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How does the market react to the U.S. presidential elections?

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Abstract

This thesis aims to analyse market behavior around presidential election periods in the U.S.. In particular, we want to determine whether excess returns for industries' portfolios react strongly in terms of mean and volatility changes in their series. By using the IEM futures, we also try to address whether investors and voters had drastic reviews of the elections' outcomes after particular events. At the same time, we try to determine the same by analysing the volatility in the whole U.S. market through the VIX. We do not find any strong evidence that the excess returns or the variance of excess returns of particular sectors are largely influenced by the election periods. However, this is found to be contrasting when analysing the VIX. Collectively, our results do not strongly support the idea that during elections, the market reports higher returns on average and increased level of stress (higher volatility).

We want to thank Copenhagen Business School for allowing us to develop ourselves as students but also as people. We want to give special thanks to our Supervisor Lisbeth La Cour for her continuous and tremendous help during this journey. Last but not least we would like to thank Francesca, Kátur, our families and our friends for their support throughout the studies.

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1. Introduction

In the last years there have been different events related to politics that are considered to have impacted financial markets consistently. To mention a few, we recall the Brexit referendum in 2016, the Trump election in 2016 and the Italian election in 2018. These three events all have in common the populist orientation of the winner party. It has been frequently claimed in the media that Brexit caused a fall in the exchange rate between GBP and other major currencies, that the Trump election caused high levels of stress and fear in the financial market, and that the Italian election caused a large increase in the difference between German government bonds and Italian government bonds. These drastic changes have been associated with the unexpected nature of the events' outcome and the uncertainty about future policies. These facts raised our curiosity and we started asking ourselves whether in the recent years similar events have had a strong impact of financial markets. In particular, since the Trump election caught our attention the most, we decided to dig deeper into U.S. Presidential elections. In the last 20 years, five elections have occurred in the U.S.. We directed our focus to these five elections. As technology has advanced substantially in the current millennium, and populist views have become more apparent in electors preferences, we believed that these five elections were homogeneous enough to create our sample of elections. What we hoped to discover was whether the market usually correctly "predicted" the outcome of such elections or whether the market has been characterized by unusual stress across the election period, due to uncertainty about the future. Therefore, to determine which effect the Presidential elections had on the financial market, we decided to examine the behavior of stock excess returns

and their volatility across these events.

Other studies have mainly analysed either cumulative excess returns around elections[1] or changes in volatility around elections[2]. We decided to analyse the first two moments of excess return series of 12 different sector portfolios. Our approach was to look at market behavior from the view of a macroeconomic investor who looks at the whole performance of the economy and then examines individual sectors to determine how to invest funds. As a result of that approach, we were able to utilize sector portfolios to determine if sectors differentiated in how they reacted to elections. We decided to analyze excess returns in the series themselves, that is *jumps* in excess returns and volatility, expecting to find increased volatility in periods leading up to elections, and changes in excess returns in periods following elections. We believe that these effects might exist in financial markets as a result of investor's uncertainty about the future state of the economy. We expect that not knowing the outcome of a given election, an investor will update his beliefs based on available information, causing increased volatility. When the outcome is known, we expect the excess returns to jump (or stay still) according to investors' expectations review, and the volatility to decrease as a result of the uncertainty resolution. To analyse the behavior of financial markets during election periods we took two approaches. The first approach was to try and model the conditional mean and the conditional variance of the excess return series of our sector portfolios simultaneously. The method chosen was an EGARCH model, as the benefits of an EGARCH methodology is that it allows for asymmetries in the conditional variance, differently from other volatility models. That means that we can model "bad news" differently from "good news", as we would expect the effect of them to be different in magnitude and sign. We constructed dummy variables that had the purpose of capturing the effects of an ongoing election. We applied an EGARCH model to all five elections individually, hoping to capture changes in volatility and changes in excess returns through the election dummies. Our second approach was to model market volatility directly. By using the Volatility index (VIX) we could utilise the same methodology as in the EGARCH model, and allow

[1] See for example Santa-Clara and Valkanov (2003), Riley Jr and Luksetich (1980) and Bialkowski et al. (2007).
[2] See for example Leblang and Mukherjee (2004) and Koulakiotis et al. (2016).

the dummy variables to capture the effects of an ongoing election on the VIX. Additionally, we incorporated the markets perceived uncertainty as well as the markets perception of the probability of a Democratic candidate taking the win. These probabilities were also inspected in order to detect any drastic changes due to external news. By doing so we could get a better understanding of the mindset of an investor during a given election. We utilized a linear regression model over the whole period. We started by utilizing the same dummy variable for each election along with the uncertainty and probability measures. Later, we decomposed the dummy variable, so that each election could have its own effects.

Our findings from the first approach were not as substantial as we had hoped. The EGARCH procedure showed that some portfolios responded to an ongoing election, but not the ones that we would have expected, in view of elections' campaigns and political business cycles. The EGARCH model managed to capture some changes in excess returns of some portfolios during election periods but it mostly failed to capture changes in the volatility of excess returns. The only exception was the 2008 election when Obama was elected over McCain. However, the election took place while financial markets were in havoc due to the financial crisis of 2008. For our second approach, our results indicated that in the period leading up to an election, the overall volatility in financial markets increased. The results also indicated that as uncertainty regarding the election outcome in financial markets increases, the volatility in the markets increases too.

Possible changes in the political structure of a country, and the uncertainty associated with those changes can have effects on a nation's economy and its financial markets. Therefore we believe that further studies in this field are needed. For an investor, the benefits of being able to quantify the level of uncertainty in a given market can allow him to make better decisions, especially for investors who view the markets in a top-down manner, like we assume them to do in this study.
We will start off by discussing previous findings from the literature, where we strengthen our standing in what we believe. Next we will provide a brief explanation of how the election procedure in the United States is performed. Next we will discuss the theory behind our models, where the

dynamics of our models are explained. We will then introduce the data that was used in this study and explain how all variables were constructed. We will additionally provide a summary of each election included in this study, as we believe it is important for the reader to understand the mentality of a voter and an investor at the time. After that we will discuss the methodology used to check the validity of our arguments. Finally, we will report our results and discuss them as well as the limitations of our study. We will then conclude in a discussion.

2. Literature Review

2.1 Main findings from the literature

Previous research on the effect of elections on stock markets has traditionally taken two different approaches, (i) analysing abnormal returns and (ii) analysing market volatility. While the two approaches differ, one can trivially argue that they are connected. If one were to assume risk averse, rational market participants, then an increase in the volatility of a stock could signal increased risk and therefore market participants would demand a higher premium on their holdings. When analysing market movements around election dates, scholars typically try to account for the perceived uncertainty associated with the events. Typically this is done by using polling data from analysts. Another approach to do so is to utilize electronic trading markets, where market participants can make bets on the outcomes of events by buying options. The following section is split into the following sections:

1. Analysing abnormal returns around election dates

2. Analysing stock market volatility around election dates

2.2 Abnormal Returns and Elections

In the run-up to all Presidential elections the media seems to be filled with whether Republicans or Democrats are better for the stock market. Historically, the two political parties have had different focal points on how to handle economic policies in the States. Democrats have focused on nurturing economic growth, whereas Republicans tend to have more anti-inflation views. Therefore one can consider a Presidential election in the United States to be an indicator of what is to come

in the mandate of a new President. As these parties have very different objectives, it is hard to state which is "better" for the stock market. Santa-Clara and Valkanov (2003) examined this, and found that excess returns in the markets are up to 16% higher (for equal weighted portfolios) under Democratic than Republican presidencies. They found no evidence of large excess returns around the election dates, as they argued that this discrepancy in excess returns seemed to build up homogeneously throughout the President's term. In their model, they examined expected and unexpected returns. If expected returns are higher under Democratic presidencies, then this would be due to a "Democratic risk premium" that is imposed on asset returns in the market. Unexpected returns would then be due to surprises in the economic policies of the party in charge, meaning that unexpected returns would only change if the policies imposed by the party in charge would drastically differ from what the market expects. The main difference in higher excess returns under Democratic presidencies is due to unexpected returns, according to their findings. By examining the volatility of returns under both Democratic and Republican presidencies, the authors found no indication that the difference in returns between parties was due to a difference in expected returns, and therefore the discrepancy in returns between Democratic and Republican government cannot be traced to a Democratic risk premium. This anomaly in returns between political parties in the States is referred to as "The Presidential Puzzle".

However, Riley Jr and Luksetich (1980) found that markets tend to favor Republicans, at least in the short run. They analysed price movements of a market index during the 17 week period around 20 election dates. Their findings indicate that in the days and weeks following the election of Republican Presidents, the market reacts positively, whereas it reacts negatively following the election of Democratic Presidents. Their results indicate that asset prices are to some extent dependent on the outcome of an election but they failed to show how the aggregate performance of the economy is affected by the party that sits in the White House, which does not concise with the findings of Santa-Clara and Volkonov, as they found an aggregate effect of higher return under a Democratic government over the 4 year period in office.

This difference in the returns around election days might have some explanations. Bialkowski et al. (2007) argued that when the possibility of political changes is presented to investors, they might adjust their required risk premiums on assets. If investors associate greater uncertainty with the Democratic party, stock market returns are expected to be higher under left winged parties. These higher returns can be viewed as a compensation to investors for taking on additional risk. In such a scenario, stock prices on Election Day would be likely to fall. This would be due to the immediate increase in the discount rate on Election Day, causing the present value of future cash flows to be lower. They analyzed the movements of stock prices around election dates, only to find no support for investors readjusting their discount rates, as their results did not show any support for abnormal returns for Democratic wins or Republican wins.

Pantzalis et al. (2000) explored the behavior of stock market indices across over 30 countries around political election dates. They examined how uncertainty around the elections and their outcomes can affect abnormal returns in stock markets. When the outcome of an election is known, uncertainty is resolved. Their results indicated positive abnormal returns during the two week period prior to the week of an election. Two factors were found to influence this positive reaction of abnormal returns; the timing of the election and how successful an incumbent was in being re-elected. Note that according to the Uncertain Information Hypothesis of Brown et al. (1988), market participants absorb news and form expectations as well as they can. Security prices will then reflect the available information. Under uncertainty, investors tend to underprice securities. When uncertainty is resolved, positive changes in prices should be expected to adjust for the underpricing in the periods before. Pantzalis et al. (2000) found that in the two week period leading up to elections there were positive abnormal returns to be made. This effect was especially strong for elections with higher uncertainty levels due to the underdevelopment of a given country. Their findings are consistent with the Uncertain Information Hypothesis, but trivially one can assume that as the election date approaches and passes, the uncertainty related to its outcome is resolved.

Oehler et al. (2013) analysed how election results may influence corporate performance, as

different parties can implement changes in government spending and taxes. Therefore some firms and industries may suffer whilst others benefit from these governmental decisions. They found that market participants incorporate their expectations about possible political changes into stock prices prior to an election. After the outcome of an election is realized investors adjust their opinions. The observed abnormal returns were stronger when a longer post-election time period was examined. Possible explanations for this could be that the uncertainty associated with the elections, and the possible monetary and fiscal consequences of the results, prevails in the market until the Presidents' political priorities are clear. The market might additionally struggle to accept the effects of any political changes. However, their findings indicate that following a Presidential election the market prices correctly in order to reflect changes in the underlying philosophy of the new government. This effect is captured in abnormal returns, but their distribution varies in direction and magnitude. These changes in stock returns and industry-performance seem to be related to the unraveling of the uncertainty associated with what person will sit in the White House, not what party.

Durnev (2010) found that political uncertainty around election dates can affect how corporate investment responds to stock prices. Investment was considerably less sensitive to stock prices during election years when compared to non-election years. Perhaps that is due to stock prices containing less information during election years; there is more noise in the prices, making it more difficult for managers to read. The effect of investment sensitivity to prices were larger when the results of elections were less certain, especially in countries associated with more corruption, more state ownership and low standards of politician disclosure.

Goodell and Vähämaa (2013) investigated potential determinants of changes in company specific price-earnings ratios during Presidential elections in the US. By incorporating uncertainty into their study they were able to measure what happens to the ratios as the uncertainty decreases and the outcome of a given election becomes more clear. Their findings indicated that as the uncertainty associated with the election outcome decreased (the projected winner became more clear) markets responded with decreases in price-earnings ratios. They argued that this was due to the markets

reacting to the campaigns of the nominees which are aimed towards influencing uncertain voters. This is trivial, as during the Presidential elections there are periods of enhanced uncertainty amongst the public, and that includes uncertainty regarding the future direction of the economy.

Wagner et al. (2018) explored market reactions to the most recent election outcome (2016). The election of Donald J. Trump as the President of the United States surprised many people, as most thought it was more probable that the election would go to the Democratic nominee, Hillary Clinton. They investigated the initial shock of stock market reactions to the results of the election, as well as the long-term effects. They found that the individual stock prices reflected investor‘s expectations of economic growth, changes in tax rates and trade policy. Their results indicated that the industries that benefited the most from the change in presidency were heavy industries and the financial sector. The industries that least benefited from the change in presidency were the healthcare industry, pharmaceutical industry and producers of medical equipment. Their findings showed that some sectors were more volatile to the result of the election. As we will later discuss in this paper, there are potentially several industries that depend to some extent on what party sits in the White House.

2.3 Volatility and Elections

By examining stock market volatility around elections, scholars can examine to what extent market participants are surprised by an election outcome. Intuitively, one can deduct that an increase in stock price volatility prior to an election indicates that there is a high degree of uncertainty of what the outcome will be. High volatility in the periods following an Election Day would indicate that market participants were surprised by the outcome of the election and therefore they adjust their holdings.

Bialkowski et al. (2007) analysed market volatility around elections in 27 OECD countries. By analysing daily observations of the performance of market indices of value weighted portfolios they were able to measure the performance of all developed equity markets as a proxy for a global

portfolio. They found that elections were accompanied with an increase in stock market volatility on the Election Day itself, which continued for a number of days afterwards. This prolonged effect might be due to the fact that official results are often not released until several days after the elections have been held. They found that in the 51 days around an election date, the country specific component of variance was over 20 percent higher than it would have been if no election had taken place. By looking at a narrower time window they found larger implied percentage changes, which can be translated into most of these large stock movements occurring around the election day. By further analysing the determinants of election surprises they found that an increase in volatility could be linked to how close the margin was of the election outcome. If a candidate won an election with a low margin, the implied volatility was higher. They concluded that if investors were surprised by the effect of an election outcome, the resulting volatility of the stock market index would be higher, ceteris-paribus.

While Santa-Clara and Valkanov (2003) found that abnormal returns on stocks seem to be higher under Democratic presidencies compared to Republicans, Leblang and Mukherjee (2004) analysed the observed increase in volatility when leftist parties won elections compared to wins by more conservative right parties. Several different approaches have been taken in order to analyse market volatility around election dates. One approach is to use Markov Switching models where investors are assumed to constantly update their beliefs, whereas another way to do it is to use traditional GARCH models. They argued that when traders anticipated a Democratic win the stock market volatility decreased. In their framework, if traders expected a Democratic candidate to implement policies that would lead to higher inflation levels, the expected value of future dividend payments would decline. Therefore traders were motivated to reduce their trading volumes to stabilize their future profits and reduce transaction costs. If traders expected a Republican to win however, the market volatility would increase as Republicans tend to have anti-inflationary views, following more conservative economic policies after winning an election. Therefore they predicted that when traders were rational and anticipated a Republican win they expected future economic policies

to be conservative, promoting lower taxes and inflation. In turn these Republican policies were expected to result in higher stock returns, increasing demand for stocks and therefore leading to more volatile trading behavior characterized by rapid selling and buying of securities. Comparing different volatility models, Leblang and Mukherjee (2004) found that GARCH and exponential GARCH models provide more accurate forecasts than Markov switching models. However, all models support their claim that stock market volatility decreases when a Democratic win is anticipated by market participants.

A well-known model to analyse the scope for government macroeconomic policies is the Political Business Cycle model. In the framework of the model, elected officials have incentives to optimize economic conditions in order to increase their probability of reelection. Therefore the PBC model states that pre - election periods are therefore often characterized by high growth and low employment, increasing inflation, followed by a recession state after elections, irregardless of the political orientation of the elected government. Siokis and Kapopoulos (2007) utilized the PBC model to analyse stock price movements in the Athens stock exchange, and if they were affected by changes in the political environment. If the ideological differences between parties are well defined and known to market participants, then a model could be implemented to examine the impact of elections on financial markets. Their findings indicated that political elections could be viewed as an indicator of the future economic policies of a government.

While Koulakiotis et al. (2016) found evidence for abnormal returns around election days, they also to found some evidence for changes in volatility of the index. Their results indicated that the market reaction on the last business day prior to the Election Day was positive and negative on the first business day after the event. Their findings indicated a rise in market volatility during the election dates. This might indicate that the ASE index required some time to incorporate the new information from the results of an election. The recorded negative return might indicate that investors bear some risk induced by the election event, without being compensated for it with some election premium.

Beaulieu et al. (2005) analyzed political risk and its effect on stock markets in Canada. Their methodology aimed to model the effect of favorable political news on financial assets. Part of their analysis focused on the political risk associated with the possible Independence of Quebec. As favorable news are expected to decrease the uncertainty regarding future cash flows and stock prices, they expect stock return volatility to decrease in response to them. They found that political risk associated with the separation of Quebec from the Canadian federation played an important role in the conditional volatility of stock returns. However, the news did have an effect on the returns themselves. This indicates that political risk is such that it can be diversified away to not affect the required return of financial assets. However, one should keep in mind that investors are only compensated for being exposed to systematic risk. Therefore, an investor who is exposed to large amounts of political risk will incur accrued costs if he diversifies it or holds it.

3. Elections in the United States

Every four years elections for the President of the United States of America are held. The elections are held on the Tuesday following the first Monday in November. The election process of the United States consists of several stages, which are shown in the Table 3.1 below:

Table 3.1: U.S. Presidential election events timeline

Period	Year	Event
Mar-May	Year before election	Candidates announce they are running in the party's primaries
Jun-Sep	Election year	Primaries and Caucus debates
Jan-Jun	Election year	States and parties hold primaries and caucuses
Jul-Sep	Election year	National Conventions
Seo-Oct	Election year	Campaigning and Debates
Nov (Tuesday following the first Monday)	Election year	Election Day
19^{th} Dec	Election year	Electoral College Results
20^{th} Jan	Year after election	Inauguration Day

This chapter provides a brief explanation of each step of the process, in order to explain the nature of the events in this study[1].

3.1 Primary elections and caucuses

The process begins by candidates announcing their candidacies for President. A candidate traditionally runs on behalf of a party, either the Republican party or the Democrat party. However, it is not needed for candidates to run on behalf of any party, as they can run independently. Once a candidate has received contributions or made expenditures over $5,000 he must register with the Federal Election Commission. Once all contenders have been declared, they go through several state-primaries and caucuses. Primaries and caucuses have the same objective, but differ in how they are run. Their purpose is to allow the states to help choose the political parties‘ nominees for

[1]The discussion in this chapter is based on information from Usa.gov (2019).

the general election, which are held later. State primaries are run by the local governments and the states themselves, and the voting is cast through a secret ballot. Caucuses are run by the political parties and are therefore held as private meetings. During most caucuses, the participants of the meetings select a contender to support and split themselves into groups accordingly. The voters in the caucuses who are undecided form a group of their own. Once the groups have been formed, each will give speeches in support of their candidate, trying to persuade other members of the caucus to join their group. When the caucus has ended, the mediators of the party will count the number of voters for each candidate. Primaries and caucuses can be held as "open", "closed" or a mix between the two. In an open gathering people are able to vote for a contender of any political party. The participants of a closed gathering must be registered with a political party in order to vote for one of its candidates.

3.2 National Conventions

After the primaries and caucuses the political parties normally hold their own National Conventions in order to finalize their chosen candidates as Presidential and Vice Presidential nominees. These conventions are typically a confirmation that a candidate has been successful in securing the required number of delegates via the primaries and caucuses. In the case of no candidate having received the majority of a party's delegates these conventions will serve as a stage for the selection of the party's Presidential nominee. Delegates can be either pledged or unpledged. Pledged delegates are required to support the candidate who they selected through the primaries or caucus process whereas unpledged delegates have the freedom to support any Presidential candidate they prefer. If no nominee has managed to receive the majority of a party's delegates during the conventions then delegates will select their candidate in a brokered convention. In such cases, the pledged delegates will typically have to vote for the candidate to whom they awarded their votes in the first round of voting, whereas unpledged delegates can cast their votes as they wish. The voting procedure will continue until a candidate has received the majority of votes required in order to win.

3.3 Election Day

When each political party has selected their Presidential candidates through the primaries, caucuses and national conventions the candidates will travel the country, reaching out to the general population. This is an opportunity for the candidates to explain their views and plans to the public in order to win the support of potential voters. During this period, rallies and debates are held, and candidates utilize adverts to a large extent. On the Tuesday following the first Monday in November, the general public will then cast their votes. The result of the votes from the general population is generally referred to as the popular vote.

3.4 Electoral College

After the general public has cast their votes for President and Vice President the next step of the election process begins. The results from the popular vote do not determine directly who becomes President and Vice President. Instead, they are chosen by electors through an operation referred to as the Electoral College. The ideology behind the Electoral College is to provide a compromise between electing a President solely through a popular vote from citizens and electing a President through Congress. Each state has a number of electors depending on how many members of House and Senate Congress the state has. In total there are 538 electors in all. The political party of each state selects their own slates of potential electors. Electors are not required by the Constitution to vote according to the popular vote of the people that they represent, but normally the electors are true to their party. The results from the popular vote are counted. In most states the winner of that state gets all of the electoral votes from that state, the incumbents party in the relevant state will vote for him in the Electoral College. To win the Electoral College a candidate needs at least half of the votes from the Electoral College, or 270 votes. The Electoral College vote takes place in each state on December 19th. However, a projected winner can normally be announced on election night. As it is required for a President to receive the majority of Electoral votes, the situation can arise where the incumbent who received the majority of the popular vote fails to secure the majority

of the Electoral votes. In these situations the Electoral College selects the President. Intuitively we can see that in these scenarios the chosen President is not the one chosen by the majority of the American population. Another situation that can arise is that no candidate manages to secure the majority of the Electoral votes. In such cases the House of Representatives will gain the decision power of who is chosen as President.

3.5 Inauguration Day

After the President and Vice President have been chosen through the popular vote and Electoral College they are officially inaugurated into office on January 20th (or January 21st if January 20th occurs on a Sunday). Inauguration Day occurs at the U.S. capitol building in Washington D.C., and the President and his Vice President are sworn into office.

4. Theoretical Framework

In the following sections the theoretical framework behind this study will be discussed. We will start off with a brief explanation of the well-known relationship between risk, return and information. Next, we will discuss political risk and uncertainty, and how they are expected to play a role in returns. Lastly, we will discuss the risk and uncertainty associated with political elections. We want to remind that the scope of our analysis consists in:

- Finding the presence of structural break[1] during the election period, for different portfolios representing different industries, in the mean and the volatility series of log-excess returns
- Finding the presence of structural breaks in the IEM[2] during political election periods
- Finding whether an increase in the VIX during elections is larger than usual.

In general, what we want to define is whether there is evidence that the series of the excess returns of the financial instruments just mentioned substantially deviate from their path during an election. In order to analyse these behaviors we test the following hypotheses:

- Hypothesis 1: excess stock returns do not show change in mean before the Election Day
- Hypothesis 2: excess stock returns show change in mean after the election day[3]
- Hypothesis 3: excess stock returns show change in volatility before the election day[4]

[1] The definition of structural break will be given in section 7.5.
[2] The definition of the IEM will be given in chapter 5.
[3] We believe that this will happen due to investors reviewing their expectations.
[4] The same holds when analysing the overall market volatility measured by the VIX.

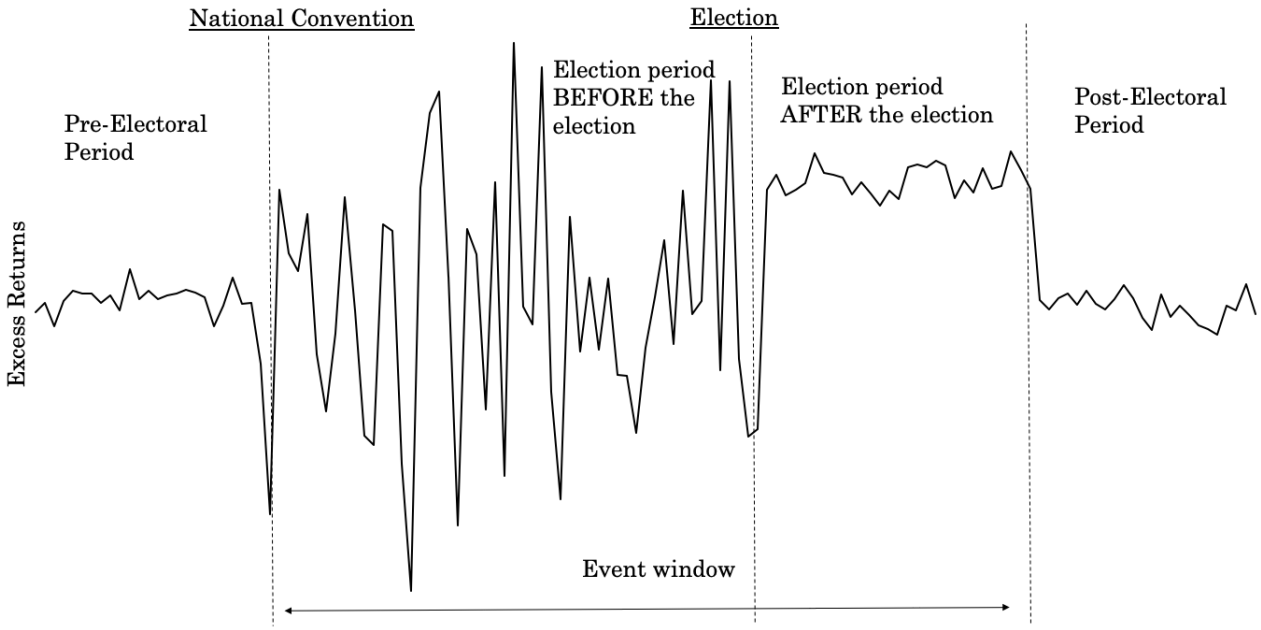
- Hypothesis 4: excess stock returns do not show change in volatility (or show a decrease in volatility) after the election day[5]

- Hypothesis 5: changes in the market uncertainty regarding the election outcome will cause changes in the overall market volatility

- Hypothesis 6: investors drastically revise their expectation about the probable winner of the election due to relevant political events.

A general overview of our idea regarding hypotheses 1 to 4 can be found in Figure 4.1.

Figure 4.1: Expected election's effect



The path of the excess return series during the "Election period AFTER the election" could also be lower than the long-run mean of the process depending on what views the investors have on the next President.

To shed some light on the methods used to test these hypotheses, we direct the reader to chapter 7.

[5]The same holds for the overall market volatility measured by the VIX.

4.1 Risk, return and information

The basic relationship between risk and return in finance is well-known. A financial asset associated with high risk is expected to yield higher returns than a financial asset associated with less risk, as the general assumption is that investors require compensation for holding riskier assets. According to Fama and French (2004), in financial applications and the literature one of the most commonly used models is the Capital Asset Pricing Model (CAPM). The model offers powerful and intuitive predictions on how risk can be measured, as well as how it relates to expected returns. The concept of the model builds on the findings of Markowitz (1952), where risk averse investors choose their portfolios, only thinking about the mean and variance of their one-period investment return. Therefore, the portfolios chosen by investors serve the purpose of minimizing the variance of total returns given an expected return, as well as maximizing total returns, given the variance. This approach is famously referred to as the "mean-variance model", and results in a frontier of efficient allocation of securities. In the framework of the CAPM model, a market portfolio lies on this minimum variance frontier. The riskiness of a stock is then measured relative to this comprehensive market portfolio. Stocks with higher risk will then be predicted to have higher returns, as stocks with lower risk will be expected to yield lower returns.

However, many factors[6] can influence the riskiness, and therefore returns of a financial asset. A common assumption in the financial literature is that market participants are rational, and that they use all available information when establishing security prices. If security prices were to incorporate all available information at any given point in time then markets would be efficient. Investors would learn how to make correct inferences about how new information will affect stock returns and form rational expectations. But this is not always straightforward. Sometimes uncertainty is associated with the available information, which would need to be taken into account in the formulation of prices. When new surprising information is released, asset prices tend to react instantaneously even though the effect of the news on stock prices may be uncertain. Although connected, risk

[6] see for e.g. Fama and French (1993), Chen et al. (2002), Pastor and Stambaugh (2003) and Viale et al. (2009)

and uncertainty are two different things. Knight (1921) used uncertainty to distinguish the defects of managerial knowledge from the traditional risks that one faces, which can be reduced and perhaps even eliminated through insurance schemes or diversification. Therefore, uncertainty can be interpreted as investors lack of ability to forecast how likely or unlikely it is that something will happen. Risk can however be interpreted as investors known probability distribution for known events. The investors can diversify this risk away, as they know all possible outcomes. But uncertainty is hard to diversify, as the probability distribution over the possible outcomes is not known. Brown et al. (1988) analysed how uncertainty regarding informational releases can affect asset prices. By assuming that investors will set stock prices prior to knowing the full ramifications of a surprise financial effect they predict that both the risk and expected return of the affected firms will increase systematically.

Some events' outcomes are not as uncertain as others, which will lead to less surprises to investors as they have already collected enough information to set their expectations correctly. Thus, investors need to adjust their expectations accordingly, and the stocks prices will vary accordingly. In such cases we would expect the market to adjust before the event itself takes place. This adjustment would probably also be quite quick, since there is not a lot of uncertainty associated with the future outcome of the event. In this case, there is no need for investors to wait until the outcome is revealed and therefore they can adjust their expectations. However, there are some events which might implicate results that are very hard to predict. In such cases, the uncertainty about an outcome can lead to uncontrolled reactions by market participants. Our interest falls in latter case. We believe that understanding market behavior around periods of uncertainty is fundamental for investors that want to exploit trading opportunities, but also for investors that would like to manage their savings in relative tranquility.

Presidential elections in the U.S. are events that centralize the interest of citizens for many weeks prior to the election day, due to candidate debates, campaigns, announcements and so on. Being able to predict the outcome of such an event would be of great advantage for investors. As we have

mentioned before, Santa-Clara and Valkanov (2003) showed that under Democratic governments, the stock market performs better than under Republican governments, by 9%. Blinder and Watson (2016) showed that for many macroeconomic measures, especially GDP growth, the performances under Democratic governments are superior. Hence, the possibility for an individual to know the election outcome could lead to an even larger return. In this study, we therefore try to analyse the performance of different sectors under different elections in order to determine whether their movements are due to the promises or the party of the next President to come. For a macro-investor, with a top-down approach[7], it is fundamental to understand the behaviors of different industries under different circumstances. In this thesis we try to study these behaviors imagining our investing approach is the same as the one of a macro-investor with a top-down approach. We therefore analyze portfolios that reflect different industries. In the next section, we will briefly explain the main drivers of the market industries that are taken into consideration in the first part[8] of our analysis.

4.2 Sectors' definitions

Since the first part of our analysis will focus on studying the dynamics of sectors' portfolios around elections, it is important that we explain their main features before we discuss the economic reasoning of our analysis on market uncertainty around elections. This will also allow us to better understand with which magnitude each sector is impacted by events associated with a lot of uncertainty[9]. The sectors that create our portfolios in this study are: Non-Durable Goods, Durable Goods, Manufacturing, Energy, Chemicals, Business Equipment, Telecommunication, Utilities, Shops, Healthcare and finally Finance and Insurance (that we will refer to as "Money").

Non-durable goods are defined as "consumer products designed and intended to last for less than

[7] Following Pedersen (2015) "Macro investors are often considered 'top-down', meaning that they begin by analyzing the overall economic conditions, decide which markets and sectors are likely to perform well, and then decide what securities to use to implement these macro views."

[8] The first part of the analysis consists in the procedure defined in section 7.3.

[9] In particular, this could help us shed some light on why some sectors might have moved more than others during the election period.

three years". These types of goods are usually thought as immediate consumption goods. Amongst others, examples of non-durable goods are food, beverages, clothing and oil. Given the high level of perishability of these goods and their necessity in every-day life, we would expect the companies producing them to not be very volatile since consumers are almost "forced" to buy these products on a fairly regular basis.

Durable Goods, on the other hand, are "those whose expected lifetime is greater than three years". Hence, companies producing these goods usually display more volatility than those producing non-durable goods. The reason for this is quite intuitive as consumers willing to buy a durable good today will still have the chance to do so tomorrow at a more favorable price. Once consumers buy these products, they have no need to buy them again in the immediate future. Eraker et al. (2015) and Mallick and Mohsin (2016) found that during periods of high inflation, there is a stronger decline in real consumption of durable goods rather than non durable goods, because of the flow of cash to equity. Therefore, durable goods can be seen as an important channel through which inflation can affect asset prices via long-run economic growth.

The Manufacturing sector agglomerates "products that have been made from raw materials, especially as a large-scale operation using machinery". Ganley and Salmon (1998) studied the impact of monetary policy shocks in the manufacturing sector. They found the effect across the industry to be very wide, ranging from a small variation in the production of food, drink and tobacco, to large variations in the production of rubber products and electrical equipment. Moreover, they argued that some of the companies having the largest responses to shocks were also the ones that were relatively small in their sample.

The Energy industry groups together all industries that are involved in the production and sale of energy. As a part of the energy industry we have the oil industry, the coal industry, the nuclear power industry, the gas industry, the renewable energy industry, the electrical power industry and others. Deese (1979) reasonably argues that the energy sector is linked to politics, claiming that the actions

taken by a country in pursuing energy security have a large impact on the industry prices. Toman and Jemelkova (2003) argue that economic growth affects energy consumption. Other scholars with similar views have also claimed that only countries with a high degree of innovation capacity can decrease energy consumption without reducing economic growth.

The Chemical sector is comprised of all companies involved in the process of converting raw materials into products such as petrochemicals, agrochemicals, polymers and oleochemicals. Trivially, we can see that this industry is somewhat connected to the energy sector. Elyasiani et al. (2011) show how closely the oil industry and the Chemical sector relate to one another by analysing the effect of shocks in oil prices on different industries, reaching the conclusion that the chemical industry is impacted the most, as well as the building industry.

The Business Equipment sector includes companies providing stationery, computers, software and other business equipment. Rather than introducing the dynamics of industries involved in stationery or other type of business equipment we focus on computers and software which in the past thirty years have taken over the scene in the world economy. As we will later discuss, the portfolios that we utilize in this study are value weighted, and we can therefore assume that tech firms (involved in computers and software) dominate this industry, at least in our study. As reported by Jorgenson (2001), drastic improvements by the companies in these two sectors have led to fundamental changes in the economy, bringing permanent advancements in growth prospects. Hence, the persistent decline in the prices in the equipment of these industries has constantly enhanced the role of technology investments as a source of economic growth.

The Telecommunication industry includes companies involved in making communication possible on a global scale. There are no restrictions regarding the way the communication is transmitted (electrical impulses, electromagnetic waves or optical pulses). The main players in this industry are companies involved in wireless operations, satellite and cable companies and, of course, internet service providers. This sector, similarly to the Business Equipment sector, has been shown to be

one of the main driver of the economic growth at a global level (see Röller and Waverman (2001)).

The Utilities sector agglomerates companies that provide essential and basic services such as electricity transmission, airports, gas delivery, water and such. These companies are heavily regulated compared to the others included in this study. This industry is often considered to be very stable in terms of stock prices relative to the whole equity market. This industry can be defined as a-cyclical, as it tends to perform poorly in periods of expansion and well in periods of recession. Moreover, in contrast to what has been found for the Chemicals and Energy industries, this sector has been shown to react poorly to oil price fluctuations.

The sector defined as Shops is comprised of industries operating in wholesale, retail and other services such as laundries and repair shops. Hence, it mainly incorporates companies that sell goods or services to the ultimate customer through different distribution channels. Since the companies that are part of this industry act as the final seller of goods and services provided by other industries we believe that shocks impacting industries like Energy, Durable Goods, etc., will also have an impact on this sector, given that it will charge the increasing or decreasing price due to the shock of the linked price to the final customer.

Finally, the Money sector includes, generally speaking, all companies involved with financial services. In today's world, it is quite clear to see links between shocks affecting the financial sector and the real economy and vice versa. The financial sector is by far the sector which can "infect" a large number of industries. Baur (2012) showed that not only was no sector was immune to adverse effects on the financial sector, but also no country could "exempt" itself from the contagion.

We additionally include a last "sector" in this study, which is referred to as Other. This "sector" is comprised of companies that do not fall under the description of any of the aforementioned sectors. Examples of such companies would be Entertainment firms, Hotels, Transportation services, the Mining industry and more. It is impossible to say how this industry is expected to respond to possible changes in presidencies, monetary shocks or any shocks that could hit the economy.

4.3 Portfolios' returns under different parties

In the previous section we introduced some of the basic behaviors characterizing different industries under shocks affecting the economy as a whole and vice versa. However, rather than measuring the impact of large economic shocks on each specific industry, our main intent lies in measuring whether political uncertainty and different party policies can influence different sectors and thus, as a result, the whole economy. As previously mentioned, Santa-Clara and Valkanov (2003) showed that historically, the markets performed better under Democratic governments than under Republican ones. Here, in this preliminary part we want to inspect how the different sectors performed across the period from 1957 to 2017. Similarly to Santa-Clara and Valkanov (2003), who analysed excess returns for one global portfolio from 1927 to 1998, we display excess returns[10] for the aforementioned sectors in order to discover whether any of them are more likely to perform better under a specific party. We decided to consider a different period mainly for two reasons:

- the data quality before the '50s was really poor
- we wanted to exclude the big recession of 1929 and the two world wars from the analysis, as they could could cause biases to our results.

In fact, Santa-Clara and Valkanov (2003) found that the portfolio they took into consideration performed much better under Democrats compared to Republicans. However, examining the findings in their study, it can be noticed how the great recession in '29 and the subsequent recovery could have driven their final results.

Figure 4.2 and Figure 4.3 plot the cumulative excess returns of each sector portfolio under different presidencies. In each figure, the dashed line represents the average cumulative excess return across the whole period in question. From these figures we can see that there is not an evident trend, as in Santa-Clara and Valkanov (2003). Therefore, we fail to precisely identify whether the

[10] Excess returns are calculated as the difference between daily returns and daily risk-free rate.

overall market performed better under Democrats than under Republicans. Even though from the aforementioned figures it is not fully clear which trend the industries are following under different parties, we notice little evidence that all the sectors have generally performed better under left presidencies compared to right ones.

The Non-Durable goods sector behaved pretty much evenly during different presidencies, with a couple of drops due to the stock market shocks during 1973-1974, and to the subprime crisis in 2008. Both events, happened during Republicans presidency (Nixon2 and Bush2).

By examining the Durable goods sector we notice spikes in cumulative returns under Democratic presidencies. Again, we do not see clearly that the sector always performed above its average during Democratic presidencies. However, an opposite conclusion can be drawn by examining cumulative returns under Republican presidencies, where for only three out of eight mandates the Durable goods sector performed above average. We therefore conclude that there is little evidence that the Durable goods sector performed better under either presidency.

Moving to the Manufacturing sector, we notice larger cumulative returns under Democratic governments, as for five out seven presidencies the sector performed above its average during the period, while under Republican presidency the situation is almost the same described as for the Durable goods sector.

The Energy sector seems to have performed substantially better during Democratic presidencies, while under Republicans ones it did not show any consistent evidence of good performance. Interestingly, we note the large drop in returns during the first Reagan presidency, perhaps due to the oil crisis.

The Chemicals industry does not show any interesting evidence or pattern. Its return distribution seems to show very similar behavior under either presidencies.

The performance of the Business Equipment sector is more interesting, as it has only yielded a positive return under Democratic governments (with the exception of Eisenhower2).

The Telecommunication industry does not show any evident proof of better performance under ei-

ther one of the parties. However, it must be noted that the two largest drops in this sector occurred during Republican presidencies (Dot-com bubble, subprime crisis). Except for the two crisis that impacted the sector, in general we see very similar returns under the two parties. This allows us to say that rather than the partisan-cycle, the global economic trend regulates the behavior of this sector.

The same consideration can perhaps be drawn for the Utilities sector, which confirms what we stated before in the brief description regarding this industry. The pattern we notice in this sector seems to be related to macroeconomic conjuncture. We notice periods of downturns and periods of growth which seem independent of the party in charge, and even the financial crisis in 2008 does not seem to have impacted the industry on a large scale, contrary to what happened for the industries previously examined. This shows the solidity of the sector, and how it seems to be independent of the party in charge.

Examining the Shops portfolio we do not see any "preference" of the industry with respect to the party in charge. Under Democratic governments, the performance was overall positive, but once again, for the Republican ones, the significant negative load has to be imputed to the two crisis during the second Nixon presidency, and the second Bush presidency.

Now we divert our focus to the Healthcare sector. Before the '90s there seemed to be a clear "market preference" of the sector towards Republicans (with the exception of the shock during the '70s), but from the 90's onwards, the industry shows an evident positive trend under the Democrats. Hence, the argument that one party tries to "leverage" its consensus with the "help" of the same industries does not hold. The trend displayed, shows a noticeable change in the return under each party for the two different sub-periods.

Finally, the Money portfolio, which consists of companies involved in financial services (e.g. banks, insurance companies, investment funds, etc.) shows a clearly positive trend during Democratic presidencies. Under Republican presidencies, the returns are negative for three terms out of eight, and for only two Republican presidencies they are evidently above average.

Therefore, we find that the Financial sector (Money), the Business Equipment industry and the Energy sector, show constantly excess returns above the average or remarkably close to it, throughout Democratic governments, while the same portfolios report negative or slightly positive excess returns during Republican presidencies. In general, we do not detect any evident pattern which allows us to say with certainty that one specific industry performs the best during Republican presidencies. However, little evidence of somewhat positive trends under the "right" party are reported by the Non-Durables goods industry and the Healthcare industry before the '90s (with the exception of the crisis during the Nixon presidency). All in all, a word of caution has to be given with respect to what has been said so far. These observed trends and patterns might not be due to an actual "Democratic premium", but they might rather be the result of the overall global trend or other macroeconomic factors that do not depend on the governments is place. However, taking into account the whole macroeconomic picture is out of the scope of this analysis, hence we defer that to further studies. The next two pages will summarize the performance of industries' portfolios under different presidencies, with the use of the graphs in Figure 4.2 and Figure 4.3.

Figure 4.2: Cumulative Excess Returns by industry and presidency (pt.1)

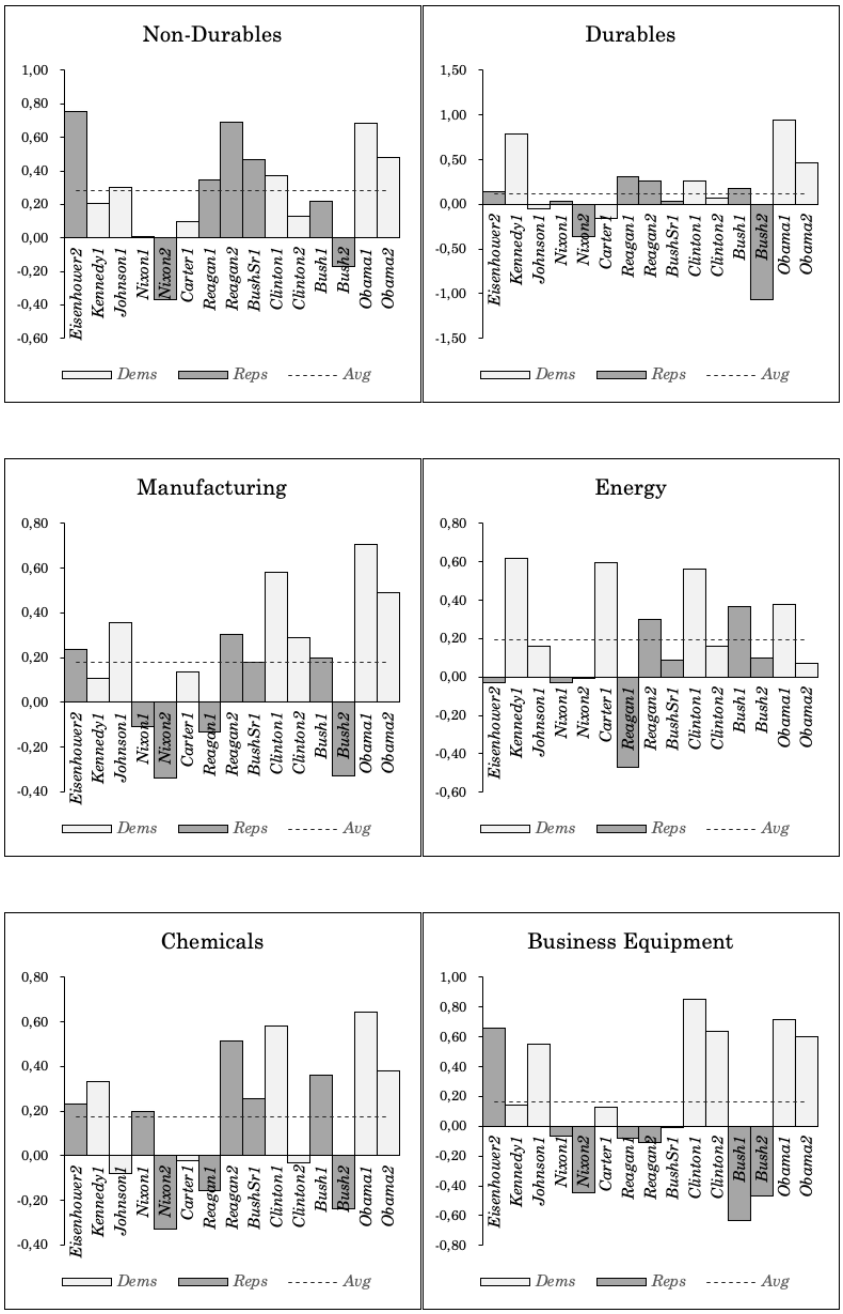
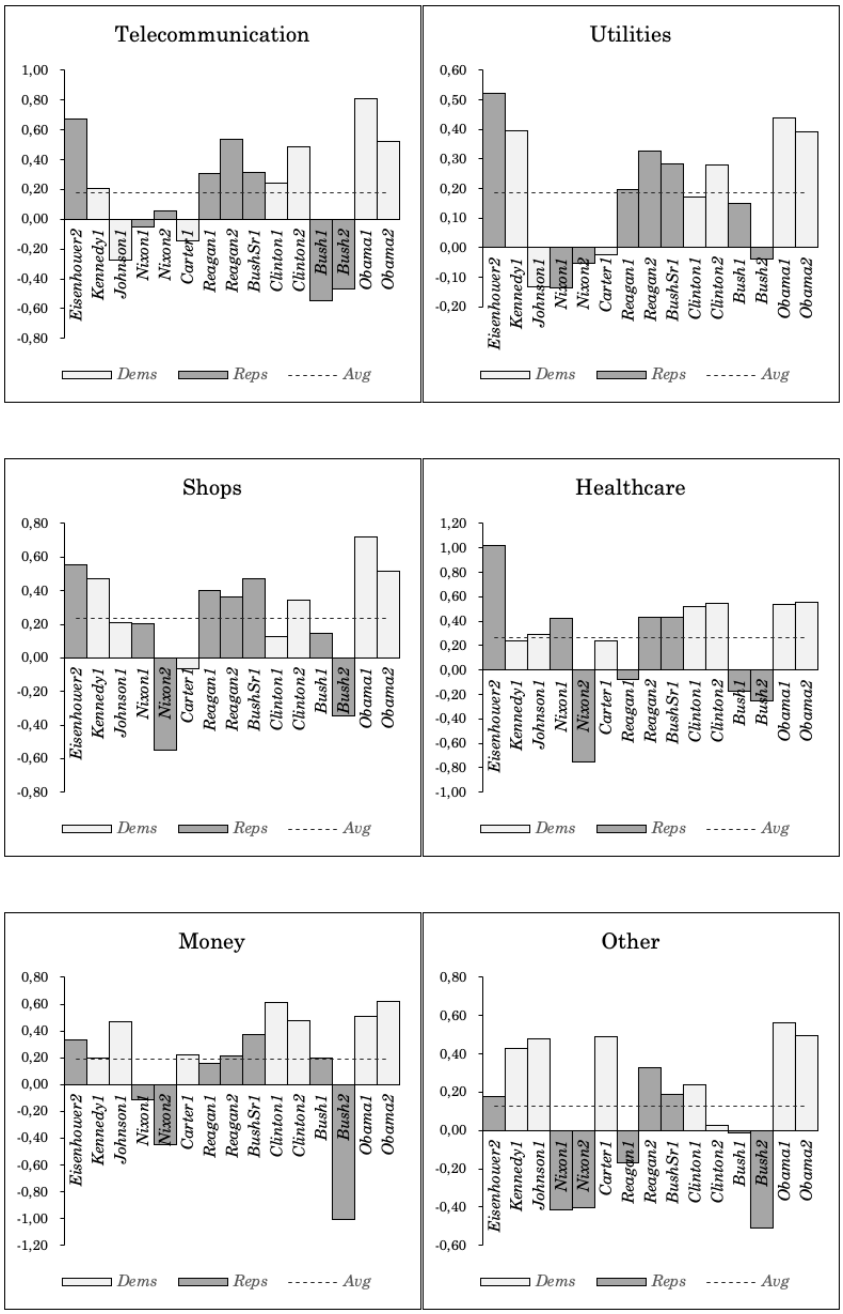


Figure 4.3: Cumulative Excess Returns by industry and presidency (pt.2)



4.4 Party financing

The aim of this thesis is not to closely examine the historical macroeconomic conditions of the U.S. economy. Therefore, in order to motivate the findings and arguments made in the previous section we divert our attention to the financing given by the industries in this study to each party. Industries can provide financing to political parties, which might in turn affect the actions taken by the next President. In order to examine the party financing of the industries we consider we examine data from the "Center for Responsive Politics"[11] (CRP), which tracks the effects of money and lobbying on elections and public policy. Even though the data is only registered from 1990, it can still provide interesting insights regarding the preference of an industry towards a party[12]. We can gain an insight into how important or unimportant the partisanship of an administration is to a certain industry by examining the largest contributions given to a party by a each industry. Table 4.1 shows the top 10 industry stakeholders of who sits in office. As we can see they differ substantially for Republicans and Democrats. While Democratic interest groups are related to the environment, civil/human rights and education, the Republican interest groups seem to be more in line with heavy industry manufacturers. We can therefore conclude that some of the industry portfolios in this study might be more influenced by an upcoming election than others, as the views of the President can differ substantially based on his partisanship. We can imagine that industries such as the energy sector, healthcare, the insurance industry and heavy metals industry might be more affected, while industries such as durable and non-durable good should remain relatively neutral to a change in presidency, as those sectors tend to remain relatively the same, no matter the political views of the person who sits in the White House.

[11] See Politics (2019).

[12] The short data length and its frequency did not allow a full comparison of industry party financing and industry returns. Hence, the conclusion drawn here are not to be considered definitive.

Table 4.1: Industries/Interest groups giving highest proportion of dollars to one party or other, sourced from Center for Responsive Politics (2018)

Ranking	Industry / Interest Group, Democrats	Industry / Interest Group, Republicans
1	Liberal	Conservative
2	Pro Abortion Rights	Anti-Abortion
3	Gun Control	Gun Rights
4	Miscellaneous Unions	Mining
5	Environment	Oil and Gas
6	Industrial Unions	Poultry and Eggs
7	Women's Issues	Building Materials
8	Education	Trucking
9	Human Rights	Business Associations
10	Public Sector Unions	Steel Production

As we saw before, five of our portfolios showed a more positive performance under a specific party compared to the other one. We examined four[13] out of those five sectors, which is summarized in brief discussion below. A general overview of the party financing from 1990 can be found under the Appendix in section A.1.

The first surprising thing we notice relates to the financing "provided" to parties by the financial sector, or as we refer to it in this study, the *Money* sector. Starting from the '90s up until today, we notice that the industry provided more finance to the Republican party, with the exception of 2008, were the level of financing provided by the sector was relatively similar for both parties. The difference between the financing of Republicans and Democrats has become even more evident after Obama's first presidency in 2008. In fact, from 2010 and onwards, the "Money" sector has allocated more than the 65% of its total Presidential expenditures to the Republican party. This somehow contrasts what we have just found in the previous section. The industry showed far more positive performance under left governments, which does not explain why the level of financing by the sector has been deeply heavier for the Republican party. However, a first explanation, especially after the "subprime crisis" can be found in the *Dodd-Frank Act*[14] which was issued under the Obama

[13] Due to the variety of the Non-Durables sector, we were unable to provide a full overview of the party financing.
[14] For more information, refer to U.S. Congress (2010).

presidency and provided a larger protection to customers against predatory lending and excess risk taking by the financial sector. Deregulation, which allows financial intermediaries to work under less strict rules and therefore more freedom, has been Republicans go-to tool in the history[15].

When we examined the excess returns of the Healthcare sector they indicated that the industry performed better under Republican presidencies up until the 90's. That changed drastically in the subsequent periods, as the excess returns indicated that the sector performed better under Democratic presidencies after the 90's. The level of financing shows a similar situation. The sector provided larger levels of financing to Republicans until the Bush presidencies in the 90's. After that the sector acted more in favor of Democrats, providing more finance to them. This might be somewhat due to Democrats focus on affordable healthcare, such as the *Obamacare* program[16]. However, it is hard to argue that the level of the returns in the Healthcare sector can be motivated by the level of party financing.

Moving to the Energy sector, the relation between the level of party financing by the industry and excess returns is even more surprising than the one found for the financial sector. We remind the reader that the excess returns for the energy sector were either above average, or close to the average returns for the whole period under Democratic presidencies, whereas they did not show any evidence of better performance under Republican presidencies, as they were above average returns for two out of seven Republican presidencies in the period in question. Throughout the whole period, 1990-2016, the industry distributed more than two thirds of its contributions to the Republican party. The reason for this could be found by the strong support of the right party to the oil and gas industry, but according to Center for Responsive Politics (2018), the Oil and Gas industry is an industry that is more often associated with Republicans. It is difficult to determine the causal relationship between the two. However, it is clear that the level of excess returns reported by the two parties does not completely agree with the financing issued by the industry.

[15] See for example Sherman (2009) and Jopson (2018).
[16] Information about Obama's Affordable Care Act can be found from ObamaCareFacts.com (2014).

The Business Equipment sector, which we can mainly summarize with the computer and computer software industry, is probably the only sector that confirms what we noted in the previous section. The industry has predominantly financed the left party in the past thirty years which might help us explain the incredibly large boom in the sector's performance under Democratic governments in this period. Nevertheless, we note that judging the low returns of the sector under Republican governments might be subject to a significant bias. Before the '90s the computer industry was considered somewhat marginal compared to the next period, and this was reflected by the returns under both presidencies which were evidently lower. Moreover, the returns under the right presidencies in the last thirty years have been characterized by the *Dot-com* bubble at the beginning of the 21st century. Despite this, based on the distribution of the returns and party financing in the recent years in this industry, we believe that some sort of a relationship might exist between the two.

Finally, for the Non-Durables sector it is very difficult to find a relationship between party financing and excess returns. As we have mentioned, the industry is more influenced by the overall macroeconomic conditions (e.g. growth, unemployment, etc.), rather than the orientation of the party in charge. Moreover, the variety of the sector itself, which contains industries in food, beverages, clothing, tobacco and so on, makes it difficult to identify the direction of party financing from this sector.

All in all, in view of the excess returns explored, and the level of party financing associated with each industry in the last thirty years, we do not find any definitive evidence which make us conclude about the causal relationship between the two.

4.5 Information uncertainty in financial markets

Since their creation, financial markets have had to deal with information uncertainty. Zhang (2006) defines information uncertainty as "ambiguity with respect to the implications of new information for a firm's value, which potentially stems from two sources: the volatility of a firm's underlying

fundamentals and poor information". Several studies, such as Chan et al. (1996), have shown that investors react slowly to the release of information. The reason for this behavior can be attributed to investors being overconfident in their private information[17], so public information disclosures might not significantly impact their expectations. Another explanation of the market's underreaction to news, could be found in the anchorage of investors' expectations to past trends[18]. Others, for example Ederington and Lee (1993), have shown how the market processed the release of information of monthly announcements (e.g. CPI, Employment, Durable Goods orders, etc), at a high frequency level, finding that the price adjustment in these cases occur within one minute after the release of the information. Volatility of financial assets was found to be higher until the next hour from the information release.

Without loss of generality, we can utilize the statement from Zhang (2006), that information uncertainty can stem from the volatility of a firm's underlying fundamentals and poor information, as well as the two ideas aforementioned (that biases can cause information to be processed slowly, and that public information is incorporated into asset prices fast). We can apply these ideas to whole industries or even to the whole financial markets. We want to narrow down the level of information uncertainty, to information uncertainty during Presidential elections in the U.S.. Presidential elections are associated with a high level of uncertainty regarding the future, as candidates and parties generally have significantly different views about the economic landscape and what the priorities of the country should be. Therefore, market participants should follow the Presidential race with a high degree of interest, as it can influence their holdings in the future. As the elections are of interest to all market participants, we expect the market to react in different ways around an election period, depending on the outcome of the election and the market expectations regarding each candidate. If the market is totally efficient and absorbs all the new information prior to the

[17] In the framework of Odean (1999), investors "overestimate the precision of their information signals". In the worst case scenario, overconfident investors believe they have accurate information when they have no information at all

[18] when individuals make estimates they require a starting point. Tversky and Kahneman (1974) state that anchoring is a cause of that, as different starting points yield different estimates which are biased to the initial value.

election outcome, there should not be any strange movements observed during and after the election period. However, the market is sometimes claimed to be efficiently inefficient, so not all the information can be absorbed right away[19]. Hence, a degree of uncertainty is present before the election day. Presidential elections are frequently characterized by close races (i.e. the candidate wins with less than 5% margin), making it difficult to predict in advance their outcome, and thus bringing with them a lot of uncertainty. For example, in the five elections examined in this study, we observe that only the 2008 election had an outcome where the margin was larger than 5% (Obama won with roughly seven percentage points), while for the remaining four elections the winner had less than 2.5% more votes than the runner up. In two of the elections in this study the winner did not win the popular vote, but won the electoral college. Given these close races, it is unlikely that the resolution of the uncertainty occurs before the outcome is known. This means that no large price movements should be observed before an election's outcome is revealed, as the market is not able to anticipate the election outcome. At the same time, if the race is close and it is hard to anticipate the outcome, the uncertainty would be resolved after the Election Day itself (when the outcome is known), and price changes should therefore be observed after that. This would be due to the resolution of uncertainty about future policies of either candidate.

We also take into consideration the volatility of the stock price. If, on average, we should not observe any price changes during the elections due to the high degree of uncertainty, we should be able to observe increased volatility in stock prices due to the unpredictability of the election outcome. As the uncertainty is resolved, the volatility should level down. Hence, differently to what has been stated by Goodell and Vähämaa (2013), we claim that the volatility should rise before Election Day if the outcome of the election is uncertain, while after the election, depending on the election result, the volatility should adjust. This means that if the election outcome has been correctly predicted, we should observe a decrease in the volatility (or at least the volatility level should be unchanged), while if the election outcome is unexpected, a drastic increase in the

[19]See for example Pedersen (2015).

volatility should be observed. For this purpose, we implemented two methods for studying volatility dynamics around the elections: (i) examining the dynamics of the residuals of the industry returns series around the election period and (ii) analysing the behavior of a volatility index (VIX) in relation to IEM (Iowa Electronic Markets) probabilities. For the second method, we believe that negative changes in the uncertainty of the election winner, should reduce the volatility that prevails in the market, due to less uncertainty about future policies (if the candidates have very different priorities or if an industry is usually known to perform better under one party rather than the other). This argument is also supported by Amengual and Xiu (2018), who stated that volatility reacts to the release of news in a positive way (i.e. declining) if the news is good and unexpected, and negatively in the opposite scenario. Moreover, they continued their analysis by showing several volatility downward jumps after the resolution of policy uncertainty[20]. Furthermore, starting from the findings of Santa-Clara and Valkanov (2003) and the preliminary findings from Figure 4.2 and Figure 4.3, we claim that a positive change in the winning probability of the Democratic candidate should also reduce the uncertainty given the stronger performance of the overall market under this party[21]. However, these two terms, winning probability of a Democratic candidate and winner uncertainty, may be conflicting[22] with each other, but we still expect that the winner uncertainty measure will predominate the closer we get to the election.

As a very preliminary result, as we did for the excess returns under each President, we now show, in Figure 4.4 and Figure 4.5 the realizations of average excess returns and variance of the excess returns in the windows before and after the election periods compared to their respective realizations in the election period[23]. This is done for each portfolio and each election[24]. It is easy

[20] In their study Amengual and Xiu (2018) showed the effect of resolution of policy uncertainty associated with FOMC announcements and the speeches of Federal Reserve Chairmen.

[21] These findings, however did not show any statistical significance. Market behaviors under different parties could be just random or deriving from business cycles. See also Lazaroff (2016).

[22] Take for example a scenario in which we have no uncertainty due to the winning of Republicans. If we have a positive change in the winning probability of a Democrats then we should have a negative change in the volatility, but at the same time we have a negative change in the winner uncertainty which has the opposite effect on the volatility.

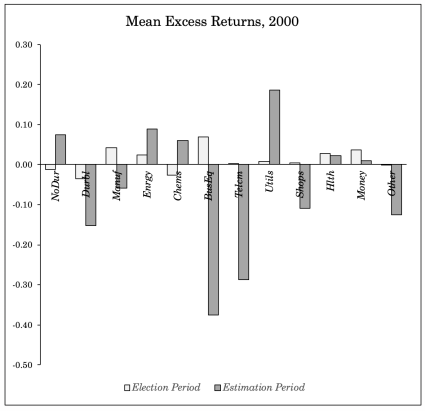
[23] For a definition of "Election period" we direct the reader to chapter 5

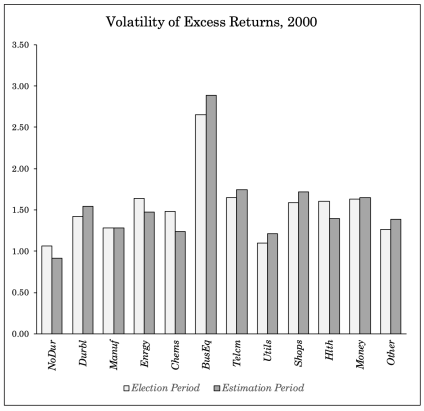
[24] Doing so by merging all the elections into one large sample, would have yielded a situation that was too dependent on the 2008 crisis.

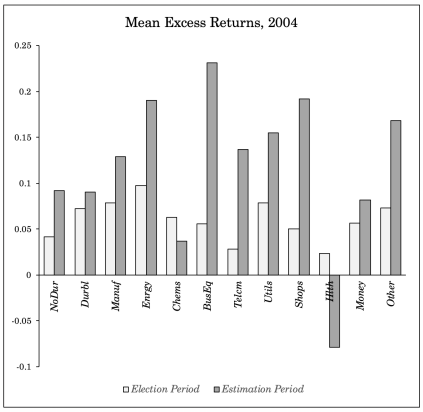
to notice that the election that shows the larger differences in the mean and the volatility of excess returns between periods is the one in 2008, almost surely due to the crisis that hit the market in early September of that year[25]. Also, the remaining elections seem to display some sort of differences in the mean and variance. However, taking for example the elections in 2012 and 2016 it seems like there is a decrease in the volatility in the election period, contrary to what we have argued. For what concerns the mean, there seem to be large differences in every election (some show an increase of the average excess returns around the elections, other show a decrease). However, it is difficult to conclude whether there are actual differences in the mean and the variance of excess returns by simply looking at these graphs, hence we postpone the conclusions about this to later sections (see section 8.1) where we will examine these differences also from a statistical point of view, and analyse sub-periods around the elections themselves.

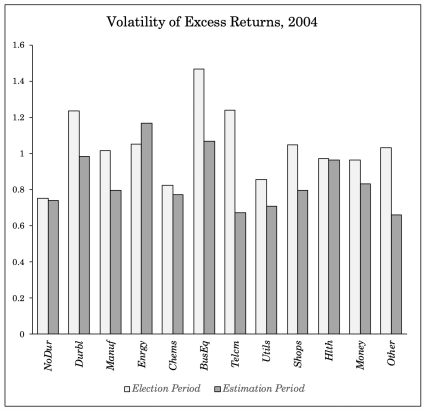
[25]For a timeline of the 2008 crisis, see for example The Guardian (2013).

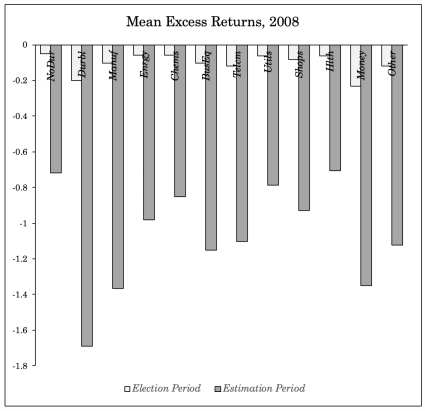
Figure 4.4: Excess Returns & Volatility of returns, during election periods and non-election periods, by industry (pt.1)











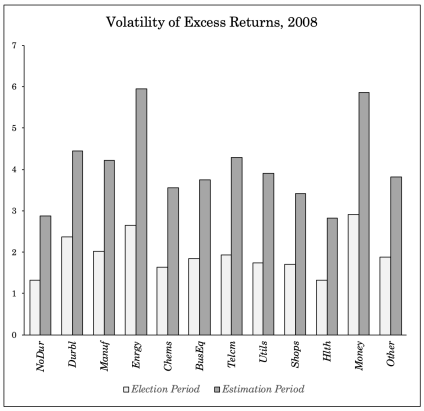
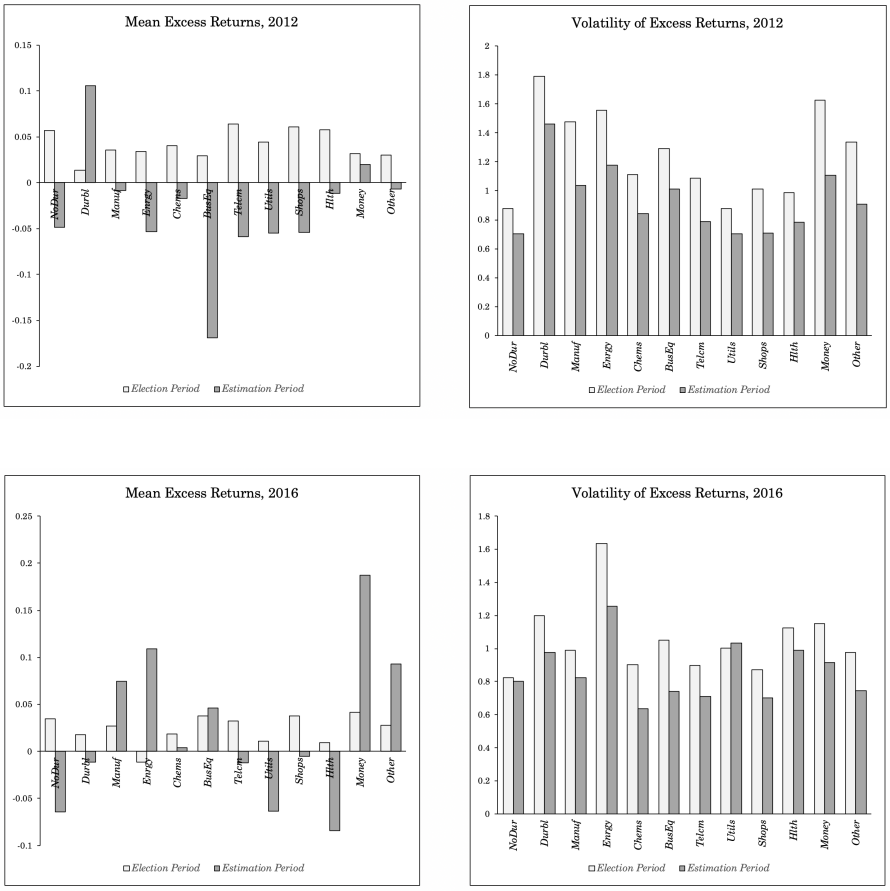


Figure 4.5: Excess Returns & Volatility of returns, during election periods and non-election periods, by industry (pt.2)



5. Data

The data used for this project is collected from several different sources. Data regarding industry portfolio returns, market returns, market volatility and the elections themselves was collected in order to analyse how stock markets react to an upcoming election. The period chosen for this thesis covers five elections, the first one occurring in 2000 and the last one taking place in 2016. This chapter will provide a description of the data used for this research.

5.1 Industry portfolios

When it comes to analysing how markets react to new information several different approaches can be taken. For this analysis we decided to utilize industry portfolios. By doing so, we are able to see how an event can have a different effect on different industries. The portfolios are generated so that the firm stocks that comprise each portfolio reflect how their respective industry is performing as a whole. French (2019) has created these portfolios. As these portfolios have been used by many scholars in the literature they were deemed appropriate for our work, and by using them we avoid creating a biased sample, as these portfolios are considered to be an appropriate reflection of each industry. This study utilizes 12 industry portfolios, the ones discussed previously in chapter 4[1]. Returns for each portfolio were retrieved, for the period 31.12.1997 up until 31.12.2018 from French (2019). Both equally weighted and value weighted portfolio returns were collected. As the data in question is a daily time series we decided to use log returns[2], which were computed in the following

[1]The portfolios represent the following sectors: Non Durables, Durables, Manufacturing, Energy, Chemicals, Business Equipment, Telecommunications, Utilities, Shops, Healthcare, Money and Other.

[2]log-returns are usually used for financial time series studies since they are associated with nice statistical properties

manner:

$$r_{t,i} = 100 * log(1 + \frac{R_{t,i}}{100}) \tag{5.1}$$

where $R_{t,i}$ is percentage return of portfolio i at time t. While, if we had prices available we could have used:

$$r_{t,i} = 100 * (log(p_{t,i}) - log(p_{t-1,i})) \tag{5.2}$$

We decided to work with the value weighted portfolios instead of the equally weighted portfolios, as we believe that they are a better representation of the market. Be believe that to be the case, as higher value firms will be more traded amongst investors and are therefore likely to show more variation in prices and returns than the lower value firms. By using portfolios where these higher valued firms are assigned higher weights we believe that we will be able to capture more variation in the series. The noise due to trading might die out as a cause of the low weights assigned to high value firms when the equally weighted portfolios are utilized[3].

5.2 Market returns

While the focus of this thesis is on the behavior of the industry portfolios previously mentioned, we additionally analysed how the Volatility Return Index, or the VIX, reacted to upcoming elections. The data for the VIX was sourced from Datastream (2019) for the period ranging from 31.12.1997 up until 31.12.2018. The VIX data was on a daily basis.

The methodology additionally required a market index. The Euro stoxx 50 index was chosen, with the purpose of serving as an index that could capture movements due to macroeconomic fluctuations, instead of the ones caused by internal events. Daily prices for the Euro stoxx 50 index for the period 31.12.1997 up until 31.12.2018 were retrieved from Bloomberg Terminal (2019), and daily log-returns were computed.

[3]Running the models from section A.6 on equally weighted portfolios yielded no results.

Hence, for the estimation in section 7.7 this variable will be used as a control variable.

We decided to use the Euro stoxx 50 instead of the S&P500 for the EGARCH procedure in section 7.3 as well. The S&P500 index was considered to be a poor variable to serve this purpose, as any variation measured in the industry portfolios of French would also be captured in the S&P500 index, as it might contain the same firms as the industry portfolios. The Euro Stoxx 50 index was therefore chosen as a market benchmark for the EGARCH estimation, as we believed that it would not be as affected by surprises in the election outcomes.

5.3 Iowa Electronic Market (IEM) data

Other studies analysing the effect of Presidential elections have made an effort to capture market perception in their analysis. Two main approaches have been used to capture this effect, (i) using polling data from market analytic firm such as Gallup and (ii) using electronic option prices as risk-neutral probabilities[4]. The Iowa Electronic Markets (2018) is an electronic market developed by the University of Iowa. It is an internet-based teaching and research tool, where students are allowed to trade real money in a variety of contracts. In the IEM political markets students can trade shares of political candidates or parties, and their eventual payout will depend on the election results. Therefore, the IEM can be considered as a forecasting tool where market participants can forecast the outcome of events such as an election. As market participants can earn real pecuniary benefits by trading the prices on these contracts, they are considered to be a good reflector of what markets believe will happen. For this thesis, we focused on five elections. The IEM markets open for trading on the outcome of an election roughly 7 to 8 months prior to an election (but the opening of the IEM markets can vary depending on the election, for the 2012 and 2016 events in our study they open about 20 months prior to the election). Notice that the markets open before the parties have announced their candidates, but market participants can still trade contracts based on a Democratic/Republican win. The IEM price data was gathered from Iowa Electronic Markets (2019) and used to create probability estimates of how likely or unlikely a Democratic victory was,

[4]Risk-neutral probabilities are not to be confused with real-world probabilities. See also Hull (2018).

for each election, according to the market perception at the time. Third party runners are often quoted in this market, but for our purpose they will be ignored[5]. We calculate the probability of a Republican win as the residual probabilities of a Democratic win. In order to calculate the probabilities from the contract prices in the IEM market we follow the methodology of Goodell and Vähämaa (2013). When available, we retrieve IEM prices from March in the election year for each election, so that all contracts have the same starting date. The IEM contracts can be viewed as futures contracts where the payoff is based on the outcome of the election in question, which can have two options, a Democratic win or a Republican win. Market prices of these contracts should reflect the market perception of the probability of its payoff. Note that we must be cautious with these IEM probabilities, and assume that the market where the contracts are traded are efficient and that changes in the probabilities are unanticipated by market participants. This simply means that we assume that traders in the Iowa Electronic Markets are not looking for possible arbitrage opportunities, which could skew our estimates. The IEM probabilities can then be calculated under the assumption that if an investor were to buy a Republican contract and a Democratic contract, this combination would generate a certain payoff equal to the cost of the contracts. Therefore, these market prices can reflect probabilities, as the payoff for a Democratic candidate would be 1 if a Democratic candidate secures a win in the election and 0 otherwise. The same goes for a Republican candidate. Moreover, since the price of the contract for a Democrats winning plus the price of the contract for a Republican winning does not sum up to one due to transaction costs, we normalize the prices in the following fashion:

$$WinProbDem_t = P.DemWin_t/(P.DemWin_t + P.RepWin_t) \tag{5.3}$$

where $WinProbDem$ is the winning probability of a Democratic candidate, $P.DemWin$ is the price of the contract for a Democratic candidate and $P.RepWin$ is the price of the contract for a Republican candidate.

Additionally, we generate a measure of election uncertainty ($WinUnc$). Again, following the

[5]Trading volume and trading prices for third party runners are usually very small and thus negligible.

methodology of Goodell and Vähämaa (2013) we construct a variable which should capture the difference between the probability of the election going to the eventual winner and the probability of the election going to the other candidate. Hence this measure can be defined as:

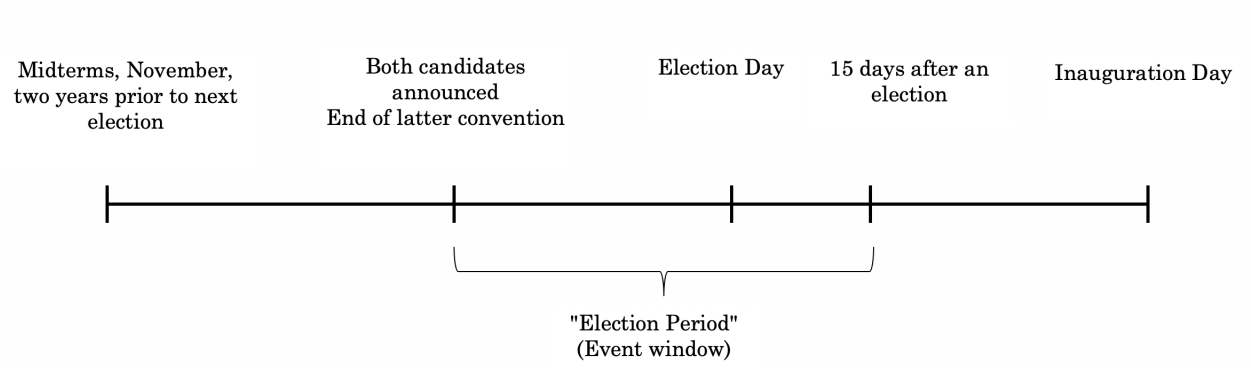
$$WinUnc_t = 1 - |2 \cdot WinProbDem_t - 1| \tag{5.4}$$

If this measure takes the value of 1, then there is complete uncertainty regarding who will eventually win the election[6], whereas a value of 0 indicates that the uncertainty has been resolved.

5.4 Election Dates and Dummy Variables

To measure the effects of the elections on the market portfolios and the VIX we require an estimation period[7], an event, an event window and a post event window. These windows will be utilised both in the EGARCH procedure and in the analysis of the VIX (section 7.3 and section 7.7). The timeline of our study can be seen in Figure 5.1

Figure 5.1: Timeline of the study



In order to define the election period for our study we needed to decide when we wanted to start recording the effects of the elections, and when we wanted to stop recording the effects. Our

[6] In fact if $WinProbDem = 0.5 = 1 - WinProbDem = WinProbRep$, then WinUnc=1

[7] It has to be noticed that the term "estimation period" does not relate to the one commonly used in the event studies methodology. Here we refer to the estimation period as the period before the event that help us in building our sample and in the estimation of the long-run path of the parameters.

estimation begins during the midterms prior to an election. As the midterms are generally held in November, 2 years before the next election (or halfway into the current President's mandate). The election period (event window) begins on the date that both parties have determined who is running on behalf of the party, so the latter of the National Conventions. We decided that the election period should start when both the Republican party and the Democratic party have selected their candidates for President and Vice President. These dates can differ depending on the election, as for some elections both parties have selected candidates during the summer, whereas in other elections the last incumbent is selected in early September. The next section will provide an overview of all the elections in this thesis. The event window ends 15 days after the election has been held. Scholars who have employed event study methodologies have used a variety of different dates to determine their event windows. As we are interested in measuring the effects of the elections themselves, the uncertainty regarding the outcomes of the events and the eventual resolution of the uncertainty this event window was deemed appropriate. The market knows with full certainty who both parties have nominated to run for office after both conventions. As the event itself nears, the election in our case, market participants can adjust their expectations and invest accordingly. After the uncertainty has been resolved we believe that investors will act fast to adjust their holdings, which explains the selection of the shorter 15 day post-event window chosen. We construct dummy variables that have the purpose of capturing market behavior during the event window. For a further analysis of the effects of the election on the industry portfolios, we decompose the dummy variables. We generate two variables, one that measures the effect of the elections from the latter of the National Conventions up until the Election Day itself and another one that measures the effect of the election 15 days after the election. When we analyse the VIX, we allow the dummy variable that measures the effect prior to an election to vary in length (15 days, 30 days and 45 days). For a summary of the dummy variables used in this thesis we direct the reader to Figure A.5, Figure A.6 and Figure A.7 in the Appendix. The post event window period ranges from 16 days after the election has been held, up until Inauguration Day, which is normally held on the 20th

of January. We retrieved the dates for the election days from Leip (2019), and the dates of the national conventions were retrieved by examining the announcement Speeches by each Presidential candidate. A discussion of each election and relevant dates can be found in chapter 6 .

5.5 Gallup Polls

Like mentioned in previous sections there are several ways that can be utilized to measure what markets believe will happen in the election. One way is to utilize the results of opinion polls from analysts. For our study we explored the results from opinion polls from the analytic and advisement company Gallup. The Gallup opinion polls are measured in quite a simple manner, Gallup takes a sample of registered voters, calls them and asks whether they would vote for the Democratic incumbent or the Republican incumbent if the election were held today. For this project the Gallup opinion polls are used in the chapter 6 and chapter 8 to explain how certain or uncertain the market was of a candidate's win. We can imagine that if opinion polls are fluctuating a lot then that might indicate high uncertainty of who will eventually be voted as President. Note that the Gallup opinion polls are shown for the elections occurring in 2000, 2004, 2008 and 2012. In 2016 Gallup did not forecast a likely winner. In the case of 2016 a opinion poll consensus from Wikipedia was utilized.

6. Election Overview and Industries affected

As we are interested in analysing the effect of elections and the uncertainty associated with them on financial markets we define an event as election day. The scope of this study covers five elections, occurring in 2000, 2004, 2008, 2012 and 2016. We decided to focus on the periods after the 2000 election. Technology advancement, information flows and therefore people's ability and speed to process new information has changed considerably in the past decades, and we believe that focusing on elections that occur in the new millennium is more relevant for this thesis, as times have changed since the declaration of Independence of the United States. This chapter will start off by discussing differences in industry preferences between Republicans and Democrats. It will then continue and provide a brief explanation of each event under the scope of this study, and finally conclude in the market perception of the probable winner in each election[1].

6.1 Industries and Elections

The following summaries regarding the five elections in our study show that in each election several promises were made by all hopeful candidates, that affect the same industries throughout the whole time frame. Both parties almost always make promises related to foreign policy (with respect to trade and war), the energy sector and gun control. As Democrats and Republicans tend to have opposing views on how the country is best run, we would expect industries that are affected by

[1]The dates, campaign information, and other relevant information in this chapter was sourced from the nominees campaign material and speeches they made. That material was accessed from www.4President.org. Data regarding election results was sourced from Dave Leip, via Leip (2019).

changes in fiscal and monetary policy to be more volatile in the period around an election. In Table 6.1 we see how positive people are towards several industries depending on their political preferences. As we can see from the table people's attitudes towards several industries can differ. Democrats seem to be more positive towards education, the healthcare sector and the automobile industry than Republicans, whereas Republicans have more positive views towards farming and agriculture and the oil and gas industry than Democrats.

Table 6.1: Positive Ratings of U.S. Business and Industry Sectors, for Republicans and Democrats, sourced from Newport (2013)

Industry	Democrats %	Republicans %
The Federal Government	39	13
Education	52	38
Healthcare Industry	43	32
Automobile Industry	54	44
Computer Industry	69	62
Internet Industry	56	54
Telephone Industry	42	41
Real Estate Industry	36	36
Grocery Industry	49	50
Retail Industry	47	49
Pharmaceutical Industry	35	38
Electric and Gas Utilities	36	40
Television and Radio Industry	36	40
Banking	30	34
Farming and Agriculture	57	66
Oil and Gas Industry	19	32

6.2 The 2000 Election

The first event in this study is the Presidential election held on November 7^{th}, 2000. The two terms prior to the election had been under a democratic presidency as President Bill Clinton and his Vice President Al Gore had been elected in 1992 and later re-elected in 1996. On August 3^{rd}, 2000, the National Convention of the Republican party ended and George W. Bush was selected to run for presidency on behalf of the party with Dick Cheney as his candidate for Vice President. On

August 17^{th} the Democratic party closed their national convention, having selected Al Gore to run for President, along with Joe Lieberman as Vice President[2].

We must note that the economic climate during this first event is not a standard one, as in March 2001 the do-called *dot-com* stock market bubble burst[3]. Therefore the economy was slowing down during the election.

The campaigning of both nominees had a certain degree of a social emphasis. Bush (2000a) pushed for large tax cuts, new drug benefits for the elderly and changes in public education. He proposed a reform of Social Security, by allowing people to allocate a portion of their payroll taxes that they could control and own. This was based on the idea that people could accumulate more wealth by investing in financial assets that yield higher returns than Treasury bonds.

The Democratic incumbent, Al Gore (2000a) had served as the Vice President of the United States in the two terms leading up to the 2000 election. While campaigning, instead of capitalizing on the economic success that the Clinton administration had made in prior terms, Gore attempted to stand on his own and distance himself from Clinton, and the scandals that occurred in that administration. The main focus of Gore's campaign was improving educational opportunities, improving healthcare, gun control and strengthening family ties. A large part of Gore's campaign was focused on protecting the environment, and Gore has since then become famous for his fight against climate change.

A third candidate ran for presidency in the 2000 election. In the summer leading up to the election the Green party nominated Ralph Nader as their candidate. While campaigning, Nader (2000) rejected both the Democratic and Republican parties, stating that their motives where of a corporate interest. Although he did not secure enough votes to be elected into office, Nader's candidacy is sometimes believed to have had an impact on the outcome of the election.

On November 7^{th}, 2000, the American public cast their votes. The popular vote went to Al Gore, who received 48.4% of votes whereas Bush won 47.9% of votes. On election night it was still unclear who had won the election, since the electoral votes of Florida were yet to be determined. After

[2]See acceptance speeches by Gore (2000b) and Bush (2000b).
[3]See for example Madslien (2010).

the votes had been counted it was found that Bush had won the state by such a low margin (a margin of 537 votes) that a recount was required by law. A month of legal battles finally ended on December 12^{th}, when the Supreme Court ruled in favor of Bush. This is one of few examples from history where the elected President fails to win the popular vote but wins the electoral college. Al Gore received over 500,000 more votes than Bush, but he failed to secure important states and therefore lost in the Electoral College. Note that Gore lost the state of Florida. The margin in the state was very low, and required a recount. The Court system had to step in, and it wasn't until mid December that the outcome of the election was clear.[4]

On January 20^{th}, 2001, George W. Bush was officially inaugurated and took over from Democrat Bill Clinton.

For the sake of this thesis, we can make the informal inference that the campaign promises of both candidate are more related to some sectors that we are focusing on than others. Both campaigns focused on changes in the *Healthcare* sector. Bush's proposed tax changes had the goal of increasing investment, so we could expect the *Money* sector to be influenced. Gore's fight for the environment might influence several industries, such as *Manufacturing* and *Energy* sectors. As the parties had opposing promises this might be translated into increased volatility of these portfolios in the period leading up to the election, depending on how uncertain investors were of the election outcome[5].

6.3 The 2004 Election

Republicans completed their national convention on September 2^{nd}, 2004. The decision was to have George W. Bush and Dick Cheney run for re-election as President and Vice President, respectively. On July 29^{th}, 2004, the Democratic National Convention ended. Democrats nominated John Kerry, a senator from Massachusetts to run for President, with Senator John Edwards as his Vice President[6]. In this election Bush was hoping for re-election. He had gained some popularity during his

[4] According to Mount (2010).

[5] Other industries might be affected based on partisanship between industries and party financing. These industries are casually inferred from the campaign discussions.

[6] See acceptance speeches of Bush (2004b) and Kerry (2004b).

first term as President. However, despite an increase in his popularity in the wake of the September 11^{th} attacks in New York, it had began to decline as the term came near to an end[7]. Bush (2004a) aimed a large part of his focus on foreign policy during the campaign the and war on terrorism. He focused on domestic issues as well, namely the creation of jobs, healthcare, stem cell research, abortion rights and more, but Republicans are notably conservative when it comes to such topics. He planned to boost job opportunities for American workers by reforming the educational system and providing job training for workers, as well as simplifying the tax code for taxpayers which would encourage saving and investment. He also proposed a scheme to assist uninsured workers by increasing the expanding health savings accounts, and make healthcare more accessible for all. He also proposed some plans to help small businesses to band together in new affordable healthcare for their employees. He additionally proposed a device with the purpose of promoting ownership. His plan had the goal of creating millions of new, affordable homes within the next 10 years to increase home ownership. Bush's campaign was very directed at discussing his four years in office had gone. Kerry (2004a) attempted to challenge Bush by criticising his performance as President. He pointed out that the economy had stagnated under the Bush administration, that millions of jobs had been lost since Bush took over. He promised to replace all those jobs within the first two years of his administration, as his plans for energy independence would create new jobs with good benefits in the energy sector. Kerry defended civil rights of all American citizens, and wanted them to be free from persecution and discrimination based on gender, religion, ethnicity or sexual orientation. He hoped to appoint judicial nominees who would preserve these rights. He hoped to provide affordable healthcare for American citizens. He additionally had plans to deal with increasing healthcare costs and the high number of uninsured Americans. Kerry (2004a) also noted that college students had been suffering under the Bush Administration. Therefore he wished to expand and protect the student loan programs and scholarships, as well as provide free college tuition to state schools for students who served within their community. Like Al Gore before him, Kerry placed a heavy focus

[7]See Bush's popularity rating from Gallup (2004).

on protecting the environment and criticised the Bush administration for their disregard for the environment, hoping to provide some changes during his time in office. Like Bush, Kerry needed to address the foreign policy in his campaign. While Kerry supported America's war on terror he hoped that the country would strengthen ties with other nations, and advocated foreign policy that would ensure human rights being upheld in other nations.

On November 2^{nd}, Americans headed to voting booths to cast their votes. George W. Bush won the popular vote, and received 50.7% of the votes, while John Kerry lost with 48.3% of votes. In addition to winning the popular vote, Bush won the Electoral College[8]. Some industries in this study can be casually related to these campaign promises, and would therefore be expected to be more sensitive in the period leading up to the election. Just as in the 2000 election, both candidates discussed matters related to the *Healthcare* sector. Bush's proposed tax cuts could again have an influence on the *Money* sector. As he hoped to increase homeownership we might also expect this to influence the *Manufacturing* sector, as well as the *Durables* sector. As he was an environmentalist, Kerry's focus in the campaign might be expected to influence the *Manufacturing* sector as well as the *Energy* sector[9].

6.4 The 2008 Election

On August 28^{th}, 2008 the Democratic National Convention ended. During the convention, the decision was made to have Barack Obama to run as President on behalf of the party, along with Joe Biden, who ran as his vice President. On September 4^{th}, the same year, Republicans completed their National Convention. The decision was to have John McCain run as President, with Sarah Palin as his Vice President[10].

The government in place was a Republican one, as the second term of President George W. Bush was coming to an end. Bush endorsed McCain, but did not make any public appearances for McCain

[8] See election results from Leip (2019).

[9] Other industries might be affected based on partisanship between industries and party financing. These industries are casually inferred from the campaign discussions.

[10] See acceptance speeches of Obama (2008b) and McCain (2008b).

during the campaign. McCain (2008a) showed voters that he did not agree with Bush on many other key issues. The campaign period was very focused on the Iraq War and the unpopularity of the departing President, Bush. McCain, a war veteran supported the war whereas Obama (2008a) was strongly opposed to it. While the focus of the early campaigning had been on the Iraq war, it shifted as Election Day neared. A huge concern for voters at the time was the status of the economy, as the fall of 2008 market the beginning of the financial crisis. McCain's following suffered during this period, as we will see in a later chapter, but he made several comments about the economy. In mid-September, the Lehman Brothers bankruptcy occurred. On the same day, McCain declared that the fundamentals of the U.S. economy was strong despite turmoil in the financial markets. Many have argued that the financial crisis and economic conditions caused severe damage to McCain's campaign, as noted by Holcomb (2013).

Both candidates had their own ideas on how to improve the access of the population to healthcare. McCain (2008a) hoped to assist people who were unable of getting insurance. His focus was more on open-market competition rather than government control. Obama (2008a) was ambitious and called for universal healthcare. His idea was based on the creation of a National Health Insurance Exchange for both private and public plans. Obama's campaign and eventual election was groundbreaking in many ways. Instead of solely trusting on paper, television, radio, rally's and other conventional campaign media, Obama took to the internet and social media.

Election Day was held on Tuesday, November 4^{th}, 2008. Obama won both the Electoral College and the popular vote. He received more votes than any candidate in history, and he became the first African-American President in the history of the United States[11]. This campaign relates to several of the industries included in this study. As the focus of the campaign was on the economy in the beginning, the *Money* sector[12] is expected to be affected. Obama's proposed changes in people's access to healthcare could indicate that the *Healthcare* sector would be affected[13].

[11] See election results from Leip (2019).

[12] However, due to the nature of the financial sector at the time, we believe that all portfolios in this study will show increased volatility during the 2008 election.

[13] Other industries might be affected based on partisanship between industries and party financing. These industries are casually inferred from the campaign discussions.

6.5 The 2012 Election

On September 6^{th}, 2012 the Democratic National Convention came to an end. Democrats opted to have Barack Obama and Joe Biden run for re-election as President and Vice President of the United States. On August 30^{th} the same year the Republican National Convention ended. The Republican party chose Mitt Romney and Paul Ryan to run for President and Vice President on behalf of the party[14]. The focus of this campaign was mainly on Domestic issues, as in the term before the economy in the U.S. had suffered in response to the financial crisis in 2008.

Romney (2012) proposed some changes to be made on the tax rate. While he planned to maintain individual tax rates the same he hoped to lower the corporate income tax rate. Additionally he wanted to make changes in regulation and put to rest programs that had been created under the Obama administration (such as Obama's healthcare program). For trade policy Romney hoped to open markets further by implement some free trade agreements. He also wanted to somehow impose law restrictions on imports from China. Foreign policy was also discussed during the campaign, mainly plans to phase out of the Iraq War, decrease military spending and how to appropriately fight terrorism. Obama (2012a) proposed changes that would simplify the tax code and at the same time encourage firms to manufacture in the U.S. to increase job supply, and he pushed for energy independence of the nation. The eventual outcome was clear on November 4^{th}, 2012 - Obama won both the popular vote, as well as the Electoral College[15].

The sectors that we believe might be more affected by this election, based on the promises and discussion throughout the campaign are the *Healthcare* sector, as Romney hoped to cut Obama's program. Changes made in trade agreements might also mean changes in the public's access to consumer goods, and therefore the *Non Durables*, *Durables* and even *Business Equipment* sectors might be affected. We might also expect the *Energy*, *Manufacturing* and *Money* industries to be impacted[16].

[14] See acceptance speech of Obama (2012b) and Romney (2012).
[15] See election results from Leip (2019)
[16] Other industries might be affected based on partisanship between industries and party financing. These industries are casually inferred from the campaign discussions.

6.6 The 2016 Election

The 2016 Democratic National Convention ended on July 26^{th}, 2016. The former U.S. Secretary of State Hillary Clinton was chosen as a nominee for President on behalf of the party. Senator Tim Kaine was selected as her running mate for Vice President. On July 21^{st} the same year the Republican National Convention concluded. Nominees from the Republican party were Donald Trump who would run for President, and Mike Pence who ran with him as his Vice President[17]. The main focus of Clinton (2016a) in her campaign was on raising middle class income, fighting for women's rights and more social issues. She proposed a plan that would lift tax reliefs for firms that moved jobs out of the country. At the same time firms that shared their profits with employees and the community would be rewarded. She hoped that job creation could be made via the Renewable Energy sector and fought for equal pay and proposed a policy that would allow undocumented immigrants to get started with applying for a citizenship. Clinton also hoped to make changes in the education system and make education more affordable, as well as improving the public's access to healthcare. Trump (2016a) mainly focused on his persona, as he was highly accustomed to media coverage prior to running for President, but he had gained some notoriety as a businessman. Trump's slogan was simple, to "Make America Great Again" and gained traction with America's middle class, without college education, that had felt ignored under Obama's administration. Trump's agenda was extremely different from Clinton's, as one of his campaign promises was to build a wall between the border of the United States and Mexico, to prevent illegal immigrants from coming to the country and to increase the supply of blue-collar jobs by imposing tax reliefs that made it more appealing for firms to manufacture in the States.

The campaign is unique in the sense that the focus was often derailed away from the candidates and the matters that they stood for. Hillary Clinton faced a tough period, as she had used her personal email server while on the job as Secretary of State, sending several classified emails through her unprotected server instead of using a governmentally issued account, as reported by Zurcher (2016).

[17] See acceptance speeches of Clinton (2016b) and Trump (2016b).

Trump used this as ammunition and painted her as an someone not fit to serve as President of the United States.

Trump also had some struggles, as his behavior towards women had been questioned in the media. In May, 2016 Barbaro and Twohey (2016) wrote an article for the New York Times, based on 50 interviews with women who had known Trump. These women discussed Trump's alleged sexual misconduct. This was used against Trump in the campaign.

Election Day was held on November 8^{th}, 2016. The eventual outcome was that Clinton won the popular vote, receiving 48.2% of votes, whereas Trump received 46.1% of the votes. As we can notice, the gap between the two was close (below 5%). However, Trump managed to secure more votes in the Electoral College and therefore won the election[18].

We note that the campaign discussions and election promises can be related to some sectors in this study, mainly the *Manufacturing*, *Healthcare* and *Money* sectors[19].

6.7 Uncertainty Surrounding Elections and Market Perception

When elections are held there is generally a lot of media covering the event. The media tries to speculate which party will be better for the economy and the stock markets, feeding information to market participants. There is informational value in the result of an election that matters to market participants, as changes in fiscal or monetary policy can affect the whole economy and in turn financial markets. Therefore, it is vital for market participants to rationally update their beliefs on what the outcome of an election will be, as it can affect their holdings. But how can investors form opinions about what will happen in the future, and how can scholars implement that in their forecasting models?

Many scholars have incorporated the results of public opinion polls into their models to account for a probability measure of a Democrat/Republican win. By incorporating these poll results, they

[18] See election results from Leip (2019).

[19] Other industries might be affected based on partisanship between industries and party financing. These industries are casually inferred from the campaign discussions.

are able to control to a certain degree for what the perception of market participants is[20]. Public opinion polls have been a useful tool in the past to forecast which candidate will win an election. By taking a sample of eligible voters and asking what candidate they intend to vote for, analysts can get a realistic idea of how the public will vote. However, these public opinion polls sometimes miss the mark. The 2000 election race between Al Gore (Democrat) and George Bush (Republican) is a famous example of public opinion polls missing the mark. While Gore was predicted a win with about 53% of the popular vote, his actual share of the votes was less[21].

Another way to account for uncertainty in the markets is to define a margin of certainty. The findings of Bialkowski et al. (2007) indicated that in the cases of a candidate winning an election with a low margin between the two prospects, the implied volatility in the market was higher. This can be interpreted so that a low margin indicates a close race, which in turn means a high degree of uncertainty in the market of who will take home a win. Therefore, a possible way to control for uncertainty in empirical models is simply to use the margins.

A third way of incorporating market perception of the eventual outcome into models is by using option prices. Some electronic markets, such as the IEM, offer investors to buy options whose payoffs depend on the outcome of the elections. As we discussed in chapter 5, these option prices can be viewed as probability measures. However, it is important to be cautious of using such estimates. We work under the assumption that the IEM markets are efficient and that the market participants are acting on their beliefs. If the market participants were to exhibit speculative behavior and look for arbitrages in these electronic markets the probabilities would not measure what they are supposed to. For example, Gemmill (1992) analysed the behavior of the stock market and options markets in London during an election taking place in 1987. His findings indicate an extremely strong relationship between the FTSE100 index and opinion polls. However, during the last week leading up to the election, option prices implied a decreasing probability of a Conservative win,

[20] for example Sigelman (1979).
[21] See for example Abramowitz (2004).

while the polls suggested the opposite. This discrepancy can be explained by a volatility arbitrage, as speculators created an arbitrage – a bubble in the prices of the options.

To get a better idea of the elections and their perceived outcomes, let's take a look at what the public opinion polls[22] and IEM probabilities looked like for the elections in this study.
The 2000 race was a close one. Bush had been leading the polls throughout the campaign period, but as the election drew closer, the gap narrowed, and it became more difficult to see in which direction the win would go to[23]. This can be seen in Figure 6.1.

Figure 6.1: Gallup polls, 2000 election

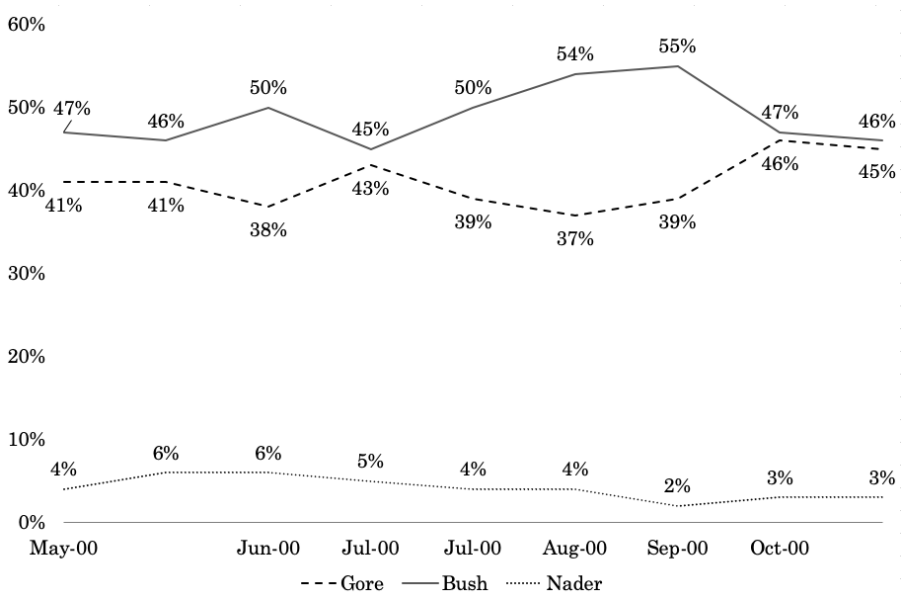
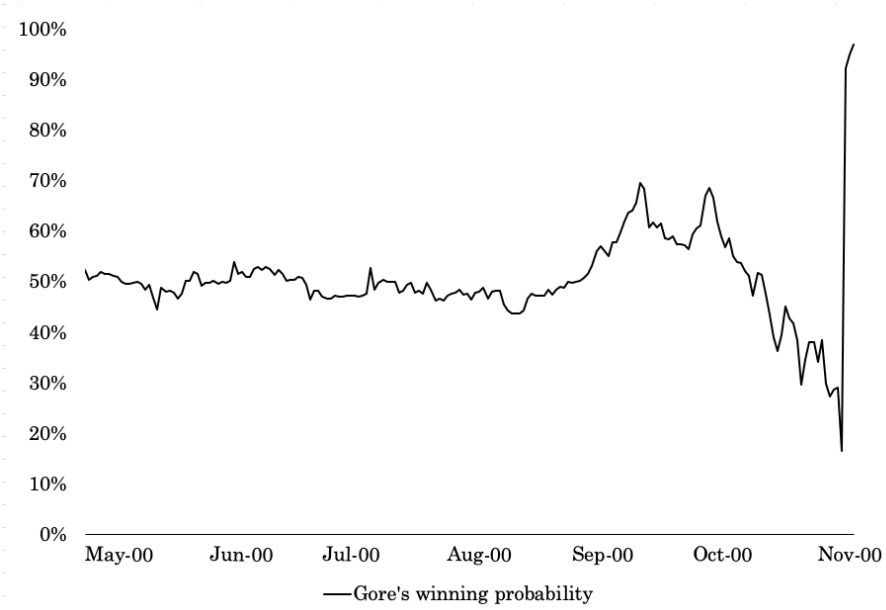


Figure 6.1 shows that as the election neared, Bush's lead decreased, while Gore's increased. However, if we examine the market perception of the election outcome via the IEM probabilities, we can see that the race was close up until October. In October the probability of Bush being elected increased and the probability of Gore being elected decreased. Note that just prior to the election the probability of Gore taking the win spiked and on Election Day the probability of a Democratic win was almost 100%. This captures what happened in this election, as Gore received the majority

[22] We will use Gallup Analytics for all elections, except for the 2016 election. For the 2016 election we utilize a census from polling agencies sourced via Wikipedia.
[23] Data for the 2000 race was retrieved from Gallup (2008).

of the popular vote, but the Electoral College was in Bush's favor. This can be seen in figure Figure 6.2.

Figure 6.2: IEM probabilities, 2000 election



In 2004, after both the Republican and the Democrat parties had announced their candidates in the Presidential election in 2004, Bush had an advantage according to the polls. This can be seen from Figure 6.3, which tracks the public opinion polls up until the election[24].

We can examine the market perception of how probable a Democratic win was in the 2004 election. Figure 6.4 below depicts the IEM probabilities for the election. We can see that the probability of Kerry being elected throughout the whole period was almost always lower than 0.5, indicating that the market perceived it more likely that the election would be in favor of Bush.

[24]Data for the 2004 race was retrieved from Gallup (2008).

Figure 6.3: Gallup polls, 2004 election

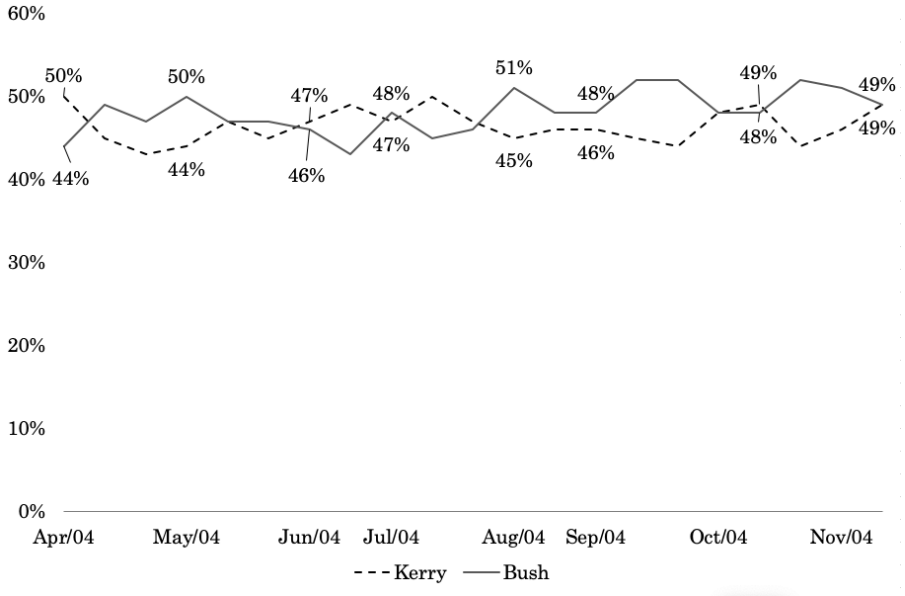
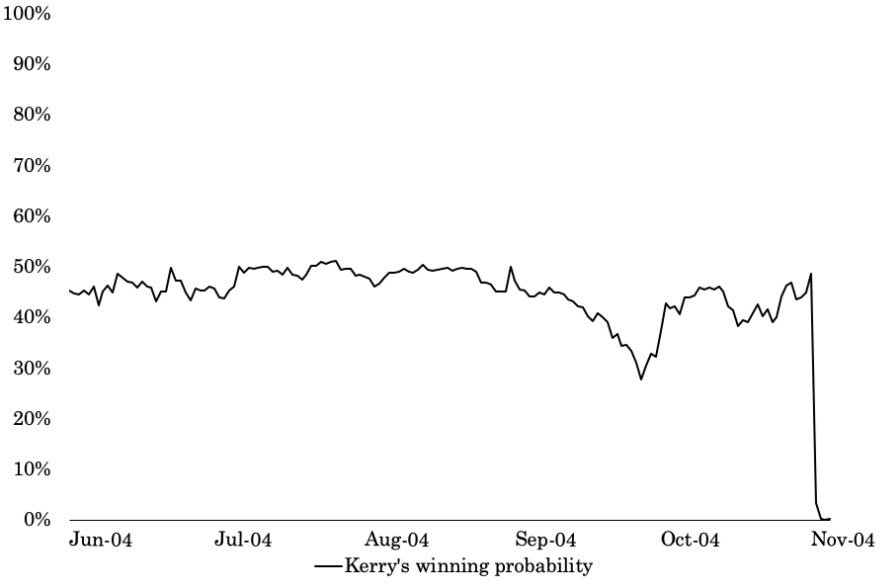
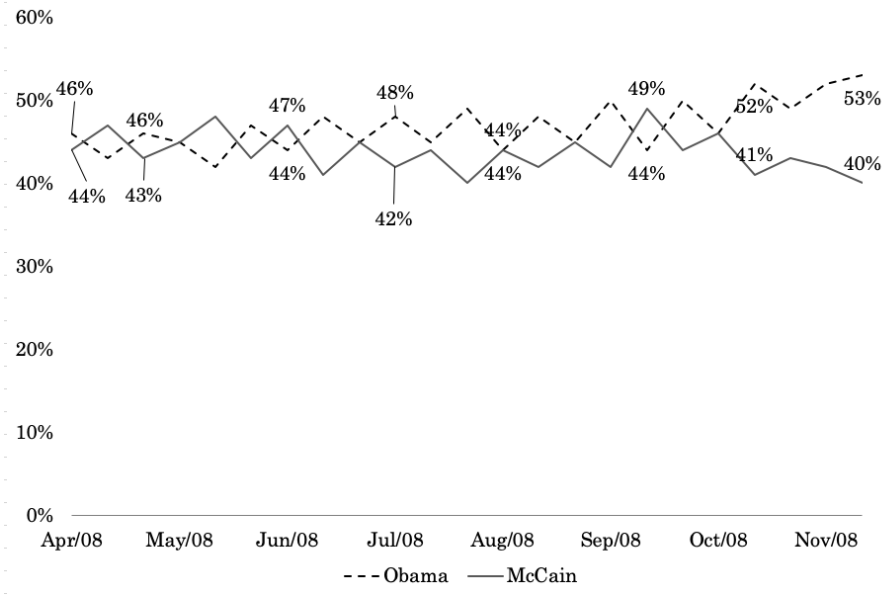


Figure 6.4: IEM probabilities, 2004 election



In 2008, as Election Day approached it became more apparent that Obama would be the winner[25]. In Figure 6.5 we can see that from October and onward, as the Election Day neared, the gap between the two candidates grew larger.

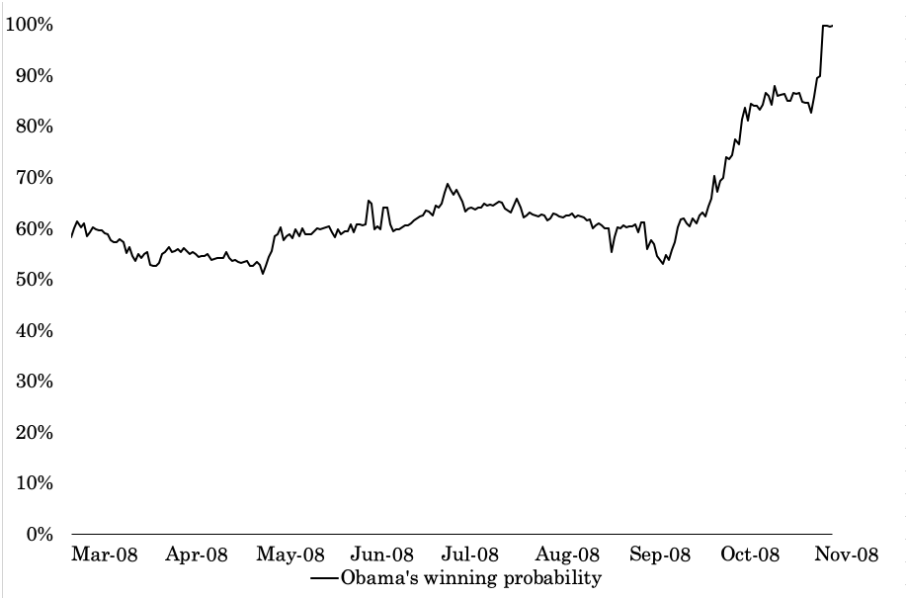
Figure 6.5: Gallup polls, 2008 election



We can additionally inspect the IEM probabilities for the same election. We notice that Obama's win was perceived very probable by the market, as the perceived probability of a Democratic, according to the Iowa Electronic Markets was almost always above 50%. This can be seen in Figure 6.6 below. Notice that from September and onward, as the Election Day approached, market participants updated their beliefs and the perceived probability of Obama winning began trending upwards, and just before the election itself, the market perceived it as extremely probable that the win would go to him.

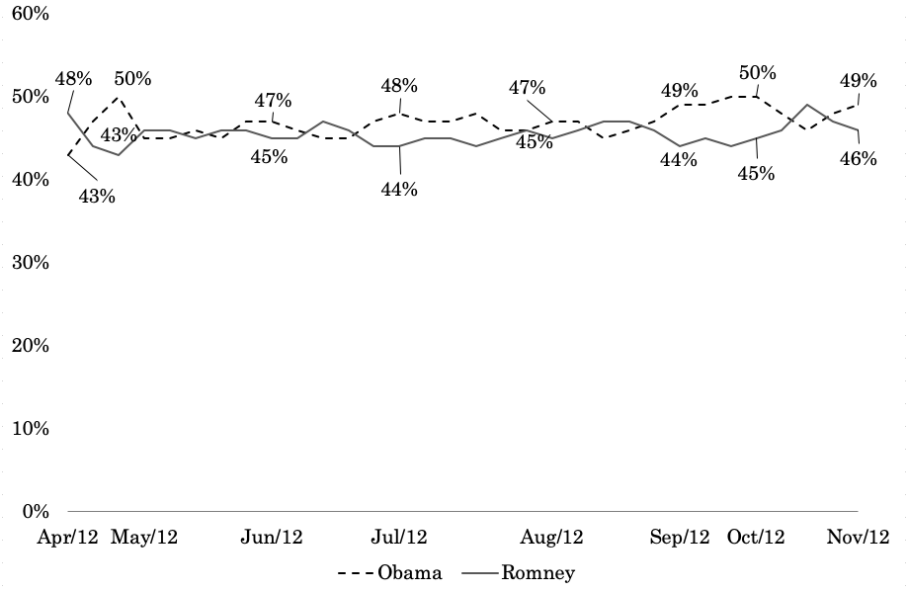
[25]Data for the 2008 race was retrieved from Gallup (2008).

Figure 6.6: IEM probabilities, 2008 election



For the 2012 election, according to the public opinion polls Obama was leading the race for the majority of the period, even though Romney's following was sometimes measured to be above Obama's[26]. This can be seen from Figure 6.7 below. The IEM probabilities show the same result.

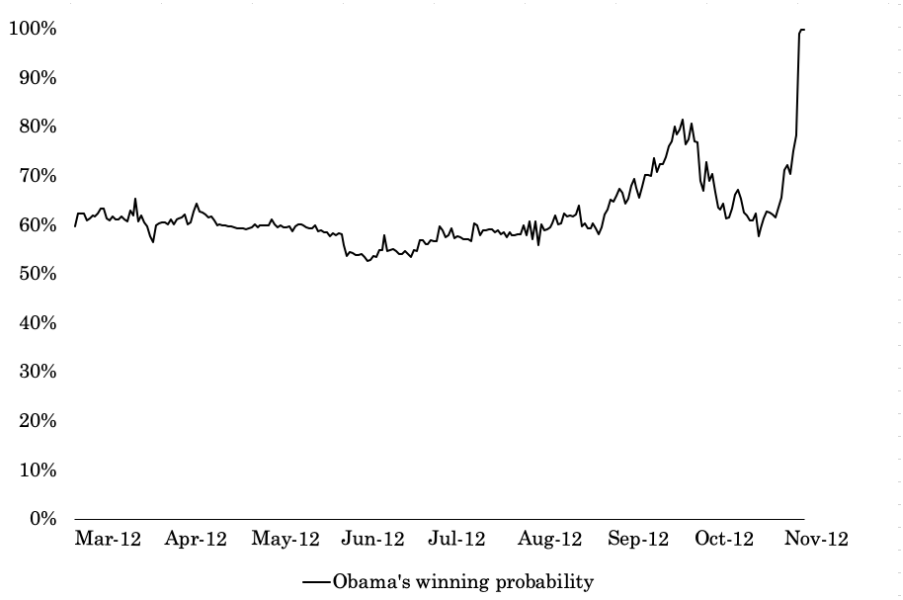
Figure 6.7: Gallup polls, 2012 election



[26]Data for the 2012 race was retrieved from Gallup (2012).

Obama was perceived as a likely winner in the 2012 election, as can be seen in Figure 6.8. The perceived probability of Obama winning the election was almost always above 60% according to the IEM probabilities. However, note the drop in perceived probability of Obama's re-election in October. As Election Day neared however, the market perceived it more probable that Obama would win the election, rather than Romney.

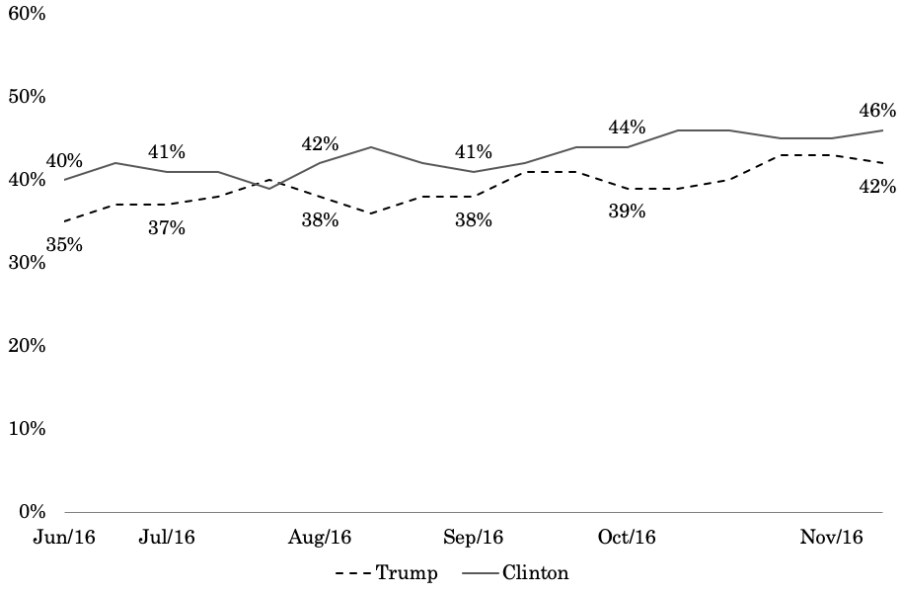
Figure 6.8: IEM probabilities, 2012 election



The 2016 election was a close one. Clinton was leading Trump in the polls throughout most of the campaign. Just prior to Election Day, she was leading Trump in the opinion polls[27]. This is shown in Figure 6.9. The IEM probabilities tell a similar story, as can be seen in Figure 6.10. The market perceived Clinton as a likely winner in the election, and the perceived probability of her being elected was quite high throughout most of the period, or above 60%. We notice a small drop in October as Election Day neared, but market participants later adjusted their expectations and Clinton was again perceived as a likely winner. Just prior to Election Day the probability of Clinton winning the election dropped substantially, to almost 30%, which in turn would indicate that Trump had a perceived probability of 70% of winning. This sharp drop was then followed by a

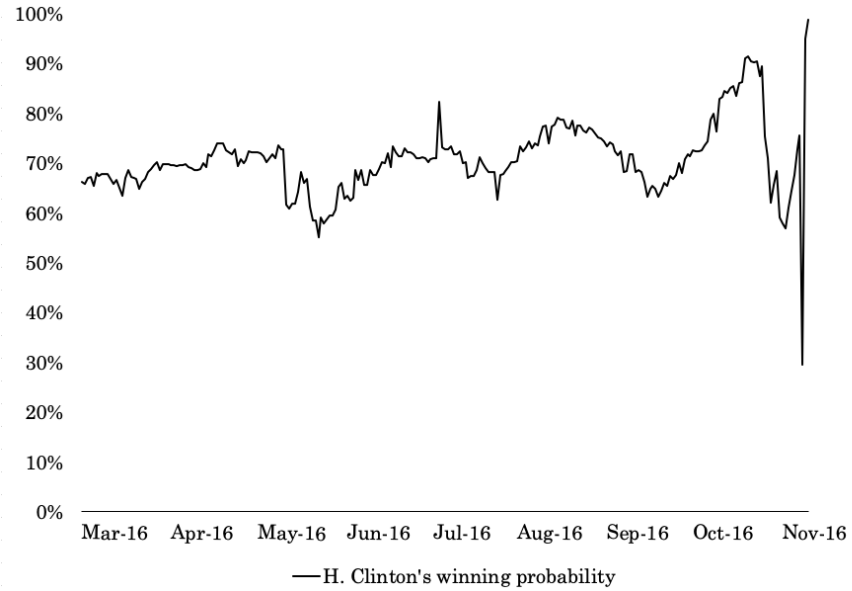
[27]Data for the 2016 race was retrieved from Wikipedia - The Free Encyclopedia (2016).

Figure 6.9: Gallup polls, 2016 election



sharp increase, and market participants in the Iowa Electronic Markets adjusted their expectations so that on Election Day the perceived probability of Clinton winning the election was almost 100%.

Figure 6.10: IEM probabilities, 2016 election



7. Methodology

In the following chapter we will direct our attention to the methodology used in this thesis to study the effect of the political elections on the stock market. We start off by describing preliminary tests used to get a first idea of how the portfolios behave around elections. We will then introduce a series of volatility models of the GARCH family and then we will go through the EGARCH model for volatility used in our analysis. Later on, we will define the steps required in the selection of our models. After that, an overview of the models used for studying the effect of political elections on the VIX will be given.

7.1 Preliminary tests

As a preliminary inspection of the behavior of each sector portfolio during our periods we conduct simple statistical tests on the mean excess returns and the variance of the excess returns. We are interested in comparing means and variance of excess returns in three periods (pre-election period, election period and post election period). We define the three periods. For each election, the period from the national convention up until 15 days after Election Day is our event window, the period which should capture market behavior during an election. As mentioned before, this period can differ in length depending on the election in question, as in some cases the National Conventions were held earlier than in other cases. We utilize the aforementioned event window (see chapter 5) which ranges from the day of the national convention, where both parties have announced their candidate, up until 15 days after Election Day. The post event window, which starts 16 days after Election Day and ends on Inauguration Day serves as our post election period in these tests.

We decided that the number of observations in the pre-election period should match the number of observations in the event window[1]. Therefore, for each election, the length of the pre-election period matches the length of the event window. We then proceed to check for differences in the mean excess returns and the variance of excess returns between periods. To test for differences in the mean, we utilize an independent sample t-test, where we assume that the population variances are equal to one another. We test the hypothesis that the difference in mean excess returns between the pre-election periods and the event window is zero. Additionally, we test the hypothesis that the difference in mean excess returns between the event window and the post event window is the same. The statistic of the test is calculated by using the following formula[2]

$$Z = \frac{\bar{r}_b - \bar{r}_d - D_0}{\sqrt{\frac{\sigma_b^2}{n_b} + \frac{\sigma_d^2}{n_d}}} \tag{7.1}$$

where $\bar{r}_b$ is the sample mean return in the pre-election period, with variance σ_b^2 , $\bar{r}_d$ is the sample mean return in the event window, with variance σ_d^2. The sample sizes are denoted as n_i, where i = [before, during]. The term D_0 represents the hypothesized mean difference, which is zero in our case.

Additionally, we test the hypothesis that the difference in mean excess returns between the event window and the post event window is the same. The statistic of the test is calculated using the following formula

$$Z = \frac{\bar{r}_d - \bar{r}_a - D_0}{\sqrt{\frac{\sigma_d^2}{n_d} + \frac{\sigma_a^2}{n_a}}} \tag{7.2}$$

where $\bar{r}_d$ is the sample mean return in the event window with variance σ_d^2, $\bar{r}_a$ is the sample mean return in the post event window with variance σ_a^2. Again, the sample sizes are denoted as n_i, where i = [during, after]. We run these tests for all portfolios during each election to get an idea of differences in mean returns around the election periods. If we reject the null hypothesis, that indicates that we have evidence to believe that there is a difference in mean excess returns between

[1] Utilizing the whole estimation period as a pre-election period in these tests can be misleading, as it contains over 500 observations.

[2] Following Özdemir (2016), page 161

periods. Note that we run two tailed tests, since we are interested in determining whether the mean difference is positive or negative[3].

For the inspection of the variance of excess returns we utilize an F-test, as the difference variance cannot be tested using a test that relies on a normal distribution. We utilize the same time periods. To test for a difference in the variance of excess returns between the pre-election period and the event window we compute the following ratio[4]

$$F = \frac{s_b^2}{s_d^2} \tag{7.3}$$

where s_b^2 is the sample variance of the excess returns in the pre-election period and s_d^2 is the sample variance of excess returns in the event window. Note that a ratio larger than one would indicate that the variance in the pre-election periods were larger than the variance in the event window[5]. We run the same test to check for a difference in the sample variance of excess returns between the event window and the post event window. The test statistic is the same, except the sample variance of the excess returns in the post event window is in the nominator of the ratio and the sample variance of the excess returns in the event window are in the denominator. A ratio larger than one would indicate that the sample variance in the event window is larger than the sample variance in the post event window[6].

7.2 Volatility models for Financial Time Series

It is well known that investors care about the volatility of assets returns (i.e. the variance). That is because, the higher the volatility of an asset, the higher is the risk associated to it. Moreover, the volatility of a stock is also very related to its performance since a rise in the stock price will lead to a decrease in its volatility, while the opposite happens when the stock price decreases. Therefore,

[3] Running one-tailed tests would allow us to be more sure of the sign of the difference, but as this is a preliminary inspection we decided to run two tailed tests and interpret results with caution

[4] According to Özdemir (2016), page 178

[5] To be able to conclude which variance is larger, a one-tailed test would be more appropriate, but as these tests are preliminary we will interpret them with caution

[6] Özdemir (2016), page 178.

for an investor it is fundamental to be able understand and forecast the behavior of the volatility of an asset.

7.2.1 ARCH model

A classical method to examine the conditional variance of a time series (e.g. stock return), is to use the well-known ARCH model introduced by Engle (1982). In particular, with this model, Engle allows us to model simultaneously the conditional mean (by using classical ARIMA models[7]) and the conditional variance of a time series. In order to understand the idea behind the ARCH modelling we will discuss an example of how a classical model for the conditional mean works, say ARMA (1,0) where the first term in the parenthesis indicates the number of AR (Auto Regressive) terms in the conditional mean equation, while the second term indicates the number of MA (Moving Average) terms in the same equation. The model specified can be written as follows:

$$y_t = \phi_0 + \beta y_{t-1} + \epsilon_t$$

$$E[y_t] = \phi_0/(1-\beta) \; and \; Var[y_t] = \sigma^2/(1-\beta^2)$$

$$since \; \epsilon_t \sim \; N(0, \sigma^2) \; and \; Cov(\epsilon_t, \epsilon_{t-i}) = 0 \; \forall \; t \neq t-i$$

It is straightforward to show that this constant variance is obtained by imposing the assumption that the variance of ϵ_t is constant for all t, meaning that $Var[\epsilon_t] = \sigma^2 \; \forall \; t$. This assumption, which states that the errors in the conditional mean equation are homoscedastic, is sometimes violated, especially when dealing with high-frequency (i.e. daily, hourly, etc.) financial time-series. Hence, we now assume that errors are heteroscedastic, meaning that their conditional variance can be expressed as follows:

$$\sigma_t^2 = \omega + \alpha_1 \epsilon_{t-1}^2 + \alpha_2 \epsilon_{t-2}^2 + ... + \alpha_p \epsilon_{t-p}^2 \tag{7.4}$$

So, if the above equation has terms $\alpha_{t-1}, ..., \alpha_{t-p}$ that do not equal to zero, then we call it an Autoregressive Conditional Heteroscedastic (ARCH) model, while if all α's are equal to 0 we are back

[7] Further information about ARIMA models can be found in Enders (2014a).

to the previous model with homoscedastic errors. Nevertheless, the ARCH equation defined above is not the best way to specify the conditional variance, hence we rewrite it with v_t as multiplicative disturbance:

$$\epsilon_t = v_t \sigma_t \tag{7.5}$$

Equation (7.5) allows us to derive the conditional mean and variance in a simpler manner. It is possible to show that the conditional variance of ϵ_t in (7.5) actually yields (7.4). Again, this indicates that conditional variance of the error terms is dependent on the realized past squared errors. A final remark related to the coefficients of the past squared errors has to be made in order to ensure the stability and the positiveness of the conditional variance, i.e. $0 < \alpha_{t-s} < 1 \ \forall s = 1, ..., q$ and $\omega > 0$.

7.2.2 GARCH model

A common extension of the classical ARCH approach seen in the previous section is the one presented by Bollerslev (1986) in which he introduced Generalized ARCH models (GARCH). In such models the conditional variance does not only depend on autoregressive components but also on moving average ones. This ARCH extension (GARCH) can be written as follows:

$$\epsilon_t = v_t \sqrt{\omega + \alpha_1 \epsilon_{t-1}^2 + ... + \alpha_p \epsilon_{t-p}^2 + \beta_1 \sigma_{t-1}^2 + ... + \beta_q \sigma_{t-q}^2} \tag{7.6}$$

where the term under the square root is σ_t:

$$\sigma_t^2 = \omega + \alpha_1 \epsilon_{t-1}^2 + ... + \alpha \epsilon_{t-p}^2 + \beta_1 \sigma_{t-1}^2 + ... + \beta_q \sigma_{t-q}^2 \tag{7.7}$$

Note that if all the β_i coefficients are equal to 0 $\forall i = 1, ..., q$, then we are back to the aforementioned ARCH(p) model, and again, if also the α_j are equal to 0 $\forall j = 1, ..., p$, the conditional variance becomes constant which means that we have homoscedastic errors. As we can see from (7.6) and (7.7) the disturbance in the model recall a classical ARMA model. This means that by looking at the residuals from an ARMA model we should observe similar pattern as in the actual series, depending on the order of the ARMA and the GARCH models. One of the key features of a GARCH

model is the *volatility clustering* behavior, which arises from the presence of ϵ_{t-1}^2 and σ_{t-1}^2 in the conditional variance equation. In other words, volatility clustering means that large values in ϵ_{t-1}^2 are followed by large values of ϵ_t^2. Moreover, the persistence, $\hat{P}$, of the model (i.e. the indicator of volatility clustering) can be seen directly from the sum of the α_j and β_i terms. This is different from the result we derived for the ARCH model where the persistency parameter was given only by summing up all the α_j. Finally, it is essential to mention that one of the main shortcomings of both ARCH and GARCH models is that negative and positive shocks impact the models in the same way, i.e. they assume that the variance of the model reacts in the same way to bad and good news.

7.2.3 EGARCH model

As pointed out in the last part of subsection 7.2.2, the main disadvantage of ARCH and GARCH models is their incapability of modeling the conditional variance in a way such that it reacts differently to bad and good news. This feature is considered to be extremely important when analyzing financial returns and was first examined by Black (1976) who noted that "a drop in the value of a firm will cause a negative return on its stock, and will usually increase the leverage of the stock. [...]. That rise in the debt-equity ratio will surely mean a rise in the volatility of the stock".
This asymmetry in the reaction to bad and good news is the so-called *leverage effect*. Furthermore, as suggested by Engle and NG (1993), the EGARCH model also allows big news to have larger impact than in a traditional GARCH model. Due to this, there has been need of creating a model which is able to capture such asymmetries and that is why the Exponential GARCH (EGARCH) model was developed. The aforementioned model for the conditional variance can be written as follows:

$$\log(\sigma_t^2) = \omega + \sum_{j=1}^{p}(\alpha_j \epsilon_{t-j} + \gamma_j(|\epsilon_{t-j}| - E|\epsilon_{t-j}|)) + \sum_{i=1}^{q} \beta_i \log(\sigma_{t-i}^2) \tag{7.8}$$

We can see that compared to the models specified in the previous sections that the EGARCH model appears more complicated. The parameters that attract our interest in (7.8) are:

- α_j which explains the *sign effect*
- β_i which explains the *persistence* of the errors
- γ_j which explains the *leverage effect* or *size effect*.

Again, differently from the previous models, we notice that the persistence of the model, $\hat{P}$, is only given by the sum of the β_i terms, hence in order to ensure a stable process we would need $\sum_{i=1}^{p} \beta_i < 1$[8]. We have defined γ as the *leverage effect* and as this coefficient is typically negative, it means that positive return shocks generate less volatility than negative return shocks, all else being equal.

We previously defined the ability to handle asymmetric effects on the conditional variance as one of the main features of EGARCH models, but this is not the only characteristic that can make EGARCH modelling superior to the classical GARCH one. In fact, another relevant feature of EGARCH, as we have seen in (7.8), is its formulation in logarithmic terms. This allows us not to impose any positivity restriction on the parameters of the equation (which we had to do for ARCH and GARCH models), since the conditional variance will be now built in a way that it will be positive regardless.

7.3 Model construction for portfolio's returns

After having defined different methodologies used to estimate the conditional variance, we will now go through the methodology we used to estimate our models. As we have mentioned, our scope is to define whether the uncertainty regarding the election of the next President causes abnormal behavior both in the conditional mean and especially in the conditional variance of our series. Therefore, for each election from 2000 to 2016 we estimate a model in which we estimate the conditional mean and the conditional variance simultaneously. Hence, the model for the conditional mean is written as follows:

$$r_t = \phi_0 + \phi_1 r_{t-1} + \theta_1 \epsilon_{t-1} + EuStoxx_t + \lambda_1 D.ElPeriod_t + \epsilon_t \tag{7.9}$$

[8] This discussion follows the idea in Ghalanos (2018).

while for the conditional variance we have:

$$\log(\sigma_t^2) = \omega + \alpha_1 \epsilon_{t-1} + \gamma_1(|\epsilon_{t-1}| - E|\epsilon_{t-1}|)) + \beta_1 \log(\sigma_{t-1}^2) + \lambda_2 D.ElPeriod_t \tag{7.10}$$

Therefore, we have defined our conditional mean equation so that it consists of an ARMA (1,1) plus two external regressors, namely:

- $EuStoxx_t$, which is the return of the Euro stoxx 50 at time t
- $D.ElPeriod_t$, which is a dummy variable taking 1 from the day that both the Presidential candidates have been announced at their party convention, until fifteen days after the election day, and 0 elsewhere[9].

For the conditional variance, the model used is an EGARCH (1,1) plus one external regressor, which is the same dummy variable as used in the conditional mean equation.

It is worth mentioning that this model will be the same for all the portfolios and for all the elections in our analysis. We decided to keep the same model for each election, and especially for each portfolio because if we would have estimated singular models for each combination of election and portfolio we would have ended up with sixty (60) different specifications of models which would have been tedious, and it would have not allowed us to make a good comparison of the reactions of the different portfolios to an election[10].

Additionally the decision to use an ARMA (1,1) is due to us wanting to use the most parsimonious model possible, that still allowed us to draw interesting conclusions with respect to our findings. Following the literature, we started out with an ARMA (0,0) which would have been reasonable, as we are dealing with financial assets and we should not be able to predict the future value of them by knowing their past values. However, when estimating such a model, the estimates were not totally consistent, as we observed auto-correlation in the residuals (which is mostly solved by using an ARMA(1,1)). Moreover, the choice of using the Euro stoxx 50 as an external control variable is

[9] For further information about the construction please refer to chapter 5.

[10] However, this might create inconsistent estimates or models which are not properly fitted.

due to the reason that we required an index which was not directly influenced by the U.S. elections. If we were to use the S&P500 index, the estimates of the coefficients on our dummy variable would likely have been insignificant since the S&P500 could have captured most of the variability of the model.

It has to be noticed that the models in (7.9) and (7.10) do not allow us to find an answer to the hypothesis defined in chapter 4. Hence, by examining these models we hope to get a general overview of the effect of the election during the period on the mean and the volatility of the excess returns.

Finally, even though we know that the choice of the election period is arbitrary, since we did not find any consistency in the literature[11], we decided to have it start on the day in which the last National Convention is held, as we believe that from that day onward the real Presidential race should start, as voters know exactly which two candidates are running for President and what their campaigns entail. We decided to end the "election period" fifteen days[12] after the election day, since we expect the market to adjust rapidly to the new information once the election's outcome is known, and the official result is not released until several days after the election day.

7.4 Model selection for portfolio's returns

We define the model built in section 7.3 as our baseline. However, to ensure that our model is consistent, we compare it against different models. We perform an initial check on the distribution of the standardized residuals, of each portfolio in all estimation windows, from our specified model. We utilize a Jarque-Bera test, which tests the null hypothesis that the residuals are normally distributed. The results and can be found in the Appendix in section A.3, where we report the p-values of the test. We are aware that using alternative distributions for the residuals might

[11] Bialkowski et al. (2007) studied cumulative abnormal returns variance in the 51 (-25,+25) days surrounding the election day. Pantzalis et al. (2000) studied cumulative abnormal returns in the 7 days around the election (-2,+4). Santa-Clara and Valkanov (2003) used different windows to analyse the behavior of cumulative abnormal returns around the election day.

[12] Be noted that the fifteen day period also includes weekends and festivities. Hence, the actual trading days after the election, are usually around 10-11.

yield better models. First, we build a second model which is the same as the one derived in (7.9) and (7.10) but now we assume that $v_t \sim \ t - Student$. We estimate this model, as it has been found in the literature that daily and high-frequency financial returns can suffer from skewed and leptokurtic[13] conditional distribution (see e.g. Wang et al. (2001)). Several information criteria can be used to determine which model provides the best fit. The purpose of the information criteria is to help the researcher select the best model, while being cautious of over-fitting the models with too many variables. The criterion used throughout this thesis is the *Bayesian Information Criterion* (BIC), as the BIC has been shown to select a more parsimonious models than other information criterion[14]. After having selected under which error distribution the model performs better we decide to decompose the dummy $D.ElPeriod$ into two dummies:

- $D.before_t$, which is a dummy variable taking 1 from the day that both the Presidential candidates have been announced at their party convention, until the day of the election, and 0 elsewhere
- $D.after_t$, which is a dummy variable taking 1 during the fifteen days after the election day, and 0 elsewhere.

We do this, as we hope to capture the effects of uncertainty regarding election outcome in the period leading up to the election, which is measured by $(D.before)$. We additionally hope to capture the effect of the uncertainty being resolved, as investors adjust their expectations after the outcome has been revealed, which is measured by $(D.after)$. Hence, the model specified in section 7.3 becomes:

$$r_t = \phi_0 + \phi_1 r_{t-1} + \theta_1 \epsilon_{t-1} + EuStoxx_t + \lambda_{1,1} D.before_t + \lambda_{2,1} D.after_t + \epsilon_t \tag{7.11}$$

while for the conditional variance we have:

$$\log(\sigma_t^2) = \omega + \alpha_1 \epsilon_{t-1} + \gamma_1(|\epsilon_{t-1}| - E|\epsilon_{t-1}|)) + \beta_1 \log(\sigma_{t-1}^2) + \lambda_{1,2} D.before_t + \lambda_{2,2} D.after_t \tag{7.12}$$

[13] Even though these problems might also be solved by an ordinary ARCH-GARCH procedure, this might not be enough.

[14] More information on model selection criteria can be found Enders (2014a).

but now the distribution of v_t[15] depends on the selection from the previous step.

The decomposition of the dummy $D.ElPeriod$ into $D.before$ and $D.after$ in (7.11) and (7.12) allows us to analyse hypothesis 1,2 (via $\lambda_{1,1}$ and $\lambda_{2,1}$) and hypothesis 3,4 (via $\lambda_{2,1}$ and $\lambda_{2,2}$) respectively[16].

7.5 Detecting structural breaks in the IEM market

As a part of our analysis, since we are interested in modelling and understanding the behavior of market participants during elections (hypothesis 6), we also want to see how the voters behave in such periods. To analyse their behavior we decided to take a closer look at the IEM probabilities[17], which can provide an indication about the perception that the electors have at a given point in time regarding the election's winner. We want to remind the reader that the probabilities used in this part of the analysis are those defined in chapter 5, and are derived from the Iowa Electronic Market (IEM). Our scope is to examine whether the probabilities on the election outcomes presented any structural break, and if such breaks occurred after major announcements by either candidate. By doing so, we are able to determine whether a change in such probabilities, and thus in investors' expectations about the future President, drastically alter after some events or whether they rather change gradually. A structural break is defined as a point in the time where the time series drastically changes its path. Detecting (and if possible, predicting) structural breaks is important since such breaks cause relevant changes in the mean (in the size and sign) of the parameters of the process that generates the series, possibly causing large forecasting errors and hence unreliability of the model.

7.5.1 Chow test and Hansen-Quandt test

In this subsection we present two classical methods with which we can detect the presence of a structural break in a series[18].

[15] It has to be noted that in order to see the v_t term, we would need to rewrite the model with it as a multiplicative disturbance as above.

[16] We remind the reader that these hypothesis have been defined in chapter 4.

[17] These probabilities have been defined in chapter 5.

[18] As discussed Enders (2014b).

On a general note, the Chow test allows us to determine whether the parameters of a model is stable or not. Hence, assuming the estimation of an ARMA model, the Chow can tell us whether after a certain date, the parameter of the estimated model alters significantly. Therefore, one way to perform the Chow test is to divide the dataset in two subsets. Assuming a length of the dataset equal to T we define the first subset as the one that goes from 1 to t_{event}, and the second subset the one that goes from $t_{event} + 1$ to T. We can then estimate two (identical) models for the different sub-samples and then construct the F statistic to test the equality of the parameters in the two models. In order to test the equality of the parameters in the two regressions we should compute the following:

$$\frac{(SSR - SSR_1 - SSR_2)/n}{(SSR_1 + SSR_2)/(T - 2n)} \tag{7.13}$$

where n is the sum of the parameters to be estimated in each regression and SSR is the sum of squared residuals.

Hence, the closer the sum of SSR_1 and SSR_2 gets to SSR the less binding is the restriction that the two models are equal.

Another way to test for structural breaks is to create a dummy variable that takes 1 from $t_{event} + 1$ to T and evaluate the following model:

$$y_t = \phi_0 + \phi_1 y_{t-1} + a_0 * D_t + a_1 D_t y_{t-1} + \epsilon_t \tag{7.14}$$

By doing this, we are able to capture possible change in the parameters by looking at significance of a_0 and a_1 individually and jointly.

However, the Chow test presents some shortcomings:

- we need to have enough data to create two separate sub-samples
- the models of the two sub-samples need to have the same variance (which has to be tested)
- we need to know the *timing* of the structural break

Thus, since it is not always straightforward to find whether a structural break occurred, we can try to test the presence of *endogenous breaks*. An endogenous break is defined as a break occurring at a

date that is not prespecified. The presence of such breaks can be tested by using the Hansen-Quandt procedure in which we basically perform a Chow test for every possible break in our time-series. This is done by trimming the dataset such that it includes at least 10% of the data in one of the two sub-samples, and then by selecting the structural break providing the largest F-statistic[19].

7.5.2 Structural break selection

For our analysis we decided to use the Hansen-Quandt procedure. This is motivated by the fact that IEM sometimes open more than ten months prior to the elections which would have made the research of relevant announcements that could have negatively or positively impacted the investors difficult. Hence, we look for potential endogenous breaks and try to connect them with "bold" statements by the potential candidates or with announcements or occurrences that could have acted in favor of one party by examining U.S. main newspapers. It has to be noted that due to the non stationarity of the price series of the IEM futures, we use the series of their log-returns to ensure stationarity. This procedure allows us to examine hypothesis 6, defined in chapter 4.

7.6 Difference in difference regression

In the following section we will describe the so-called difference-in-difference (DID) regression estimation which will help us in the analysis later presented in section 7.7 regarding the behavior of the VIX around the election period. DID is a quasi-experimental design with the scope of estimating a causal effect. This methodology is often applied to panel data analysis but in our study we will apply it to time-series data[20]. However, we will begin by explaining the classical setup and later on we will define how we move away from the classical approach. In the basic model, the outcomes for the dependent variable are observed for two groups for two (or more) time periods, in which one of the groups is exposed to the treatment in the second period but not in the first (i.e. *treatment group*), and the other is not exposed to the treatment in either periods (i.e. *control group*). Thus,

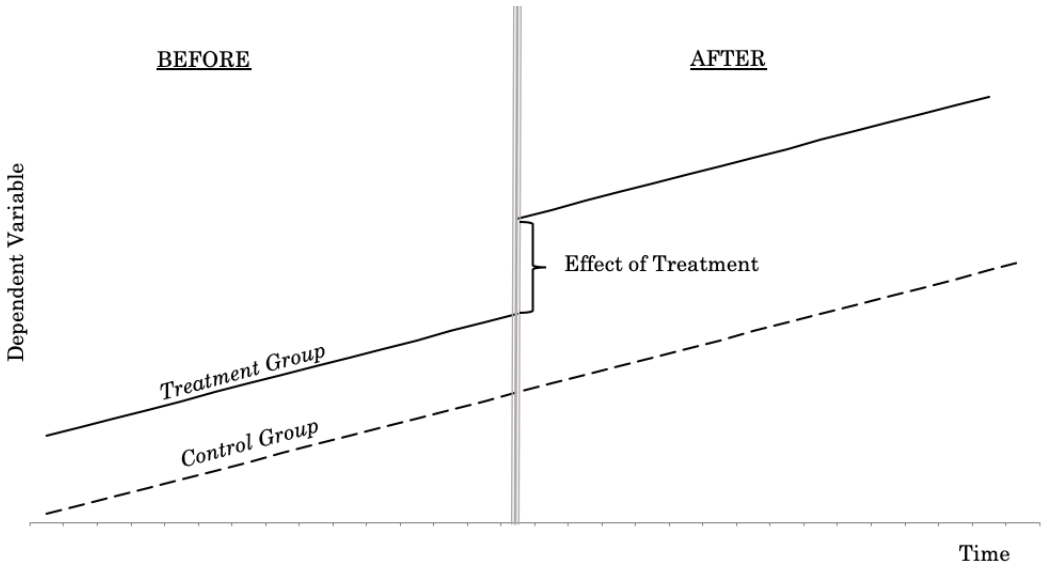
[19] In order to assess the F-statistic, simulated critical values are needed. See Andrews (2006).
[20] For further details on the DID estimation see Wooldridge (2012).

the classical methodology that applies to panel data, consists in a model that writes as follows:

$$y_{i,t} = \beta_0 + \beta_1 D_{i,t} + \beta_2 T_{i,t} + \beta_3 D_{i,t} \cdot T_{i,t} + other.factors + \epsilon_{i,t} \tag{7.15}$$

where $T_{i,t}$ is the dummy variable indicating the treatment group and $D_{i,t}$ is the time dummy that takes value equal to 1 in period 2 and 0 elsewhere. Hence, what we want to capture can be summarized in Figure 7.1 below:

Figure 7.1: DID estimation



What Figure 7.1 shows, is that the group subject to a treatment should experience a "jump" (a deviation) from its path. If the reason for this jump is only due to the treatment to which the group has been exposed, then, as shown in Figure 7.1, we should not observe similar deviations in the control group.

7.7 Modelling implied volatility

As mentioned before, we try to report a similar approach in a time-series context, in which we do not have a proper treatment and control group, but we still want to measure the effect of a certain event/policy on our dependent variable. Thus, what we want to inspect is a deviation of the series

from its path (as shown in Figure 7.1, due to such an event. Our event is the Presidential election. Since our main interest is to examine particular deviations from the equilibrium of the volatility in the market due to the elections, we estimate the following model:

$$VIX_t = \beta_0 + \beta_1 WinProbDem_t + \beta_2 WinUnc_t + \beta_3 D.before_t + \beta_4 D.after_t + \beta_5 EuStoxx_t + \beta_6 + \epsilon_t \tag{7.16}$$

where $D.before_t$ and $D.after_t$ are the dummy variables that already appeared in (7.11) and (7.10), while the variables $WinProbDem_t$ and $WinUnc_t$ have been defined in chapter 5. It has to be noted that all the variables, except for the dummies, are defined in log-returns. This allows us to determine the percentage change in the VIX due a percentage change in the probability and uncertainty measures. Rather than exploring whether the VIX is high when the uncertainty in the market is high, we want to determine whether a large change in the uncertainty measure will also lead to a large change in the volatility measure. Moreover, instead of starting with only one dummy variable defining the election period as we did in equations Equation 7.9 and Equation 7.10, we immediately decompose the dummy variable in two, allowing us to determine whether there is an immediate change in volatility right after the election outcome becomes known. The model estimated is very similar to the one in Goodell and Vähämaa (2013), although we believe that the two models present some major differences. The main interest in this regression comes from the size and the sign (and obviously the significance) of the coefficient β_2 and β_3. β_2 will capture if and how much the percentage change in the VIX is impacted by a percentage change in the winning uncertainty. $beta_3$, at the same time, will determine whether there are changes in the VIX from its path, the closer we get to the election. Although our main focus is on the coefficients just mentioned, an eye of regard will be given to the coefficient β_1 to determine if the market cares about the party of the winner, or is rather interested in predicting the winner to immediately adjust its expectations. Notice that the variable $EuStoxx$ will serve as our control variable, which help us to conduct a model similar to the one presented in the DID estimation.

Furthermore, in the EGARCH modelling we defined $D.before_t$ so that it assumes values equal to

1 starting on the day of the last National Convention, now we also try to analyse the sensitivity of this decision, by allowing $D.before_t$ to take values equal to 1 also forty-five, thirty and fifteen days before the election day. Our reason for doing so is that it is to better capture the window in which the market becomes more volatile under the election period. We will end up with three additional regressions:

$$VIX_t = \beta_{0,45} + \beta_{1,45} WinProbDem_t + \beta_2 WinUnc_t + \beta_{3,45} D.before45_t + \beta_{4,45} D.after_t + \beta_{5,45} EuStoxx_t + \epsilon_t \quad (7.17)$$

$$VIX_t = \beta_{0,30} + \beta_{1,30} WinProbDem_t + \beta_{2,30} WinUnc_t + \beta_{3,30} D.before30_t + \beta_{4,30} D.after_t + \beta_{5,30} EuStoxx_t + \epsilon_t \quad (7.18)$$

$$VIX_t = \beta_{0,15} + \beta_{1,15} WinProbDem_t + \beta_{2,15} WinUnc_t + \beta_{3,15} D.before15_t + \beta_{4,15} D.after_t + \beta_{5,15} EuStoxx_t + \epsilon_t \quad (7.19)$$

Finally, we decided to decompose the terms in (7.16), to determine the size and the significance of the coefficient β_3 under each President. Therefore, we will have $\beta_{3,1}, \beta_{3,2}, ..., \beta_{3,5}$, and also $\beta_{4,1}, \beta_{4,2}, ..., \beta_{4,5}$, where each coefficient determines whether there was a drastic change in our dependent variable before and after the election for each individual President. Once again, (7.16), (7.17), (7.18) and (7.19) allow us to examine hypothesis 3,4 (via β_3, $\beta_{3,45}$, $\beta_{3,30}$, $\beta_{3,15}$ for the primer hypothesis and β_4, $\beta_{4,45}$, $\beta_{4,30}$ and $\beta_{4,15}$ for the latter) and hypothesis 5 (via β_2,$\beta_{2,45}$,$\beta_{2,30}$ and $\beta_{2,15}$).

8. Results and Discussion

In this section we will go through the results of our analysis. Where our results allow, we will try to shed some light on the relation between politics and financial markets.

8.1 Preliminary results

To examine whether or not mean returns differ in election periods we performed independent sample t-tests[1] where we test the null hypothesis that the mean excess returns in the pre-election periods does not differ from the mean excess returns in the event window. We perform the same test for the mean excess returns in the event window against the mean excess returns in the post event window. We conduct a similar test for the variance of the excess returns, where we tested whether the variance of the returns differs during the event window compared to the pre-election period. We additionally examined whether the variance of the returns in the event window differs from the variance of the returns in the post event window.

The results for the tests in the differences in the mean of excess returns can be found in Figure A.9 in the Appendix. Very few differences in mean excess returns are significantly different from zero at any conventional significance level. Those that are measured as being significantly different from each other are not the ones that we expected, based on the candidate's election promises, party financing or industry partisanship. For the 2008 election several portfolios show differences in excess returns between periods, so that the mean excess returns in the event window are less than the mean excess returns in the pre-election period. Mean excess returns in the event window are additionally larger than the mean excess return in the post event window. This is what we could have expected,

[1] Equal variances between populations are assumed.

as in the fall of 2008 the financial crisis was hitting the markets. Therefore, the preliminary test of the mean excess returns around election periods does not provide us with any solid findings. The preliminary inspection of the variance between the periods does not provide any solid results either. From Figure A.10 in the Appendix we see that while some portfolios exhibit differences in the variance of excess returns between periods, they are not the portfolios which we would have expected to be affected, based on the discussions during the campaigns, party financing or industry partisanship. Notably, the 2008 election shows that during the pre-election period the variance of excess returns is significantly lower than the variance of excess returns in the event window (as the financial crisis was starting). However, the 2016 election shows some significant differences in the variance of excess returns during the pre-election period compared to the variance of excess returns in the event window. Seven out of twelve portfolios show a significant difference in the variance of excess returns between the two periods, but these differences are not as we would have expected. Note that in all cases, the ratio between the variance in the pre-election period and the event window is larger than one, indicating that in the pre-election period the variance of excess returns was larger than in the event window. The magnitude of these ratios might be worrisome, as it contradicts what we would expect according to our theory as we discussed in chapter 4. However, in 2015 and 2016 global stock markets were on their shakiest footing in years, according to Randall and Gaffen (2016), which might explain why these findings contradict our theory.

These preliminary inspections of mean excess returns and the variance of excess returns during election periods do not provide us with any solid, concise findings. In the next section we will attempt to model the conditional mean of excess returns and the conditional variance of excess returns simultaneously, to see whether we can catch some jumps in the processes around election days.

8.2 EGARCH procedure results

In the following section we discuss the recorded results from the EGARCH modelling. We will first present the results for the model selection process implemented, after which we will go through the results of the volatility modelling under the selected model.

8.2.1 Model selection

As mentioned before in section 7.4, we need to determine which model to use in terms of errors distribution. We do so by comparing information criteria (IC) of the models. Hence, to determine the underlying distribution of the error terms of the model we implement the EGARCH procedure for each election and portfolio as stated in section 7.3 with both Normally and Student-t distributed errors. By examining the results of both models we can see which model is selected by the BIC for each election and each portfolio[2]. The results of BIC comparisons can be found in Figure A.11 in the Appendix.

For the 2000 election the BIC indicates that a Student-t distribution is more appropriate than a Normal distribution for the majority of the portfolios (9 out of 12 portfolios have a superior IC under Student-t errors distribution). The results for the 2004 election are similar, as the BIC selects a model with Student-t distributed errors for 7 out of 12 portfolios. For the 2008 election a Student-t distribution is again more appropriate for the underlying error distribution, as the BIC prefers it over a Normal distribution for 9 out of 12 portfolios. Once again, for the 2012 election a Student-t distribution is the preferred one over a Normal distribution, as the BIC selects it for 11 out of 12 portfolios. Finally, for the 2016 election, the BIC selects a Student-t distribution as the underlying error distribution instead of a Normal distribution for 10 out of 12 portfolios. The results from this exercise indicate that for the majority of models an underlying t-distribution for the error terms is more appropriate than a Normal distribution, as the information criterion we selected (BIC) chooses it for the majority of portfolios in each election. To remain consistent, we use this distribution as

[2]Please note that the model selection is done by comparing the models with one dummy defining the election period. In the next step, a two dummy model will be implemented.

the one applied on all further models involving the EGARCH modelling.

These results are not surprising, since the underlying error distribution of financial returns is not always best described with a Normal distribution. A Student-t distribution which has thicker tails, and therefore more probable outcomes in the tails of the distribution is often considered more appropriate for financial returns. Platen (2008) found that the Student-t distribution with the appropriate number of degrees of freedom to be the typical estimated log-return distribution of stock indices, as the distribution allows more probability in "extreme" outcomes that lie in the tail of the distribution.

8.2.2 EGARCH results for individual elections

For the EGARCH models on each portfolios and all elections, our coefficients of interest are the coefficients on the variable $D.ElPeriod_t$, as specified in equation (7.9) and (7.10). Note that traditional residual diagnostics are performed, as we check them for the presence of autocorrelation and heteroskedasticity. The results from these diagnostic checks can be found in the Appendix, under Figure A.14 and Figure A.15. Based on these checks we find that our residuals do not suffer greatly from autocorrelation nor heteroskedasticity, and therefore we continue with our analysis.

Remember that the variable $D.ElPeriod_t$ takes the value 1 from the day that both Presidential candidates have been announced until fifteen days after the election has taken place, and 0 otherwise. We remind the reader that, on average, we expect excess return during the election period to be larger than the excess returns before or after the election period[3]. Therefore, we expect the sign of the coefficient to be positive. As we have discussed before, we expect volatility in the election period to be larger than the volatility in the period before and after the election period. Therefore, we expect the coefficient in the variance equation to be positive as well. Figure A.12 and Figure A.13 in the Appendix show the results for the EGARCH estimates for each election and each portfolio when one dummy is used to capture the effect over the whole election period.

[3]The pre-election period is intended as the period going from post-midterm Election Day to the day before the National Convention. The post-election period is the period going from the sixteenth day after the Election Day to the Presidential inauguration day.

The changes in excess returns during the election periods do not show what we expected. The coefficient of interest is mostly non-significantly different from 0 in all the elections examined, with the exception of the 2008 election, where the changes in excess returns during the election period are negative for all 12 portfolios. This is not surprising, as the election period in 2008 overlaps with the financial crisis in 2008. For other elections the changes in excess returns on the portfolios during the election period are mostly insignificant, and in those cases where they are significant they are negative, which is the opposite of what we expected. Note that in the 2012 election, the coefficient on the variable $D.ElPeriod_t$ is significant for five out of twelve portfolios, and it is negative in all five cases. This can be interpreted so that for the portfolios Non Durables, Chemicals, Business Equipments, Telecommunications and Shops the excess returns during the election period were lower than in the overall estimation period. For the 2016 election the coefficient is significant for four out of twelve portfolios, and negative in three cases. This indicates that during the 2016 election the excess returns for the Non Durables, Shops and Healthcare portfolios were lower than their long-run mean, but higher for the Energy portfolio. The results for the variance coefficient are not strong either, as the coefficient is statistically non-different from 0 in most cases. Once again, for the 2008 election there seems to be increased volatility during the election period. The coefficient is most likely capturing the effect of the financial crisis. These results mostly reject our hypotheses and our thoughts previously defined.

To further analyze the behavior of the sector portfolios and to better understand the controversial results obtained before, we split the event window into two periods[4]. Now we can see changes in the excess returns and volatility of returns of each portfolio before a given election and after it. This allows us to test hypothesis 1,2,3 and 4 in a more precise manner. As we have discussed before, we expect there to be no change in the excess returns before the election (hypothesis 1), as market participants are constantly updating their beliefs regarding what will happen in the election. However, after the election we expect there to be a change in the mean returns (if the outcome was not totally

[4]As explained in section 7.3 we decompose the dummy $D.ElPeriod$ into $D.before$ and $D.after$. For further explanation about their meaning please refer to chapter 5.

expected), as the uncertainty of the outcome has been resolved (hypothesis 2). We are interested in the signs of these effects, as the evidence from the literature indicates that excess returns are higher under Democratic presidencies than under Republican presidencies, as found by Santa-Clara and Valkanov (2003). For the volatility of excess returns, we expect to observe an increase in it during the period leading up to the election, and no or small effects after the election, as we expect the uncertainty associated with the election outcome to affect the volatility of returns during the election period (hypothesis 3), but after the Election Day the uncertainty is resolved and we expect the volatility to return to its long-run path (hypothesis 4).

The results from the EGARCH procedure with the decomposed election dummy variables can be seen in Figure 8.1 and Figure 8.2. The changes in the mean of excess returns are not as we expected. For the 2000 election the results indicate that for the Non Durables, Utilities, Money and Other portfolios, changes in the excess returns are statistically significant in the period before the election. In three out of four cases the excess returns are larger in the period before the election, compared to other periods. However in the period after the election the Energy, Telecommunications, Money and Other portfolios exhibit a change in excess returns that are statistically significant, but the sign of these changes does not follow a common direction. The analysis of the variance for the 2000 election indicates that only one portfolio shows a statistically significant decrease in variance after the election, the Energy portfolio. Other portfolios do not show any change in variance, neither before or after the election.

For the 2004 election we find that two portfolios exhibit a statistically significant change in excess returns before the election (Chemicals and Healthcare). In both cases the change in excess returns is negative. Two portfolios show a statistically significant change in excess returns after the election (Manufacturing and Other). In both cases, the change in excess returns is positive, which is what we expected. The analysis of the volatility in the model indicates that three portfolios show a statistically significant change in variance in the period leading up to the election (Business Equipment, Utilities, Other). The results indicate that the volatility decreases for the Business Equipment and

Other portfolios, whereas it increases for the Utilities portfolio. Four portfolios show a change in variance in the period after the election (Durables, Energy, Healthcare and others). The effect was negative, indicating a decrease in volatility in all cases, with the exception of the Energy portfolio, which depicts an increase in volatility in the period after the election.

The 2008 election is a special case, as it takes place at the same time as the financial crisis. Four portfolios show a significant decrease in excess returns before the election (Manufacturing, Business Equipment, Telecommunications and Utilities). One portfolio (Other) shows a significant decrease in excess returns during the 15 days after the election. The volatility increases for almost all portfolios both before and after the election, but this was expected, due to the climate in financial markets at the time.

In the period leading up to the 2012 election three portfolios (Non Durables, Business Equipment and Shops) show a statistically significant decrease in excess returns. These changes are significant at the common significance levels. Two portfolios show a statistically significant decrease in excess returns during the 15 days after the election, the Telecommunications and Shops portfolio. No portfolio shows a significant change in volatility in the period leading up to the election nor the period after the election.

The results for the 2016 election indicate that four portfolios (Non Durables, Telecommunication, Shops and Healthcare) show a statistically significant decrease in excess returns in the period leading up to the election. However, six portfolios show a statistically significant increase in excess returns during the 15 days after the election. These portfolios are Durables, Manufacturing, Energy. Telecommunications, Shops, Healthcare, Money and Other. Only one portfolio shows a significant change in volatility in the period after the election (Shops). The effect is negative, indicating a decrease in volatility of the portfolio.

These results are not as strong as we would have liked. Only a few portfolios exhibit a changes in excess returns and volatility. Notice that some portfolios show a change in excess returns more often than other, namely the Telecommunications, Business Equipment, Utilities and Other portfolios.

Remember that we expected the Utilities portfolio to be mostly unaffected by the elections and the uncertainty associated with them. The Utilities sector is composed of firms that are generally considered a vital part of society, and changes in government should not affect the sector to a large extent. Seeing changes in the excess returns of the portfolio was not expected. The results on the decomposition of the dummy in $D.before$ and $D.after$ can be found in Figure 8.1 and Figure 8.2.

Figure 8.1: EGARCH coefficients for each portfolio in each election (2000-2004-2008)

2000, 2 dummies		*Portfolios*											
	Coefficient	*NoDur*	*Durbl*	*Manuf*	*Enrgy*	*Chems*	*BusEq*	*Telcm*	*Utils*	*Shops*	*Hlth*	*Money*	*Other*
Conditional mean	μ	-0.045	-0.072	0.026***	-0.035	-0.028	0.056	0.031	-0.047***	-0.011	0.003	-0.061***	-0.015***
	r_{t-1}	0.702***	-0.377***	0.97***	0.784***	0.954***	-0.064	0.616***	0.291***	0.812***	-0.429**	0.37***	0.973***
	ϵ_{t-1}	-0.747***	0.24***	-1***	-0.855***	-0.971***	-0.067	-0.716***	-0.272***	-0.871***	0.513***	-0.451***	-1***
	EuStoxx	0.081***	0.33***	0.342***	0.145***	0.142***	0.662***	0.401***	0.015*	0.37***	0.223***	0.387***	0.348***
	D.before	0.107*	0.039	-0.052	0.127	0.038	-0.079	-0.193	0.201***	-0.028	0.068	0.238***	-0.145**
	D.after	0.187	-0.467	-0.011	0.360*	0.227	-1.000	-0.875***	0.320	-0.040	-0.180	0.697***	-0.887***
Conditional variance	ω	10**	3.838**	0.499***	5.181*	0.39***	0.738***	0.995*	1.287	0.104***	2.216	0.045***	1.068***
	sign effect	0.032	-0.001	-0.141***	-0.077	-0.062	-0.185***	-0.067	-0.071	-0.046**	-0.115*	-0.09***	-0.159***
	persistence	-0.071	0.605***	0.948***	0.492*	0.96***	0.931***	0.901***	0.861	0.99***	0.78***	0.996***	0.885***
	size effect	0.145	0.327***	0.103*	0.08	0.176***	0.16***	0.211***	0.332	0.047***	0.212*	-0.035***	0.25***
	D.before	-0.214	0.107	-0.015	-0.041	0.001	-0.006	0.017	0.06	0.005	-0.041	0.004	-0.025
	D.after	-0.729	-0.019	-0.033	-0.81*	0.063	0.059	-0.102	-0.088	0.006	0.03	-0.028	0.01

2004, 2 dummies		*Portfolios*											
	Coefficient	*NoDur*	*Durbl*	*Manuf*	*Enrgy*	*Chems*	*BusEq*	*Telcm*	*Utils*	*Shops*	*Hlth*	*Money*	*Other*
Conditional mean	μ	0.049**	0.071**	0.076***	0.094***	0.057**	0.041	0.024	0.010***	0.044	0.049***	0.066***	0.073***
	r_{t-1}	-0.053	0.115	0.161**	0.714***	0.199**	-0.011	0.31**	-0.992***	0.263	0.981***	0.244**	0.343**
	ϵ_{t-1}	-0.075	-0.254	-0.33***	-0.786***	-0.405***	-0.139	-0.485***	0.98***	-0.44*	-1***	-0.488***	-0.548***
	EuStoxx	0.242***	0.555***	0.47***	0.2***	0.3***	0.639***	0.513***	0.185***	0.454***	0.326***	0.464***	0.514***
	D.before	-0.106	-0.169	-0.121	0.063	-0.180**	0.083	0.030	-0.047	-0.011	-0.032**	-0.096	-0.016
	D.after	0.222	0.173	0.289*	0.283	0.249	0.303	0.155	0.159	0.303	-0.050	0.099	0.253**
Conditional variance	ω	0.067***	0.276***	0.418***	10**	0.148***	0.244***	0.071***	0.114***	10*	1.022**	0.069***	10**
	sign effect	-0.044***	-0.041**	-0.053***	-0.09	-0.068***	0.018	-0.004	-0.006	0.037	-0.037	-0.01	0.023
	persistence	0.992***	0.97***	0.952***	-0.09	0.982***	0.975***	0.992***	0.986***	-0.118	0.885***	0.992***	-0.132
	size effect	0.043*	0.012***	-0.038*	0.071	0.047***	0.023	0.089***	0.106***	0.082	0.176***	0.035	-0.077
	D.before	0.01	-0.011	-0.003	0.232	0.023	-0.033**	-0.011	0.035*	-0.963	0.043	0.013	-0.466*
	D.after	-0.03	-0.106*	-0.089	0.723*	-0.068	-0.061	-0.043	-0.03	0.208	-0.279**	-0.085	-0.96**

2008, 2 dummies		*Portfolios*											
	Coefficient	*NoDur*	*Durbl*	*Manuf*	*Enrgy*	*Chems*	*BusEq*	*Telcm*	*Utils*	*Shops*	*Hlth*	*Money*	*Other*
Conditional mean	μ	0.011	0.004	0.048*	0.102**	0.036	0.037	0.003	0.082	-0.005	0.015	-0.036	-0.005
	r_{t-1}	-0.058**	-0.121	-0.105	-0.04	-0.139	-0.018	0.028	0.081	0.045	-0.144***	0.27***	0.132
	ϵ_{t-1}	-0.236***	-0.14	-0.228***	-0.196	-0.178	-0.321***	-0.375***	-0.295	-0.338*	-0.084**	-0.529***	-0.47***
	EuStoxx	0.406***	0.764***	0.671***	0.654***	0.497***	0.593***	0.614***	0.432***	0.572***	0.405***	0.673***	0.642***
	D.before	0.005	-0.346	-0.669**	-0.762	-0.35	-0.509**	-0.454**	-0.632**	-0.176	-0.212	-0.304	-0.252
	D.after	-0.746	-1	-0.999	-0.266	-0.663	-0.999	-0.999	-0.576	-0.969	-0.658	-1	-1.000***
Conditional variance	ω	0.451***	0.279***	0.334***	0.316***	0.483***	0.406***	0.352***	0.661**	0.246***	0.404***	0.241***	0.289***
	sign effect	-0.128***	-0.065*	-0.09***	-0.063**	-0.09**	-0.057*	-0.088***	-0.096	-0.028	-0.046	-0.145***	-0.11***
	persistence	0.947***	0.971***	0.964***	0.968***	0.946***	0.956***	0.961***	0.927***	0.973***	0.953***	0.976***	0.968***
	size effect	0.206***	0.237***	0.148***	0.151***	0.226***	0.19***	0.169***	0.266***	0.214***	0.185**	0.322***	0.161***
	D.before	0.135***	0.081**	0.09***	0.091***	0.136***	0.111***	0.141***	0.186**	0.091***	0.139***	0.068	0.082**
	D.after	0.248**	0.2*	0.193**	0.13*	0.26**	0.17*	0.208**	0.344*	0.11	0.254***	0.153	0.223***

Note that ω, $D.before$ and $D.after$ in the conditional variance have been multiplied by 100 for graphical purposes.

Figure 8.2: EGARCH coefficients for each portfolio in each election (2012-2016)

2012, 2 dummies		*Portfolios*											
	Coefficient	*NoDur*	*Durbl*	*Manuf*	*Enrgy*	*Chems*	*BusEq*	*Telcm*	*Utils*	*Shops*	*Hlth*	*Money*	*Other*
Conditional mean	μ	0.085***	0.048	0.060**	0.059	0.077***	0.076**	0.109***	0.055**	0.093***	0.091***	0.070**	0.047
	r_{t-1}	-0.8***	-0.983***	-0.759***	-0.82***	-0.722***	-0.667*	-0.822***	-0.864***	0.293**	-0.769***	-0.214	-0.777**
	ϵ_{t-1}	0.719***	0.971***	0.689***	0.746***	0.64***	0.556	0.717***	0.801***	-0.403***	0.687***	-0.047	0.671*
	EuStoxx	0.364***	0.711***	0.592***	0.596***	0.439***	0.514***	0.448***	0.307***	0.348***	0.382***	0.621***	0.519***
	D.before	-0.222**	0.024	-0.1	-0.139	-0.116	-0.241***	-0.171	-0.055	-0.142*	-0.05	-0.042	-0.048
	D.after	-0.121	-0.431	-0.313	-0.312	-0.233	-0.318	-0.467***	-0.376	-0.346***	-0.306	-0.44	-0.325
Conditional variance	ω	1.835*	0.321***	0.233***	0.406***	0.337***	0.394***	0.388***	0.487***	0.283***	0.353***	0.215***	0.296***
	sign effect	-0.132**	-0.093***	-0.139***	-0.121***	-0.092***	-0.077***	-0.04	-0.059	-0.076**	-0.101***	-0.051*	-0.126***
	persistence	0.772***	0.966***	0.974***	0.956***	0.96***	0.956***	0.954***	0.94***	0.966***	0.957***	0.976***	0.966***
	size effect	0.446***	0.115***	0.112***	0.139***	0.158***	0.169***	0.225***	0.239***	0.15***	0.143***	0.188***	0.157***
	D.before	0.087	0.029	0.03	0.024	0.027	0.039	0	0.029	0.017	0.035	0.021	0.03
	D.after	0.294	-0.11	-0.07	-0.096	-0.015	-0.071	0.009	0.059	0.012	-0.075	-0.012	-0.072

2016, 2 dummies		*Portfolios*											
	Coefficient	*NoDur*	*Durbl*	*Manuf*	*Enrgy*	*Chems*	*BusEq*	*Telcm*	*Utils*	*Shops*	*Hlth*	*Money*	*Other*
Conditional mean	μ	0.053***	0.025	0.011	-0.074	0.009	0.037	0.036	0.045	0.050***	0.062***	0.033*	0.003
	r_{t-1}	0.821***	-0.227	-0.288**	0.334***	0.187***	-0.596***	-0.326***	0.233	0.972***	0.841***	0.344***	-0.166***
	ϵ_{t-1}	-0.911***	0.081	0.174	-0.431***	-0.289***	0.518***	0.248*	-0.319	-1***	-0.917***	-0.49***	0.014
	EuStoxx	0.252***	0.517***	0.392***	0.421***	0.307***	0.375***	0.294***	0.173***	0.288***	0.331***	0.477***	0.393***
	D.before	-0.122***	-0.073	-0.005	0.007	-0.016	-0.031	-0.126*	-0.102	-0.148***	-0.165***	-0.004	-0.021
	D.after	-0.063	0.351*	0.512***	0.749***	0.061	-0.008	0.436**	-0.086	0.436***	-0.099	0.706***	0.487***
Conditional variance	ω	4.329**	3.423*	0.558***	0.123***	1.116***	0.89	0.098***	7.352**	1.739**	0.401***	1.631*	0.934*
	sign effect	-0.146**	-0.115*	-0.11***	-0.092***	-0.166***	-0.238	-0.103***	0.027	-0.178***	-0.122***	-0.126**	-0.098**
	persistence	0.495**	0.626***	0.936***	0.988***	0.871***	0.899***	0.988***	0.195	0.798***	0.955***	0.817***	0.892***
	size effect	0.443***	0.317***	0.162**	0.092***	0.338***	0.164**	0.033***	0.228**	0.309***	0.095**	0.251***	0.277***
	D.before	-0.272	-0.187	0.009	-0.014	-0.093	-0.051	-0.002	-0.006	-0.078	0.023	-0.09	-0.028
	D.after	0.065	-0.213	-0.146	0.034	-0.259	-0.082	0.011	0.517	-0.406*	-0.027	0.191	-0.281

Note that ω, $D.before$ and $D.after$ in the conditional variance have been multiplied by 100 for graphical purposes.

After inspecting the movements that characterized the elections we notice that there were some unexpected movements compared to what we stated in chapter 6. We will first try to address which movements had a "reason" to happen, in light of our views. In 2000, even though both candidates showed their interest towards climate change, Gore was definitely more involved in that topic. This might explain why in the fifteen days after the Election Day we notice an increase in the mean of the excess returns and a decrease in the volatility of the Energy portfolio. The popular vote was in favor of Gore, while the Electoral vote was delayed due to vote recounting for one state. If we assume that the market interpreted the winner of the popular vote to become President, our regression would capture the effect of the fifteen days after election dummy as Gore had won election. For the jump observed in the Financial sector (Money), which is in the opposite direction of what we believed, we find no reasons for such a movement, though we note that the election took place in the midst of the dot-com bubble and the market was trending down. The 2004 election does not present any relevant patterns in terms of movements related to candidate's views on particular sectors or party financing. Moreover, these movements are small and the reason might also be found in the fact that this election involved an incumbent President([5], which might bring less uncertainty to the election outcome. As already mentioned, the 2008 election occurred in the very middle of the financial crisis and we were not able to decompose the effects of the two events (election and crisis). For the 2012 election, the arguments used for 2004 also hold. We do not observe any movements in the variance and very small ones in the mean of excess returns, which we have no reason to believe are related to Presidential views. Finally, in 2016 we note that the Manufacturing portfolio exhibits a large increase in the conditional mean during the 15 days after the election, which is not surprising, as under Trump's presidency a wall was to be built and blue collar jobs would be increased, which could indicate future growth of the sector. The Energy sector also shows a large increase in the conditional mean of the excess returns during the 15 days after the election. Our Energy sector portfolio is made up of all firms that are involved in the production of energy. Remember that while

[5]Incumbent Presidents have not been able to report a win only in two cases after the Second World War. See The White House (2016).

Democrats have shown more interest in Renewable Energy, the Oil and Gas industry is more often related to Republicans, as can be seen in table Table 6.1. As our portfolios are value weighted, the firms in the Energy portfolio that might drive the response to the 2016 election could be Oil and Gas companies. If that is the case, then that might explain the increase in the conditional mean of the Energy portfolio. The Money portfolio exhibits a large increase in the conditional mean during the 15 days after the election, which might be expected, as the financial sector is often more fond of Republicans. We also notice that in the period leading up to the election the conditional mean of the excess returns for the Healthcare sector decreased slightly. As mentioned by Brown et al. (1988), when faced with uncertain news, investors tend to under-price securities as a cause of this uncertainty. Trump was taking over from Obama, and Trump had revealed some planned changes to Obama's healthcare scheme, Obamacare[6]. Other changes in expected returns are reported, but a casual inspection of why those portfolios did not yield any findings. For the changes in the conditional variance during the 2016 election, only one portfolio shows a response in the variance to the election, the portfolio Shops. We have no reason to believe that the Shops portfolio should be more sensitive than others to changes in presidencies.

8.3 Structural breaks in the IEM

As a part of our analysis on the market behavior around the Presidential elections, we decided to analyse the return on the IEM futures by implementing the Hansen-Quandt procedure as explained in subsection 7.5.1. We remind the reader that we analyse the "log-returns of the winning probability of a Democratic win", since the probabilities themselves are not stationary. We want to remark that the decision of splitting the analysis in different sub-samples (one for each election) is due to the discontinuity in the price of such futures[7]. The results do not show any clear evidences of structural breaks in the IEM returns. The significance level for the breaks found are far away from the usual ones. However, it is worth mentioning that the breaks identified by the procedure

[6] See Abelson (2016).

[7] The Iowa Electronic Market allows bets on the Presidential race winner usually starting from 7-8 months before election day.

lead us to some interesting findings. The IEM returns during the 2000 election present a break (statistically significant) on the day of the first Presidential debate between G.W. Bush and Al Gore. In particular, after that day, looking carefully at the series of the returns we notice a slight decrease in the level of the series. This decrease in the series can be detected by examining Figure 6.2, where we see that in October 2000 the probability of Gore winning the election trends down, and does not return to it's previous path. This means that the returns started to be slightly negative for the people betting on Gore as the next President. In the debate, as pointed out by Healy (2016), Bush's strengths were highlighted, and it has been argued that this debate cost Gore the presidency. The analysis of the IEM returns for the 2004 election did not show any clear changes. The procedure detected a possible break that occurred the day of a debate. In this case, it was the second Presidential debate between the incumbent President Bush and the Democratic nominee Kerry. However, by looking at the series we can see that there is not a clear deviation in the series from that day onward, but only a small one in favor of Kerry (the returns are slightly more positive). This can be seen by looking at the series themselves in Figure 6.4. In late September there is a drop in the winning probability of Kerry, but the series return to their mean, so the drop did not have a "permanent impact" on the series. This is also confirmed in a report by Culpepper (2004), in which he showed that the debate did not indicate any clear winner, but Kerry gained a slight advantage. The IEM returns during the 2008 election showed a strong break in favor of Obama, happening between 11-09-2008 and 12-09-2008. This can also be seen from Figure 6.6. In September 2008, the series start trending upwards, and they "stay" there. However, during these days, we did not find any particular event or statement by either candidate, that could lead to an advantage to Obama[8]. In the end the remaining elections of 2012 and 2016 suggest two breaks, which are not statistically significant at all and we did not find any evident coverage in the media. A summary of the results can be found in Figure 8.3 below.

[8]It has to be noted that 11-09-2008 was the anniversary of the attack on the Twin Towers. Both candidates were interviewed separately and showed similarities in terms of their approach to war. Up until that the day, the media were presenting Obama has the one with stronger economic arguments, while McCain was stronger in terms of military arguments. See Duffy (2008) and Whitesides (2008).

Figure 8.3: IEM results summary

F-statistic	*Date of the break*	*Event happened*
15.020***	04/10/2000	First Bush-Gore debate
4.304	09/10/2004	Second Bush-Kerry debate
12.64***	12/09/2008	Day after Obama's speech on War views
5.226	06/04/2012	/
2.950	01/10/2016	Clinton's hacked audio on nuclear strategy
Note:	* sign. at 10%, ** 5%, * 1%.	

8.4 VIX and IEM

As mentioned in section 7.7 we analyse the behavior of the VIX during the election period, with the scope of determining its relationship with the risk-neutral probabilities and the uncertainty measure derived from the IEM. We recall that our idea is that an increase in the percentage change of the winner uncertainty variable ($WinUnc$) will lead to an increase in the percentage change of the VIX. We believe this to be the case, since voters change their decisions and that can lead the investors to become more stressed about the election's result. We also want to estimate whether an increase in the probability of a Democratic candidate winning the election will also lead to a decrease in the VIX, as the market has usually behaves better under Democratic presidencies. The results of the regressions can be seen in Figure 8.4.

Figure 8.4: VIX percentage changes

Dependent variable: VIX								
	National Conv.		*45 days*		*30 days*		*15 days*	
Intercept	-0.0008		-0.0007		-0.0006		-0.0006	
WinProbDem	-0.0034		-0.0032		-0.0031		-0.0028	
D.after15	-0.0101		-0.0102		-0.0103		-0.0104	
WinUnc	0.0093	**	0.0094	**	0.0094	**	0.0095	**
D.before	0.0071	*	0.0098	**	0.0100	*	0.0154	*
EuStoxx	-0.0218	***	-0.0218	***	-0.0218	***	-0.0218	***
VIX_{t-1}	-0.1725	***	-0.1726	***	-0.1725	***	-0.1722	***
N. obs.	4721		4721		4721		4721	
Adj-R	0.2436		0.2437		0.2435		0.2436	
F-statistic	254.3	***	254.5	***	254.2	***	254.3	***
Note:	* sign. at 10%, ** 5%, * 1%.							

Please note that all non-dummy variables are expressed in log-returns.

We run four regressions[9] using the same explanatory variables. The only differences between the regressions presented is the length of $D.before$. We, in fact, run three regressions estimating the effect 15, 30 and 45 days prior to the election day, plus one starting from the day of the National convention day[10]. As we can notice, the results show evidence regarding the effect of the winning uncertainty on the volatility index. In fact, in all four the regressions presented, the variable $WinUnc$ is always statistically different from 0 at the usual significant levels. This confirms our idea that not only does the market care about the level of uncertainty as shown by other studies, but it also cares about change in the uncertainty level of the voters. For instance, this means that if we were to go from an uncertainty level at 0.1 to 0.5, this would have a larger impact in the percentage of the volatility than going from an uncertainty level of 0.9 to 0.95. Of course this does not mean that the volatility will be lower in the latter case, but rather that the change in it will be

[9] These regressions are presented in section 7.7.

[10] Note that our decision of implementing these four regression is due to the lack of clear evidence from the EGARCH procedure, as we did not find any clear evidence that there was a jump in volatility, starting from the National Convention day.

smaller. Interestingly, we notice that the variable $D.before$ is always significant, and that its size magnitude increases the closer we get to the election. This can be interpreted as:

- the overall market volatility increases during the elections
- the daily percentage in the volatility is larger during elections than in other periods.

Surprisingly, we do not find any evidence that the variable $WinProbDem$ is of any significance in our regressions, as it is always statistically not different from 0. However, the sign of it somehow confirms our previous statements and findings. We recall that the decision of adding this variable in the regression is motivated by the fact that historically, the market has performed better under Democratic Presidents (see Santa-Clara and Valkanov (2003) and Figure 4.2 and Figure 4.3 in this thesis). In fact, the variable presents a negative sign, which means that a percentage change in the volatility diminishes more as a Democrats candidate gains consensus. The same can be concluded for the dummy $D.after15$. Even though the coefficient is not statistically different from 0, it shows a negative sign, allowing us to say that once the election's outcome is known, the volatility in the market slowly decreases. Additionally, we try to determine whether the winning uncertainty measure has a stronger impact on the change in the volatility when the Election Day was imminent. The results from this procedure can be found in the Appendix in Figure A.16. It can be noticed that the change in volatility does not increase if the winning uncertainty is higher during the days close to the election[11]. So, in the first part of the analysis on the percentage change in the VIX due to a percentage change in the winning uncertainty, we found quite strong evidence for the relationship between the two, as an increase in market uncertainty causes an increase in the VIX. However, we note that as the election draws near, if the winning uncertainty increases, it does not cause any major changes in the VIX. We see this by examining the interaction effect between the two variables. The measured interaction coefficient was both insignificant and extremely small in magnitude (see Figure A.16). Note that this does not mean that during election periods the volatility does not rise

[11] This can be seen by looking at the significance level of the interaction term $WinUnc \times D.before$, and at its size.

due to uncertainty. This rather means that the increase in the volatility is not larger than usual (at a daily level).

Moved by the interesting results yielded by these regressions, we then decided to check whether the estimated effects were the same for all the elections, or whether there were some elections which showed stronger or weaker effects. Hence, by taking the regression (15 days) in Figure 8.4, we decompose the variable $D.before15$[12] and $D.after15$ as explained in section 7.7. The results presented in Figure 8.5 weaken our findings.

Figure 8.5: VIX percentage changes under different Presidents

Dependent variable: VIX		
	15 days	
Intercept	-0.0007	
WinProbDem	0.0008	
WinUnc	0.0071	
D.afterBush1	-0.0016	
D.beforeBush1	0.0086	
D.afterBush2	-0.0269	
D.beforeBush2	0.0184	
D.afterObama1	0.0136	
D.beforeObama1	0.0006	
D.afterObama2	-0.0054	
D.beforeObama2	0.0159	
D.afterTrump	-0.0469	*
D.beforeTrump	0.0341	*
EuStoxx	-0.0221	***
VIX_{t-1}	-0.1740	***
N. obs.	4721	
Adj-R	0.2479	
F-statistic	110.4	***
Note:	* sign. at 10%, ** 5%, * 1%.	

Please note that all non-dummy variables are expressed in log-returns.

Surprisingly the winning uncertainty measure loses its significance. This is likely due to the loss of degrees of freedom given by the addition of eight more variables. By analysing the dummies, it seems as if Trump's election was driving the results. Not surprisingly, as in this election we have the

[12] We have decided to use the dummy for fifteen days before the election since it was the one with the largest magnitude in the previous regressions.

largest coefficients both for the dummy variables before the election and after the election. But why does the 2016 election seem to display more volatility in the election periods compared to the other ones? We can note that as elections are held every 4 years the profile of electors is changing too. In the last years it has been recorded that people's access to information has changed substantially and the voter's access to candidate material in 2000 and 2016 is hugely different. In 2018 it was reported that about two thirds of adult Americans get their news via social media[13]. Interestingly, in 2016 the use of social media in the election was substantial, as the candidates could send out messages which would immediately get picked up by potential voters. According to Pew Research Center (2018), the 2016 election, paired with the 2012 election, are the two elections where social media played a large role in. With this increased speed of information transfer candidates can almost have a live debate through social media. This increased speed in information transfer could facilitate investors, who update their beliefs based on available information. As the candidates can get more messages, more frequently out to the public, investors could be encouraged to update their beliefs more often, adjusting their portfolios accordingly. This would mean more frequent trading and therefore higher volatility.

8.5 Limitations

As we have seen, our results are somehow contrasting and they do not lead to any clear conclusion. In fact, for the EGARCH procedure, by analysing each election separately we do not find any strong evidence of excess returns being larger and more volatile during election periods. In the literature discussed in this thesis, people have frequently tried to capture the effect of the election period by running one model that aggregates all the elections. This approach has allowed them to find somehow interesting results[14]. However, they have never tried to decompose their samples in order to examine whether the results are driven by only a few specific elections, or whether there has been evidence from all of them. For e.g. Bialkowski et al. (2007) examine twenty years of

[13] According to Matsa and Shearer (2018).

[14] It has to be noted that many of the studies have focused on analysing cumulative abnormal returns during the elections. Hence, it is important to remind ourselves that it is not the same as what we want to find.

elections for 27 countries, all at once. In the paper they claim that "since elections are essentially rare events, the single-country approach leads to a small sample and many statistical problems specific to it". At the same time Santa-Clara and Valkanov (2003) run a regression on a eighty year horizon for the U.S. elections. They both find interesting results, but they do not dig down into discovering whether there were some other economic forces influencing their results (which might be the case in such long time-series datasets). Moreover, in Santa-Clara and Valkanov (2003) they also mention that their results might be driven by data mining issues, and when they try to correct for it, their results become statistically insignificant since their tests already have modest power. We tried to replicate these approaches and ran the EGARCH procedure for the whole period ranging from 2000 to 2016. Even though the this procedure yielded nicer results, meaning that the election dummy variables were significant, we found that the diagnostic checks on the residuals indicated that the null hypothesis of well behaved residuals (no autocorrelation and no heteroskedasticity) was rejected.

Other studies (see Ejara et al. (2012) and Nippani and Medlin (2002)) have also tried to study the stock returns under one singular election at a time and for only few market indices. This allows them to gain a better understanding of the model and use the regressors in a more suitable approach for their studies. Hence, this might be the reason why, when we decompose the elections in our study we do not find the same strong evidences.

Overall, for what is our knowledge, in the literature there have not been any studies involved in the analysis of structural breaks in the excess returns series using an EGARCH approach. Our results suggest that using EGARCH modelling to detect breaks in the mean and the variance of the excess returns series might not be the most suitable approach. However, as an extension, a sensitivity[15] check as the one performed for the VIX analysis could be done to confirm this claim. By doing so we would be able to better determine whether the elections do not cause any breaks

[15]For sensitivity check, we mean sequently reducing the numbers of days before and after the election period.

at all in the series of excess returns, of if these breaks are just delayed[16].

The same consideration holds when analysing structural breaks in the IEM futures. Very few studies have involved these instruments, but we believe that they can still be of relevant meaning when dealing with elections' uncertainty. For what is our knowledge, none of the papers involving these instruments have tried to analyse their series singularly, and hence there were no other results that we could have compared ours to in order to demonstrate the strength of our results when dealing with structural break in the IEM probabilities.

Once again, another reason for why we do not find any breaks in the mean and the volatility of the excess returns of sectors' portfolios might be found in their construction. These portfolio in fact include all the companies in each respective sector. even though some of the largest companies in each sector might be more influenced by investors' expectations on an election outcome, the rest of the industry might not observe movements of the same size, reducing the impact of the event on the overall sector, or vice-versa. In view of this, an extension of our study could be done by dividing each industry portfolio into subcategories consisting of companies with large-, mid- and small-caps in order to assess whether any differences emerge.

[16]Investors may have behavioral biases for which they underreact to news.

9. Conclusions

In the first place, we want that remark that the first part of this work differs from other studies[1] as we attempt to analyse the impact of elections on the excess returns of different sectors' portfolios, by trying to detect structural breaks in their mean and variance series. We utilized an EGARCH model to do so, but we must note that from Figure A.12, Figure A.13, Figure 8.1 and Figure 8.2 we can see that the procedure yields most of the times a persistence parameter close to 1. This might be an indication of the presence of an Integrated GARCH, but the analysis of such model is out of the scope of our work. Moreover, Bowes (2018), has similar finding and he also does not address the presence of high persistence in his model. To our knowledge, the approach used (EGARCH) has been used for similar analyses only a few times, so we believe that this will aid in future studies on the topic, offering a possible starting point. Our hypotheses claimed that since elections are uncertain events[2], we should not observe large movements in the returns before the election's outcome is known, while the volatility should rise for the same reason. At the same time, when the election's outcome becomes known the market should adjust[3], since the investors are assumed to revise their expectations about the future policies of the new government in place. Our results show that there are not any large deviations in terms of mean and variance of the excess returns during the election period window. There are not any constant patterns in terms of deviations from the mean and the variance for any of the industry portfolios taken into account. This also

[1] Other studies, as already pointed out, measure cumulative abnormal returns during election periods (e.g. Bialkowski et al. (2007)), or try to determine whether there exist political cycles for stock prices (e.g. Santa-Clara and Valkanov (2003)).

[2] Further studies could try to insert this uncertainty into the EGARCH methodology by using IEM probabilities.

[3] However, the market, should adjust only if the outcome of the election is unexpected, otherwise the returns trend should continue.

holds when we decompose the election window into excess returns "before election day" and excess returns "after election day". This means that the mean and volatility of excess returns are not substantially different during election periods when compared to the whole returns series. Using a different approach, contrary to what we observed for the excess returns, by examining the change in the volatility index (VIX) we find evidence that the market perceives the pre-election period as a more stressful one (we see an increase in the percentage of the volatility the closer we get to the elections), while the after-election period is viewed as a more "relaxing" period. That might be due to the notion that there is more certainty about future policies and how they will impact the overall economy. This argument in confirmed by our examination of the change in the election winner uncertainty. When the market suddenly becomes less certain (more uncertain) about the outcome of an election, it reflects its sentiments by significantly increasing its stress (a rise in the percentage change of the VIX). Hence, the IEM probabilities seem to provide a good explanation of the overall market volatility. This finding is consistent to what has been observed by Goodell and Vähämaa (2013), but we claim that the sign and the size of the coefficients involved, and the approach used for our results can provide a better explanation of the market perception around the election. Moreover, by analysing the IEM futures during the election for the perceived election winners, we observe that investors significantly change their expectations about the next Presidents in only two cases, 2000 and 2008, in concurrence to relevant events related to the two candidates and in favor of who would become the next President. The 2004 and 2012 elections did not show any fundamental changes, and the same goes for the 2016 election. However, for the 2004 and 2012 election this can be somehow expected. In fact, historically U.S. Presidents have been re-elected almost in all cases[4].

To conclude, we believe that further analyses should be made in order to address the proper behavior of different sectors' stock returns across election periods to possibly exploit trading opportunities in such a period. We believe that this work could be used as a relevant starting point to dig

[4] After the WWII, only Carter and Bush Sr. have not been re-elected. See The White House (2016).

deeper into this field. The political climate of developed nations has changed in the past years. Parties now often seem to lie more extremely on either rightist or leftist views. As these views bare with them very different opinions regarding the overall economy and society of nations, one can imagine how uncertainty regarding the future direction of a given economy would affect the decision making process of investors. Several studies exist that attempt to quantify the degree of uncertainty in a given economy, and how it affects the labour market, financial markets and other parts of a nation's society[5]. This is especially relevant for investors who use a macroeconomic (or a top-down) approach when they decide where to allocate funds, as the first step of such an approach is to inspect the status of a whole economy, then narrowing down on industries and finally looking at possible investments on a company level. As mentioned, according to Knight (1921) uncertainty is defined as the inability to make forecasts about the future, as the given event's probability distribution for outcomes is unknown. When investors deal with risks under King's definition, they know the probability distribution of those outcomes and can therefore diversify the risks away, or insure themselves against those outcomes. But perhaps these outcomes are not as simple as asking oneself the question of which party is better for business. If, for example, we put ourselves in the shoes of a possible top-down investor prior to the 2016 election we can imagine what we would think about. Donald Trump was very imposed to jobs being moved out of the country by American businesses and hoped to minimize that through tax cuts and sanctions. Hillary Clinton hoped to create new jobs by focusing on the renewable energy industry, and believed that it had large opportunities for growth. Therefore, under Trump's presidency we might believe that the Manufacturing industry would grow substantially, as more blue-collared jobs are moved to the States, increasing production in the industry and therefore our potential profits. However, under Clinton's presidency we would believe the renewable energy sector to grow hugely in the next years, and we might therefore be tempted to invest our funds in renewable energy firms. Our task is quite difficult, as these two Presidents have opposing views on how to run the country, which might

[5]See for example the economic policy uncertainty index of Bloom (2012).

in turn affect some businesses more than others. In our study, we focused on a two-party set-up as there are two possible outcomes from an election - a Democratic or Republican government[6]. We can imagine this being even more difficult to estimate in nations where there are multiple parties that run for government, as there are more possible outcomes and more scenarios that can occur. For a top-down investor, viewing such an economy and estimating the probable macroeconomic state of such a nation when there are several different parties running, and can eventually form a multi-party government, the level of uncertainty can be quite high. Therefore, the ability to be able to analyse the uncertainty in a given economy or sector provides an applicable benefit to investors. We believe that this field is still unexplored, and further studies on how to quantify political and eventually economic uncertainty are needed.

[6]Even though in some elections there are other candidates running for President, in our study, but with the exception of the 2000 election those candidates generally don't influence the election outcomes too extremely.

A. Appendix

A.1 Party financing figures

Figure A.1: Party financing from Money sector

Money				
Election Cycle	Donations to Democrats	Donations to Republicans	% to Democrats	% to Republicans
2020	$1,077,747	$1,169,479	48%	52%
2018	$247,476,326	$263,956,086	48%	52%
2016	$289,628,164	$339,174,205	46%	54%
2014	$135,259,639	$224,576,871	38%	62%
2012	$177,959,031	$371,029,057	32%	68%
2010	$147,027,504	$166,285,164	47%	53%
2008	$267,755,900	$252,652,807	51%	49%
2006	$129,016,896	$158,974,634	45%	55%
2004	$147,064,390	$208,969,719	41%	59%
2002	$102,280,229	$141,097,356	42%	58%
2000	$131,023,100	$188,896,872	41%	59%
1998	$64,006,928	$95,367,913	40%	60%
1996	$72,149,482	$110,669,147	39%	61%
1994	$55,962,904	$55,290,459	50%	50%
1992	$62,818,594	$63,410,750	50%	50%
1990	$35,051,562	$32,511,161	52%	48%
Total	$2,065,558,396	$2,674,031,680	44%	56%

Figure A.2: Party financing from Healthcare sector

Healthcare				
Election Cycle	Donations to Democrats	Donations to Republicans	% to Democrats	% to Republicans
2020	$280,672	$688,837	29%	71%
2018	$101,105,190	$77,333,719	57%	43%
2016	$109,249,427	$100,966,207	52%	48%
2014	$58,643,263	$76,536,592	43%	57%
2012	$93,707,366	$117,801,039	44%	56%
2010	$73,790,167	$69,744,757	51%	49%
2008	$100,536,437	$81,788,647	55%	45%
2006	$40,700,325	$65,975,753	38%	62%
2004	$50,133,011	$78,087,122	39%	61%
2002	$33,878,457	$63,252,207	35%	65%
2000	$39,919,806	$59,843,298	40%	60%
1998	$24,205,747	$35,599,814	40%	60%
1996	$27,923,455	$42,985,976	39%	61%
1994	$24,921,834	$25,989,367	49%	51%
1992	$23,675,743	$21,784,393	52%	48%
1990	$11,536,629	$11,278,560	51%	49%
Total	$814,207,529	$929,656,288	47%	53%

Figure A.3: Party financing from Energy sector

Energy

Election Cycle	Donations to Democrats	Donations to Republicans	% to Democrats	% to Republicans
2020	$46,926	$407,576	10%	90%
2018	$20,682,315	$71,478,546	22%	78%
2016	$27,212,324	$91,212,932	23%	77%
2014	$19,026,258	$72,390,311	21%	79%
2012	$23,837,889	$98,697,887	19%	81%
2010	$26,275,136	$46,764,546	36%	64%
2008	$28,988,326	$55,590,459	34%	66%
2006	$13,163,411	$39,039,015	25%	75%
2004	$13,763,032	$42,127,498	25%	75%
2002	$15,837,157	$43,168,912	27%	73%
2000	$16,895,992	$50,861,399	25%	75%
1998	$12,204,868	$30,281,039	29%	71%
1996	$13,251,096	$34,619,073	28%	72%
1994	$13,595,160	$17,770,090	43%	57%
1992	$14,496,631	$21,670,017	40%	60%
1990	$8,643,994	$11,625,279	43%	57%
Total	$267,920,515	$727,704,579	27%	73%

Figure A.4: Party financing from Business Equipment sector

Business Equipment

Election Cycle	Donations to Democrats	Donations to Republicans	% to Democrats	% to Republicans
2020	$10,748	$38,774	22%	78%
2018	$13,593,557	$4,027,590	77%	23%
2016	$15,854,377	$8,335,861	66%	34%
2014	$6,257,173	$4,459,412	58%	42%
2012	$11,495,512	$7,583,983	60%	40%
2010	$6,280,035	$3,465,010	64%	36%
2008	$11,785,905	$5,563,762	68%	32%
2006	$4,838,936	$4,117,750	54%	46%
2004	$7,484,056	$5,376,201	58%	42%
2002	$8,324,099	$5,848,081	59%	41%
2000	$7,568,827	$6,656,420	53%	47%
1998	$1,695,481	$2,064,958	45%	55%
1996	$978,861	$997,088	50%	50%
1994	$296,240	$494,610	37%	63%
1992	$810,630	$705,119	53%	47%
1990	$141,108	$167,165	46%	54%
Total	$97,415,545	$59,901,784	62%	38%

A.2 Event windows

Figure A.5: T and F tests windows construction

T/F tests	*Windows*					
	Pre-election period		*Election Period*		*Post-election Period*	
Election	*From*	*To*	*From*	*To*	*From*	*To*
2000	14/04/2000	02/08/2000	03/08/2000	22/11/2000	23/11/2000	20/01/2001
2004	18/06/2004	01/09/2004	02/09/2004	17/11/2004	18/11/2004	20/01/2005
2008	20/06/2008	03/09/2008	04/09/2008	19/11/2008	20/11/2008	20/01/2009
2012	26/06/2012	05/09/2012	06/09/2012	17/11/2012	18/11/2012	20/01/2013
2016	01/04/2016	27/07/2016	28/07/2016	23/11/2016	24/11/2016	20/01/2017

Figure A.6: EGARCH 1 dummy windows construction

EGARCH, 1 dummy	*Windows*					
	Pre-election period		*Election Period*		*Post-election Period*	
Election	*From*	*To*	*From*	*To*	*From*	*To*
2000	03/11/1998	02/08/2000	03/08/2000	22/11/2000	23/11/2000	20/01/2001
2004	05/11/2002	01/09/2004	02/09/2004	17/11/2004	18/11/2004	20/01/2005
2008	06/11/2006	03/09/2008	04/09/2008	19/11/2008	20/11/2008	20/01/2009
2012	02/11/2010	05/09/2012	06/09/2012	17/11/2012	18/11/2012	20/01/2013
2016	04/11/2014	27/07/2016	28/07/2016	23/11/2016	24/11/2016	20/01/2017

Figure A.7: EGARCH 2 dummies windows construction

EGARCH, 2dummies	*Windows*							
	Pre-election period		*Election Period*				*Post-election Period*	
			Pre-election day		*Post-election day*			
Election	*From*	*To*	*From*	*To*	*From*	*To*	*From*	*To*
2000	03/11/1998	02/08/2000	03/08/2000	07/11/2000	08/11/2000	22/11/2000	23/11/2000	20/01/2001
2004	05/11/2002	01/09/2004	02/09/2004	02/11/2004	03/11/2004	17/11/2004	18/11/2004	20/01/2005
2008	06/11/2006	03/09/2008	04/09/2008	04/11/2008	05/11/2008	19/11/2008	20/11/2008	20/01/2009
2012	02/11/2010	05/09/2012	06/09/2012	02/11/2012	03/11/2012	17/11/2012	18/11/2012	20/01/2013
2016	04/11/2014	27/07/2016	28/07/2016	08/11/2016	09/11/2016	23/11/2016	24/11/2016	20/01/2017

A.3 Test for residuals Normality

Figure A.8: Normality test for residuals based on EGARCH with 1 dummy (*El.Period*)

normality, 1 dummy	*Elections*				
Portfolios	2000	2004	2008	2012	2016
NoDur	19.363***	34.542***	5.808*	13.474***	52.149***
Durbl	19.261***	29.439***	36.603***	153.088***	45.555***
Manuf	1.507	6.373**	84.116***	23.387***	4.197
Enrgy	30.335***	2.313	16.32***	44.913***	46.403***
Chems	54.062***	6.679**	20.817***	128.363***	7.418**
BusEq	3.072	4.916*	31.181***	6.611**	51.197***
Telcm	45.671***	10.01***	16.609***	254.283***	14.947***
Utils	12.938***	65.514***	162.54***	13.305***	27.615***
Shops	14.446***	4.568	582.226***	224.284***	26.413***
Hlth	15.958***	3.347	24.486***	10.901***	41.668***
Money	3.604	24.819***	21.228***	119.206***	36.13***
Other	18.023***	42.011***	5.147*	23.786***	17.774***

Note: null hypothesis is normality of the sample. * sign. at 10%, ** 5%, * 1%.

The table reports the Chi-statistic for each portfolio in each election.

A.4 Preliminary Results

Figure A.9: T-test for difference in mean excess returns in three different sub-periods

T-test for difference in mean	*Elections*									
	2000		2004		2008		2012		2016	
Portfolios	$\mu_b - \mu_d$	$\mu_d - \mu_a$	$\mu_b - \mu_d$	$\mu_d - \mu_a$	$\mu_b - \mu_d$	$\mu_d - \mu_a$	$\mu_b - \mu_d$	$\mu_d - \mu_a$	$\mu_b - \mu_d$	$\mu_d - \mu_a$
NoDur	0.038	0.062	-0.181	0.012	0.717*	-0.833	0.139	-0.266*	0.113	-0.162
Durbl	-0.077	-0.248	-0.211	0.166	1.476*	-1.926*	0.022	-0.33	0.058	-0.188
Manuf	0.034	-0.175	-0.127	0.168	1.159*	-1.545*	0.152	-0.343*	0.019	0.018
Enrgy	-0.044	0.43	-0.116	0.147	0.581	-0.916	0.275	-0.31	-0.026	0.045
Chems	-0.263	0.15	-0.002	-0.033	0.808	-0.709	0.168	-0.286*	0.056	-0.112
BusEq	0.391	-0.4	-0.418*	0.358*	0.991*	-1.279*	0.327	-0.386*	0.02	-0.049
Telcm	0.051	-0.549	-0.141	0.142	1.052*	-1.251	0.256	-0.296*	0.087	-0.2
Utils	-0.116	0.52	-0.038	0.116	0.543	-0.838	0.109	-0.207	0.152	-0.174
Shops	-0.056	-0.224	-0.317*	0.218	0.965*	-1.155*	0.183	-0.273*	0.054	0.009
Hlth	0.119	0.252	-0.012	-0.114	0.848*	-0.822	0.142	-0.244	0.223	-0.1
Money	0.026	-0.185	-0.067	0.069	1.336	-0.968	0.117	-0.287	-0.128	0.086
Other	0.177	-0.129	-0.205	0.163	1.013*	-1.183	0.1	-0.331*	-0.049	0.041

Note: null hypothesis of means being equal. * sign. at 10%, ** 5%, * 1%.

The table reports the difference in mean. μ_b is the mean before the election period, μ_d is the mean during the election period and μ_a is the mean after the election period.

Figure A.10: F-test for difference in the variance of excess returns in three different sub-periods

F-test for difference in variance	*Elections*									
	2000		2004		2008		2012		2016	
Portfolios	σ_b/σ_d	σ_a/σ_d	σ_b/σ_d	σ_a/σ_d	σ_b/σ_d	σ_a/σ_d	σ_b/σ_d	σ_a/σ_d	σ_b/σ_d	σ_a/σ_d
NoDur	1.423	1.7*	0.574*	0.601*	0.1*	0.585*	0.943	1.033	0.941	0.601*
Durbl	1.067	1.719*	0.942	0.626	0.29*	1.099	0.723	0.471*	1.871*	1.265
Manuf	1.369	1.807*	1.283	0.83	0.133*	0.748	1.074	0.623	1.572*	0.5*
Enrgy	1.272	1.491	0.706	0.955	0.149*	0.541*	0.944	0.622	1.118	0.973
Chems	1.39	1.314	0.973	0.787	0.116*	0.605	0.847	0.799	1.759*	0.805
BusEq	1.222	3.003*	1.547	0.702	0.134*	0.755	1.053	0.892	1.786*	0.906
Telcm	1.247	1.862*	1.1	0.744	0.119*	0.586*	0.943	1.224	1.019	0.832
Utils	1.085	2.028*	0.664	0.984	0.089*	0.51*	0.713	0.889	0.594*	0.658
Shops	1.047	1.109	1.215	0.82	0.244*	0.611	0.958	0.929	1.166	0.611*
Hlth	1.324	1.409	0.823	0.783	0.112*	0.64	0.984	0.728	0.949	0.532*
Money	1.284	1.162	0.539*	0.614	0.306*	0.934	0.696	0.642	2.043*	0.85
Other	1.01	2.948*	1.25	1.03	0.153*	0.971	0.846	0.647	1.709*	0.552*

Note: null hypothesis of variance ratio being equal to 1. * sign. at 10%, ** 5%, * 1%.

The table reports the ratio of the variances. σ_b is the variance before the election period, σ_d is the variance during the election period and σ_a is the variance after the election period.

A.5 BIC comparison

Figure A.11: BIC comparison for EGARCH under Normality and T-student distribution of the residuals.

BIC for distribution	*Elections*														
	2000			2004			2008			2012			2016		
Portfolios	Normal	Student t	Choice	Normal	Student t	Choice	Normal	Student t	Choice	Normal	Student t	Choice	Normal	Student t	Choice
NoDur	12.250	12.209	t	11.267	11.262	t	11.669	11.677	norm	11.055	11.049	t	11.437	11.405	t
Durbl	12.712	12.703	t	12.167	12.141	t	12.868	12.864	t	12.683	12.558	t	12.050	12.024	t
Manuf	12.362	12.374	norm	11.740	11.732	t	12.681	12.484	t	11.962	11.959	t	11.628	11.633	norm
Enrgy	13.129	13.116	t	12.141	12.166	norm	13.218	13.226	norm	12.306	12.286	t	12.828	12.813	t
Chems	12.661	12.638	t	11.434	11.441	norm	12.104	12.104	t	11.620	11.467	t	11.457	11.459	norm
BusEq	13.710	13.722	norm	12.486	12.497	norm	12.618	12.478	t	11.895	11.902	norm	11.798	11.692	t
Telcm	12.991	12.970	t	11.940	11.940	t	12.321	12.314	t	11.593	11.450	t	11.527	11.519	t
Utils	12.217	12.211	t	11.644	11.605	t	12.523	12.339	t	11.150	11.149	t	12.081	12.070	t
Shops	12.958	12.929	t	11.843	11.847	norm	12.652	12.404	t	11.613	11.470	t	11.469	11.464	t
Hlth	13.008	12.995	t	11.832	11.839	norm	11.796	11.779	t	11.270	11.268	t	12.042	12.012	t
Money	12.942	12.947	norm	11.607	11.586	t	13.084	13.072	t	12.177	12.126	t	11.857	11.810	t
Other	12.229	12.223	t	11.732	11.706	t	12.272	12.277	norm	11.794	11.781	t	11.544	11.537	t

A.6 EGARCH results

Figure A.12: EGARCH coefficients for each portfolio in each election (2000-2004-2008)

2000, 1 dummy		*Portfolios*											
	Coefficient	*NoDur*	*Durbl*	*Manuf*	*Enrgy*	*Chems*	*BusEq*	*Telcm*	*Utils*	*Shops*	*Hlth*	*Money*	*Other*
Conditional mean	μ	-0.045	-0.072	0.025***	-0.054	-0.035	0.061	0.028	-0.045*	-0.031	0.005	-0.056***	-0.014
	r_{t-1}	0.706***	-0.422***	0.97***	-0.79***	-0.744***	-0.129	0.594	0.283***	-0.978***	-0.446	0.496***	0.975***
	ϵ_{t-1}	-0.749***	0.289*	-1***	0.818***	0.803***	-0.004	-0.687	-0.264***	0.986***	0.528	-0.571***	-1***
	EuStoxx	0.079***	0.333***	0.341***	0.12*	0.129***	0.666***	0.408***	0.014	0.353***	0.23***	0.408***	0.347***
	D.ElPeriod	0.121	-0.030	-0.049	0.0234	0.049	-0.21969	-0.286*	0.21533	-0.026	0.015	0.205***	0.034
Conditional variance	ω	10**	3.882**	0.489***	10	0.349***	0.673***	1.048**	1.539	0.113***	1.878	0.018***	0.826**
	sign effect	0.03	-0.002	-0.14***	-0.053	-0.069**	-0.176**	-0.063	-0.071	-0.065***	-0.112***	-0.078***	-0.145***
	persistence	-0.071	0.601***	0.949***	0.021	0.964***	0.937***	0.895***	0.833***	0.989***	0.814*	0.998***	0.911***
	size effect	0.149	0.329***	0.101**	0.183***	0.169***	0.152***	0.212***	0.367**	0.055***	0.195	-0.029***	0.214***
	D.ElPeriod	-0.278	0.098	-0.016	-0.239	0.009	0.011	0.013	0.05	0.005	-0.025	0.001	0.014

2004, 1 dummy		*Portfolios*											
	Coefficient	*NoDur*	*Durbl*	*Manuf*	*Enrgy*	*Chems*	*BusEq*	*Telcm*	*Utils*	*Shops*	*Hlth*	*Money*	*Other*
Conditional mean	μ	0.049*	0.069*	0.076**	0.085**	0.056**	0.038	0.023	0.0994***	0.047	0.028	0.065***	0.073***
	r_{t-1}	-0.073	0.096	0.131	0.667***	0.152	-0.006	0.302	-0.992***	0.276**	0.434**	0.228***	0.337**
	ϵ_{t-1}	-0.05	-0.23	-0.295	-0.742***	-0.353**	-0.141	-0.476**	0.979***	-0.442***	-0.53***	-0.462***	-0.536***
	EuStoxx	0.242***	0.554***	0.47***	0.205***	0.299***	0.637***	0.513***	0.184***	0.454***	0.337***	0.463***	0.512***
	D.ElPeriod	-0.020	-0.053	-0.011	0.101	-0.914	0.144	0.599	-0.157	0.301	-0.148	-0.402	0.366
Conditional variance	ω	0.066***	0.225***	0.343***	0.345***	0.136***	0.188***	0.062***	0.19***	10	0.917**	0.037***	10
	sign effect	-0.046***	-0.046**	-0.056***	-0.02	-0.074***	0.014	-0.005	-0.01	0.06	-0.041	-0.019	0.015
	persistence	0.992***	0.976***	0.961***	0.962***	0.984***	0.98***	0.993***	0.977***	-0.117	0.897***	0.996***	-0.132
	size effect	0.04	0.008	-0.032***	0.017**	0.047***	0.024	0.087***	0.125***	0.102***	0.165***	0.033	-0.082
	D.ElPeriod	0.001	-0.028**	-0.014	0.03**	0.008	-0.031***	-0.014	0.026	-0.669	-0.001	-0.004	-0.485***

2008, 1 dummy		*Portfolios*											
	Coefficient	*NoDur*	*Durbl*	*Manuf*	*Enrgy*	*Chems*	*BusEq*	*Telcm*	*Utils*	*Shops*	*Hlth*	*Money*	*Other*
Conditional mean	μ	0.106	0.004	0.050*	0.103**	0.037	0.037	0.003	0.082***	-0.005	0.015	-0.036**	-0.004
	r_{t-1}	-0.058	-0.117	-0.101	-0.04	-0.139*	-0.018	0.032	0.082***	0.053	-0.141***	0.292***	0.132
	ϵ_{t-1}	-0.236***	-0.141	-0.232***	-0.197	-0.18**	-0.318***	-0.379***	-0.296***	-0.344***	-0.089*	-0.546***	-0.469***
	EuStoxx	0.407***	0.761***	0.668***	0.654***	0.495***	0.592***	0.613***	0.43***	0.574***	0.405***	0.67***	0.637***
	D.ElPeriod	-0.066	-0.482	-0.771***	-0.572	-0.387*	-0.606***	-0.512**	-0.604**	-0.303	-0.245	-0.658*	-0.418*
Conditional variance	ω	0.439***	0.26***	0.295***	0.29***	0.443***	0.392***	0.342***	0.621***	0.245***	0.359***	0.245***	0.269***
	sign effect	-0.128***	-0.064*	-0.084***	-0.058*	-0.085**	-0.057*	-0.087***	-0.087*	-0.028	-0.044	-0.147***	-0.108***
	persistence	0.948***	0.973***	0.968***	0.971***	0.95***	0.958***	0.962***	0.932***	0.973***	0.958***	0.975***	0.97***
	size effect	0.203***	0.229***	0.146***	0.148***	0.223**	0.187***	0.17***	0.272***	0.213***	0.18***	0.324***	0.158***
	D.ElPeriod	0.152***	0.1***	0.102***	0.091***	0.149***	0.119***	0.149***	0.202***	0.096***	0.147***	0.097**	0.109***

Note that ω and *D.ElPeriod* in the conditional variance have been multiplied by 100 for graphical purposes.

Figure A.13: EGARCH coefficients for each portfolio in each election (2012-2016)

2012, 1 dummy		*Portfolios*											
	Coefficient	*NoDur*	*Durbl*	*Manuf*	*Enrgy*	*Chems*	*BusEq*	*Telcm*	*Utils*	*Shops*	*Hlth*	*Money*	*Other*
Conditional mean	μ	0.085***	0.046	0.079***	0.061**	0.077***	0.076**	0.117***	0.053**	0.093***	0.091***	0.070**	0.046
	r_{t-1}	-0.804***	-0.984***	1***	-0.822***	-0.73	-0.659***	0.081	-0.862***	0.276***	-0.778***	-0.239	-0.774***
	ϵ_{t-1}	0.724***	0.973***	-0.997***	0.746***	0.649	0.546***	-0.233*	0.8***	-0.383***	0.698***	-0.017	0.666***
	EuStoxx	0.365***	0.711***	0.582***	0.597***	0.44***	0.513***	0.458***	0.31***	0.349***	0.384***	0.621***	0.521***
	D.ElPeriod	-0.210**	-0.048	-0.110	-0.164	-0.132*	-0.259**	-0.239***	-0.779	-0.169**	-0.078	-0.081	-0.078
Conditional variance	ω	1.885**	0.333***	0.203***	0.488***	0.353***	0.447***	0.418***	0.622***	0.289***	0.415***	0.224***	0.327***
	sign effect	-0.134**	-0.091***	-0.151***	-0.123***	-0.092***	-0.08**	-0.032	-0.07*	-0.074**	-0.095***	-0.048*	-0.12***
	persistence	0.766***	0.965***	0.977***	0.947***	0.958***	0.949***	0.951***	0.924***	0.966***	0.95***	0.975***	0.962***
	size effect	0.457***	0.12***	0.1***	0.152	0.163***	0.178	0.248***	0.27***	0.152***	0.164	0.194***	0.172***
	D.ElPeriod	0.129	0.009	0.02	0.006	0.02	0.024	-0.001	0.043	0.015	0.025	0.016	0.017

2016, 1 dummy		*Portfolios*											
	Coefficient	*NoDur*	*Durbl*	*Manuf*	*Enrgy*	*Chems*	*BusEq*	*Telcm*	*Utils*	*Shops*	*Hlth*	*Money*	*Other*
Conditional mean	μ	0.053***	0.026	0.010	-0.076**	0.008	0.037	0.041	0.040	0.047***	0.062***	0.037**	0.002
	r_{t-1}	0.822***	-0.275	-0.334***	0.333***	0.194**	-0.594***	-0.321***	0.293**	0.966***	0.847***	0.066	-0.226***
	ϵ_{t-1}	-0.913***	0.143	0.226***	-0.419***	-0.295***	0.515***	0.241***	-0.373***	-0.998***	-0.923***	-0.217***	0.092
	EuStoxx	0.25***	0.515***	0.392***	0.416***	0.306***	0.375***	0.3***	0.162***	0.285***	0.33***	0.477***	0.39***
	D.ElPeriod	-0.117***	-0.018	0.063	0153***	-0.011	-0.030	-0.110	-0.104	-0.0730***	-0.161***	0.016	0.035
Conditional variance	ω	3.891**	3.287*	0.547***	0.109***	1.116**	0.889	0.718	1.585	1.604**	0.461***	1.637**	0.892
	sign effect	-0.146**	-0.121*	-0.12***	-0.086***	-0.168***	-0.238*	-0.073*	-0.018	-0.154***	-0.13***	-0.101**	-0.103***
	persistence	0.546***	0.642***	0.937***	0.989***	0.871***	0.899***	0.917***	0.826	0.813***	0.949***	0.818***	0.897***
	size effect	0.435***	0.294**	0.156**	0.077***	0.341***	0.163**	0.237***	0.129	0.33***	0.101*	0.32***	0.275***
	D.ElPeriod	-0.209	-0.168	-0.001	-0.01	-0.109	-0.053	-0.02	0.038	-0.078	0.019	-0.086	-0.029

Note that ω and *D.ElPeriod* in the conditional variance have been multiplied by 100 for graphical purposes.

Figure A.14: Autocorrelation (Ljung-Box) test on EGARCH residuals

Residuals Autocorrelation, 2 dummies

		Portfolios											
Election	*Lags*	*NoDur*	*Durbl*	*Manuf*	*Enrgy*	*Chems*	*BusEq*	*Telcm*	*Utils*	*Shops*	*Hlth*	*Money*	*Other*
2000	5	1.630	0.841	2.416	8.933*	3.265	3.022	7.808*	7.983*	5.136	12.687*	2.848	10.062*
	10	5.901	1.556	4.146	10.612	4.245	14.62*	12.078	9.675	13.559*	15.705*	5.351	14.654*
	15	7.188	3.487	10.404	11.712	7.557	16.927	21.294*	10.671	18.084	20.176*	9.094	19.554
2004	5	2.021	8.069*	7.565	8.561*	0.53	0.431	1.21	2.867	9.502*	9.525*	9.120*	5.318
	10	4.423	14.027*	18.336*	10.429	5.333	6.226	3.22	5.506	18.777*	14.097*	10.239	7.536
	15	6.677	18.826	26.784*	14.934	8.288	9.907	6.928	10.002	23.623*	20.659*	14.183	11.482
2008	5	5.080	5.109	1.134	1.601	3.878	1.712	1.034	2.325	5.932	1.692	4.516	0.614
	10	9.120	6.577	8.984	5.368	5.226	7.082	9.526	9.589	6.335	6.181	6.596	4.147
	15	13.411	17.524	15.227	10.209	11.325	15.476	12.59	16.686	13.393	9.799	12.192	11.876
2012	5	2.721	6.332	6.309	1.865	3.614	10.876*	12.373*	9.527*	6.959	5.085	7.793*	8.824*
	10	5.071	7.859	6.881	2.954	6.542	13.963*	13.005	10.666	9.043	8.558	13.500*	9.766
	15	8.601	12.501	10.689	6.931	11.068	16.642	14.328	17.866	12.653	13.304	13.937	13.515
2016	5	4.742	1.177	3.428	1.037	0.886	4.228	7.636	4.581	2.508	2.944	4.032	3.178
	10	6.720	5.944	6.555	1.950	2.006	11.940	10.684	7.844	9.721	8.088	8.585	7.810
	15	15.025	17.03	16.239	2.702	10.898	21.147*	17.880	10.600	15.517	14.594	13.960	22.668*

Residuals Autocorellation, 1 dummy

		Portfolios											
Election	*Lags*	*NoDur*	*Durbl*	*Manuf*	*Enrgy*	*Chems*	*BusEq*	*Telcm*	*Utils*	*Shops*	*Hlth*	*Money*	*Other*
2000	5	1.662	0.805	2.221	8.440*	2.411	4.406	5.202	8.177*	5.108	12.357*	0.482	8.289*
	10	6.103	1.836	4.137	10.056	4.520	13.164	12.398	11.432	13.576*	16.43*	4.812	15.945*
	15	7.499	3.787	10.395	11.108	7.720	16.462	21.241*	12.507	18.092	20.843*	9.146	19.509
2004	5	1.140	8.295*	7.405*	8.162*	0.447	0.369	0.715	1.96	2.373	4.094	6.017	5.147
	10	5.353	14.093*	16.158*	9.392	4.621	6.044	3.038	5.474	19.949*	11.317	9.663	6.677
	15	7.549	18.973	24.666*	10.868	7.257	9.977	6.560	9.893	24.555*	16.908	13.506	10.315
2008	5	3.232	5.515	0.192	0.908	4.547	1.591	0.968	2.557	5.777	1.780	4.207	0.599
	10	9.487	6.860	9.261	5.535	5.735	7.437	8.762	10.022	6.651	6.489	6.670	4.402
	15	13.656	17.911	15.072	10.179	11.305	15.814	12.04	17.108	13.883	9.723	12.043	11.915
2012	5	2.991	3.775	7.664*	1.597	3.575	9.534*	5.762	1.522	5.808	4.338	7.025*	5.909
	10	5.230	9.189	9.868	3.196	6.690	14.192*	6.303	2.755	9.218	9.147	12.925	9.033
	15	8.768	14.669	13.685	7.199	11.112	16.822	8.056	8.984	12.929	14.022	13.383	12.746
2016	5	4.485	1.542	2.904	0.889	0.857	4.064	5.841	1.557	3.475	2.748	2.109	3.033
	10	6.608	5.774	6.664	2.275	2.130	12.033	7.933	7.721	10.524	7.928	8.501	8.806
	15	14.150	16.984	17.253	3.049	11.074	21.253*	16.087	10.605	16.713	14.620	13.831	23.865*

Note: null hypothesis is no autocorrelation in the residuals. The significance for the reject of the null are shown as before.

Figure A.15: Heteroskedasticity test on EGARCH residuals

Residuals Heteroschedasticity, 1 dummy

		Portfolios											
Election	*Lags*	*NoDur*	*Durbl*	*Manuf*	*Enrgy*	*Chems*	*BusEq*	*Telcm*	*Utils*	*Shops*	*Hlth*	*Money*	*Other*
2000	5	6.408	1.150	2.658	1.790	0.374	3.562	4.779	8.369	5.442	3.874	6.562	2.190
	10	11.226	3.314	5.763	4.541	2.647	5.397	20.337*	13.302	8.010	6.491	12.031	3.461
	15	19.599	12.165	10.235	7.136	4.143	12.005	29.527*	14.649	13.874	10.883	17.561	6.019
2004	5	7.034	0.955	0.973	0.345	3.402	1.794	0.338	5.878	0.859	1.184	9.339*	1.913
	10	6.703	13.896	6.403	2.893	9.291	7.337	1.262	7.514	6.691	7.768	20.078*	9.604
	15	9.378	20.512	14.632	6.563	14.96	15.779	5.139	9.255	9.472	9.848	26.723*	14.994
2008	5	4.208	1.962	2.645	5.613	1.019	4.047	2.433	1.806	0.973	1.077	2.341	2.985
	10	13.925	3.739	4.308	11.994	3.04	6.195	7.042	15.904	3.937	4.139	5.466	7.253
	15	15.543	5.544	13.756	13.217	6.146	21.079	10.926	17.155	5.753	7.575	10.38	13.232
2012	5	3.895	0.377	3.172	4.949	13.417*	1.612	2.62	12.535*	10.254*	2.395	2.113	1.154
	10	7.056	4.829	5.604	5.706	17.487*	4.533	5.695	15.685	13.391	5.339	3.904	4.119
	15	30.232*	8.545	6.678	18.95	23.182*	8.037	7.164	18.335	18.504	18.669	6.169	6.649
2016	5	1.327	3.67	13.716*	0.836	2.742	4.227	1.178	5.906	3.858	1.740	22.753*	4.605
	10	3.226	6.396	18.314*	9.188	13.701	7.028	3.481	10.872	5.291	4.604	25.320*	8.217
	15	5.144	13.843	22.080	11.510	15.976	8.760	7.376	18.710	7.168	9.765	27.674*	15.161

Residuals Heteroschedasticity, 2 dummies

		Portfolios											
Election	*Lags*	*NoDur*	*Durbl*	*Manuf*	*Enrgy*	*Chems*	*BusEq*	*Telcm*	*Utils*	*Shops*	*Hlth*	*Money*	*Other*
2000	5	6.492	1.223	2.682	1.550	0.274	2.913	4.958	24.099*	5.439	2.870	5.818	1.152
	10	11.316	3.275	5.823	5.507	2.543	6.464	22.396*	25.989*	8.034	7.782	12.114	3.329
	15	20.208	12.045	10.268	8.584	4.006	12.782	33.448*	27.209*	13.896	11.899	17.704	4.694
2004	5	7.220	0.973	1.163	2.850	3.526	1.750	0.367	5.717	1.474	1.186	13.642*	3.966
	10	7.508	13.361	6.562	4.683	8.990	6.751	1.419	7.220	6.880	6.207	33.049*	15.471
	15	9.339	19.809	14.741	4.990	14.477	14.903	5.190	8.988	10.537	10.248	39.13*	20.669
2008	5	4.455	1.953	2.813	5.566	0.945	4.220	2.487	1.887	0.974	1.013	2.705	3.140
	10	13.701	3.629	4.501	12.005	2.497	6.370	6.962	15.628	3.838	4.348	6.054	7.166
	15	15.073	5.338	13.365	13.404	5.567	21.531	10.813	17.144	5.426	7.639	10.82	12.856
2012	5	3.892	0.724	2.807	6.440	13.82*	1.653	4.051	12.679*	10.461*	2.587	2.533	2.192
	10	7.100	6.322	4.820	7.300	17.872*	4.075	8.282	16.14*	13.556	5.315	4.333	5.017
	15	31.038*	9.537	5.591	20.979	23.953*	7.37	9.365	17.828	18.947	17.329	6.478	7.836
2016	5	1.005	4.077	9.831*	1.490	3.071	4.240	8.664	4.961	2.325	1.731	8.851	4.888
	10	3.196	8.572	14.444	6.824	14.293	7.054	12.479	10.183	4.216	4.398	11.669	8.406
	15	4.884	15.719	17.765	8.611	16.380	8.821	15.562	17.843	6.475	9.904	14.008	13.994

Note: null hypothesis is no heteroskedasticity in the residuals. The significance for the reject of the null are shown as before.

A.7 VIX regression with interaction

Figure A.16: VIX regression with interaction term between winning uncertainty and election proximity.

Dependent variable: VIX								
	National Conv.		*45 days*		*30 days*		*15 days*	
Intercept	-0.0008		-0.0007		-0.0006		-0.0006	
WinProbDem	-0.0033		-0.0032		-0.0032		-0.0028	
D.after15	-0.0102		-0.0102		-0.0102		-0.0104	
WinUnc	0.0100	**	0.0094	*	0.0088	*	0.0091	*
D.before	0.0070	*	0.0098	**	0.0102	*	0.0158	*
EuStoxx	-0.0218	***	-0.0218	***	-0.0218	***	-0.0218	***
VIX_{t-1}	-0.1724	***	-0.1726	***	-0.1725	***	-0.1723	***
WinUnc $\times$ *D.before*	-0.0040		0.0006		0.0038		0.0029	
N. obs.	4721		4721		4721		4721	
Adj-R	0.2435		0.2436		0.2434		0.2435	
F-statistic	218	***	218.1	***	217.8	***	218	***
Note:	* sign. at 10%, ** 5%, * 1%.							

Bibliography

Reed Abelson. Donald Trump Says He May Keep Parts of Obama Health Care Act, 2016. URL https://www.nytimes.com/2016/11/12/business/insurers-unprepared-for-obamacare-repeal.html.

Alan I. Abramowitz. When good forecasts go bad: The time-for-change model and the 2004 presidential election. In *PS - Political Science and Politics*, 2004. doi: 10.1017/S1049096504045056.

Dante Amengual and Dacheng Xiu. Resolution of policy uncertainty and sudden declines in volatility. *Journal of Econometrics*, 203(297-315), 2018. ISSN 18726895. doi: 10.1016/j.jeconom.2017.12.003.

Donald W. K. Andrews. Tests for Parameter Instability and Structural Change With Unknown Change Point. *Econometrica*, 61(4):821, 2006. ISSN 00129682. doi: 10.2307/2951764.

Michael Barbaro and Megan Twohey. Crossing the Line: How Donald Trump Behaved With Women in Private, 2016. URL https://www.nytimes.com/2016/05/15/us/politics/donald-trump-women.html.

Dirk G. Baur. Financial contagion and the real economy. *Journal of Banking and Finance*, 36(10): 2680–2692, 2012. ISSN 03784266. doi: 10.1016/j.jbankfin.2011.05.019.

Marie Claude Beaulieu, Jean Claude Cosset, and Naceur Essaddam. The impact of political risk on the volatility of stock returns: The case of Canada, 2005. ISSN 00472506.

Jedrzej Bialkowski, Katrin Gottschalk, and Tomasz Piotr Wisniewski. Political orientation of

government and stock market returns. *Applied Financial Economics Letters*, 3(4):269–273, 7 2007. ISSN 1744-6546. doi: 10.1080/17446540701222359. URL https://doi.org/10.1080/17446540701222359.

Fischer Black. Studies in stock price volatility changes, 1976.

Alan S. Blinder and Mark W. Watson. Presidents and the US Economy: An econometric exploration, 2016. ISSN 00028282.

Nicholas Bloom. Research on Economic Policy Uncertainty: Our Research and Commentary, 2012. URL http://www.policyuncertainty.com/research.html.

Bloomberg Terminal. Euro Stoxx 50 Index - Historical Price Table, 31/12/1997 to 31/12/2018, 2019.

Tim Bollerslev. Generalized autoregressive conditional heteroskedasticity. *Journal of Econometrics*, 31(3):307–327, 1986. ISSN 0304-4076. doi: https://doi.org/10.1016/0304-4076(86)90063-1. URL http://www.sciencedirect.com/science/article/pii/0304407686900631.

David R. Bowes. Stock market volatility and presidential election uncertainty: Evidence from political futures markets. *Journal of Applied Business Research*, 34(1):143–150, 2018. ISSN 08927626. doi: 10.19030/jabr.v34i1.10105.

Keith C. Brown, W. V. Harlow, and Seha M. Tinic. Risk aversion, uncertain information, and market efficiency. *Journal of Financial Economics*, 22(2):355–385, 1988. ISSN 0304405X. doi: 10.1016/0304-405X(88)90075-X.

George Bush. George W. Bush for President 2000 Campaign Brochure, 2000a. URL http://www.4president.org/brochures/2000/georgewbush2000brochure.htm.

George Bush. Bush Cheney 2004 Campaign Brochure, 2004a. URL http://www.4president.org/brochures/2004/bushcheney2004brochure.htm.

George W Bush. Governor George W. Bush - Acceptance Speech, 2000b. URL http://www.4president.org/speeches/2000/bushcheney2000convention.htm.

George W Bush. George W. Bush 2004 Convention Speech, 2004, 2004b. URL http://www.4president.org/speeches/2004/bushcheney2004convention.htm.

Center for Responsive Politics. Most Heavily Partisan Industries, 2018. URL https://www.opensecrets.org/industries/.

Louis K.C. Chan, Narasimhan Jegadeesh, and Josef Lakonishok. Momentum strategies. *Journal of Finance*, 51(5):1681–1713, 1996. ISSN 00221082. doi: 10.1111/j.1540-6261.1996.tb05222.x.

Nai-Fu Chen, Richard Roll, and Stephen A. Ross. Economic Forces and the Stock Market. *The Journal of Business*, 2002. ISSN 0021-9398. doi: 10.1086/296344.

Hilary Clinton. Hillary Clinton 2016 Website - July 28, 2016, 2016a. URL http://www.4president.us/websites/2016/hillaryclinton072816website.htm.

Hilary Clinton. Holary Clinton 2016 Convention Acceptance Speech, 2016b. URL http://www.4president.org/speeches/2016/hillaryclinton2016conventionacceptance.htm.

Scott Culpepper. Bush-Kerry Presidential Debates, 2004. URL http://cphcmp.smu.edu/2004election/bush-kerry-debates/.

Datastream. VIX index - Historical Price Table, 31/12/1997 to 31/12/2019, 2019.

David A. Deese. Energy: Economics, Politics, and Security. *International Security*, 4(3):140, 1979. ISSN 01622889. doi: 10.2307/2626698.

Michael Duffy. McCain, Obama find common ground on national service, 2008. URL http://edition.cnn.com/2008/POLITICS/09/12/candidates.sept11/.

Art Durnev. The Real Effects of Political Uncertainty: Elections and Investment Sensitivity to Stock Prices, 2010.

Louis H Ederington and Jae Ha Lee. How Markets Process Information: News Releases and Volatility. *The Journal of Finance*, 48(4):1161, 1993. ISSN 15406261. doi: 10.1111/j.1540-6261.1993.tb04750.x.

Demissew Diro Ejara, Raja Nag, and Kamal P. Upadhyaya. Opinion polls and the stock market: Evidence from the 2008 US presidential election. *Applied Financial Economics*, 24(10), 2012. ISSN 09603107. doi: 10.1080/09603107.2011.617692.

Elyas Elyasiani, Iqbal Mansur, and Babatunde Odusami. Oil price shocks and industry stock returns. *Energy Economics*, 33(5):966–974, 2011. ISSN 01409883. doi: 10.1016/j.eneco.2011.03.013.

Walter Enders. *Applied econometric time series*. Wiley, 2014a. ISBN 9780511606885. doi: 10.1017/CBO9780511606885.

Walter Enders. *Applied econometric time series*. Wiley, 2014b. ISBN 9780511606885. doi: 10.1017/CBO9780511606885.

Robert F Engle. Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation. *Econometrica*, 50(4):987–1007, 1982. ISSN 00129682, 14680262. doi: 10.2307/1912773. URL http://www.jstor.org/stable/1912773.

Robert F. Engle and Victor K. NG. Measuring and Testing the Impact of News on Volatility. *The Journal of Finance*, 48(5):1749, 1993. ISSN 15406261. doi: 10.1111/j.1540-6261.1993.tb05127.x.

Bjørn Eraker, Ivan Shaliastovich, and Wenyu Wang. Durable Goods, Inflation Risk, and Equilibrium Asset Prices. *Review of Financial Studies*, 29(1):193–231, 2015. ISSN 14657368. doi: 10.1093/rfs/hhv049.

Eugene F. Fama and Kenneth R. French. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33(1):3–56, 1993. ISSN 0304405X. doi: 10.1016/0304-405X(93)90023-5.

Eugene F. Fama Fama and Kenneth R. French. The Capital Asset Pricing Model: Theory and Evidence. *Journal of Economic Perspectives*, 18(3):25–46, 2004. doi: 10.1257/0895330042162430.

Kenneth R. French. 12 Industry Portfolios [Daily], 2019. URL https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

Gallup. Presidential Approval Ratings – George W. Bush, 2004. URL https://news.gallup.com/poll/116500/presidential-approval-ratings-george-bush.aspx.

Gallup. Gallup Presidential Election Trial-Heat Trends, 1936-2008, 2008. URL https://news.gallup.com/poll/110548/gallup-presidential-election-trial-heat-trends.aspx.

Gallup. Election 2012 Registered Voters Trial Heat: Obama vs. Romney, 2012. URL https://news.gallup.com/poll/150743/obama-romney.aspx.

Joe Ganley and Chris Salmon. The Industrial Impact of Monetary Policy Shocks: Some Stylised Facts, 1998.

Gordon Gemmill. Political risk and market efficiency: Tests based in British stock and options markets in the 1987 election. *Journal of Banking and Finance*, 16(1):211–231, 1992. ISSN 03784266. doi: 10.1016/0378-4266(92)90086-F.

Alexios Ghalanos. Introduction to the rugarch package (Version 1.3-8), 2018. ISSN 1868-4238.

John W. Goodell and Sami Vähämaa. US presidential elections and implied volatility: The role of political uncertainty. *Journal of Banking and Finance*, 37(3):1108–1117, 2013. ISSN 03784266. doi: 10.1016/j.jbankfin.2012.12.001.

Al Gore. Al Gore for President 2000 Campaign Brochure, 2000a. URL http://www.4president.org/brochures/gore2000brochure.htm.

Al Gore. Al Gore 2000 Convention Speech, 2000b. URL http://www.4president.org/speeches/2000/gorelieberman2000convention.htm.

Patrick Healy. Debacle: What Al Gore's First Debate Against George W. Bush Can Teach Hillary Clinton, 2016. URL https://www.nytimes.com/interactive/2016/09/25/us/politics/george-w-bush-al-gore-2000-presidential-debate.html.

Jesse Holcomb. How the Lehman Bros. crisis impacted the 2008 presidential race, 2013. URL https://www.pewresearch.org/fact-tank/2013/09/19/how-the-lehman-bros-crisis-impacted-the-2008-presidential-race/.

John C. Hull. Options, Futures and other Derivatives. In *Options, Futures and other Derivatives*, chapter 13, pages 276–278. Pearson, 2018.

Iowa Electronic Markets. What is the IEM?, 2018. URL https://iemweb.biz.uiowa.edu/media/summary.html.

Iowa Electronic Markets. Closed Markets and Historical Data (1998 - Now), 2019. URL https://iemweb.biz.uiowa.edu/closed/.

Barney Jopson. House Republicans push for more sweeping bank deregulation, 2018. URL https://www.ft.com/content/9559a52a-27e4-11e8-b27e-cc62a39d57a0.

Dale W. Jorgenson. Information technology and the U.S. Economy. *American Economic Review*, 91(1):1–32, 2001. ISSN 00028282. doi: 10.1257/aer.91.1.1.

John Kerry. John Kerry for President 2004 Campaign Brochure, 2004a. URL http://www.4president.org/brochures/2004/kerryedwards2004brochure.htm.

John Kerry. John Kerry 2004 Convention Speech, 2004b. URL http://www.4president.org/speeches/2004/kerryedwards2004convention.htm.

F. H. Knight. Risk, Uncertainty and Profit, 1921. *Boston and New York*, 36(4):682, 1921. ISSN 0898-5626. doi: 10.1017/CBO9781107415324.004.

Athanasios Koulakiotis, Harry Papapanagos, and Nicholas Papasyriopoulos. Political elections, abnormal returns and stock price volatility: The case of Greece. *Investment Management and Financial Innovations*, 13(1):161–169, 2016. ISSN 18129358. doi: 10.21511/imfi.13(1-1).2016.03.

Peter Lazaroff. Democrats Vs. Republicans: Who Is Better For The Stock Market?, 2016. URL https://www.forbes.com/sites/peterlazaroff/2016/07/26/democrats-vs-republicans-who-is-better-for-the-stock-market/#4967f250239d.

David Leblang and Bumba Mukherjee. Presidential elections and the stock market: Comparing Markov-switching and fractionally integrated GARCH models of volatility. *Political Analysis*, 12 (3):296–322, 2004. ISSN 10471987. doi: 10.1093/pan/mph020.

Dave Leip. United States Presidential Election Results, 2019. URL https://uselectionatlas.org/RESULTS/.

Jorn Madslien. Dotcom bubble burst: 10 years on, 2010. URL http://news.bbc.co.uk/2/hi/business/8558257.stm.

Sushanta K. Mallick and Mohammed Mohsin. Macroeconomic Effects of Inflationary Shocks with Durable and Non-Durable Consumption. *Open Economies Review*, 27(5):895–921, 2016. ISSN 1573708X. doi: 10.1007/s11079-016-9405-0.

H. Markowitz. Portfolio Selection. *The Journal of Finance*, 7(1):77, 1952.

Katerina Eva Matsa and Elisa Shearer. News Use Across Social Media Platforms 2018, 2018. URL https://www.journalism.org/2018/09/10/news-use-across-social-media-platforms-2018/.

John McCain. John McCain 2008 Website - September 4, 2008, 2008a. URL http://www.4president.us/websites/2008/mccain090408website.htm.

John McCain. John McCain 2008 Convention Speech, 2008b. URL http://www.4president.org/speeches/2008/johnmccain2008acceptance.htm.

Steve Mount. The Election of 2000, 2010. URL https://www.usconstitution.net/elec2000.html.

Ralph Nader. Statement of Ralph Nader, Announcing His Candidacy for the Green Party's Nomination for President, 2000. URL http://www.4president.org/speeches/2000/ralphnader2000announcement.htm.

Frank Newport. Democrats, Republicans See Many U.S. Industries Differently, 2013. URL https://news.gallup.com/poll/164111/democrats-republicans-industries-differently.aspx.

Srinivas Nippani and W. Bobby Medlin. The 2000 presidential election and the stock market. *Journal of Economics and Finance*, 26(2):162–169, 2002. ISSN 19389744. doi: 10.1007/BF02755983.

Barack Obama. Barack Obama 2008 Website - August 28, 2008, 2008a. URL http://www.4president.us/websites/2008/obama082808website.htm.

Barack Obama. Barack Obama 2012 Convention Speech, 2008b. URL http://www.4president.org/speeches/2008/barackobama2008acceptance.htm.

Barack Obama. Barack Obama 2012 Website - September 6, 2012, 2012a. URL http://www.4president.us/websites/2012/obamabiden090612website.htm.

Barack Obama. Barack Obama 2008 Convention Speech, 2012b. URL http://www.4president.org/speeches/2012/barackobama2012conventionacceptance.htm.

ObamaCareFacts.com. ObamaCare Facts: Facts on the Affordable Care Act, 2014. URL https://obamacarefacts.com/obamacare-facts/.

Terrance Odean. Do investors trade too much? *American Economic Review*, 89(5):1279–1298, 1999. ISSN 00028282. doi: 10.1257/aer.89.5.1279.

Andreas Oehler, Thomas J. Walker, and Stefan Wendt. Effects of election results on stock price

performance: evidence from 1980 to 2008. *Managerial Finance*, 39(8):714–736, 2013. ISSN 17587743. doi: 10.1108/MF-May-2012-0126.

Durmuş Özdemir. *Applied Statistics for Economics and Business*. Springer, 2016. doi: 10.1007/978-3-319-26497-4.

Christos Pantzalis, David A. Stangeland, and Harry J. Turtle. Political elections and the resolution of uncertainty: The international evidence. *Journal of Banking and Finance*, 24(10), 2000. ISSN 03784266. doi: 10.1016/S0378-4266(99)00093-X.

Lubos Pastor and Robert F. Stambaugh. Liquidity Risk and Expected Stock Returns. *Journal of Political Economy*, 111(3):642–685, 2003. ISSN 00223808, 1537534X. doi: 10.1086/374184. URL http://www.jstor.org/stable/10.1086/374184.

Lasse Heje Pedersen. *Efficiently Inefficient - How Smart Money Invests and Market Prices Are Determined*. Princeton University Press, 41 William Street, Princeton, New Jersey 08540, 2015.

Journalism Media Pew Research Center. Candidates differ in their use of social media to connect with the public, 2018. URL https://www.journalism.org/2016/07/18/candidates-differ-in-their-use-of-social-media-to-connect-with-the-public/.

Eckhard Platen. Empirical evidence on student-t log-returns of diversified world stock indices. *Journal of Statistical Theory and Practice*, 2(2):233–251, 2008. ISSN 15598616. doi: 10.1080/15598608.2008.10411873.

The Center for Responsive Politics. Center for Responsive Politics, 2019. URL https://www.opensecrets.org/industries/.

David Randall and David Gaffen. What's behind the global stock market selloff?, 2016. URL https://www.reuters.com/article/us-usa-markets-idUSKCN0VL0XO.

William B Riley Jr and William A Luksetich. The market prefers Republicans: Myth or Reality. *Journal of Financial & Quantitative Analysis*, 15(3):541, 1980.

Lars Hendrik Röller and Leonard Waverman. Telecommunications infrastructure and economic development: A simultaneous approach. *American Economic Review*, 91(4):909–923, 2001. ISSN 00028282. doi: 10.1257/aer.91.4.909.

Mitt Romney. Mitt Romney 2012 Website - August 30, 2012, 2012. URL http://www.4president.us/websites/2012/romney083012website.htm.

Pedro Santa-Clara and Rossen Valkanov. The Presidential Puzzle: Political Cycles and the Stock Market, 2003. ISSN 00221082.

Matthew Sherman. A Short History of Financial Deregulation in the United States, 2009. ISSN 00359009.

Lee Sigelman. Presidential Popularity and Presidential Elections. *The Public Opinion Quarterly*, 43 (4):532–534, 1979. ISSN 0033362X, 15375331. URL http://www.jstor.org/stable/2748551.

Fotios Siokis and Panayotis Kapopoulos. Parties, elections and stock market volatility: Evidence from a small open economy. *Economics and Politics*, 19(1):123–134, 2007. ISSN 09541985. doi: 10.1111/j.1468-0343.2007.00305.x.

The Guardian. Financial crisis: timeline, 2013. URL https://www.theguardian.com/business/2012/aug/07/credit-crunch-boom-bust-timeline.

The White House. Presidents, 2016. URL https://www.whitehouse.gov/about-the-white-house/presidents/.

Michael A. Toman and Barbora Jemelkova. Energy and Economic Development: An Assessment of the State of Knowledge. *Energy Journal*, 24(4), 2003. ISSN 01956574. doi: 10.5547/ISSN0195-6574-EJ-Vol24-No4-5.

Donald J. Trump. Donald J. Trump 2016 Presidential Campaign Website - July 21, 2016, 2016a. URL http://www.4president.us/websites/2016/donaldjtrump072116website.htm.

Donald J Trump. Donald J. Trump 2016 Convention Acceptance Speech, 2016b. URL http://www.4president.org/speeches/2016/donaldtrump2016acceptance.htm.

Amos Tversky and Daniel Kahneman. Judgment under Uncertainty: Heuristics and Biases. *Science*, 185(4157):1124–1131, 1974. ISSN 00368075, 10959203. URL http://www.jstor.org/stable/1738360.

U.S. Congress. Dodd-Frank Wall Street reform and consumer protection act, 2010. URL https://www.govinfo.gov/content/pkg/PLAW-111publ203/html/PLAW-111publ203.htm.

Usa.gov. Presidential Election Process, 2019. URL https://www.usa.gov/election.

Ariel M. Viale, James W. Kolari, and Donald R. Fraser. Common risk factors in bank stocks. *Journal of Banking and Finance*, 33(3):464–472, 2009. ISSN 03784266. doi: 10.1016/j.jbankfin.2008.08.019.

Alexander F. Wagner, Richard J. Zeckhauser, and Alexandre Ziegler. Company stock price reactions to the 2016 election shock: Trump, taxes, and trade. *Journal of Financial Economics*, 130(2):428–451, 2018. ISSN 0304405X. doi: 10.1016/j.jfineco.2018.06.013.

Kai Li Wang, Christopher Fawson, Christopher B. Barrett, and James B. McDonald. A flexible parametric GARCH model with an application to exchange rates. *Journal of Applied Econometrics*, 16(4):521–536, 2001. ISSN 08837252. doi: 10.1002/jae.606.

John Whitesides. Obama vs. McCain: sharp differences on key issues, 2008. URL https://www.reuters.com/article/us-usa-politics-issues/obama-vs-mccain-sharp-differences-on-key-issues-idUSN2725487120080604.

Wikipedia - The Free Encyclopedia. Historical polling for United States presidential elections, 2016. URL https://en.wikipedia.org/wiki/Historical_polling_for_United_States_presidential_elections.

Jeffrey M Wooldridge. *Introductory econometrics : a modern approach*. Fifth edition. Mason, Ohio : South-Western Cengage Learning, [2012] ©2012, 2012. URL https://search.library.wisc.edu/catalog/9910154038602121.

X. Frank Zhang. Information uncertainty and stock returns. *Journal of Finance*, 61(1):105–137, 2006. ISSN 00221082. doi: 10.1111/j.1540-6261.2006.00831.x.

Anthony Zurcher. Hillary Clinton emails - what's it all about?, 2016. URL https://www.bbc.com/news/world-us-canada-31806907.