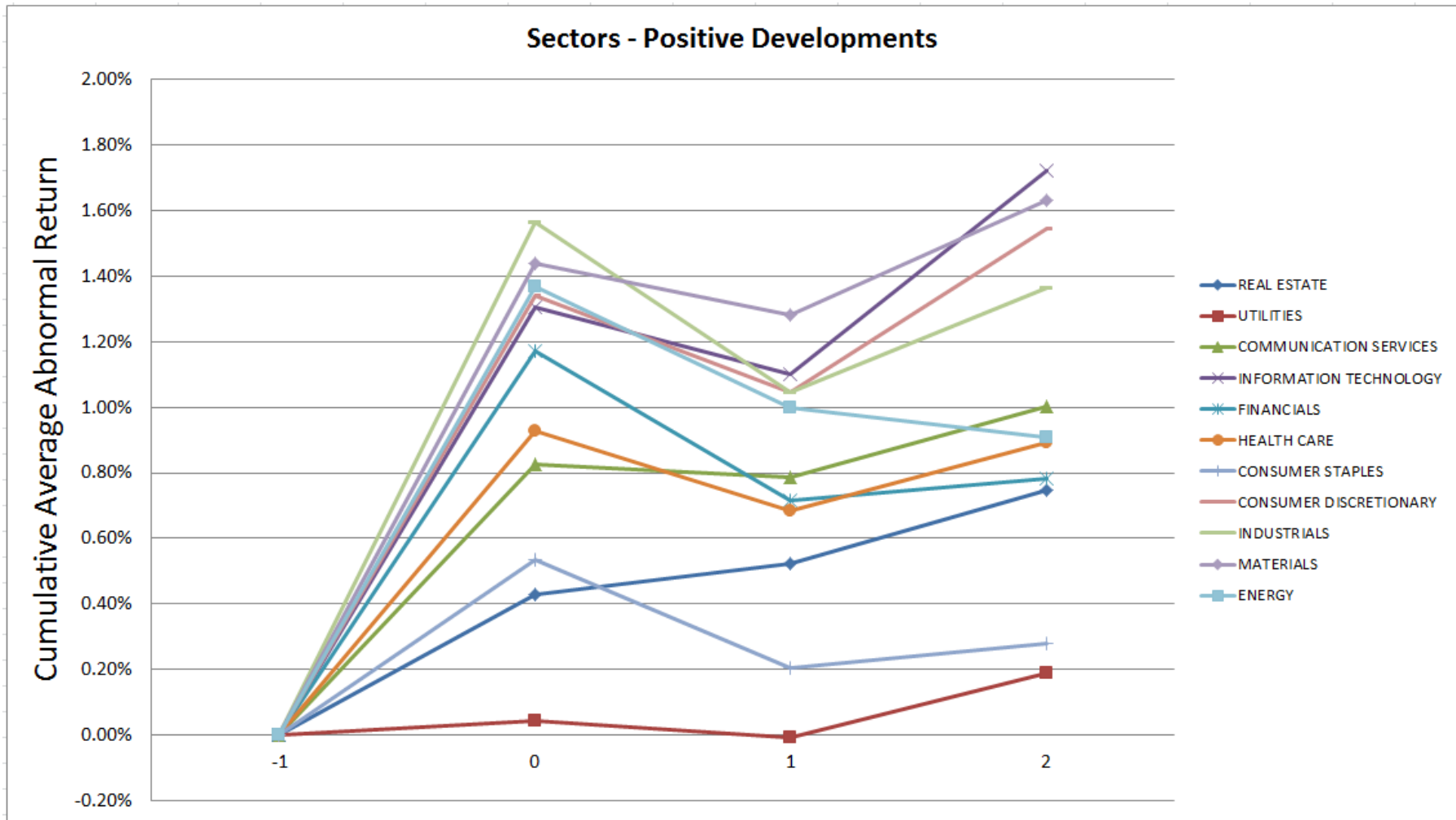*Figure 6: CAARs for sectors using a 3-day event window, negative developments*

Figure 7: CAARs for sectors using a 3-day event window, positive developments

Table 9: Aggregated Average ARs and CARs for sectors using a 21-day event window, negative developments, Results are percentages.

Day	Comm Serv		Cons Disc		Cons Stap		Energy		Financials		Health Care		Industrials		IT		Materials		Real Estate		Utilities	
	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
-10	-0.20	-0.20	-0.25	-0.25	-0.23	-0.23	0.11	0.11	0.03	0.03	-0.16	-0.16	-0.06	-0.06	-0.30	-0.30	-0.11	-0.11	0.14	0.14	0.00	0.00
-9	-0.06	-0.26	0.04	-0.20	0.23	-0.01	-0.17	-0.07	-0.07	-0.05	0.14	-0.02	0.21	0.15	0.10	-0.20	0.18	0.07	0.15	0.30	0.29	0.29
-8	0.58	0.32	0.30	0.09	0.16	0.15	0.02	-0.04	-0.01	-0.05	0.21	0.19	-0.07	0.08	0.18	-0.02	0.06	0.13	0.31	0.60	0.18	0.47
-7	-0.24	0.08	-0.08	0.01	-0.14	0.01	-0.40	-0.45	-0.18	-0.24	0.19	0.37	-0.03	0.05	-0.35	-0.37	0.12	0.25	-0.04	0.56	-0.05	0.42
-6	0.16	0.25	-0.03	-0.02	-0.03	-0.02	-0.23	-0.68	-0.29	-0.53	-0.19	0.18	-0.21	-0.16	-0.11	-0.48	-0.57	-0.32	-0.02	0.54	0.12	0.55
-5	0.19	0.44	-0.60	-0.62	0.11	0.09	-0.15	-0.82	-0.51	-1.04	-0.25	-0.07	-0.31	-0.46	-0.86	-1.34	-0.46	-0.78	0.21	0.75	0.29	0.84
-4	0.23	0.67	0.24	-0.38	0.07	0.16	0.29	-0.53	0.29	-0.75	0.35	0.28	0.38	-0.08	0.67	-0.67	0.25	-0.53	-0.01	0.74	0.06	0.90
-3	0.20	0.87	0.05	-0.33	0.00	0.16	-0.13	-0.66	-0.23	-0.98	-0.05	0.23	0.08	0.00	-0.12	-0.79	0.03	-0.50	0.10	0.84	-0.10	0.81
-2	-0.22	0.65	-0.21	-0.54	-0.15	0.01	-0.11	-0.77	0.01	-0.97	0.12	0.36	0.02	0.02	-0.04	-0.83	-0.07	-0.56	-0.35	0.49	-0.32	0.48
-1	-0.19	0.45	-0.06	-0.60	0.07	0.08	0.27	-0.50	-0.31	-1.28	0.07	0.43	-0.12	-0.10	0.10	-0.73	0.01	-0.55	0.23	0.71	0.35	0.83
0	-0.97	-0.52	-1.53	-2.13	-0.60	-0.52	-0.97	-1.47	-1.38	-2.66	-1.22	-0.79	-1.53	-1.63	-1.81	-2.54	-1.28	-1.83	-0.49	0.22	0.27	1.10
1	-0.14	-0.66	-0.10	-2.23	-0.46	-0.98	-0.28	-1.75	-0.42	-3.08	-0.17	-0.96	-0.13	-1.76	0.04	-2.49	-0.27	-2.10	-0.43	-0.20	-0.77	0.33
2	0.51	-0.15	0.66	-1.57	0.36	-0.62	0.60	-1.15	0.35	-2.72	0.32	-0.64	0.42	-1.34	0.49	-2.00	0.40	-1.70	0.30	0.10	0.04	0.37
3	0.02	-0.13	0.10	-1.46	0.02	-0.61	-0.31	-1.46	0.15	-2.58	0.04	-0.60	0.01	-1.33	-0.07	-2.08	0.17	-1.53	-0.07	0.03	0.30	0.67
4	-0.29	-0.43	-0.47	-1.94	-0.10	-0.71	-0.52	-1.98	-0.43	-3.01	-0.11	-0.72	-0.49	-1.82	-0.39	-2.47	-0.52	-2.05	0.13	0.15	0.21	0.88
5	-0.10	-0.53	-0.18	-2.12	-0.15	-0.86	0.38	-1.60	-0.07	-3.08	0.10	-0.61	0.01	-1.81	-0.11	-2.58	-0.03	-2.07	-0.37	-0.22	-0.05	0.83
6	0.30	-0.23	-0.27	-2.39	-0.27	-1.13	-0.01	-1.62	0.03	-3.05	-0.20	-0.81	-0.18	-1.98	-0.15	-2.73	-0.30	-2.38	-0.41	-0.62	-0.40	0.43
7	0.13	-0.10	0.21	-2.18	0.09	-1.04	0.22	-1.40	0.00	-3.05	-0.04	-0.85	0.06	-1.92	-0.06	-2.79	0.16	-2.22	0.11	-0.51	0.03	0.46
8	-0.22	-0.32	-0.25	-2.43	0.09	-0.96	-0.12	-1.52	0.26	-2.79	0.08	-0.76	0.05	-1.87	-0.11	-2.91	0.15	-2.07	-0.12	-0.63	0.24	0.70
9	0.06	-0.26	0.10	-2.33	-0.15	-1.11	-0.23	-1.75	-0.26	-3.05	-0.10	-0.86	-0.04	-1.91	-0.12	-3.03	-0.04	-2.11	0.28	-0.36	0.47	1.18
10	-0.59	-0.85	-0.45	-2.78	-0.11	-1.22	-0.08	-1.82	-0.46	-3.51	-0.18	-1.04	-0.28	-2.19	-0.43	-3.46	-0.26	-2.36	-0.12	-0.47	0.02	1.20

Table 10: Aggregated Average ARs and CARs for sectors using a 21-day event window, positive developments, Results are percentages.

| Day	Comm Serv		Cons Disc		Cons Stap		Energy		Financials		Health Care		Industrials		IT		Materials		Real Estate		Utilities	
	AR	CAR	AR	CAR	AR	CAR	AR	CAR	AR	CAR	AR	CAR	AR	CAR	AR	CAR	AR	CAR	AR	CAR	AR	CAR
-10	0.19	0.19	0.05	0.05	0.28	0.28	0.32	0.32	0.59	0.59	0.57	0.57	0.71	0.71	0.65	0.65	0.83	0.83	0.20	0.20	0.44	0.44
-9	-0.28	-0.09	-0.15	-0.10	-0.09	0.19	0.12	0.44	-0.02	0.57	-0.13	0.44	0.04	0.75	-0.33	0.32	-0.18	0.64	0.00	0.20	-0.33	0.10
-8	0.28	0.19	-0.16	-0.27	-0.18	0.01	-0.23	0.21	-0.67	-0.10	-0.19	0.26	-0.20	0.55	-0.24	0.08	-0.21	0.44	-0.22	-0.02	-0.09	0.01
-7	0.45	0.63	0.51	0.24	0.54	0.55	1.23	1.44	0.62	0.53	0.49	0.75	0.74	1.29	1.09	1.18	0.66	1.09	0.48	0.46	0.17	0.19
-6	-0.42	0.21	-0.58	-0.35	-0.03	0.52	-0.81	0.63	-0.48	0.05	-0.37	0.38	-0.22	1.08	-0.45	0.72	-0.60	0.49	0.13	0.59	0.33	0.52
-5	0.40	0.61	0.15	-0.19	0.08	0.60	-0.30	0.32	0.08	0.14	0.20	0.57	-0.01	1.07	0.13	0.86	0.08	0.57	0.08	0.67	0.03	0.54
-4	-0.78	-0.17	-0.07	-0.27	0.28	0.88	0.01	0.34	0.09	0.23	-0.11	0.46	0.06	1.13	-0.16	0.70	-0.17	0.40	0.23	0.90	0.07	0.61
-3	0.65	0.49	0.80	0.54	0.29	1.17	0.19	0.52	0.49	0.72	0.29	0.75	0.55	1.68	0.49	1.20	0.50	0.89	-0.04	0.86	0.01	0.62
-2	-0.09	0.39	-0.39	0.15	-0.11	1.07	-0.04	0.48	0.05	0.77	-0.34	0.42	-0.17	1.52	-0.69	0.51	-0.05	0.84	-0.07	0.79	-0.19	0.44
-1	0.66	1.06	0.33	0.48	0.49	1.55	0.40	0.88	0.48	1.25	0.81	1.23	0.55	2.06	0.48	0.99	0.54	1.38	0.55	1.34	0.57	1.00
0	0.83	1.88	1.34	1.82	0.54	2.09	1.37	2.25	1.17	2.43	0.93	2.16	1.57	3.63	1.30	2.29	1.44	2.82	0.43	1.77	0.05	1.05
1	-0.04	1.84	-0.30	1.52	-0.33	1.76	-0.37	1.88	-0.46	1.97	-0.25	1.91	-0.52	3.11	-0.20	2.09	-0.16	2.66	0.09	1.86	-0.05	0.99
2	0.21	2.06	0.50	2.02	0.07	1.83	-0.09	1.79	0.07	2.04	0.21	2.12	0.32	3.43	0.62	2.71	0.35	3.02	0.22	2.08	0.20	1.19
3	-0.11	1.94	0.03	2.06	0.09	1.92	0.21	2.00	0.17	2.21	-0.30	1.82	0.17	3.60	-0.18	2.53	0.12	3.14	0.17	2.26	0.46	1.65
4	0.03	1.97	0.00	2.05	0.01	1.92	0.23	2.23	-0.22	1.99	0.19	2.01	-0.13	3.48	0.14	2.67	0.04	3.18	0.22	2.48	0.23	1.88
5	0.06	2.03	0.00	2.06	0.06	1.98	-0.05	2.18	-0.02	1.97	-0.35	1.66	-0.02	3.45	-0.06	2.60	0.24	3.42	0.19	2.67	-0.28	1.60
6	0.20	2.23	0.04	2.10	-0.04	1.94	-0.21	1.97	-0.09	1.88	0.16	1.82	-0.23	3.22	0.00	2.60	-0.15	3.26	-0.13	2.54	0.24	1.83
7	0.24	2.47	0.23	2.33	0.06	2.00	-0.31	1.66	0.06	1.94	0.03	1.85	0.12	3.34	0.57	3.17	0.15	3.41	0.24	2.78	0.25	2.09
8	0.04	2.52	-0.49	1.84	0.09	2.09	-0.15	1.51	-0.39	1.55	-0.42	1.43	-0.12	3.23	-0.54	2.63	-0.50	2.91	-0.05	2.73	0.27	2.36
9	-0.05	2.47	-0.45	1.39	-0.20	1.90	-0.13	1.38	0.12	1.67	-0.17	1.26	-0.06	3.16	-0.18	2.45	-0.01	2.90	-0.58	2.15	-0.34	2.02
10	0.16	2.63	0.16	1.55	0.13	2.02	-0.45	0.94	0.01	1.67	-0.27	1.00	0.11	3.28	0.30	2.74	0.00	2.90	0.34	2.49	0.21	2.23
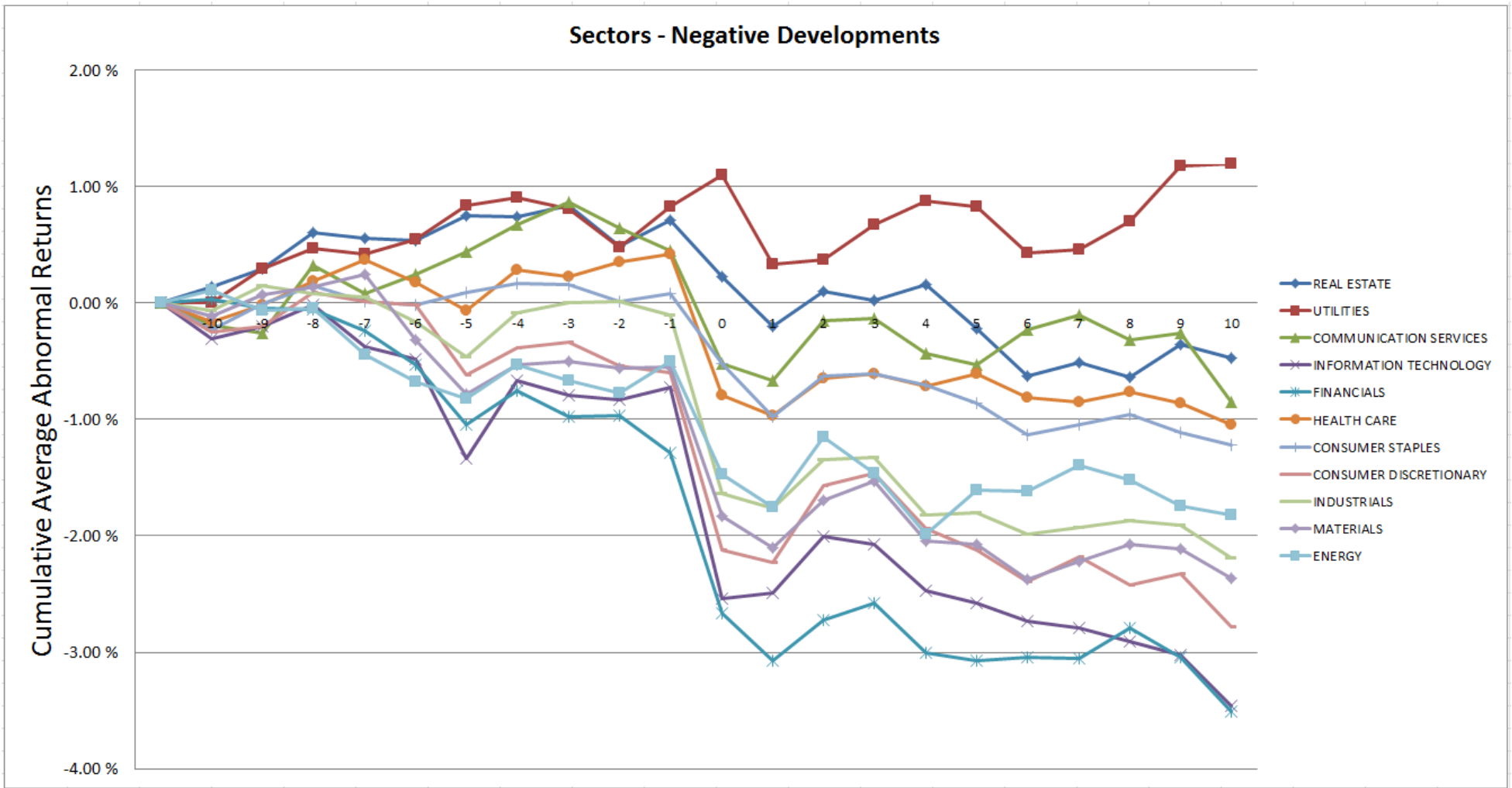
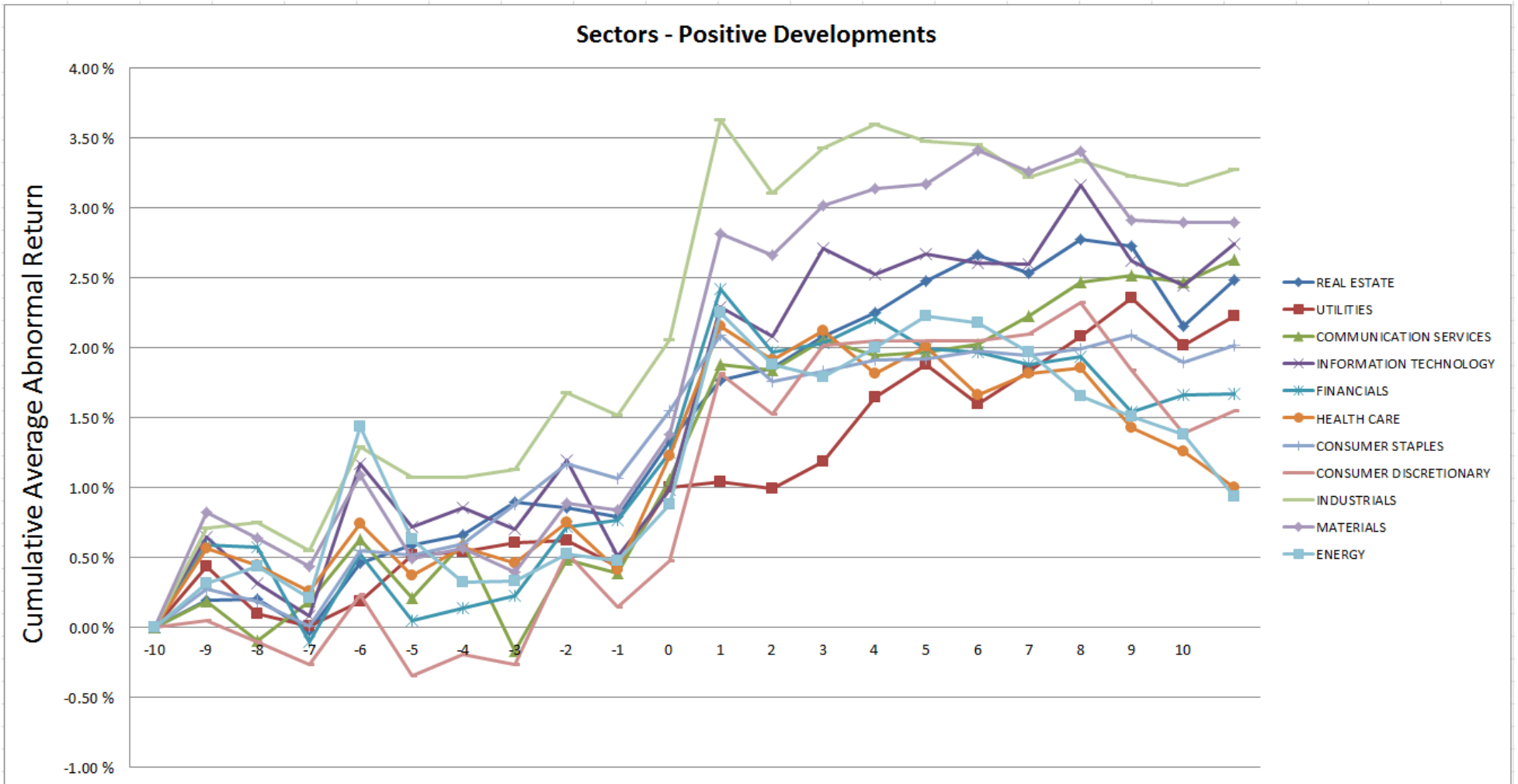*Figure 8: CAARs for sectors using a 21-day event window, negative developments*

Figure 9: CAARs for sectors using a 21-day event window, positive developments

7. 3 Market Caps

Table 11: Results for all markets caps analyzed separately for each date

March 1	Russell 1000	Russell 2000	Russell 2500	Russell 3000	Microcap	Midcap	Mega Cap
AR DAY 0	-1.313 %	-0.375 %	-0.518 %	-1.243 %	-0.152 %	-0.872 %	-1.485 %
AR DAY 1	0.508 %	1.656 %	1.269 %	0.594 %	2.013 %	0.711 %	0.415 %
CAR 0-2	0.241 %	2.077 %	1.724 %	0.377 %	2.553 %	0.996 %	-0.060 %
CAR 0-5	0.798 %	3.620 %	2.947 %	1.009 %	3.955 %	1.811 %	0.366 %
March 22	**Russell 1000**	**Russell 2000**	**Russell 2500**	**Russell 3000**	**Microcap**	**Midcap**	**Mega Cap**
AR DAY 0	-2.590 %	-2.332 %	-2.403 %	-2.570 %	-1.975 %	-2.412 %	-2.808 %
AR DAY 1	-2.142 %	-2.276 %	-2.055 %	-2.152 %	-2.114 %	-1.963 %	-2.314 %
CAR 0-2	-2.177 %	-2.469 %	-2.309 %	-2.199 %	-2.483 %	-2.179 %	-2.350 %
CAR 0-5	-3.039 %	-3.590 %	-3.128 %	-3.081 %	-4.405 %	-2.618 %	-3.367 %
April 2	**Russell 1000**	**Russell 2000**	**Russell 2500**	**Russell 3000**	**Microcap**	**Midcap**	**Mega Cap**
AR DAY 0	-2.335 %	-2.511 %	-2.480 %	-2.349 %	-2.366 %	-2.351 %	-2.372 %
AR DAY 1	1.162 %	1.238 %	1.133 %	1.168 %	0.860 %	1.004 %	1.226 %
CAR 0-2	-0.115 %	-0.060 %	-0.337 %	-0.110 %	-0.019 %	-0.324 %	0.011 %
CAR 0-5	-1.521 %	-1.395 %	-1.742 %	-1.512 %	-1.632 %	-1.850 %	-1.214 %
April 16	**Russell 1000**	**Russell 2000**	**Russell 2500**	**Russell 3000**	**Microcap**	**Midcap**	**Mega Cap**
AR DAY 0	0.775 %	0.832 %	0.850 %	0.779 %	0.614 %	0.943 %	0.608 %
AR DAY 1	1.018 %	1.030 %	0.971 %	1.019 %	1.251 %	0.876 %	1.149 %
CAR 0-2	1.862 %	2.064 %	2.087 %	1.878 %	2.089 %	2.098 %	1.524 %
CAR 0-5	0.326 %	0.590 %	0.699 %	0.346 %	0.575 %	0.705 %	-0.060 %
June 15	**Russell 1000**	**Russell 2000**	**Russell 2500**	**Russell 3000**	**Microcap**	**Midcap**	**Mega Cap**
AR DAY 0	-0.138 %	-0.108 %	-0.148 %	-0.136 %	0.077 %	-0.109 %	-0.234 %
AR DAY 1	-0.213 %	0.447 %	0.310 %	-0.160 %	0.738 %	0.044 %	-0.275 %
CAR 0-2	-0.813 %	0.338 %	-0.088 %	-0.720 %	0.691 %	-0.564 %	-0.893 %
CAR 0-5	-1.225 %	-0.306 %	-0.623 %	-1.152 %	0.704 %	-0.939 %	-1.302 %
July 6	**Russell 1000**	**Russell 2000**	**Russell 2500**	**Russell 3000**	**Microcap**	**Midcap**	**Mega Cap**
AR DAY 0	0.816 %	0.798 %	0.825 %	0.815 %	0.476 %	0.797 %	0.813 %
AR DAY 1	0.829 %	0.555 %	0.702 %	0.808 %	0.416 %	0.698 %	0.861 %
CAR 0-2	1.913 %	0.759 %	1.239 %	1.822 %	0.032 %	1.564 %	2.084 %
CAR 0-5	2.003 %	0.057 %	0.701 %	1.851 %	-1.000 %	1.341 %	2.387 %
July 11	**Russell 1000**	**Russell 2000**	**Russell 2500**	**Russell 3000**	**Microcap**	**Midcap**	**Mega Cap**
AR DAY 0	-0.743 %	-0.766 %	-0.765 %	-0.745 %	-0.811 %	-0.746 %	-0.632 %
AR DAY 1	0.803 %	0.334 %	0.384 %	0.767 %	0.195 %	0.560 %	0.961 %
CAR 0-2	0.106 %	-0.680 %	-0.516 %	0.045 %	-1.031 %	-0.204 %	0.315 %
CAR 0-5	0.486 %	-0.572 %	-0.348 %	0.404 %	-1.504 %	0.029 %	0.845 %
July 31	**Russell 1000**	**Russell 2000**	**Russell 2500**	**Russell 3000**	**Microcap**	**Midcap**	**Mega Cap**
AR DAY 0	0.477 %	0.986 %	0.897 %	0.515 %	0.976 %	0.753 %	0.187 %
AR DAY 1	-0.147 %	-0.170 %	-0.208 %	-0.149 %	-0.090 %	-0.524 %	0.359 %
CAR 0-2	0.853 %	1.505 %	1.471 %	0.903 %	1.449 %	0.898 %	1.158 %
CAR 0-5	1.783 %	1.641 %	1.950 %	1.772 %	1.028 %	1.649 %	2.314 %
August 23	**Russell 1000**	**Russell 2000**	**Russell 2500**	**Russell 3000**	**Microcap**	**Midcap**	**Mega Cap**
AR DAY 0	-0.242 %	-0.397 %	-0.333 %	-0.254 %	-0.308 %	-0.319 %	-0.133 %
AR DAY 1	0.569 %	0.423 %	0.443 %	0.557 %	0.429 %	0.574 %	0.545 %
CAR 0-2	1.007 %	0.105 %	0.475 %	0.938 %	0.008 %	0.763 %	1.230 %
CAR 0-5	0.967 %	0.099 %	0.325 %	0.900 %	0.265 %	0.435 %	1.485 %
Sept 17	**Russell 1000**	**Russell 2000**	**Russell 2500**	**Russell 3000**	**Microcap**	**Midcap**	**Mega Cap**
AR DAY 0	-0.689 %	-1.126 %	-1.036 %	-0.722 %	-0.993 %	-0.772 %	-0.830 %
AR DAY 1	0.469 %	0.370 %	0.404 %	0.462 %	0.540 %	0.404 %	0.524 %
CAR 0-2	-0.216 %	-1.293 %	-1.139 %	-0.298 %	-0.974 %	-0.680 %	-0.144 %
CAR 0-5	-0.049 %	-1.348 %	-1.319 %	-0.148 %	-0.634 %	-0.893 %	0.300 %
Oct 30	**Russell 1000**	**Russell 2000**	**Russell 2500**	**Russell 3000**	**Microcap**	**Midcap**	**Mega Cap**
AR DAY 0	1.542 %	1.945 %	1.872 %	1.572 %	1.744 %	1.882 %	1.234 %
AR DAY 1	1.102 %	0.295 %	0.676 %	1.043 %	0.357 %	0.940 %	1.489 %
CAR 0-2	3.772 %	4.415 %	4.543 %	3.819 %	4.064 %	4.506 %	3.532 %
CAR 0-5	4.167 %	5.068 %	5.002 %	4.233 %	4.184 %	5.126 %	3.489 %

Sept 24	Russell 1000	Russell 2000	Russell 2500	Russell 3000	Microcap	Midcap	Mega Cap
AR DAY 0	-0.408 %	-0.462 %	-0.509 %	-0.412 %	-0.257 %	-0.675 %	-0.158 %
AR DAY 1	-0.147 %	0.152 %	0.053 %	-0.125 %	0.071 %	-0.157 %	-0.047 %
CAR 0-2	-0.971 %	-1.373 %	-1.327 %	-1.001 %	-1.111 %	-1.478 %	-0.572 %
CAR 0-5	-0.558 %	-2.635 %	-2.090 %	-0.715 %	-2.577 %	-1.658 %	0.235 %
Nov 19	Russell 1000	Russell 2000	Russell 2500	Russell 3000	Microcap	Midcap	Mega Cap
AR DAY 0	-1.751 %	-2.051 %	-2.008 %	-1.772 %	-1.795 %	-1.770 %	-2.039 %
AR DAY 1	-1.802 %	-1.858 %	-1.643 %	-1.806 %	-1.645 %	-1.534 %	-1.961 %
CAR 0-2	-3.164 %	-2.606 %	-2.431 %	-3.123 %	-1.902 %	-2.391 %	-3.873 %
CAR 0-5	-2.249 %	-1.429 %	-1.135 %	-2.189 %	-1.419 %	-1.095 %	-3.135 %
Nov 28	Russell 1000	Russell 2000	Russell 2500	Russell 3000	Microcap	Midcap	Mega Cap
AR DAY 0	2.274 %	2.484 %	2.301 %	2.289 %	2.483 %	1.963 %	2.686 %
AR DAY 1	-0.213 %	-0.326 %	-0.214 %	-0.221 %	-0.446 %	-0.264 %	-0.168 %
CAR 0-2	2.868 %	2.675 %	2.659 %	2.854 %	2.337 %	2.301 %	3.447 %
CAR 0-5	0.638 %	-0.806 %	-0.186 %	0.534 %	-1.010 %	0.180 %	1.158 %
Dec 3	Russell 1000	Russell 2000	Russell 2500	Russell 3000	Microcap	Midcap	Mega Cap
AR DAY 0	1.089 %	1.012 %	1.091 %	1.084 %	1.032 %	1.166 %	1.223 %
AR DAY 1	-3.318 %	-4.509 %	-3.952 %	-3.404 %	-4.388 %	-3.304 %	-3.503 %
CAR 0-2	-2.352 %	-3.728 %	-2.954 %	-2.451 %	-3.541 %	-2.266 %	-2.346 %
CAR 0-5	-4.686 %	-6.300 %	-5.786 %	-4.801 %	-5.759 %	-4.915 %	-4.514 %
Dec 4	Russell 1000	Russell 2000	Russell 2500	Russell 3000	Microcap	Midcap	Mega Cap
AR DAY 0	-3.307 %	-4.494 %	-3.939 %	-3.392 %	-4.373 %	-3.293 %	-3.491 %
AR DAY 1	-0.112 %	-0.216 %	-0.080 %	-0.120 %	-0.171 %	-0.116 %	-0.054 %
CAR 0-2	-5.785 %	-6.706 %	-6.152 %	-5.851 %	-6.144 %	-5.619 %	-6.131 %
CAR 0-5	-5.165 %	-6.179 %	-5.983 %	-5.238 %	-5.735 %	-5.394 %	-5.151 %
Dec 7	Russell 1000	Russell 2000	Russell 2500	Russell 3000	Microcap	Midcap	Mega Cap
AR DAY 0	-2.359 %	-1.990 %	-2.128 %	-2.333 %	-1.598 %	-2.206 %	-2.579 %
AR DAY 1	0.133 %	-0.331 %	-0.405 %	0.100 %	-0.220 %	-0.213 %	0.445 %
CAR 0-2	-2.281 %	-2.513 %	-2.779 %	-2.297 %	-2.166 %	-2.602 %	-2.110 %
CAR 0-5	-3.680 %	-4.527 %	-4.556 %	-3.740 %	-4.491 %	-4.013 %	-3.555 %
Dec 14	Russell 1000	Russell 2000	Russell 2500	Russell 3000	Microcap	Midcap	Mega Cap
AR DAY 0	-1.872 %	-1.534 %	-1.381 %	-1.849 %	-1.511 %	-1.323 %	-2.276 %
AR DAY 1	-2.160 %	-2.338 %	-2.491 %	-2.173 %	-2.353 %	-2.425 %	-2.024 %
CAR 0-2	-4.027 %	-3.937 %	-3.803 %	-4.021 %	-4.551 %	-3.787 %	-4.093 %
CAR 0-5	-9.303 %	-10.300 %	-9.608 %	-9.372 %	-10.860 %	-8.855 %	-9.677 %
Dec 21	Russell 1000	Russell 2000	Russell 2500	Russell 3000	Microcap	Midcap	Mega Cap
AR DAY 0	-2.090 %	-2.570 %	-2.256 %	-2.124 %	-2.362 %	-1.875 %	-2.329 %
AR DAY 1	-2.727 %	-1.946 %	-2.213 %	-2.672 %	-1.413 %	-2.665 %	-2.737 %
CAR 0-2	-4.814 %	-4.496 %	-4.451 %	-4.791 %	-3.745 %	-4.523 %	-5.067 %
CAR 0-5	0.763 %	1.019 %	0.885 %	0.782 %	1.545 %	0.562 %	0.982 %
Jan 7	Russell 1000	Russell 2000	Russell 2500	Russell 3000	Microcap	Midcap	Mega Cap
AR DAY 0	0.847 %	1.850 %	1.702 %	0.919 %	2.086 %	1.306 %	0.616 %
AR DAY 1	1.075 %	1.579 %	1.580 %	1.111 %	1.327 %	1.331 %	1.040 %
CAR 0-2	2.448 %	4.368 %	4.219 %	2.586 %	4.196 %	3.487 %	1.993 %
CAR 0-5	2.552 %	4.199 %	4.452 %	2.670 %	3.304 %	3.837 %	1.801 %
Jan 18	Russell 1000	Russell 2000	Russell 2500	Russell 3000	Microcap	Midcap	Mega Cap
AR DAY 0	1.358 %	1.104 %	1.293 %	1.339 %	0.559 %	1.603 %	1.208 %
AR DAY 1	0.060 %	0.070 %	0.070 %	0.061 %	0.073 %	0.071 %	0.057 %
CAR 0-2	0.047 %	-0.459 %	-0.169 %	0.010 %	-1.014 %	0.320 %	-0.305 %
CAR 0-5	1.516 %	1.479 %	1.913 %	1.513 %	0.894 %	2.345 %	0.945 %
February 7	Russell 1000	Russell 2000	Russell 2500	Russell 3000	Microcap	Midcap	Mega Cap
AR DAY 0	-0.884 %	-0.799 %	-0.660 %	-0.878 %	-1.042 %	-0.411 %	-1.153 %
AR DAY 1	0.087 %	0.072 %	0.103 %	0.086 %	0.206 %	0.214 %	-0.024 %
CAR 0-2	-0.677 %	0.127 %	0.047 %	-0.619 %	-0.053 %	0.147 %	-1.293 %
CAR 0-5	0.681 %	1.895 %	1.616 %	0.769 %	1.688 %	1.497 %	0.009 %
Feb 12	Russell 1000	Russell 2000	Russell 2500	Russell 3000	Microcap	Midcap	Mega Cap
AR DAY 0	1.286 %	1.280 %	1.181 %	1.286 %	1.247 %	1.132 %	1.437 %
AR DAY 1	0.310 %	0.327 %	0.331 %	0.311 %	0.430 %	0.375 %	0.222 %
CAR 0-2	1.768 %	1.768 %	1.561 %	1.396 %	1.752 %	1.342 %	1.347 %
CAR 0-5	3.713 %	3.713 %	3.032 %	2.704 %	4.178 %	2.563 %	2.557 %

Feb 15	Russell 1000	Russell 2000	Russell 2500	Russell 3000	Microcap	Midcap	Mega Cap
AR DAY 0	1.064 %	1.554 %	1.207 %	1.100 %	1.718 %	1.005 %	0.981 %
AR DAY 1	0.001 %	0.004 %	-0.001 %	0.001 %	0.000 %	0.001 %	-0.004 %
CAR 0-2	1.214 %	1.893 %	1.424 %	1.264 %	2.365 %	1.176 %	1.130 %
CAR 0-5	1.690 %	2.890 %	2.286 %	1.777 %	3.460 %	1.773 %	1.765 %
Feb 25	**Russell 1000**	**Russell 2000**	**Russell 2500**	**Russell 3000**	**Microcap**	**Midcap**	**Mega Cap**
AR DAY 0	0.135 %	-0.061 %	0.040 %	0.120 %	-0.033 %	-0.011 %	0.298 %
AR DAY 1	-0.116 %	-0.697 %	-0.650 %	-0.159 %	-0.688 %	-0.373 %	0.085 %
CAR 0-2	0.033 %	-0.515 %	-0.331 %	-0.007 %	-0.294 %	-0.183 %	0.277 %
CAR 0-5	-0.017 %	-0.817 %	-0.649 %	-0.076 %	-0.737 %	-0.377 %	0.644 %
April 1	**Russell 1000**	**Russell 2000**	**Russell 2500**	**Russell 3000**	**Microcap**	**Midcap**	**Mega Cap**
AR DAY 0	1.142 %	1.056 %	1.167 %	1.136 %	0.741 %	1.206 %	1.161 %
AR DAY 1	-0.029 %	-0.175 %	-0.140 %	-0.039 %	0.044 %	-0.004 %	0.115 %
CAR 0-2	1.335 %	1.369 %	1.533 %	1.338 %	1.206 %	1.598 %	1.462 %
CAR 0-5	2.019 %	2.524 %	2.437 %	2.055 %	2.627 %	2.359 %	1.960 %
May 7	**Russell 1000**	**Russell 2000**	**Russell 2500**	**Russell 3000**	**Microcap**	**Midcap**	**Mega Cap**
AR DAY 0	-1.720 %	-2.039 %	-1.889 %	-1.737 %	-1.910 %	-1.676 %	-1.750 %
AR DAY 1	-0.195 %	-0.460 %	-0.353 %	-0.207 %	-0.238 %	-0.199 %	-0.233 %
CAR 0-2	-2.234 %	-2.806 %	-2.436 %	-2.254 %	-2.327 %	-1.941 %	-2.505 %
CAR 0-5	-3.638 %	-4.525 %	-3.979 %	-3.661 %	-3.440 %	-3.214 %	-4.295 %
May 13	**Russell 1000**	**Russell 2000**	**Russell 2500**	**Russell 3000**	**Microcap**	**Midcap**	**Mega Cap**
AR DAY 0	-2.543 %	-3.225 %	-3.000 %	-2.591 %	-2.879 %	-2.649 %	-2.689 %
AR DAY 1	0.821 %	1.313 %	1.157 %	0.856 %	1.434 %	0.993 %	0.695 %
CAR 0-2	-1.688 %	-1.843 %	-1.497 %	-1.200 %	-1.022 %	-1.335 %	-1.146 %
CAR 0-5	-1.711 %	-3.075 %	-2.823 %	-1.808 %	-2.339 %	-2.207 %	-1.674 %

Table 12: Aggregated Average ARs and CARs for market caps using a 3-day event window, negative developments, Results are percentages.

Day	Russell 1000		Russell 2000		Russell 2500		Russell 3000		Microcap		Midcap		Mega Cap	
	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
0	-1.30	-1.30	-1.40	-1.40	-1.32	-1.32	-1.31	-1.31	-1.29	-1.29	-1.21	-1.21	-1.42	-1.42
1	-0.17	-1.47	-0.10	-1.50	-0.13	-1.45	-0.17	-1.47	0.00	-1.29	-0.18	-1.38	-0.16	-1.58
2	0.15	-1.32	0.09	-1.41	0.13	-1.32	0.17	-1.30	0.06	-1.23	0.16	-1.23	0.19	-1.39

Table 13: Aggregated Average ARs and CARs for market caps using a 3-day event window, positive developments, Results are percentages.

Day	Russell 1000		Russell 2000		Russell 2500		Russell 3000		Microcap		Midcap		Mega Cap	
	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
0	1.12	1.12	1.32	1.32	1.28	1.28	1.14	1.14	1.26	1.26	1.20	1.20	1.10	1.10
1	-0.13	0.99	-0.36	0.96	-0.25	1.02	-0.14	0.99	-0.34	0.92	-0.18	1.03	-0.03	1.07
2	0.16	1.16	0.37	1.33	0.37	1.40	0.18	1.17	0.33	1.25	0.29	1.32	0.10	1.17

All AARs for day 0 and CAAR 0-2 were found significant at a 0.05 level of significance.
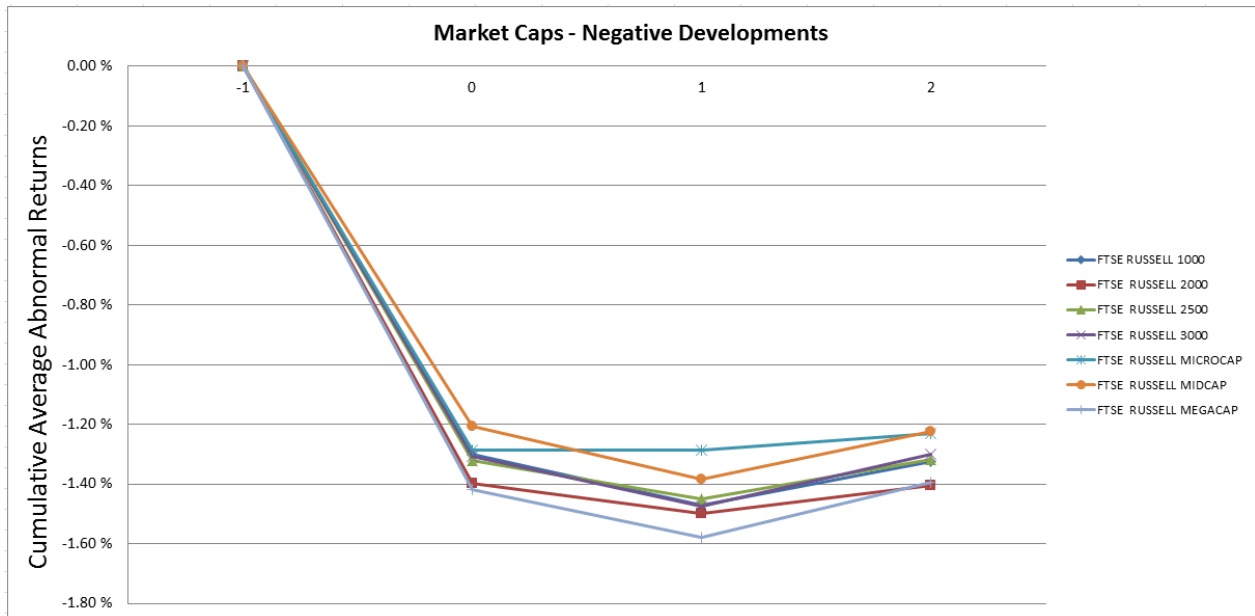
Figure 10: CAARs for market caps using a 3-day event window, negative developments
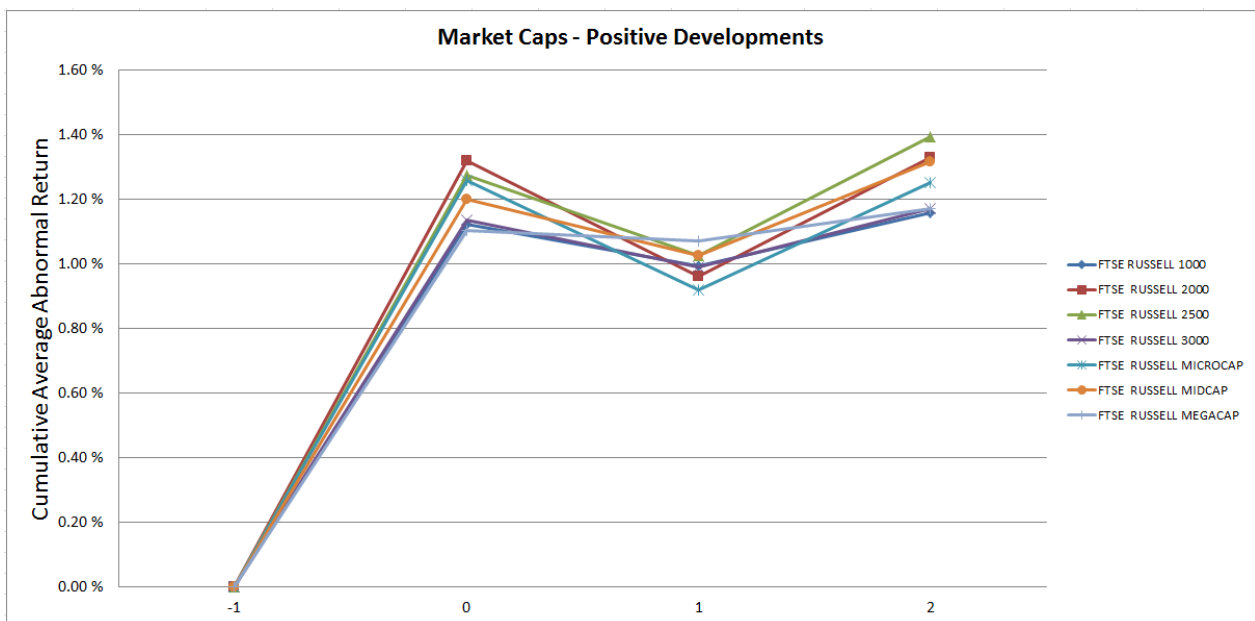

Figure 11: CAARs for market caps using a 3-day event window, positive developments

Table 14: Aggregated Average ARs and CARs for market caps using a 21-day event window, negative developments, Results are percentages.

Day	Russell 1000		Russell 2000		Russell 2500		Russell 3000		Microcap		Midcap		Mega Cap	
	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
-10	-0.23	-0.23	-0.25	-0.25	-0.23	-0.23	-0.25	-0.25	-0.16	-0.16	-0.20	-0.20	-0.29	-0.29
-9	0.38	0.15	0.35	0.10	0.38	0.15	0.38	0.13	0.22	0.05	0.42	0.23	0.38	0.09
-8	-0.19	-0.04	-0.27	-0.17	-0.27	-0.12	-0.19	-0.06	-0.23	-0.18	-0.23	-0.01	-0.16	-0.07
-7	-0.04	-0.08	0.05	-0.13	0.04	-0.08	-0.02	-0.08	0.02	-0.15	0.03	0.02	-0.08	-0.15
-6	-0.21	-0.29	-0.28	-0.41	-0.26	-0.34	-0.23	-0.31	-0.36	-0.51	-0.27	-0.25	-0.18	-0.33
-5	-0.09	-0.38	-0.22	-0.63	-0.19	-0.53	-0.10	-0.41	-0.29	-0.80	-0.10	-0.35	-0.12	-0.45
-4	0.14	-0.24	0.11	-0.53	0.09	-0.44	0.14	-0.27	0.12	-0.68	0.12	-0.23	0.19	-0.26
-3	-0.26	-0.50	-0.24	-0.77	-0.22	-0.66	-0.26	-0.53	-0.33	-1.01	-0.22	-0.45	-0.29	-0.55
-2	0.25	-0.25	0.27	-0.49	0.25	-0.41	0.25	-0.28	0.29	-0.72	0.20	-0.25	0.25	-0.30
-1	-0.08	-0.34	-0.16	-0.65	-0.12	-0.53	-0.09	-0.37	-0.17	-0.89	-0.08	-0.33	-0.09	-0.38
0	-1.30	-1.64	-1.40	-2.05	-1.32	-1.86	-1.31	-1.68	-1.29	-2.18	-1.21	-1.54	-1.42	-1.80
1	-0.17	-1.81	-0.10	-2.15	-0.13	-1.98	-0.17	-1.84	0.00	-2.18	-0.18	-1.72	-0.16	-1.96
2	0.15	-1.66	0.09	-2.06	0.13	-1.85	0.17	-1.67	0.06	-2.12	0.16	-1.56	0.19	-1.78
3	0.31	-1.35	0.28	-1.78	0.25	-1.60	0.28	-1.39	0.17	-1.96	0.25	-1.31	0.34	-1.43
4	-0.40	-1.75	-0.55	-2.33	-0.50	-2.10	-0.41	-1.80	-0.57	-2.53	-0.42	-1.72	-0.41	-1.84
5	-0.04	-1.79	-0.14	-2.47	-0.11	-2.21	-0.04	-1.84	-0.10	-2.63	-0.07	-1.80	-0.03	-1.87
6	-0.14	-1.93	-0.13	-2.59	-0.17	-2.38	-0.11	-1.96	-0.10	-2.73	-0.18	-1.97	-0.06	-1.93
7	-0.08	-2.01	-0.07	-2.66	-0.09	-2.47	-0.11	-2.07	-0.07	-2.80	-0.12	-2.10	-0.07	-2.01
8	-0.01	-2.03	-0.24	-2.90	-0.21	-2.68	-0.03	-2.10	-0.33	-3.13	-0.14	-2.23	0.05	-1.96
9	-0.18	-2.21	-0.21	-3.12	-0.20	-2.88	-0.19	-2.28	-0.11	-3.24	-0.16	-2.40	-0.01	-1.97
10	0.12	-2.09	-0.07	-3.19	-0.02	-2.90	0.09	-2.19	-0.39	-3.63	0.08	-2.32	-0.24	-2.21

Table 15: Aggregated Average ARs and CARs for market caps using a 21-day event window, positive developments, Results are percentages.

| Day	Russell 1000		Russell 2000		Russell 2500		Russell 3000		Microcap		Midcap		Mega Cap	
	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
-10	0.12	0.12	0.38	0.38	0.29	0.29	0.14	0.14	0.54	0.54	0.20	0.20	0.31	0.31
-9	0.37	0.49	0.40	0.78	0.40	0.69	0.37	0.51	0.85	1.38	0.33	0.53	0.97	1.28
-8	0.60	1.09	0.72	1.50	0.72	1.40	0.61	1.12	0.25	1.63	0.66	1.18	0.16	1.44
-7	0.01	1.10	-0.10	1.40	-0.04	1.36	0.00	1.13	-0.03	1.60	0.06	1.24	-0.10	1.34
-6	-0.34	0.76	-0.28	1.12	-0.29	1.07	-0.34	0.79	-0.30	1.30	-0.25	0.99	-0.29	1.05
-5	0.30	1.07	0.22	1.34	0.27	1.34	0.30	1.09	0.13	1.44	0.28	1.27	0.28	1.33
-4	-0.18	0.88	-0.33	1.01	-0.28	1.06	-0.19	0.89	-0.35	1.09	-0.18	1.09	-0.21	1.12
-3	0.45	1.33	0.73	1.74	0.59	1.65	0.47	1.36	0.84	1.93	0.47	1.55	0.48	1.61
-2	-0.28	1.05	-0.25	1.49	-0.19	1.46	-0.28	1.08	-0.33	1.60	-0.18	1.37	-0.38	1.23
-1	0.51	1.56	0.54	2.03	0.49	1.95	0.51	1.59	0.47	2.07	0.49	1.86	0.48	1.71
0	1.12	2.68	1.32	3.35	1.28	3.22	1.14	2.73	1.26	3.33	1.20	3.06	1.10	2.82
1	-0.13	2.55	-0.36	2.99	-0.25	2.97	-0.14	2.58	-0.34	2.99	-0.18	2.89	-0.03	2.79
2	0.16	2.72	0.37	3.36	0.37	3.34	0.18	2.76	0.33	3.32	0.29	3.18	0.10	2.88
3	0.03	2.75	0.11	3.47	0.06	3.40	0.04	2.80	0.06	3.38	0.07	3.25	0.00	2.88
4	-0.13	2.62	-0.18	3.28	-0.15	3.25	-0.13	2.66	-0.19	3.20	-0.09	3.16	-0.15	2.73
5	0.17	2.79	0.10	3.39	0.14	3.39	0.16	2.83	0.09	3.29	0.15	3.32	0.19	2.93
6	0.23	3.02	0.14	3.53	0.15	3.54	0.22	3.05	0.12	3.40	0.16	3.48	0.33	3.26
7	-0.35	2.67	-0.47	3.06	-0.45	3.09	-0.36	2.69	-0.47	2.93	-0.36	3.12	-0.32	2.94
8	-0.16	2.51	-0.25	2.80	-0.17	2.92	-0.16	2.53	-0.25	2.68	-0.12	2.99	-0.17	2.77
9	-0.11	2.40	-0.17	2.63	-0.16	2.76	-0.12	2.41	-0.37	2.30	-0.10	2.90	-0.12	2.65
10	0.18	2.58	0.13	2.76	0.15	2.91	0.17	2.59	0.03	2.33	0.17	3.06	0.24	2.89
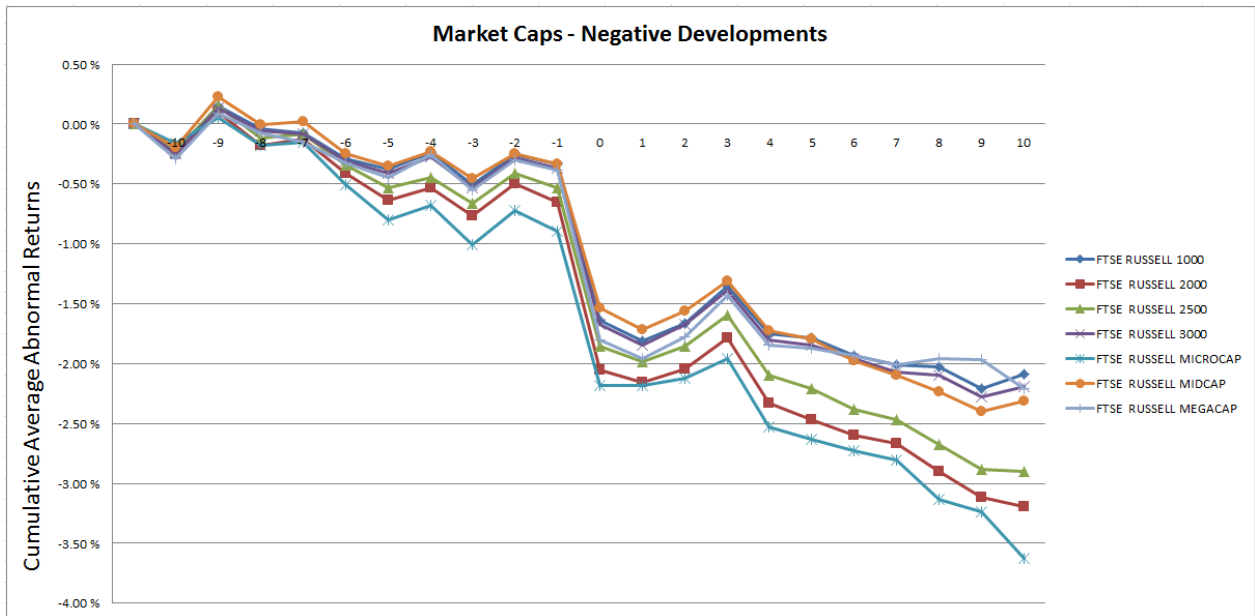
Figure 12: CAARs for market caps using a 21-day event window, negative developments
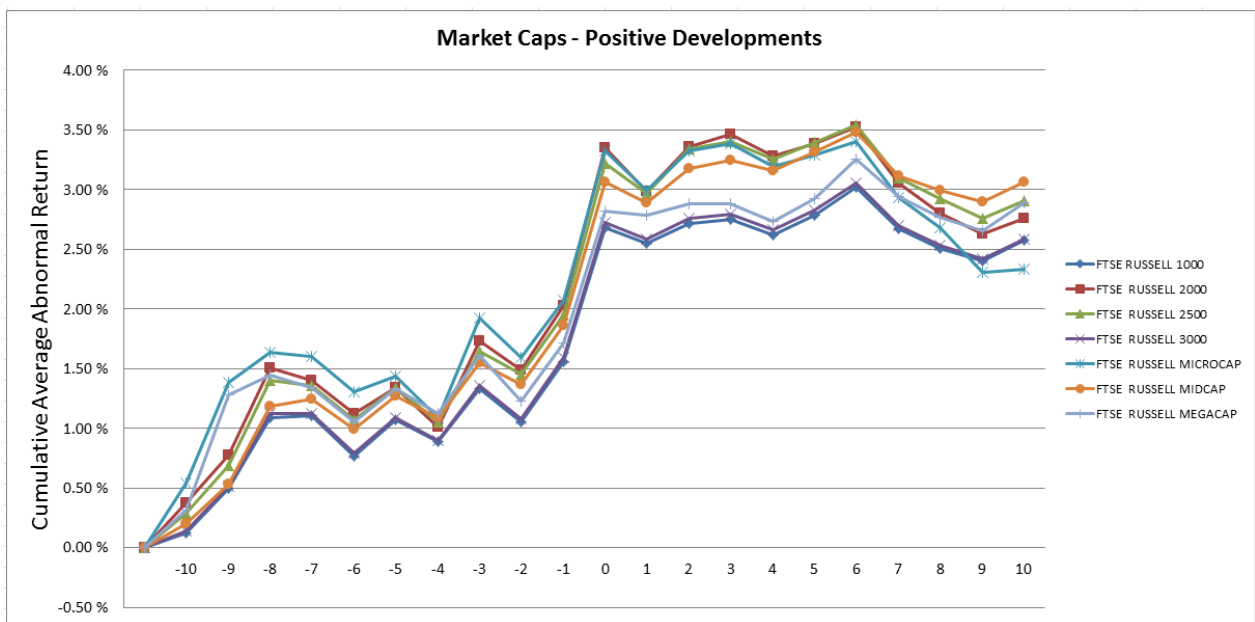

Figure 13: CAARs for market caps using a 21-day event window, positive developments

7. 4 Treasury Yields

Table 16: Results for all treasury yields analyzed separately for each date

March 1	5 Year Yield	10 Year Yield	30 Year Yield
AR DAY 0	-2.987 %	-2.312 %	-1.261 %
AR DAY 1	1.731 %	1.818 %	1.377 %
CAR 0-2	-0.574 %	0.287 %	0.746 %
CAR 0-5	-1.339 %	-0.400 %	0.155 %
March 22	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	-2.606 %	-2.687 %	-1.953 %
AR DAY 1	-0.930 %	-0.144 %	0.211 %
CAR 0-2	-2.750 %	-2.446 %	-1.922 %
CAR 0-5	-5.947 %	-6.320 %	-5.250 %
April 2	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	-0.637 %	-0.398 %	-0.073 %
AR DAY 1	2.007 %	1.817 %	1.597 %
CAR 0-2	1.319 %	1.494 %	1.849 %
CAR 0-5	0.743 %	1.216 %	1.501 %
April 16	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	0.109 %	0.024 %	-0.206 %
AR DAY 1	-0.339 %	-0.719 %	-1.037 %
CAR 0-2	1.577 %	1.089 %	0.304 %
CAR 0-5	4.291 %	4.474 %	3.445 %
June 15	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	-0.781 %	-0.862 %	-0.684 %
AR DAY 1	-0.176 %	-0.044 %	0.233 %
CAR 0-2	-2.283 %	-2.151 %	-1.368 %
CAR 0-5	-2.558 %	-2.246 %	-0.897 %
July 6	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	-0.808 %	-0.401 %	0.554 %
AR DAY 1	0.911 %	0.935 %	-0.786 %
CAR 0-2	0.679 %	0.903 %	**-0.425 %**
CAR 0-5	-1.404 %	-0.822 %	0.829 %
July 11	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	-1.318 %	-1.173 %	-0.897 %
AR DAY 1	0.389 %	0.298 %	0.151 %
CAR 0-2	-2.108 %	-1.737 %	-1.342 %
CAR 0-5	-1.088 %	-0.459 %	0.495 %
July 31	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	-0.248 %	-0.470 %	-0.760 %
AR DAY 1	0.766 %	1.208 %	1.400 %
CAR 0-2	-0.427 %	0.071 %	0.400 %
CAR 0-5	-1.381 %	-0.664 %	0.286 %
August 23	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	0.100 %	-0.197 %	-0.486 %
AR DAY 1	0.172 %	0.051 %	0.018 %
CAR 0-2	0.844 %	0.503 %	0.219 %
CAR 0-5	0.621 %	0.544 %	0.371 %
Sept 17	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	-0.034 %	0.130 %	0.162 %
AR DAY 1	0.993 %	1.450 %	1.771 %
CAR 0-2	1.601 %	2.618 %	3.210 %
CAR 0-5	1.052 %	2.144 %	2.285 %
Oct 30	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	0.513 %	0.623 %	0.745 %
AR DAY 1	1.451 %	1.444 %	1.299 %
CAR 0-2	1.157 %	1.472 %	1.539 %
CAR 0-5	3.374 %	3.316 %	2.497 %

Sept 24	5 Year Yield	10 Year Yield	30 Year Yield
AR DAY 0	-0.010 %	0.208 %	0.107 %
AR DAY 1	0.629 %	0.659 %	0.665 %
CAR 0-2	-0.402 %	-0.580 %	-0.584 %
CAR 0-5	-0.873 %	-0.314 %	0.546 %
Nov 19	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	-0.603 %	-0.681 %	-0.420 %
AR DAY 1	-1.242 %	-0.421 %	-0.421 %
CAR 0-2	-1.127 %	-0.804 %	-0.747 %
CAR 0-5	-0.016 %	-1.379 %	-0.771 %
Nov 28	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	-1.166 %	-0.483 %	0.224 %
AR DAY 1	-0.190 %	-0.418 %	-0.107 %
CAR 0-2	-1.862 %	-1.751 %	-0.472 %
CAR 0-5	-5.797 %	-6.771 %	-6.132 %
Dec 3	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	-0.343 %	-0.812 %	-1.083 %
AR DAY 1	-1.550 %	-2.412 %	-3.180 %
CAR 0-2	-3.863 %	-4.992 %	-5.675 %
CAR 0-5	-4.367 %	-5.226 %	-6.143 %
Dec 4	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	-1.543 %	-2.410 %	-3.180 %
AR DAY 1	-1.963 %	-1.766 %	-1.412 %
CAR 0-2	-5.539 %	-5.195 %	-4.452 %
CAR 0-5	-3.383 %	-3.581 %	-4.539 %
Dec 7	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	-2.032 %	-1.012 %	0.150 %
AR DAY 1	0.360 %	0.107 %	-0.519 %
CAR 0-2	-0.473 %	-0.207 %	-0.442 %
CAR 0-5	-1.421 %	-0.102 %	-0.214 %
Dec 14	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	-1.107 %	-0.798 %	-0.720 %
AR DAY 1	-1.451 %	-1.292 %	-1.013 %
CAR 0-2	-4.064 %	-3.324 %	-2.949 %
CAR 0-5	-4.960 %	-4.825 %	-4.876 %
Dec 21	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	-0.500 %	0.046 %	0.487 %
AR DAY 1	-2.420 %	-1.614 %	-0.872 %
CAR 0-2	-0.858 %	0.102 %	1.061 %
CAR 0-5	-6.046 %	-4.132 %	0.010 %
Jan 7	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	1.422 %	0.813 %	0.105 %
AR DAY 1	1.985 %	1.212 %	0.473 %
CAR 0-2	2.881 %	2.418 %	1.580 %
CAR 0-5	1.527 %	1.612 %	2.676 %
Jan 18	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	1.823 %	1.278 %	0.682 %
AR DAY 1	-1.955 %	-1.945 %	-1.429 %
CAR 0-2	0.810 %	0.258 %	-0.255 %
CAR 0-5	0.459 %	-0.102 %	-0.511 %
February 7	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	-2.018 %	-1.855 %	-1.486 %
AR DAY 1	-0.698 %	-0.744 %	-0.563 %
CAR 0-2	-1.337 %	-1.489 %	-1.273 %
CAR 0-5	-1.431 %	-1.600 %	-0.987 %
Feb 12	**5 Year Yield**	**10 Year Yield**	**30 Year Yield**
AR DAY 0	0.680 %	0.877 %	0.774 %
AR DAY 1	1.391 %	0.907 %	0.407 %
CAR 0-2	-0.093 %	-0.100 %	0.297 %
CAR 0-5	-0.025 %	-0.163 %	0.095 %

Feb 15	5 Year Yield	10 Year Yield	30 Year Yield
AR DAY 0	0.918 %	0.377 %	-0.315 %
AR DAY 1	-0.975 %	-0.677 %	-0.182 %
CAR 0-2	0.177 %	0.003 %	-0.177 %
CAR 0-5	0.717 %	0.832 %	1.005 %
Feb 25	5 Year Yield	10 Year Yield	30 Year Yield
AR DAY 0	0.753 %	0.709 %	0.485 %
AR DAY 1	-1.719 %	-1.361 %	-0.905 %
CAR 0-2	0.966 %	1.520 %	1.677 %
CAR 0-5	2.678 %	2.691 %	2.427 %
April 1	5 Year Yield	10 Year Yield	30 Year Yield
AR DAY 0	3.055 %	3.402 %	2.374 %
AR DAY 1	-0.844 %	-0.621 %	-0.076 %
CAR 0-2	3.451 %	4.244 %	3.701 %
CAR 0-5	3.784 %	4.388 %	3.543 %
May 7	5 Year Yield	10 Year Yield	30 Year Yield
AR DAY 0	-1.740 %	-2.048 %	-1.543 %
AR DAY 1	1.519 %	1.434 %	0.956 %
CAR 0-2	-1.568 %	-1.572 %	-0.986 %
CAR 0-5	-3.848 %	-2.968 %	-1.807 %
May 13	5 Year Yield	10 Year Yield	30 Year Yield
AR DAY 0	-2.797 %	-1.987 %	-1.200 %
AR DAY 1	0.636 %	0.652 %	0.517 %
CAR 0-2	-4.141 %	-2.931 %	-1.679 %
CAR 0-5	-1.489 %	-1.175 %	-1.179 %

Table 17: Aggregated Average ARs and CARs for treasury yields using a 3-day event window, negative developments, Results are percentages.

	5 Year Yield		10 Year Yield		30 Year Yield	
Day	AAR	CAAR	AAR	CAAR	AAR	CAAR
0	-1.21	-1.21	-1.02	-1.02	-0.76	-0.76
1	0.08	-1.14	0.14	-0.89	0.14	-0.62
2	-0.01	-1.15	0.03	-0.86	0.07	-0.54

Table 18: Aggregated Average ARs and CARs for treasury yields using a 3-day event window, positive developments, Results are percentages.

	5 Year Yield		10 Year Yield		30 Year Yield	
Day	AAR	CAAR	AAR	CAAR	AAR	CAAR
0	0.74	0.74	0.63	0.63	0.32	0.32
1	-0.16	0.58	-0.27	0.37	-0.23	0.09
2	-0.26	0.32	-0.05	0.31	0.17	0.26

CAAR 0-2 for the 5 and the 10 year yields for positive trade related developments were found statistically insignificant at the 0.05 level of significance All remaining AARs for day 0 and CAAR 0-2 were found significant at a 0.05 level of significance.
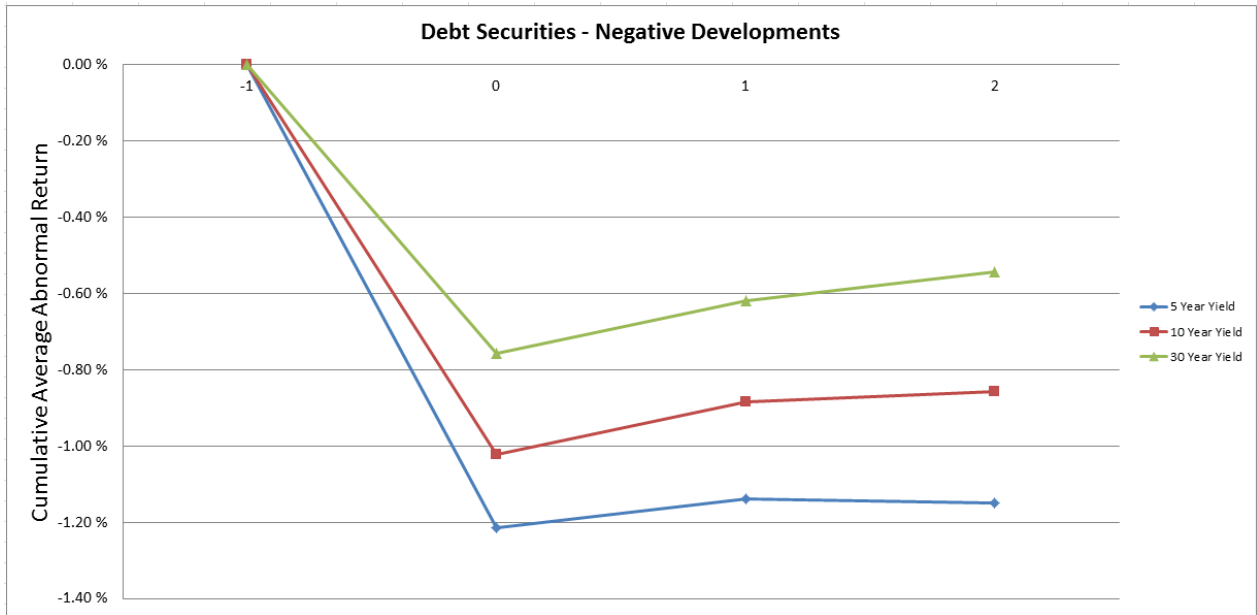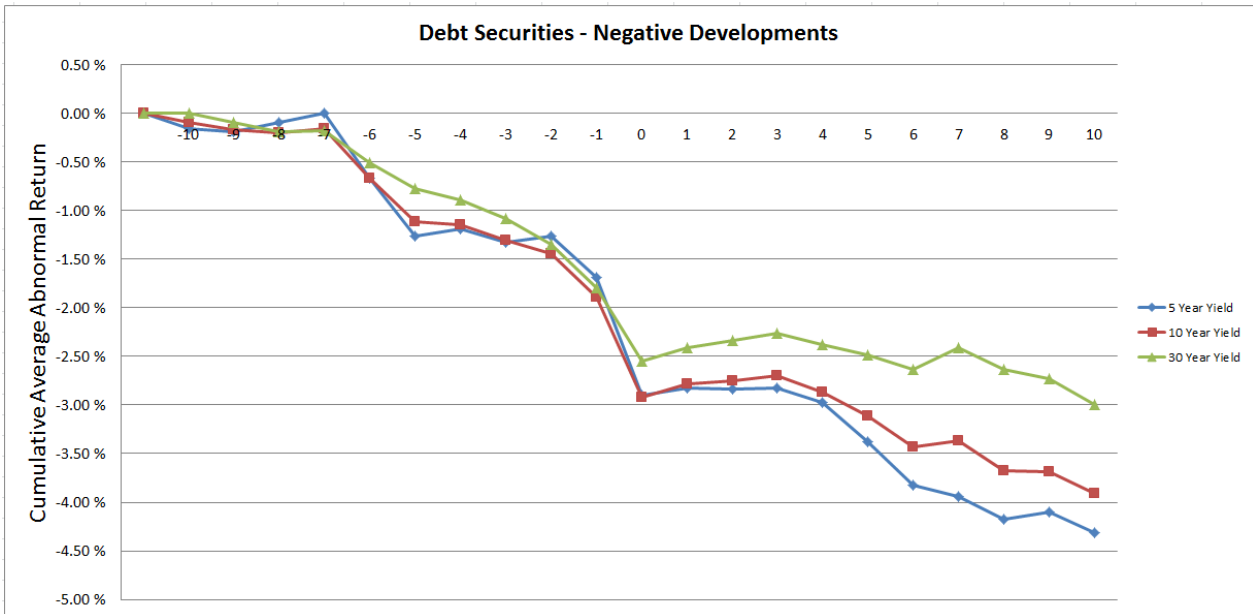
Figure 14: CAARs for treasury yields using a 3-day event window, negative developments

Figure 15: CAARs for treasury yields using a 3-day event window, positive developments

Table 19: Aggregated Average ARs and CARs for treasury yields using a 21-day event window,negative developments, Results are percentages.

Day	5 Year Yield		10 Year Yield		30 Year Yield	
	AAR	CAAR	AAR	CAAR	AAR	CAAR
-10	-0.15	-0.15	-0.10	-0.10	0.00	0.00
-9	-0.03	-0.19	-0.07	-0.17	-0.09	-0.09
-8	0.09	-0.10	-0.03	-0.20	-0.09	-0.19
-7	0.10	0.00	0.04	-0.15	0.00	-0.18
-6	-0.67	-0.67	-0.51	-0.66	-0.32	-0.50
-5	-0.60	-1.26	-0.45	-1.11	-0.27	-0.77
-4	0.08	-1.18	-0.04	-1.15	-0.12	-0.89
-3	-0.14	-1.32	-0.16	-1.30	-0.19	-1.08
-2	0.06	-1.26	-0.13	-1.44	-0.26	-1.35
-1	-0.42	-1.69	-0.45	-1.89	-0.45	-1.79
0	-1.21	-2.90	-1.02	-2.92	-0.76	-2.55
1	0.08	-2.83	0.14	-2.78	0.14	-2.41
2	-0.01	-2.84	0.03	-2.75	0.07	-2.34
3	0.02	-2.82	0.05	-2.70	0.08	-2.26
4	-0.15	-2.97	-0.17	-2.87	-0.12	-2.38
5	-0.40	-3.37	-0.24	-3.11	-0.11	-2.49
6	-0.45	-3.83	-0.32	-3.44	-0.15	-2.63
7	-0.12	-3.95	0.07	-3.37	0.22	-2.41
8	-0.23	-4.18	-0.30	-3.67	-0.22	-2.63
9	0.07	-4.11	-0.01	-3.69	-0.10	-2.73
10	-0.21	-4.32	-0.22	-3.91	-0.26	-2.99

Table 20: Aggregated Average ARs and CARs for treasury yields using a 21-day event window,positive developments, Results are percentages.

Day	5 Year Yield		10 Year Yield		30 Year Yield	
	AAR	CAAR	AAR	CAAR	AAR	CAAR
-10	0.32	0.32	0.18	0.18	-0.04	-0.04
-9	0.05	0.37	0.25	0.43	0.35	0.30
-8	-0.91	-0.54	-0.74	-0.31	-0.42	-0.12
-7	0.62	0.07	0.63	0.32	0.51	0.39
-6	-0.86	-0.78	-0.65	-0.33	-0.20	0.20
-5	-0.65	-1.43	-0.56	-0.89	-0.43	-0.23
-4	-0.46	-1.89	-0.37	-1.26	-0.03	-0.26
-3	-0.26	-2.15	-0.26	-1.52	-0.17	-0.43
-2	-0.38	-2.54	-0.38	-1.90	-0.28	-0.72
-1	0.41	-2.12	0.29	-1.61	0.21	-0.50
0	0.74	-1.38	0.63	-0.98	0.32	-0.18
1	-0.16	-1.55	-0.27	-1.25	-0.23	-0.41
2	-0.26	-1.80	-0.05	-1.30	0.17	-0.24
3	-0.06	-1.86	-0.03	-1.33	0.11	-0.13
4	-0.30	-2.16	-0.38	-1.70	-0.44	-0.57
5	0.13	-2.03	0.08	-1.62	0.04	-0.53
6	-0.42	-2.45	-0.25	-1.87	0.03	-0.50
7	-0.36	-2.81	-0.15	-2.03	-0.02	-0.52
8	-0.58	-3.38	-0.56	-2.59	-0.51	-1.03
9	0.60	-2.78	0.54	-2.05	0.29	-0.74
10	-0.29	-3.07	-0.14	-2.19	0.00	-0.74

Figure 16: CAARs for treasury yields using a 21-day event window, negative developments
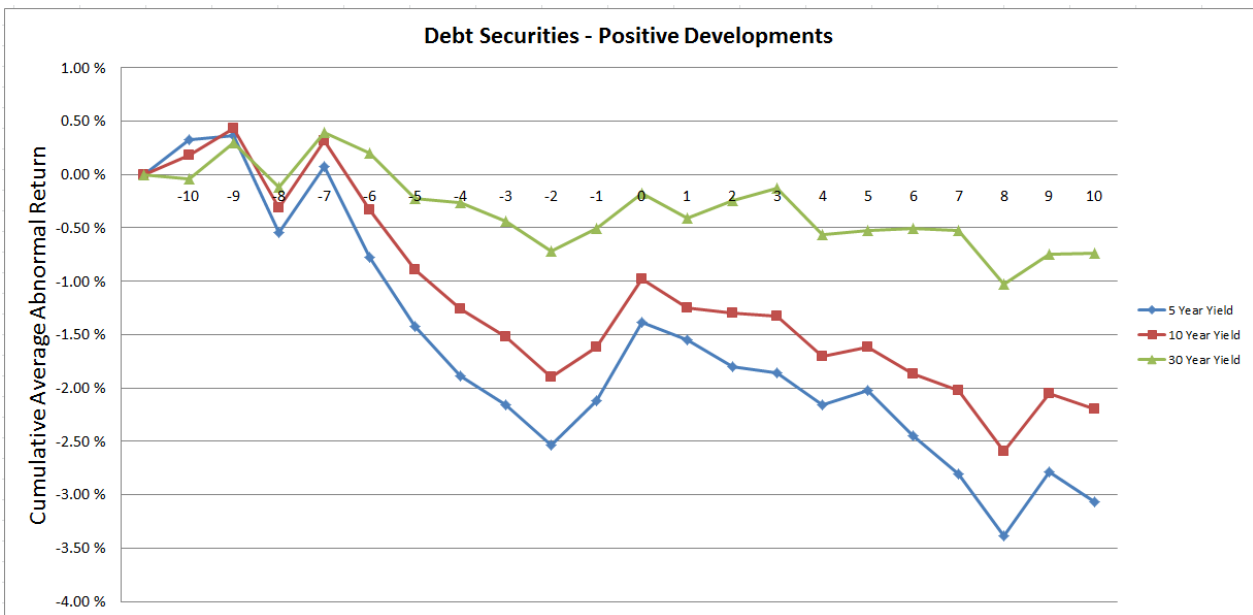

Figure 17: CAARs for treasury yields using a 21-day event window, negative developments

7. 5 Volatility

Table 21: Results for VIX analyzed separately for each date

March 1	VIX	Sept 24	VIX	Feb 12	VIX
AR DAY 0	12.086 %	AR DAY 0	4.199 %	AR DAY 0	-3.313 %
AR DAY 1	-14.028 %	AR DAY 1	1.630 %	AR DAY 1	1.543 %
CAR 0-2	-6.744 %	CAR 0-2	9.387 %	CAR 0-2	1.935 %
CAR 0-5	-20.114 %	CAR 0-5	1.761 %	CAR 0-5	-12.259 %
March 22	**VIX**	**Nov 19**	**VIX**	**Feb 15**	**VIX**
AR DAY 0	26.634 %	AR DAY 0	10.008 %	AR DAY 0	-8.361 %
AR DAY 1	6.223 %	AR DAY 1	10.938 %	AR DAY 1	-0.142 %
CAR 0-2	15.960 %	CAR 0-2	12.927 %	CAR 0-2	-14.396 %
CAR 0-5	10.410 %	CAR 0-5	3.224 %	CAR 0-5	-8.465 %
April 2	**VIX**	**Nov 28**	**VIX**	**Feb 25**	**VIX**
AR DAY 0	16.664 %	AR DAY 0	-3.096 %	AR DAY 0	9.460 %
AR DAY 1	-11.404 %	AR DAY 1	1.340 %	AR DAY 1	2.135 %
CAR 0-2	0.083 %	CAR 0-2	-5.933 %	CAR 0-2	8.451 %
CAR 0-5	7.896 %	CAR 0-5	9.184 %	CAR 0-5	7.983 %
April 16	**VIX**	**Dec 3**	**VIX**	**April 1**	**VIX**
AR DAY 0	-5.134 %	AR DAY 0	-9.677 %	AR DAY 0	-2.034 %
AR DAY 1	-8.370 %	AR DAY 1	23.011 %	AR DAY 1	-0.046 %
CAR 0-2	-11.364 %	CAR 0-2	15.257 %	CAR 0-2	0.977 %
CAR 0-5	-7.116 %	CAR 0-5	17.240 %	CAR 0-5	-2.426 %
June 15	**VIX**	**Dec 4**	**VIX**	**May 7**	**VIX**
AR DAY 0	-1.327 %	AR DAY 0	23.039 %	AR DAY 0	**22.490 %**
AR DAY 1	2.552 %	AR DAY 1	1.950 %	AR DAY 1	0.485 %
CAR 0-2	9.170 %	CAR 0-2	33.984 %	CAR 0-2	21.488 %
CAR 0-5	11.772 %	CAR 0-5	25.471 %	CAR 0-5	16.104 %
July 6	**VIX**	**Dec 7**	**VIX**	**May 13**	**VIX**
AR DAY 0	-11.359 %	AR DAY 0	8.861 %	AR DAY 0	24.775 %
AR DAY 1	-5.276 %	AR DAY 1	-2.904 %	AR DAY 1	-12.919 %
CAR 0-2	-17.085 %	CAR 0-2	1.662 %	CAR 0-2	2.455 %
CAR 0-5	-20.959 %	CAR 0-5	0.070 %	CAR 0-5	1.654 %
July 11	**VIX**	**Dec 14 / 17**	**VIX**		
AR DAY 0	7.324 %	AR DAY 0	4.400 %		
AR DAY 1	-8.233 %	AR DAY 1	12.305 %		
CAR 0-2	-4.357 %	CAR 0-2	20.701 %		
CAR 0-5	-5.667 %	CAR 0-5	36.297 %		
July 31	**VIX**	**Dec 21**	**VIX**		
AR DAY 0	-10.667 %	AR DAY 0	5.588 %		
AR DAY 1	2.363 %	AR DAY 1	17.731 %		
CAR 0-2	-15.985 %	CAR 0-2	5.922 %		
CAR 0-5	-27.195 %	CAR 0-5	-12.989 %		
August 23	**VIX**	**Jan 7**	**VIX**		
AR DAY 0	1.348 %	AR DAY 0	-0.332 %		
AR DAY 1	-3.393 %	AR DAY 1	-4.868 %		
CAR 0-2	-0.588 %	CAR 0-2	-8.048 %		
CAR 0-5	10.238 %	CAR 0-5	-13.985 %		
Sept 17	**VIX**	**Jan 18**	**VIX**		
AR DAY 0	12.401 %	AR DAY 0	-1.790 %		
AR DAY 1	-6.847 %	AR DAY 1	15.236 %		
CAR 0-2	-3.046 %	CAR 0-2	6.756 %		
CAR 0-5	0.353 %	CAR 0-5	2.351 %		
Oct 30	**VIX**	**February 7**	**VIX**		
AR DAY 0	-5.928 %	AR DAY 0	6.385 %		
AR DAY 1	-9.826 %	AR DAY 1	-3.905 %		
CAR 0-2	-25.386 %	CAR 0-2	4.203 %		
CAR 0-5	-23.404 %	CAR 0-5	6.195 %		

Table 22: Aggregated Average ARs and CARs for volatility using a 3-day event window, negative developments,

Day	VIX	
	AAR	CAAR
0	9.35 %	9.35 %
1	-1.30 %	8.05 %
2	-2.79 %	5.26 %

Table 23: Aggregated Average ARs and CARs for volatility using a 3-day event window, positive developments,

Day	VIX	
	AAR	CAAR
0	-3.57 %	-3.57 %
1	3.07 %	-0.50 %
2	-3.14 %	-3.64 %

All ARs and CAR 0-2 were found significant at a 5% level.
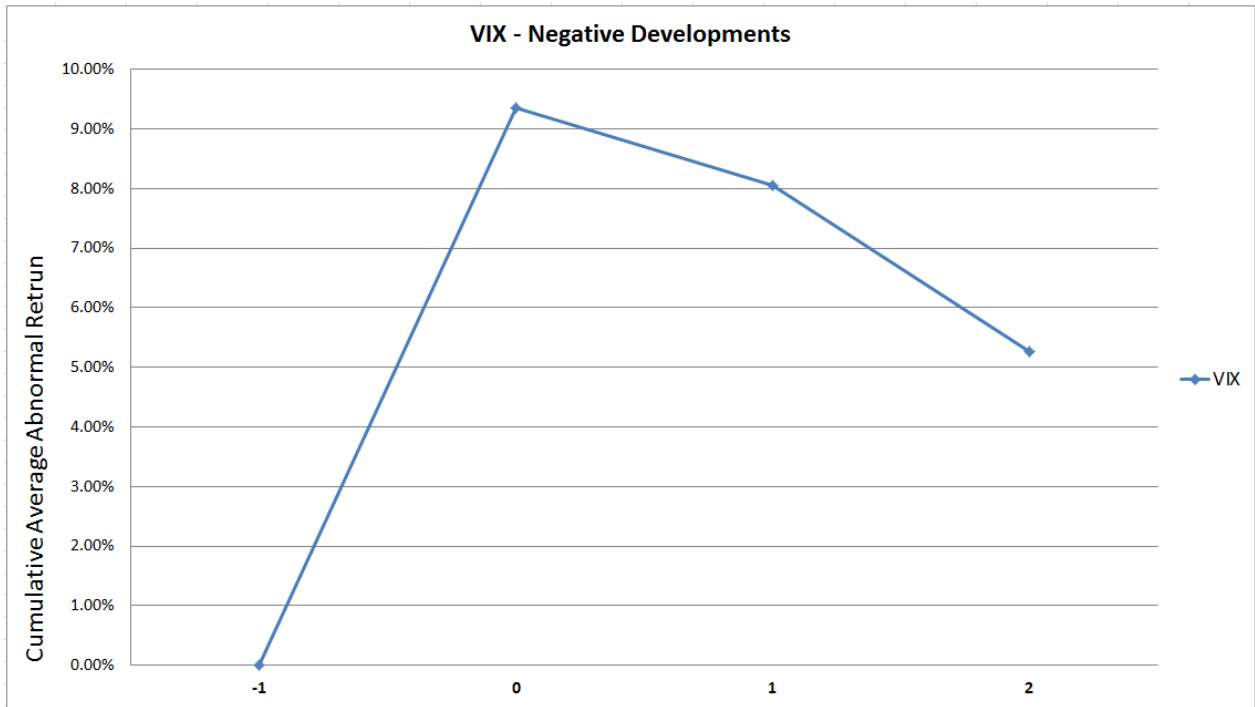
Figure 18: CAARs for VIX using a 3-day event window, negative developments
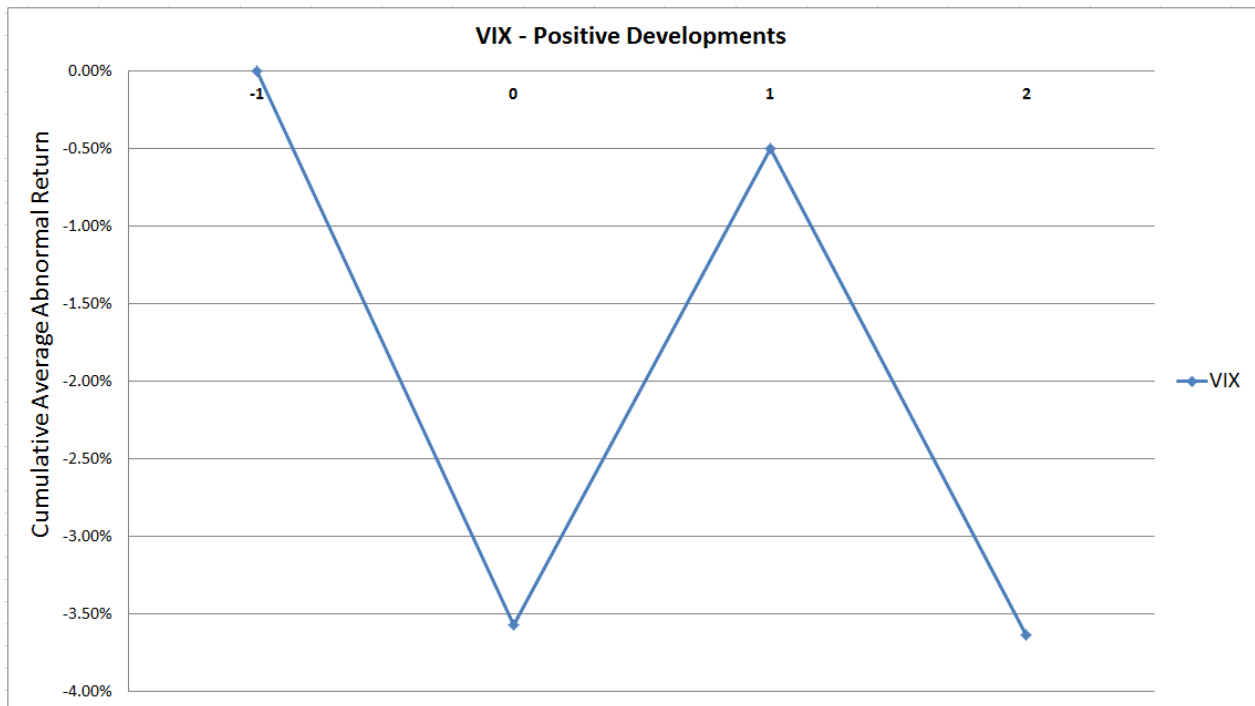
Figure 19: CAARs for VIX using a 3-day event window, positive developments

Table 24: Aggregated Average ARs and CARs for volatility using a 21-day event window, negative developments, Results are percentages.

Day	VIX	
	AAR	CAAR
-10	-1.36	-1.36
-9	0.53	-0.82
-8	-0.27	-1.10
-7	-0.49	-1.59
-6	1.70	0.11
-5	1.99	2.10
-4	-2.25	-0.15
-3	-0.76	-0.92
-2	0.00	-0.92
-1	-2.84	-3.75
0	9.35	5.60
1	-1.30	4.30
2	-2.79	1.51
3	-1.31	0.20
4	1.25	1.45
5	-1.62	-0.17
6	1.42	1.25
7	-1.50	-0.25
8	0.64	0.40
9	-0.58	-0.19
10	-0.08	-0.26

Table 25: Aggregated Average ARs and CARs for volatility using a 21-day event window, negative developments, Results are percentages.

Day	VIX	
	AAR	CAAR
-10	-4.88	-4.88
-9	1.45	-3.43
-8	2.95	-0.47
-7	-4.35	-4.83
-6	3.16	-1.67
-5	-2.63	-4.30
-4	-0.62	-4.92
-3	-1.75	-6.68
-2	0.13	-6.54
-1	-2.27	-8.82
0	-3.57	-12.39
1	3.07	-9.32
2	-3.14	-12.45
3	-1.69	-14.14
4	-1.79	-15.93
5	2.02	-13.91
6	-0.09	-14.01
7	-1.78	-15.79
8	2.02	-13.77
9	1.60	-12.17
10	-0.48	-12.65
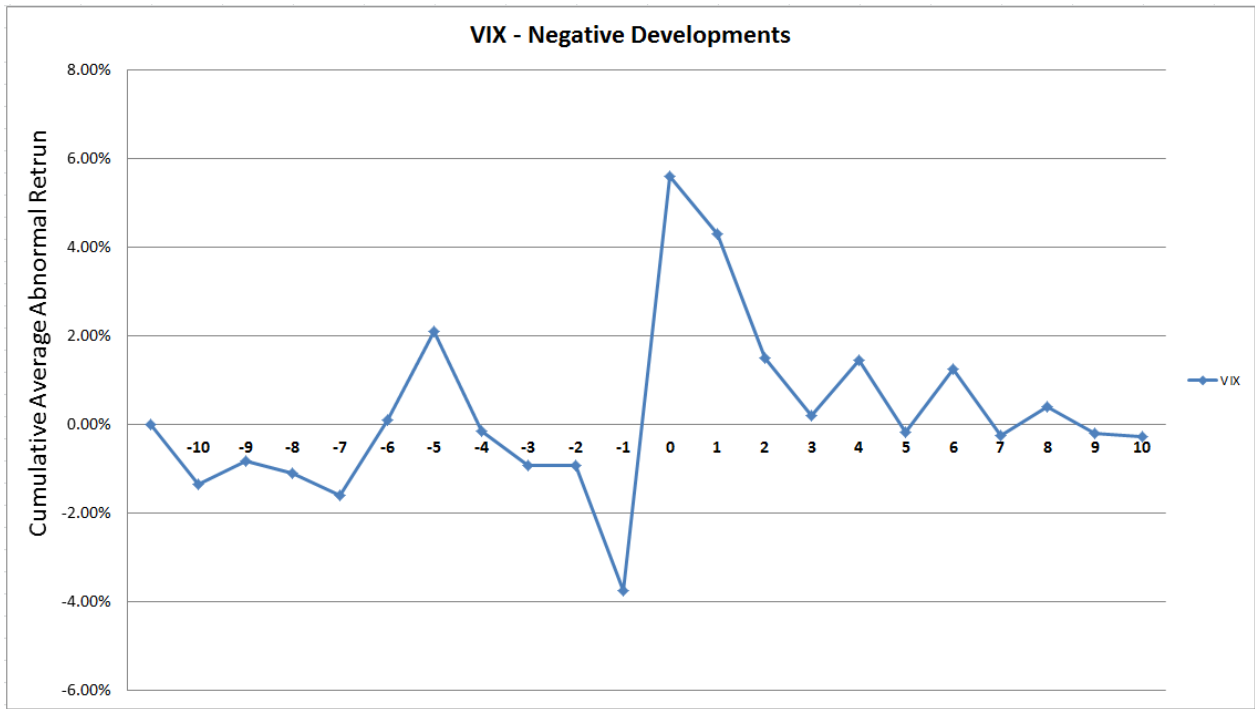
Figure 20: CAARs for VIX using a 21-day event window, negative developments
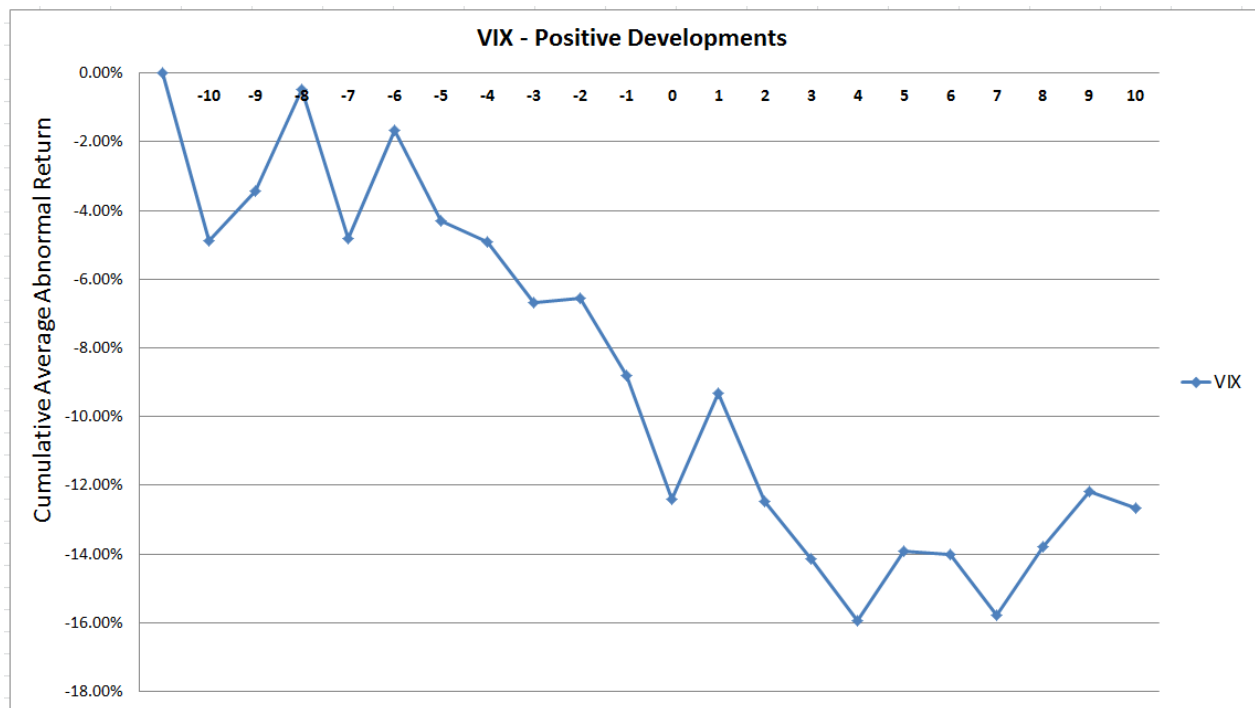
Figure 21: CAARs for VIX using a 21-day event window, positive developments

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8. Discussion

According to EMH, the market will process all trade war related information instantly and efficiently, eliminating any anomalies and abnormalities. The markets will determine fair value and correct to it instantly, meaning there should not be any abnormal return in the days following the event.

According to behavioral finance, investors are affected by emotional and psychological factors which may alter their judgement and behavior, causing them to deviate from rational behavior when faced with new information. Under BF, the stabilization and correction of financial markets is not instantaneous.

Discussion will focus on the results of the 3-day estimation window due to enhanced precision of the results.

8.1 Major Indices

All aggregated AAR and CAAR 0-2 for all major indices were found statistically significant at the 0.05 level of significance, rejecting the null hypothesis that there is no abnormal return.

Out of the major U.S. Indices, NASDAQ Composite appears to be most sensitive to trade war related developments, having witnessed a substantial 1.66 percent AAR loss and 1.23 percent gain on event days analyzed in this study. The NASDAQ Composite index is considered a good proxy for the technology segment of U.S. financial markets, as the vast majority of the stocks are within the technology segment of the economy. The sector analysis will confirm whether the technology stocks are among the most sensitive to trade-related developments.

The Dow Jones Industrial Average witnessed a 1.37 percent loss and a 1.22 percent gain, placing it in the middle of the three U.S. indices with regard to sensitivity.

The S&P 500 appears least affected by trade-related developments, having witnessed an average loss and an average gain of 1.30 and 1.10 percent, respectively. Out of the three major indices, the S&P 500 is considered the most diverse and well-rounded, and may be the reason why the S&P 500 is affected to a lesser degree than the other major indices.

For negative developments, all three U.S. indices showed negative abnormal return on the day of an event and on the following day, meaning the markets are not incorporating the new information instantly. All CAR 0-2 were found significant at a 0.05 level of significance. The results do not support the EMH, as the markets require time in order to "come to grips" with the implications of the announcements.

The U.S. markets are slightly less responsive to positive news (relative to negative), although still at over one percentage point gain across the board.

Results show that the Chinese SSE is nearly twice as sensitive to positive developments as it is to negative, with a 1.90 percent gain and a 1.13 percent loss. Contrary to U.S. investors, the SSE was found highly responsive to positive news and less responsive to negative. This may indicate less optimism among Chinese investors, as the market appears to be factoring in negativity surrounding trade to a greater degree. One possible factor contributing to this difference is how the country's leaders address their citizens. The Chinese president, Xi Jinping, prepares his country for a prolonged trade war and a "Long March" (CNBC, 2019). This is contrary to the way the U.S. President addresses U.S. citizens, informing them that trade wars are easy to win and that the U.S. have the upper hand (CNBC, 2019). It is evident that two of the world's largest economies are being led by two different leaders from two different ideologies, which may influence investor sentiment and behavior in two different ways.

There is no indication of any information leakage prior to event day. Reactions come on the event day itself and not before, meaning that the broad markets do not anticipate trade-related developments.

Although the trade war has (during the time of this writing) lasted for over fourteen months, investors are not indifferent to trade-related headlines, positive or negative. The reactions to events in 2018 are similar in magnitude to the reactions in 2019. This is evident by the market reactions to tariffs in March of 2018 versus May of 2019. The S&P 500 witnessed an AR loss of 1.38 percent on March 1, a 2.61 percent loss on March 22, a 1.70 percent loss on May 7, and a 2.47 percent loss on May 13.

Results indicate that if the market anticipates an imposition of a tariff, it can determine the fair value and adjust itself accordingly. Meaning, the market may absorb the actual imposition of tariffs if it is informed about the upcoming imposition through an initial announcement, giving investors an opportunity to hedge against that event. For the SSE, the tariff announcement of June 15 had a negative AR impact of almost four percent, while the imposition of the tariff on July 6 can be considered priced in. However, tariffs can be imposed rapidly without a hint or prior announcements, the reactions to which will be discussed in more detail later in this thesis.

8.2 Sectors

All aggregated AARs and CAARs were statistically significant at the 0.05 level of significance, rejecting the null hypothesis that there is no abnormal return.

For negative developments, the sectors affected the most (always in a descending order) are IT, Industrials, Consumer Discretionary, Financials, Materials and Health Care, all having negative return greater than one percent. Sectors within a negative mid-range of 0.6 to 1 percent are Energy, Communication Services and Consumer Staples. Real Estate witnessed an AAR decline of 0.49 percent on day zero and the Utilities sector a surprisingly positive 0.27 percent gain.

For positive developments, the sectors affected the most are Industrials, Materials, Energy, Consumer Discretionary, IT and Financials, all having positive return greater than one percent. Sectors within a positive mid-range of 0.6 to 1 percent are Health Care and Communication Services. Consumer Staples had a 0.54 percent increase. Real Estate and Utilities finished at the bottom with a 0.43 and a 0.05 percent gain, respectively.

The fact that the results are so similar for both the positive and the negative developments, along with the fact that real estate and utilities sectors are relatively unaffected (when their relative exposure to international trade related disputes should in fact be minimal), indicates that the research has, at least to some degree, managed to isolate the impact of the U.S. – China trade war on financial markets.

The worst performer is the information technology sector, witnessing the largest average AR drop of 1.81 percent and confirming the theory behind NASDAQ Composite's decline in relation to other major indices. The IT sector has witnessed an average AR drop of nearly

2 percent. The result indicates that this sector has one of the highest exposures to foreign trade and shows how reliant companies are on access to foreign markets. Slowing earnings growth and revenue among technology-companies is a clear concern for investors, who refuse to pay premium prices for tech-company stocks when negative trade related issues arise, dragging down the sector.

The industrials sector has been relatively hard hit amid the trade war, witnessing the second largest average AR drop of 1.53 percent. It is also the sector with the highest average AR gain of 1.57 percent for positive developments, making it perhaps the most sensitive sector. Industrials is comprised of railroad and airplane manufacturers to military weapons that rely on critical components like metal for their production. Companies like Boeing are affected by tariffs on both imports and exports, forcing them to rethink their supply chains. An alternative source of supply is likely more expensive, and by shifting their imports away from China, they still increase their expenses and the extra cost does not go to their home country's government.

"Both China and the U.S. report weaker retail sales and industrial production for April, even before the latest escalation of the trade war" (CNBC, 2019)

In general, higher production cost as a result of higher import price due to tariffs or as a result of using more expensive sources of supply not based in China is a cost which tends to get passed on to the consumer. Companies that respect their bottom line will balance higher cost by charging consumers higher price. Furthermore, unaffected companies that produce their goods domestically may also increase their prices to match what the tariffed companies are selling for, cutting consumers' purchasing power and leaving consumers worse off than they were before. As such, it has had an affect on the consumer discretionary sector of the economy, having witnessed an AAR drop and an AAR gain of 1.53 and 1.34 percent, respectively. Consumer discretionary goods include apparel, diamond rings and automobiles.

"Goldman Sachs is now forecasting an 8 percent to 20 percent increase in the price of a new washing machine, thanks to new tariffs." (CNBC, 2018)

"Apple would need to raise the price of the iPhone by 14% in order to offset the costs of new tariffs, J.P. Morgan estimates." (CNBC, 2019)

Financials is a domestically oriented sector, and while not directly exposed to tariffs and uncertainties related to foreign trade, it does make investors worry about how an escalating trade war affects the overall economy, causing companies and banks to re-examine their investment and lending decisions. Lower GDP, lower wages, lower industrial production and lower employment are some of the concerns that may cause managers to reduce their U.S. holdings, which puts financials under pressure. The sector has witnessed a considerable AAR decline of 1.38 percent on the day of the event followed by a 0.42 percent drop the following day.

Companies within the materials sector supply the other sectors with the raw materials they need to conduct business. These materials include metals, paper, chemicals, wood, and industrial ore. In light of the headwinds, the sector has witnessed an AAR drop and an AAR gain of 1.28 and 1.44 percent, respectively, indicating that investors are nervous that the trade dispute causes disruption in imports and exports of critical components (components that derive a portion of their value from their tradeability), thus impacting "materials" businesses.

Trade restrictions have had an impact on health care sector of the economy. China is a major supplier of raw ingredients used in medical compounds such as antibiotics, antidepressants and insulin. Furthermore, China supports U.S. biotech and health care developers by pouring money into U.S. drug development. Rising tensions between the nations will likely affect Chinese investment in the U.S. health care sector. *"U.S. - China Trade Tensions Threaten Biotech Cash Surge"* (Bloomberg, 2018). Health Care witnessed an AAR event day decline of 1.22 percent.

Tariffs have also had a significant impact on the energy and communication services sectors, both having witnessed an event day AAR drop of 0.97 percent with energy dropping an additional 0.28 percent the following day. The energy sector relies on materials such as aluminum and steel for projects like pipeline construction and solar/wind power installation. Increased cost of such projects increases consumer prices and may also reduce demand for clean energy. The communication services sector includes satellite companies, cable companies, wireless operators and Internet service providers.

Among the less affected sectors that are showing relative strength are consumer staples and real estate, having witnessed event day AAR losses of 0.60 and 0.49 percent, respectively. The

consumer staples sector consists of companies that sell essential consumer products like toothpaste and packaged food. Real estate includes property-related stocks. Real estate companies are dependent on other companies to sign leases. If companies are unsure whether their businesses will prosper, they may be hesitant to sign. Furthermore, the Chinese are the biggest foreign buyers of U.S. single-family homes (CNBC, 2019). Recent reports have indicated that chinese investors are exiting U.S. real estate thanks to the slowdown in their economy and the trade war making it less attractive for Chinese investors. (CNBC, 2019).

The utilities sector has come out unscathed, showing a surprising AAR gain of 0.27 percent despite headwinds, outperforming the broader market and indicating that investors view it as a defensive sector amid negative trade related developments. Companies within the utilities sector are domestically oriented and therefore do not have as much international exposure as other sectors. In addition, unlike financials and other sectors, research indicates that they are also less affected by other macroeconomic factors that are impacted by trade restrictions, thus offering a refuge from the trade war. Another interesting observation is the negligible 0.05 AAR reaction to positive developments, indicating that investors put money into other sectors while maintaining their defensive holdings within utilities.

8.3 Market Caps

All aggregated AAR and CAAR 0-2 were statistically significant at the 0.05 level of significance, thus rejecting the null hypothesis that there is no abnormal return.

All aggregated ARs associated with negative developments are within a negative 1.21 to 1.42 percent range and the reactions to positive within a 1.10 to 1.32 percent range, making distinguishing between indices difficult. They appear to be affected somewhat equally in terms of abnormal return.

For negative developments, the Russell 2000 and the mega cap index are affected the most, with AARs of -1.40 and -1.42 percent, respectively. The Russell 2000 is an index comprised of small cap firms, indicating that small cap and mega cap firms are affected equally. One possible factor contributing to this result is that smaller companies tend to have large multinational companies as their buyer. Micro and mid cap firms are affected the least. Micro cap firms tend

to have even more domestically-driven revenue sources than other market caps mentioned previously, which reduces their exposure to international trade related disputes.

For positive developments, the small-cap Russell 2000 and the small-to-mid-cap 2500 indices are affected the most. The large-cap Russell 1000 and the mega cap indices are affected the least.

Considering how the Russell 2000 is among the most affected indices for both positive and negative developments, indicates that the small cap firms are the most sensitive to trade announcements. However, due to all the results being within such a narrow range, the broad conclusion on market caps is that they are affected somewhat equally.

The Russell 3000 represents nearly 98% of the investable U.S. stock market, making it an accurate representation of the overall stock market performance. The event day AAR for Russell 3000 was measured at a negative 1.31 percent, similar to the S&P 500 reaction of 1.30 percent. This indicates the diversity of the S&P 500 Index and its ability to represent the overall stock market, and perhaps another indication of the reliability of the U.S. sector analysis.

8.4 Treasury Yields

Cumulative average abnormal returns for days 0-2 for the 5 and the 10 year yields for positive trade related developments were found statistically insignificant at the 0.05 level of significance, failing to reject the null hypothesis. All remaining aggregated AARs and CAARs were statistically significant at the 0.05 level of significance, rejecting the null hypothesis that there is no abnormal return.

For negative developments, the AARs of the 5-year, the 10-year, and the 30-year yields were measured at a negative 1.21, 1.02 and 0.75 percent (respectively), indicating risk averse behavior among traders. All CAAR 0-2 were significant at the 0.05 level. Bond prices rise and yields get suppressed as money flows into the bond market. Re-allocation of funds from risky to less risky assets is a risk averse behavior during times of fear and uncertainty, as investors attempt to reduce their exposure to stock markets. The shorter-term treasuries appear to be the most affected.

The impact of positive developments on treasury yields is less pronounced, indicating that investors, at least to some degree, maintain their positions within the safety of the debt market even during optimistic times. This is evident by the magnitude of the AARs on day zero, in addition to CAARs for the 5 and the 10 year yields being found statistically insignificant.

The 5-year yield dropping more than the longer-term yields indicates that investors do not view shorter term risk as greater than longer term risk (in relation to the other yields analyzed in this study). More yields would have to be analysed for a broader interpretation of the reactions, at the very least including the 6-month and the 2-year yields.

8.5 Volatility

All aggregated ARs and CARs were statistically significant at the 0.05 level of significance, thus rejecting the null hypothesis that there is no abnormal return (volatility).

Volatility, as measured by the CBOE Volatility Index (VIX), appears to be rising rapidly with concerns around foreign trade. The average abnormal return for day zero measured at a positive 9.35 percent for negative developments, indicating a significant rise in volatility. Investors are willing to pay more for a hedge against unfavorable market conditions. In other words, option traders are buying more protection which increases implied volatility levels of the VIX. The reaction to positive news on event day is measured at a negative 3.57 percent average. In general, there seems to be low volatility with steady market uptrends.

For positive developments, the average volatility returns to its original level on the day following an event, as evident by the negative 3.57 percent fall on day zero and the 3.07 percent rise on day +1, offsetting the drop. This snapback effect on extremes in volatility with regard to positive developments is interesting. The correction is less evident for negative news, where the average abnormal volatility rises up to 9.35 percent on day 0, with AR +1 and +2 measured at a negative 1.30 and a negative 2.79 percent (respectively), dropping the volatility by only 4.09 percent and still ending at 5.26 percent on day +2. This indicates a much slower return to normality as trade war concerns resume. The longer 21-day estimation window shows that it takes 3 trading days for the volatility (following negative developments) to return to a normal level. Comparing the two reactions may indicate that a trade resolution of some sort is (to a

relative degree) priced into the markets, seeing how the reaction to positive news in terms of both return and volatility is less pronounced.

Another interesting observation is the strong increase in volatility on March 22, December 4, May 7 and May 13 (of 2019). All four events saw an increase in volatility by over 20 percent. This is particularly interesting, because they were reactions to negative developments that came at unexpected times, often following positive events. In other words, they represent a sudden reaction to bad news when investor sentiment could be considered relatively high. On March 22, the imposition of China-specific tariffs with the comment *"this is the first of many"* can be considered unexpected and according to Google Trends spiked an interest on the terms *"tariff"* and *"trade war"* (Google Trends, 2019). The increase in volatility on December 4 following the *"Tariff Man"* news could be due to the trade truce announcement the previous day, which was now being questioned along with the validity of previous positive developments. May 7 announcement came as a complete surprise for the markets, after what can be considered months of positive developments and optimism surrounding a mutually beneficial trade deal, leaving investors wondering whether any progress had been made at all.

The reaction to bad news on March 22, 2018 at the very start of the trade war is above 20 percent as it is on May 7, 2019. The market does not appear to be "immune" to trade war news, positive or negative. The market appears to be staying on alert as negotiations play out, paying close attention to any developments and then acting accordingly.

9. Conclusion

The objective of this thesis was to analyze the impact of the U.S. – China trade war on financial markets. By utilizing event study methodology, research has analyzed the reactions of various financial data to tariffs and trade-related announcements. Based on the results, it is found that the trade war has a significant impact on financial markets. This conclusion will focus on the U.S. markets, unless stated otherwise.

The sector and market cap analysis has provided interesting insight into the dynamics of various markets and their response to trade developments. Among the discoveries is the resilience of the utilities sector and the fragility of the information technology sector. Market cap analysis indicates that the trade war does not discriminate between company size, as all market caps

exhibit similar reactions.

The results indicate a relatively optimistic sentiment among U.S. investors, as the markets seem to have priced in some of the positive news regarding an eventual resolution or a trade deal. This is, of course, in relation to reactions to negative developments. In general, the magnitude of negative reactions is larger than that of positive, and the sustained volatility as a result of negative developments indicates a significant shock to the stock market.

Contrary to U.S. investors, the Chinese SSE index was found highly responsive to positive news and less responsive to negative (in relation to the three major U.S. indices). Chinese investors appear to be factoring or "pricing" in negative news to a greater degree. One possible factor contributing to this difference is how the country's leaders address their citizens. It is evident that two of the world's largest economies are being led by two different leaders from two different ideologies, which may influence investor sentiment and behavior in two different ways.

Reactions to events in 2018 are similar to reactions in 2019. Investors are still not indifferent to trade-related headlines, positive or negative. When tensions escalate, volatility increases significantly as investors sell their holdings within sectors such as industrials and information technology in favor of utilities and government treasuries while hedging their positions with options. When tensions ease, volatility tends to ease along with it, as investors maintain some of their defensive positions within utilities and debt securities while buying risky assets.

There is no indication of any information leakage prior to event day. Reactions come on the event day itself and not before, meaning the market does not anticipate trade-related developments. Abnormal returns are sustained in the days following an event and do not support the efficient markets hypothesis. The results are more in line with the theory of behavioral finance, as the markets require time in order to "come to grips" with the implications.

In general, the volatility is at its highest when positive headlines are followed by negative. It is difficult for investors to factor in "the unknowns" such as sudden presidential tweets containing announcements of new tariffs after months of positive news.

Results indicate that if the market anticipates a new tax on a particular set of goods, it can determine the fair value and adjust itself accordingly. Meaning, the markets may absorb the actual imposition of tariffs if they are informed about the upcoming imposition through an initial announcement, giving investors an opportunity to hedge against that particular event. Results show that this is generally not possible amid a modern day, tweet-driven trade war. Tariffs can be imposed rapidly without a hint or prior announcements, making it difficult for investors to know where to invest the next couple of weeks, months or years, signaling a lack of conviction among investors.

Tariffs have an accumulative effect. The longer they are in place, the harder they hit. In the future, investors may become less confident in risky assets and change their outlook to slightly more pessimistic now that trade talks have halted and new tariffs have been put in effect, representing a bigger threat to global growth and implying little to no progress with regard to reaching a mutually beneficial trade deal.

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