The effect of political uncertainty on stock market uncertainty.

Master thesis Financial Economics

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A B S T R A C T

In this study, a panel data regression analysis is performed to test for the association between political uncertainty and stock market uncertainty in the U.S.. The dependent variable of the regression model represents stock market uncertainty which is measured using percentage changes in the implied volatility index VIX. The main test variable in this analysis represents political uncertainty and is measured using the changes in odds of a candidate to win the elections, which are derived from the prediction markets, namely, the IOWA electronic markets.

Keywords: Political uncertainty, stock market uncertainty, VIX

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1. Introduction

This paper empirically examines the association between political uncertainty and stock market uncertainty in the U.S framework. For this, it uses the changes in the probability of win of a candidate during the U.S. presidential elections as a measure of the change in political uncertainty, and changes in the implied volatility index VIX as a measure of the change in stock market uncertainty. The analysis uses a panel data regression model where changes in stock market uncertainty are regressed on changes in political uncertainty to find out the effect of political uncertainty on stock market uncertainty.

A lot of research in the past has examined the effects of politics on asset returns in general (see e.g., (Duyvesteyn, Martens, & Verwijmeren, 2016); (Guo, Li, & You, 2021); (Kang & Ratti, 2013); (Antonakakis, Chatziantoniou, & Filis, 2013); (Santos, Klotzle, & Pinto, 2021), etc.) but not a lot of research is done on the effects of election induced political uncertainty on stock market volatility in particular. To best of my knowledge, the exceptions are (see e.g., (Smales, 2014); (Jens, 2017); (Goodell & Vahamaa, 2013); (Goodell, McGee, & McGroarty, 2020); (Durnev, 2010); (Kelly, Pastor, & Pietro, 2016)). The motivation behind this study is to examine specifically the effects of election induced political uncertainty on the stock markets' implied volatility. This study contributes to the existing literature on the effects of political uncertainty on stock market volatility and emphasize specifically on the effects of political uncertainty on stock market uncertainty (proxied by implied volatility). It uses the framework applied by (Goodell & Vahamaa, 2013) in their study. The significant difference in this study is the additional approaches used to calculate both the political uncertainty and stock market uncertainty. Moreover, as per my knowledge, this is the first study to involve the data from the recently concluded U.S. presidential elections of 2020. The United States presidential elections take place every four year. This is the country's biggest political event and attracts global attention. According to a recent report by Statista[1], the U.S. stock markets accounted for almost 56% of the total world stock value (or equity value). Therefore, it makes sense that not only

[1] https://www.statista.com/statistics/710680/global-stock-markets-by-country/

the investors with exposure in the U.S. markets, but investors from all around the globe monitor this event cautiously and make decisions in line with their expectations of the outcome, given the co-movements in the global markets (see e.g., (Graham, Kiviaho, Nikkinen, & Omran, 2013); (Fernandez, 2015); (Huang, 2020); (Sakemoto, 2018)) and cross-country spill-over effects (see e.g., (Kelly, Pastor, & Pietro, 2016); (Antonakakis & Badinger, 2016); (Stolbov & Shchepeleva, 2016); (Balli, Uddin, Mudassar, & Yoon, 2017); (Jiang, Zhu, Tian, & Nie, 2019); (Davoine & Molnar, 2020)). In politics, a two-party system is one where there are only two major political parties that dominate the political landscape. The U.S. is a perfect example of a nation with two-party system, where the two major parties are, the Democratic party and the Republican party. These parties differ in terms of their stances on the political spectrum (Left-wing, Right-wing & Centrist), and also have different economic outlook perspectives which has its implications in the form of policy reforms. (Hibbs Jr, 1977) in his paper examines for the association between political parties and macroeconomic policies, and his study reveals a low employment , high inflation macroeconomic configuration associated with countries regularly governed by left-wing parties whereas a high employment, low inflation macroeconomic configuration for nations regularly governed by centrist and right-wing parties. These associations are subject to change as the political landscape has changed considerably over the years. Past studies have also examined the association between political parties (assuming the two-party system) and unemployment rate. (Wright, 2012) and (Hibbs Jr, 1977) both reveal in their respective studies that the unemployment rate is driven downwards by the Democratic governments and upwards by the Republican governments. These party associations have real impacts on the economy in general and are looked upon as political risks from the point of view of investors in times of uncertainty. It is obvious that these risks become more prominent as the election date comes closer, and also increase in magnitude with the increase in uncertainty about the outcome of the elections. (Li & Born, 2006) in their paper hypothesise that uncertainty regarding the outcome of the U.S. presidential elections is reflected in the stock returns in the period prior to the elections. They find that if none of the candidates have a dominant lead in the election, the stock market volatility and average returns rise. Data

from the pre-election polls is used to measure the election uncertainty, and for this they start taking their recordings from the month of august till the last week prior to the election date. Similarly, many other studies have made use of the election data prior to the elections to specifically examine the effects of election induced uncertainty. Using monthly changes in the probability of success of the candidate as a proxy for change in election uncertainty, is an approach often used in the past literature (Goodell & Vahamaa, 2013). In their paper, they derived these probabilities from prediction markets using monthly data on the change in the probability of the candidate starting from the month of February till the month of November. In this study, the same time period is used for taking the measurements as the panel runs from February till the election date, which is on the first Tuesday of the month of November. The reasoning behind selecting this time period is the assumption that political uncertainty will become more prominent for investors as the elections come closer and thereby any uncertainty in regard to the future political scenario should be also reflected in the stock market as investors price in this uncertainty in their decisions. Uncertainty is inherently unstable for an election event as the outcome for this event is bound to come with time. Therefore, this study measures the political uncertainty by using monthly changes in the probability of win of the candidate using data on probability change in the 10 months prior to the election date. Studies previously have examined the impact of this election induced uncertainty and have attempted to capture these effects using different approaches. A short-term approach is implemented by (Gemmill, 1992) to examine political uncertainty, measuring changes in probability of conservative win from the polling data of 1987 British elections and its effect on stock and option prices. Using this short-term approach, his study starts taking measurements in the week prior to the election date, following the assumption that the effects of political uncertainty would be more prominent when the outcome of the event is expected to be soon. The study reveals a very close relationship between political uncertainty, as measured by the change in probability of conservative win using opinion polls and the FTSE index level. The study also confirms that option prices in the last week of the election showed evidence of market inefficiency because they implied a reduction in the probability of a conservative win, but the opinion polls showed the

opposite. As discussed above, a lot of research in the past has been conducted on the effects of political uncertainty on markets in general. For this, there have been different approaches implemented which can be classified as long- middle- and short termed depending on the time period chosen to analyse. The long-term approach is used by (Goodell & Vahamaa, 2013) in their paper, to examine the effects of political uncertainty in the U.S., where they start recording the monthly changes in candidate probability from the month of February till November of the election year. The middle-termed approach is implemented by (Li & Born, 2006) who make use of the polling data from the U.S. elections, starting from the month of August till November of the election year. Finally, the short-term approach is used by (Gemmill, 1992) to examine the effects of political uncertainty on stock market in the U.K., where they use the opinion-polls data to calculate the candidate odds and thereby measure changes in political uncertainty. For this, they use the data starting from a week prior to the election and running through till the election date itself.

Rest of this paper proceeds as follows. Section 2 discusses the background and reviews the existing literature related to this paper along with providing the research hypothesis. Section 3 provides information on the data used in this study along with the sources used for obtaining the data. Section 4 discusses the methodology implemented in this analysis along with the model and its specifications. Section 5 reports the empirical findings of the regression analysis which examines the association between stock market uncertainty and political uncertainty using the different approaches mentioned in the previous section. Finally, section 6 provides concluding remarks on this paper.

2. Background and literature review

This section discusses in detail the past literature which aligns with this study and can be viewed as a build up for it. It is structured in a way that it first discusses the past papers examining the associations between uncertainty and assets in general and then digs into the past research specific to this study.

2.1. Asset valuation, risk and uncertainty.

This section focusses on the past literature that analyses the effects of risk and uncertainty on the asset prices in general. A significant amount of literature in the past has documented a negative association between asset valuation and level of uncertainty regarding the economy (see e.g., (Hirshleifer, 2002); (Brown, Harlow, & Tinic, 1988); (Daniel, Hirshleifer, & Subhrahmanyam, 1998)). (Brown, Harlow, & Tinic, 1988) in their paper develop and test the uncertain information hypothesis (UIH) as a means of explaining the response of investors to the arrival of unanticipated information. They postulate that asset valuations rises with decreasing uncertainty, as a rise in asset values is associated with a decrease of required return and an accompanying reduction in volatility. Their model begins with the assumption that investors often set stock prices before the full ramification of a dramatic financial event are known and the findings reveal that an increase in uncertainty, caused by favourable or unfavourable news, immediately causes rational investors to take a conservative approach by setting stock prices significantly below their conditional expectations. With time, as the uncertainty over the outcome is resolved, the price changes subsequently tend to be positive on average, regardless of the nature of the news event (favourable or un-favourable). These findings from the uncertain information hypothesis strongly suggest that asset prices in general rise with decreasing uncertainty.

A lot of prior research has been conducted on the effects of political risk on asset valuations. There has also been a significant number of studies done to empirically analyse the pricing of this political uncertainty in the stock markets and the risk premia associated with it. (Kelly, Pastor, & Pietro, 2016) in their paper examine the price of political uncertainty using options market. The challenge in measuring political uncertainty is to isolate the exogenous variation present in this uncertainty. For this, they use the data on major political events which are the national elections and global summits from 20 countries around the globe. Other studies like (Baker, Bloom, & Davis , 2016); (Pastor & Veronesi, 2013); (Baker, Bloom, & Davis, 2012); (Dzielinski, 2012); (Colombo, 2013); (Jens,

2017) have used the economic policy uncertainty index EPU[2] to examine the uncertainty regarding government future policy actions. This time series measure though might not be the best proxy for uncertainty regarding governmental policy itself as it might also include uncertainty due to economic fundamentals. To counter this challenge and to isolate the effects of political uncertainty, (Kelly, Pastor, & Pietro, 2016) exploit its variation around political events and investigate if this uncertainty is priced in the options market. The option market is particularly a good fit for this analysis because they are short termed and can be chosen to cover the dates of the political event. It makes sense that the price of the option covering the political event should reflect political risk associated with that event. Essentially, the option's price should reflect the valuation of the protection that it offers from the political risk associated with the event it covers. Their results confirm their hypothesises that political uncertainty is priced in the options market and the price increases with increase in political uncertainty and weaker economic conditions.

(Pastor & Veronesi, 2013) in their paper explore the asset pricing implications of their government policy model and show that stock prices are driven by three types of shocks, capital shock, impact shock and political shock. Their study reveals that political uncertainty is associated with a risk premium, the magnitude of which is higher in weaker economic conditions and lower in stronger economic conditions. This is achieved by developing a general equilibrium model of government policy choice. In this model, stock prices respond to political news. The source of political uncertainty is the uncertainty about political costs which is interpreted as uncertainty about governments future actions. The study further reveals that larger heterogeneity among the potential new government policies increases risk premia as well as volatilities and correlations of stock returns. (Robays, 2016) analyse the asset pricing implications of macroeconomic uncertainty on the oil price and show that higher macroeconomic uncertainty causes higher volatility in oil price. This is done by implementing a threshold vector autoregressive model which identifies low and high uncertainty regimes and estimates

[2] (Baker, Bloom, & Davis, Policy uncertainty: a new indicator, 2012) develop a new measure for government policy actions.

the effects of oil demand and supply shocks. Their study also reveals that higher macroeconomic uncertainty, as measured by global industrial production volatility, significantly increases the sensitivity of oil prices to shocks in oil demand and supply. The reason behind this is the fact that uncertainty lowers the price elasticity of the oil demand and supply (Robays, 2016). Finally, the paper concludes by stating that the difference in the estimated oil price elasticities is economically meaningful. This is because, in uncertain times, the price impact of a similar change in oil production might double in magnitude. As such, varying uncertainty can explain why oil price volatility is typically higher during periods of economic stress recessions, and also why oil price volatility changes over time more generally (Robays, 2016).

There exists a considerable amount of literature examining the determinants of asset prices and their association with risk and uncertainty (see e.g., (Abel, 1990), (Abel, 1999), (Bekaert, Engstrom, & Xing, 2009)). (Bekaert, Engstrom, & Xing, 2009) in their paper identify the importance of changes in fundamental factors and investor's risk preference as driving factors for variation in term structure, equity premiums, dividend yields, and conditional volatility returns. Their results reveal the important driving factors, which are, conditional volatility of cash flow growth and time-varying risk aversion. The study concludes that uncertainty is a driving factor more important for volatility and risk aversion is a driving factor more important for dividend yields and risk premiums. This conclusion is also in line with the findings of (Bansal & Yaron, 2005) and (Bansal, Khatchatrian, & Yaron, 2005)

2.2. Politics, political parties and economy

It is logical to think that the prevailing economic conditions have an influence on the voting behavior of voters during an election. There have been studies in the past that have confirmed this hypothesis (see for e.g., (Chappell & Keech, 1986); (Weschle, 2014); (Lewis-Beck, 1986)). (Lewis-Beck, 1986) in his paper analyses the voting determinants in the Western European countries elections, and reveals that the economic conditions are relatively the most important vote determinant, even exceeding the impact of partisan

identifications. Moreover, its importance is further enhanced in the case of incumbent coalition, as the governments performance evaluation has a strong effect on the probability of a vote for the incumbent administration. (Hibbs Jr, 1977) claims that the macroeconomic results are dependent on the policy choices of the government, and are not completely the result of the economy itself. In support of this view, the study by (Chappell & Keech, 1986) links party differences between the Democratic and the Republican to their preferred choice of macroeconomic configuration. Further, their study reveals that, on average, the inflation rate under the Democratic administration has been 2.5% higher compared to Republican administration. This finding is in line with the works of (Alesina, 1987) and (Hibbs Jr, 1977). Political parties differ in terms of their stances on the political spectrum (Left-wing, Right-wing & Centrist), and also have different economic outlook perspectives which has its implications in the form of policy reforms (Hibbs Jr, 1977). (Wright, 2012) and (Hibbs Jr, 1977) in their paper examine the association between political parties and unemployment rate, revealing that the unemployment rate is driven downwards by the Democratic governments and upwards by the Republican governments.

There exists a considerable amount of literature documenting the 4-year common stock return cycle around the U.S. presidential elections (see e.g., (Gartner & Wellershoff, 1995); (Huang R. D., 1985); (Hashim & Mosallamy, 2020) etc.). (Gartner & Wellershoff, 1995) in their paper show that U.S. stock prices have followed a four-year cycle for more than three decades, where the stock prices fall during the first half of a presidency and rise during the second. There also exists a considerable amount of research identifying the business cycles associated with the presidential elections. (Nordhaus, 1975) and (Hibbs Jr, 1977) established the theory of political business cycle (PBC), which postulates that the growth rate of real gross domestic products rises during election seasons, followed by an inflation curtailing contraction in the post-election period. The reason for this cycle is attributed to the opportunistic politicians who influence the growth of the economy in order to affect the sentiments of the voters in their favour. (Grier, 2008) shows the presence of political business cycles in the U.S. using the data from 1961 – 2004. He labels this cycle as electoral cycle, and its presence is confirmed by an analysis

that allows for rational partisan effects as well as a wide range of control variables. The model control for multiple lags in interest rate changes, inflation, money growth, energy prices, lagged output growth, government spending and temporary partisan effects. Some studies in the past have attributed these political business cycles in the U.S. to partisan effects. (Alesina, 1987) provides a Rational Partisan Theory (RPT) which theorizes that expectations about future inflation can impact wage negotiations well before elections. Further, it is expected that left-wing voters will support measures to promote growth and thereby generate higher inflation, and the right-wing voters will support measures to curtail the inflation. This theory is in line with the finding of (Hibbs Jr, 1977) too.

An extensive amount of literature has examined the effects of presidential elections on stock markets. (see e.g., (Niederhoffer, Gibbs, & Bullock, 1970); (Riley Jr. & Luksetich, 1980); (Hensel & Ziemba, 1995); (Goodell, McGroarty, & Urquhart, 2015); (Li & Born, 2006); (Santa-Clara & Valanov, 2003). The studies by (Niederhoffer, Gibbs, & Bullock, 1970) and (Riley Jr. & Luksetich, 1980) empirically examine the association between U.S. presidential elections and stock markets. Their study reveals that the markets react positively to the victory of a Republican candidate and negatively to a Democratic candidate in the short run after the election. Some studies have focussed on the long-term associations between stock markets and party affiliations and have documented that, on average, returns during the Democratic administrations have been higher as compared with the Republican (see e.g., (Johnson, Chittenden, & Jensen, 1999); (Hensel & Ziemba, 1995)). (Santa-Clara & Valanov, 2003) in their paper examine stock returns across the four-year presidential term during the period 1927 – 1998. The results reveal a persistent stock market return difference between Democratic and Republican administrations. Speaking specifically, their studies indicate that the annual excess return on a value-weighted index have, on average, been about 9% higher under Democratic presidencies.

Contradictory to the literature above, some recent studies have found out that there exists no robust evidence to support the hypothesis that stock market returns vary across presidencies or partisan control of the government (like (Powell, Shi, Smith, &

Whaley, 2007); (Jones & Banning, 2008); (Sy & Zaman, 2011)). (Sy & Zaman, 2011) in their studies confirm that there exists no statistically significant difference in stock returns between Democratic and Republican presidencies, after controlling for estimation biases and difference in systematic risk across presidencies. (Sy & Zaman, 2011) further indicate that the higher stock returns during Democratic presidencies are related to higher market premiums and default risk premiums. (Jones & Banning, 2008) examine the association between stock market performance and various U.S. elections using monthly stock returns over a century's time. They find out that different control combinations of the White House and/or the U.S. Congress does not have any systematic effect on stock markets. (Lehkonen & Heimonen, 2015) in their paper study 49 emerging financial markets to examine if their performance is related to their country's democracy level and, in particular, to its interaction with political risk. They use annualized panel data for these emerging markets for 2000–2012. The evidence indicates that democracy and political risk have an impact on stock market returns and the relationship between democracy and political risk is parabolic, i.e., there is a threshold level of democracy after which political risk begins to decline (Lehkonen & Heimonen, 2015). Also, their results suggest that decreases in political risk led to higher returns. They use two measures for democracy and two panel data methods, which are pooled OLS and system GMM in an attempt to capture the direct and interaction effects of democracy and political risk on the global market adjusted 12-month average returns.

2.3. Political uncertainty and stock markets

The past literature focussing on the effects of political uncertainty on stock markets are discussed in this section, along with the approaches used in these papers to measure political uncertainty. Given the significant differences between the Republicans and the Democrats regrading the future macroeconomic policy choice (see e.g., (Wright, 2012) (Hibbs Jr, 1977) (Chappell & Keech, 1986); (Lewis-Beck, 1986)), it follows that any uncertainty regarding the future government should be reflected in the stock markets. There exists a vast amount of literature examining the effects of political uncertainty on

stock markets in general. These studies use different sources for measuring political uncertainty. Majorly, the studies have used presidential election data from the prediction markets and from pre-election opinion polls to determine the level of political uncertainty in the economy. Many of them also invove the use of the economic policy uncertainty index, EPU, developed by (Baker, Bloom, & Davis, 2012). For the purpose of the analysis in this study, the data is derived from the prediction markets as they are expected to outperform polls and EPU as prediction vehicles (Goodell, McGee, & McGroarty, 2020). This section discusses in detail the methods used in the past literature to meausre political uncertainty, and it's effect on the stock markets.

Prediction markets (also known as betting markets, political betting markets, predictive markets, event derivatives, etc.) are exchange-traded markets created for the purpose of trading the outcome of events. The main purposes of prediction markets are eliciting aggregating beliefs over an unknown future outcome. Traders have different beliefs regarding the outcome of a particular event which is reflected by their choice of contract as the payoffs are related to the unknown future outcome and the market prices of the contracts are considered as the aggregated belief. The most popular prediction markets for political events are the IOWA electronic markets[3] and the Betfair exchange[4]. For the purpose of the analysis in this paper, the data on probabilities of a candidate are extracted from the IOWA electronic markets. Studies in the past have made use of these markets for derriving the probabilities of success on the candidates and thereby use them for measuring political uncertainty (see e.g., (Goodell & Vahamaa, 2013); (Goodell, McGroarty, & Urquhart, 2015); (Chang, Chen, Gupta, & Nguyen, 2015)). (Goodell & Vahamaa, 2013) in their paper define two alternative hypotheis regarding the effects of political uncertainty on stock markets volatility in the U.S. They name these hypothesis as political uncertainty hypothesis (PUH) and election uncertainty hypothesis (EUH). The PUH uses monthly percentage changes in the probability of success of the evetual winning presidential candidate as a measure of the monthly change in political uncertainty. The EUH uses the monthly percentage changes in the difference between the probabilities of

[3] https://iemweb.biz.uiowa.edu
[4] https://www.betfair.com

the two candidates competing for the election as a measure of the change in overall election uncertainty. This study contributes to the work of (Goodell & Vahamaa, 2013) and uses their framework for measuring political uncertainty, although the significant difference is in the sample period used for this study and an additionl alternative approaches used for calculating the political uncertainty. This study, as far as I know, is the study to be conducted on the effets of political uncertainty by including the the 2020 U.S. presidential elections.

Another popular source for extracting data on election outcomes is the use of pre-election polls. Typically, these polls include trial questions, which require respondents to indicate their vote preference for the upcoming election. Numerous organizations in the United States and around the world conduct pre-election polls, and the number and frequency of such polls has been growing. Many pre-election polls are public, conducted by news organizations, academic institutions, and nonprofit organizations. Many others are privately conducted by partisan party organizations and campaigns to assist in candidates' message development, resource allocation, and overall strategy. As established by (Nordhaus, 1975); (Hibbs Jr, 1977); (Alesina, 1987) etc., political events have an effect on the business cycles and stock markets, and these effects maginify with an increase in uncertainty about the event outcome. (Li & Born, 2006) in their paper further hypothesize that uncertainty about the U.S. presidential elections should be reflected in the pre-election stock market returns. Their study is unique compared to other similar studies as in their study, the election outcome is assumed to be not known priori. They use candidate data for U.S. presidential elections of 1964 through 2000 which they obtain from the Gallup Polls [5], who have been conducting presidential election polls since 1936 election. Assuming the date of release of these polls as the date when it could begin to influence stock returns, in each election year, they examine polls from the date of last major party convention (which is usually mid august) until the election day. To construct the measure of political uncertainty during the U.S. presidential elections, they using the polls database and first subtract the percentage of the responsents who prefer the candidate of the party out of power from the percentage of responsents who prefer

[5] https://www.gallup.com/home.aspx

the candidate of the party currently controlling the white house. Then this difference is divided by the poll's sampling error. In their study, (Li & Born, 2006) further examine the partisan difference in the stock market response to political uncertainty. For this, they construct a measure of of Democratic elector uncertainty, a measure based on the paper of which measures the likelihood that the Democratic candidate will win or loose the election.

The other measure of political uncertainty commonly used in prior literature is the Economic Policy Uncertainty index (EPU) developed by (Baker, Bloom, & Davis, 2012). This is a new index of economic policy uncertainty (EPU) for the United States based on newspaper coverage frequency and reflects the frequency of articles in 10 leading U.S. newspapers that contain the following trio of terms: ''economic'' or ''economy''; ''uncertain'' or ''uncertainty''; and one or more of ''Congress,'' ''deficit,'' ''Federal Reserve,'' ''legislation,'' ''regulation,'' or ''White House''[6]. Looking at the graph of the index, one can see sharp spikes in economic policy uncertainty levels around major elections, wars and the 9/11 terrorist attack[7]. (Baker, Bloom, & Davis , 2016) in their paper propose that policy uncertainty could be high simply because general economic uncertainty is also high, and further test this view by using Google News listings to construct a broader index of economic uncertainty in general. On comparing these two indices, the result reveals several incidents that involve large spikes in economic uncertainty but little or no jump in policy uncertainty. Examples include the Asian financial crisis of 1997 and several bouts of recessionary fears in the second half of the 1980s[8]. To conclude, the data refuses the view that economic uncertainty necessarily facilitates policy uncertainty[9]. (Brogaard & Detzel, 2015) examine the asset pricing implications of the uncertainty regarding government's future policy choice. For this, they use the Economic Policy Uncertainty (EPU) index developed by (Baker, Bloom, & Davis, 2012) as a proxy for measuring economic policy uncertainty. Their paper reveals that EPU index has a positive correlation with the general economic uncertainty, which is captured using the

[6] https://cep.lse.ac.uk/pubs/download/cp362.pdf
[7] https://cep.lse.ac.uk/pubs/download/cp362.pdf
[8] https://blogs.lse.ac.uk/politicsandpolicy/policy-uncertainty-bloom/
[9] https://blogs.lse.ac.uk/politicsandpolicy/policy-uncertainty-bloom/

volatility of market returns. Investors/ Economic agents make their decisions based on the expectations over future economic policy environment. These expectations can change as policymakers can create an environment of uncertainty about their decisions regarding the future economic policies, which is captured by this index of economic policy uncertainty and also shows a positive correlation with the volatility of market returns implying that EPU is an economically important risk factor.

2.4. VIX index and stock market uncertainty

The implied volatility index VIX, created by the Chicago Board of exchange, is commonly known as the "fear gauge" and is a widely used indicatory for measuring the level of uncertainty in the U.S. stock market. It's inherent forward-looking nature makes it a very good proxy for stock market uncertainty as it is calculated using the mid-quote prices of call and put options of the S&P 500 index. It provides a constant measure of 30-day forward-looking expected volatility of the U.S. stock market. It is one of the most recognized measures of volatility widely reported by financial media[10]. This study uses changes in the VIX index as a proxy for changes in stock market uncertainty, similar to a lot of research in the past (see e.g., (Goodell & Vahamaa, 2013); (Hsu, Lee, & Lien, 2020); (Wang, Lu, He, & Ma, 2020); (Sarwar, 2014); (Smales, 2014); (Antonakakis, Chatziantoniou, & Filis, 2013)). (Hsu, Lee, & Lien, 2020) in their research examine whether stock market uncertainty has an influence on the subsequent stock-bond return correlations. They use three different proxies for measuring stock market uncertainty, namely, VIX, VIX futures and the volatility connectedness index of the U.S. financial institutions. Similarly, (Goodell & Vahamaa, 2013) in their research use monthly percentage returns in the VIX index as a proxy for stock market uncertainty to examine the effects of the election induced political uncertainty on the stock market uncertainty.

There are sources, other than the VIX index, used in the past to measure to stock market uncertainty in the U.S. (Chulia, Guillen, & Uribe, 2017) propose a new index for measuring stock market uncertainty that considers the differentiation between

[10] https://www.cboe.com/tradable_products/vix/

uncertainty (unexpected variation) and risk (expected variation) by considering common variation in the series as risk. (Hsu, Lee, & Lien, 2020) use the volatility connectedness index of U.S. financial institutions as one of the proxies for measuring stock market uncertainty. This index is developed using the generalised VAR framework of (Diebold & Yilmaz, 2014) where they empirically measure connectedness of U.S. financial firms at various levels, from pairwise to system-wide using VAR variance-decomposition theory and network topology theory. Their empirical evidence reveals that this volatility connectedness index contains more information for explaining the stock-bond return correlations than the VIX index and VIX future prices for both linear and non-linear models and is in line with the intermediary asset pricing theory.

2.5. Election markets data and political uncertainty

This section discusses the past literature which have made use of the election markets/prediction markets data to measure political uncertainty, the main variable of interest in this study. Prediction markets are exchange-traded markets which are created for the purpose of trading the outcome of events. The market prices of the contract traded indicates the crowd sentiments regarding the outcome of the event and thereby also reflective of the probability of that event. A prediction market contract is traded between 0 and 100% of its value and is a binary option (where the payoff is either some fixed monetary amount or nothing) that will expire at the price of 0 or 100%. A significant amount of research in the past have made use of data from these markets to derive the probability of candidates participating in the U.S. presidential elections, for the purpose of measuring the change in political uncertainty. The most significant of them is the paper by (Goodell & Vahamaa, 2013) in which they measure the monthly change in the probability of win of the eventual winning presidential candidate using the probabilities derived from prediction markets. They use the data from IOWA electronic markets, a real money futures market run for teaching and research purposes. Similar to their paper, this study also uses the data from IOWA electronic markets to derive the probabilities of success of the candidates, an attempt to measure political uncertainty.

The approach to measure political uncertainty using elections data has been explored in other studies as well. (Li & Born, 2006) in their paper make use of the data from pre-election polls to determine the level of uncertainty in the economy. Their research caters to the serious flaw which most of the similar studies were suffering from – the eventual winner of the elections is assumed to be known. For this, they use the Gallup Poll results to measure the voting intentions in the U.S.[11] The Gallup organization has been actively conducting opinion polls for presidential elections in the U.S. starting from the 1936 elections, and (Li & Born, 2006) use their data for the U.S. presidential elections of 1936 through 2000. Using this sample, they construct their measure of uncertainty by first subtracting the percentage of respondents who prefer the candidate of party not in power, from the percentage of respondents who prefer the candidate of the incumbent party. Then the difference obtained is divided by the poll's sampling error. (Santa-Clara & Valanov, 2003) in their paper too use the data from Gallup polls to construct a measure of Democratic elector uncertainty. This measure is obtained by subtracting the polling percentage of the Republican candidate from the polling percentage of the Democratic candidate, and finally dividing it with the poll's sampling error.

(Gemmill, 1992) examine political uncertainty using a short-term approach, measuring changes in probability of conservative win from the polling data of 1987 British elections and its effect on stock and option prices. Using this short-term approach, this study starts taking measurements in the week prior to the election date, following the assumption that the effects of political uncertainty would be more prominent when the outcome of the event is expected to be soon. The study reveals a very close relationship between political uncertainty, as measured by the change in probability of conservative win using opinion polls and the FTSE index level. The study also confirms that option prices in the last week of the election showed evidence of market inefficiency because they implied a reduction in the probability of a conservative win, but the opinion polls showed the opposite.

[11] https://news.gallup.com/home.aspx

2.6. Hypothesis

Essentially, this paper asks a single important question: Does political uncertainty has an effect on stock market uncertainty? Therefore, in this paper, I posit two alternative hypotheses regarding the association between stock market uncertainty and political uncertainty.

Hypothesis 1.

H0: Political uncertainty has no effect on stock market's implied volatility.
H1: An increase in political uncertainty will lead to an increase in stock market's implied volatility and vice-versa – i.e., there exists a positive relationship.

Hypothesis 2.

H0: Political uncertainty has no effect on stock market's implied volatility.
H1: An increase in political uncertainty will lead to a decrease in stock market's implied volatility and vice-versa – i.e., there exists a negative relationship.

This study uses a number of approaches to measure the main variable of interest, political uncertainty and the dependent variable, stock market uncertainty. For measuring changes in political uncertainty, this study implements three approaches, all of which use the data from IOWA prediction market contracts, but they all differ in terms of capturing the magnitude of the change in political uncertainty. The first approach uses the monthly changes in the probability of success of the eventual winner as a proxy for political uncertainty, the second uses probability of success of the candidate assuming election results are not known priori, and the third approach measures changes in the probability of success of the eventual winner with respect to a situation of maximum uncertainty regarding the elections. These approaches are discussed further in detail in the methodology section. For measuring changes in stock market uncertainty, this study uses

three approaches using the implied volatility index VIX. The first approach uses monthly changes in the VIX index as a proxy for measuring stock market uncertainty, the second uses the square of the monthly returns calculated in the first approach and the third uses the monthly change in the VIX index with respect to the long-term average of the index. These approaches are further explained in detail in the methodology section.

3. Data.

This section discusses the variables used in the regression model and also the sources for collecting the data on these variables. This study examines the effects of political uncertainty on stock market uncertainty during the past seven U.S. presidential election cycles[12]. For this, it uses a panel data regression model where the dependent variable represents stock market uncertainty and the main test variable represents political uncertainty, along with a control variable.

3.1. Stock market uncertainty

To measure stock market uncertainty, the dependent variable, this study uses changes in the implied volatility index VIX. The VIX Index is a calculation designed to produce a measure of constant, 30-day expected volatility of the U.S. stock market, derived from real-time, mid-quote prices of S&P 500 Index (SPX) call and put options[13]. It is created by the Chicago Board of Exchange (CBOE) and this study uses the data on this index from 1996 – 2000. The data is collected from the CBOE website itself[14]. As discussed in the previous section, this index serves as a good proxy for measuring the level of uncertainty in the U.S. stock markets. There are three different approaches used in this paper for measuring stock market uncertainty using the VIX index. These approaches are discussed in detail in the next section.

[12] See appendix A1 for the overview of past seven U.S. presidential elections.
[13] https://www.cboe.com/tradable_products/vix/
[14] https://ww2.cboe.com/products/vix-index-volatility/vix-options-and-futures/vix-index/vix-historical-data

3.2. Political uncertainty

The main variable of interest in this study represents political uncertainty. To measure political uncertainty, this study uses the election data from the IOWA electronic markets. The Iowa Electronic Markets (IEM) is a futures market run for research and teaching purposes where traders can buy and sell real-money contracts based on their belief about the outcome of an election or other event[15]. Using this "wisdom of crowds", the price of a contract at any given time is a forecast of the outcome[16]. This study uses the candidate probabilities derived from the data of the IEM U.S. Presidential Election Winner takes All Market[17]. The payoffs in this market are based on the popular vote received by the official Democratic and Republican nominees in the U.S. Presidential election. Payoffs remain unaffected by votes received by nominees from other parties, the outcome of the electoral college or any vote taken by the House of Representatives[18]. The financial contracts traded are these types[19]:

DEMOCRATIC TICKET - $1 if the Democratic Party nominee receives the majority of popular votes cast for the two major parties in the U.S. Presidential election, $0 otherwise

REPUBLICAN TICKET - $1 if the Republican Party nominee receives the majority of popular votes cast for the two major parties in t U.S. Presidential election, $0 otherwise

The payoff in this market is directly related to the share of popular vote belonging to the candidate, casted during the U.S. presidential elections. The candidate who receives the higher share will be determined the winner. The market prices of the IEM presidential contracts reflect candidate probability for success because the payoff to the Republican ticket is $1 if the republican candidate wins and $0 otherwise. Likewise, if the

[15] https://iemweb.biz.uiowa.edu
[16] https://iemweb.biz.uiowa.edu
[17] https://iemweb.biz.uiowa.edu/pricehistory/pricehistory_SelectContract.cfm?market_ID=384
[18] https://iemweb.biz.uiowa.edu/markets/pr_Pres16_WTA.html
[19] https://iemweb.biz.uiowa.edu/markets/pr_pres20_WTA.html

Democratic candidate wins, the payoff is $1 and $0 if he doesn't. Therefore, if the cost of the republican ticket is 70 cents, then Democratic ticket must cost 30 cents. This is because buying both the tickets would then ensure a payoff of $1. Hence, the probability of a Republican victory at this time would be 0.7 and the probability of a democratic victory would be 0.3. To support of this view, (Berg, Nelson, & Rietz, 2008) in their paper provide a detailed discussion of the no-arbitrage relationship between expected outcomes and market prices of prediction contracts.

3.3. Control Variable

A control variable is a variable which is not of primary interest to the study's aim but is held constant across the analysis. It is controlled because it could influence the outcome. There is a control variable used in this study which is related to the performance of the S&P 500 firms. It represents monthly percentage price change in the S&P 500 index. "The S&P 500 index is widely regarded as the best single gauge of large-cap U.S. equities. There is over USD 11.2 trillion indexed or benchmarked to the index, with indexed assets comprising approximately USD 4.6 trillion of this total. The index includes 500 leading companies and covers approximately 80% of available market capitalization"[20]. The data on this index is collected from Thomson Reuters[21]. Control variables enhance the internal validity of a study by limiting the influence of confounding and other extraneous variables[22]. Aside from the independent and dependent variable, usually, all variables that can impact the results should be controlled for, else, one may not be able to demonstrate that they didn't influence the results. In this study, only one control variable is used and an attempt to control for more variables affecting the results is not made simply because the main variable of interest in this study is statistically insignificant and adding more control variables will not contribute anything towards the goal of this study.

[20] https://www.spglobal.com/spdji/en/indices/equity/sp-500/#overview
[21] https://www.thomsonreuters.com/en.html
[22] https://www.scribbr.com/methodology/control-variable/

4. Methodology

For the purpose of examining the association between stock market uncertainty and political uncertainty, this study uses a panel data regression model. This is done by regressing changes in implied volatility on changes in the probability of win of the candidate, along with a control variable.

4.1. Model

$$\%\Delta\textbf{StockMarketUncertainty}_{c,m} = \alpha + \beta 1\ \%\Delta\textbf{PoliticalUncertainty}_{c,m} + \beta 2\ \%\Delta SNP_{c,m} + \beta 3\ \%\Delta VIX_{c,m-1} + \sum_{c=1,n-1}\lambda_c \text{ fixed effect}_{c,m} + \varepsilon_{c,m}$$

$StockMarketUncertainty_{c,m}$ – denotes the monthly change in the stock market uncertainty during the election cycle c in month m, measured using three approaches labelled as VIX, VIXX, VIXXX.

$PoliticalUcertainty_{c,m}$ – denotes the monthly change in political uncertainty during cycle c and month m, measured using three approaches labelled as PU, PUU, PUUU.

$SNP_{c,m}$ - denotes the monthly return of the S&P 500 index during cycle c and month m.

$VIX_{c,m-1}$ - denotes the one-period lagged monthly percentage change in the VIX index during cycle c and month m. This is included to capture the mean reverting aspect of the stock market volatility.

Fixed $effect_{c,m}$ - dummy variables used to control for fixed effects across election cycles.

This study makes use of three different approaches for measuring the changes in stock market uncertainty using the implied volatility index VIX. Similarly, three different approaches are also used for measuring the changes in political uncertainty using probability of win of the candidate derived from IOWA electronic markets. These

approaches essentially operationalize the different concepts used in this study to capture the magnitude of changes in the dependent and the independent variable. These different concepts are the main added value of this thesis as they check for the association from different perspectives, covering all the angles. In totality there are nine different regressions in this study examining the association between stock market uncertainty and political uncertainty, along with a control variable SNP which is related to the performance of the S&P 500 firms. The timeframes of the dependent variable and independent variables form a panel with the grouping variable being the seven election years in the period 1996 - 2020. Each election year contains 10 observations for each of the dependent variable and independent variables which represent percentage change in the variables on a monthly basis for every month starting from February and running through November of the presidential election year. So essentially, the analysis uses monthly data for a period of 10 months right before the U.S. presidential elections. See appendix A2 and A3 for descriptive statistics and correlation coefficients for the variables used.

4.2. Approaches for measuring political uncertainty using probability of win of the candidate.

i. Monthly percentage change in the probability of win of the eventual winner (PU):

   In this approach, the change in political uncertainty is calculated by taking monthly percentage changes in the probability of win of the eventual winner of the U.S. presidential elections. This approach assumes that the eventual winner of the election is known.

ii. Monthly percentage changes in the probability of win of the candidate, as determined by the market itself, assuming election results are not known priori (PUU):

This approach measures political uncertainty by taking monthly percentage changes in the probability of the candidate to win the election. The candidate chosen is based on data from the markets itself, and therefore differs from the previous approach where the eventual winner is already known. For this, the candidate who is favourite to win the elections on the first trading day of the month when the observations are taken, is deemed to be the market favourite and any change in his/her probability is considered to be the change in political uncertainty. This approach typically changes the measurements for the election year 2000 and 2016, as compared to the previous approach, because the market sentiment about the eventual winner in these two elections were completely wrong.

iii. Monthly percentage change in the probability of win of the eventual winner with respect to the 50-50 probability scenario, where political uncertainty is maximum (PUUU):

In this approach, the absolute change in political uncertainty is calculated by taking monthly percentage changes in the probability of win of the eventual winning presidential candidate with respect to the situation of maximum political uncertainty. This situation of maximum political uncertainty is essentially represented when both the candidates have a 0.5 probability to win the elections (i.e., PU equal to 0.5). To calculate the absolute change in political uncertainty for a particular month, the closing value of the probability of the candidate during that month is subtracted from 0.5, and then the answers is taken as an absolute value. Mathematically, |PU| = probability of success of the candidate – 0.5. This approach of calculating the change in political uncertainty captures different effects compared to the first and second approach. To exemplify, if the probability of the eventual winning presidential candidate changes from 0.45 to 0.55, representing a large update in political uncertainty using the first two approaches, but no change in political uncertainty using the third approach.

4.3. Approaches for measuring stock market uncertainty using changes in implied volatility index VIX.

i. Monthly percentage changes in the VIX index with respect to the previous month (VIX).

In this approach, the monthly percentage returns of the VIX index are calculated starting from the month of February running through till the election date. For this, the closing price at the last trading day of the previous month is considered as the opening price for the current month and the closing price on the last trading day of the current month is considered as the closing price for the current month (also, the opening price for the next month).

ii. Monthly percentage returns of the VIX index squared (VIXX).

Here, the returns calculated in the previous step (i) are squared to help explain bigger movements.

iii. Monthly percentage changes in the value of the VIX index with respect to a long-term average (VIXXX)

In this approach, the monthly percentage change in the VIX index is calculated using a long-term average value. The long-term average value is calculated using the data of the VIX index monthly returns from the previous three years leading up to the election year. Then the monthly closing value of the VIX index, which is determined by the closing price at the last trading day, is subtracted from this long-term value and multiplied with the 100 to come to the monthly percentage figure with respect to the long-term average. The idea behind this approach is to check for politically induced uncertainty when the elections are close and is attempted

to be captured by this change in implied volatility compared to the average level of implied volatility in the previous years.

5. Results

In this section, the results from the regression analysis discussed in the previous section are presented in a tabular form. Because this study implements three different approaches for measuring the dependent variable, and three different approaches also for measuring the main variable of interest, there are in total nine regression results examining the effect of political uncertainty on stock market uncertainty using the same model, but with different inputs. The results are tabulated below in the three tables. Each of the tables below considers a separate approach for measuring political uncertainty, and reports the subsequent estimates for stock market uncertainty, for each of its respective measures. The description for each is given below:

Table 1 – reports the regression estimates for the effects of political uncertainty, measured using approach (i), on all three alternative measures of stock market uncertainty.

Table 2 – It reports the regression estimates for the effects of political uncertainty on all three alternative measures of stock market uncertainty. The approach used for calculating political uncertainty applied here is the approach (ii) mentioned in the methodology section.

Table 3 – It reports the regression estimates for the effects of political uncertainty on all three alternative measures of stock market uncertainty. The approach used for calculating political uncertainty applied here is the approach (iii) mentioned in the methodology section.

Table 1

Regression results: The effect of political uncertainty. (Approach (i))

Variable	Model 1 (%ΔVIX)	Model 2 (%ΔVIXX)	Model 3 (%ΔVIXXX)
Constant	6.03***	679.14***	30.16***
%ΔPU	-0.03	-3.43	0.07
%ΔSNP	-4.60***	-169.91***	-4.25***
%ΔVIX m-1	-0.26***	-3.70	0.87***
Fixed or random effect	Fixed	Fixed	Fixed
R^2	0.54	0.16	0.41
No. of obs./group	70/7	70/7	70/7

This table reports the estimates of the alternative versions of the regression equations:

$\%\Delta VIX_{c,m} = \alpha + \beta 1\ \%\Delta PU_{c,m} + \beta 2\ \%\Delta SNP_{c,m} + \beta 3\ \%\Delta VIX_{c,m-1} + \sum_{c=1,n-1} \lambda c\ \text{fixed effect}_{c,m} + \varepsilon_{c,m}$
$\%\Delta VIXX_{c,m} = \alpha + \beta 1\ \%\Delta PU_{c,m} + \beta 2\ \%\Delta SNP_{c,m} + \beta 3\ \%\Delta VIX_{c,m-1} + \sum_{c=1,n-1} \lambda c\ \text{fixed effect}_{c,m} + \varepsilon_{c,m}$
$\%\Delta VIXXX_{c,m} = \alpha + \beta 1\ \%\Delta PU_{c,m} + \beta 2\ \%\Delta SNP_{c,m} + \beta 3\ \%\Delta VIX_{c,m-1} + \sum_{c=1,n-1} \lambda c\ \text{fixed effect}_{c,m} + \varepsilon_{c,m}$

where %ΔVIX, %ΔVIXX, %ΔVIXXX are the alternative measures for change in stock market uncertainty calculated using approach (i), (ii), and (iii) respectively, %ΔPU is the monthly measure for change in political uncertainty using approach (i) and %ΔSNP is the monthly measure for change in the S&P 500 index. %ΔVIX m-1 denotes the one-period lagged monthly change in the VIX index.

*** Significance at the 0.01, levels, respectively.
** Significance at the 0.05, levels, respectively.
* Significance at 0.1, levels, respectively.

Table 1 reports the regression results for the effects of political uncertainty on stock market uncertainty. The estimates are reported for three alternative versions of the regression equation. Essentially, the three alternative measures of changes in stock market uncertainty are regressed on the first measure of change in political uncertainty

to report the estimates of the effect of political uncertainty on stock market uncertainty. As discussed previously, this study uses election fixed effects to control for heterogeneity across election cycles. The results show that the estimated coefficient for PU, the main variable of interest, is almost zero but statistically insignificant. The estimate for the control variable SNP is negative and statistically highly significant. It implies that a decrease in stock market uncertainty is associated with an increase in the S&P 500 index, which is as expected. Finally, the coefficient for the lagged change in VIX is negative and highly significant, thereby confirming that volatility tends to mean-revert during the election cycles. The coefficients in Model 2 are relatively very large compared to the coefficients in Model 1 and Model 3. This is in line with the expectations as Model 2 uses squared monthly returns of the VIX index and therefore the coefficients representing the association are also relatively very large.

Table 2

Regression results: The effect of political uncertainty.

Variable	Model 1 (%ΔVIX)	Model 2 (%ΔVIXX)	Model 3 (%ΔVIXXX)
Constant	6.32***	703.25***	30.23***
%ΔPUU	-0.05	-4.70	0.02
%ΔSP	-4.62***	-171.68***	-4.24***
%ΔVIXLAG	-0.26***	-3.25	0.88***
Fixed or random effect	Fixed	Fixed	Fixed
R^2	0.54	0.17	0.41
No. of obs./group	70/7	70/7	70/7

This table reports the estimates of the alternative versions of the regression equations:

$\%\Delta VIX_{c,m} = \alpha + \beta 1\ \%\Delta PUU_{c,m} + \beta 2\ \%\Delta SNP_{c,m} + \beta 3\ \%\Delta VIX_{c,m-1} + \sum c=1,n-1 \lambda c\ \text{fixed effect}_{c,m} + \varepsilon_{c,m}$

$\%\Delta VIXX_{c,m} = \alpha + \beta 1\ \%\Delta PUU_{c,m} + \beta 2\ \%\Delta SNP_{c,m} + \beta 3\ \%\Delta VIX_{c,m-1} + \sum c=1,n-1 \lambda c\ \text{fixed effect}_{c,m} + \varepsilon_{c,m}$

$\%\Delta VIXXX_{c,m} = \alpha + \beta 1\ \%\Delta PUU_{c,m} + \beta 2\ \%\Delta SNP_{c,m} + \beta 3\ \%\Delta VIX_{c,m-1} + \sum c=1,n-1 \lambda c\ \text{fixed effect}_{c,m} + \varepsilon_{c,m}$

where %ΔVIX, %ΔVIXX, %ΔVIXXX are the alternative measures for change in stock market uncertainty calculated using approach (i), (ii), and (iii) respectively, %ΔPUU is the monthly measure for change in political uncertainty using approach (ii), and %ΔSNP is the monthly measure for change in the S&P 500 index. %ΔVIX m-1 denotes the one-period lagged monthly change in the VIX index.

*** Significance at the 0.01, levels, respectively.

** Significance at the 0.05, levels, respectively.

* Significance at 0.1, levels, respectively.

Table 2 reports the regression results for the effects of political uncertainty on stock market uncertainty. The estimates are reported for three alternative versions of the regression equation. As discussed previously, this study uses election fixed effects to control for heterogeneity across election cycles. The results show that the estimated coefficient for PU, the main variable of interest, is almost zero but statistically insignificant. The estimate for the control variable SNP is negative and statistically highly significant. It implies that a decrease in stock market uncertainty is associated with an

increase in the S&P 500 index, which is as expected. Finally, the coefficient for the lagged change in VIX is negative and highly significant, thereby confirming that volatility tends to mean-revert during the election cycles. The coefficients in Model 2 are relatively very large compared to the coefficients in Model 1 and Model 3. This is in line with the expectations as Model 2 uses squared monthly returns of the VIX index and therefore the coefficients representing the association are also relatively very large.

Table 3

Regression results: The effect of political uncertainty.

Variable	Model 1 (%ΔVIX)	Model 2 (%ΔVIXX)	Model 3 (%ΔVIXXX)
Constant	6.16***	669.98***	30.59***
%ΔPUUU	-0.001	-0.002	0.001
%ΔSP	-4.59***	-169.72***	-4.25***
%ΔVIXLAG	-0.26***	-3.93	0.88***
Fixed or random effect	Fixed	Fixed	Fixed
R^2	0.54	0.16	0.41
No. of obs./group	70/7	70/7	70/7

This table reports the estimates of the alternative versions of the regression equations:

$$\%\Delta VIX_{c,m} = \alpha + \beta 1\ \%\Delta PUUU_{c,m} + \beta 2\ \%\Delta SNP_{c,m} + \beta 3\ \%\Delta VIX_{c,m-1} + \sum_{c=1,n-1} \lambda c \text{ fixed effect}_{c,m} + \varepsilon_{c,m}$$

$$\%\Delta VIXX_{c,m} = \alpha + \beta 1\ \%\Delta PUUU_{c,m} + \beta 2\ \%\Delta SNP_{c,m} + \beta 3\ \%\Delta VIX_{c,m-1} + \sum_{c=1,n-1} \lambda c \text{ fixed effect}_{c,m} + \varepsilon_{c,m}$$

$$\%\Delta VIXXX_{c,m} = \alpha + \beta 1\ \%\Delta PUUU_{c,m} + \beta 2\ \%\Delta SNP_{c,m} + \beta 3\ \%\Delta VIX_{c,m-1} + \sum_{c=1,n-1} \lambda c \text{ fixed effect}_{c,m} + \varepsilon_{c,m}$$

where %ΔVIX, %ΔVIXX, %ΔVIXXX are the alternative measures for change in stock market uncertainty calculated using approach (i), (ii), and (iii) respectively, %ΔPUUU is the monthly measure for change in political uncertainty using approach (iii) and %ΔSNP is the monthly measure for change in the S&P 500 index. %ΔVIX m-1 denotes the one-period lagged monthly change in the VIX index.

*** Significance at the 0.01, levels, respectively.
** Significance at the 0.05, levels, respectively.
* Significance at 0.1, levels, respectively.

Table 3 reports the regression results for the effects of political uncertainty on stock market uncertainty. The estimates are reported for three alternative versions of the regression equation. As discussed previously, this study uses election fixed effects to control for heterogeneity across election cycles. The results show that the estimated coefficient for PU, the main variable of interest, is almost zero but statistically insignificant. The estimate for the control variable SNP is negative and statistically highly significant. It implies that a decrease in stock market uncertainty is associated with an increase in the S&P 500 index, which is as expected. Finally, the coefficient for the lagged change in VIX is negative and highly significant, thereby confirming that volatility tends to mean-revert during the election cycles. The coefficients in Model 2 are relatively very large compared to the coefficients in Model 1 and Model 3. This is in line with the expectations as Model 2 uses squared monthly returns of the VIX index and therefore the coefficients representing the association are also relatively very large.

6. Conclusion

This paper examines the effects of political uncertainty on stock market uncertainty in the United States. As discussed previously, there exists a vast amount of literature examining the effects of election induced political uncertainty on stock market returns in general, but not a lot of research has been conducted on the effects of political uncertainty on stock market uncertainty in particular. Therefore, this study attempts to fill in this gap, and also contributes further to the already existing literature. Previous studies have documented that political elections are associated with periods of considerable public uncertainty, and therefore, it is of interest to examine the effects of election-induced uncertainty on stock markets' uncertainty levels. This study uses the data from the Iowa Electronic Markets (IEMs) to derive monthly measures of uncertainty about the winner of the presidential election. Based on prices of these IEM presidential contracts, the empirical measures of political uncertainty are constructed over seven US

presidential election cycles between 1996 and 2020. Similarly, monthly measures for changes in stock market uncertainty are constructed by using changes in the implied volatility index VIX.

This study uses a panel data regression model to find out the association between changes in stock market uncertainty, as measured by the changes in the VIX index, and changes in political uncertainty, as measured by the changes in the probability of success of the presidential candidate. The empirical findings from this study provide no support for the hypothesis that political uncertainty effects stock market uncertainty. This relationship is tested using different approaches for measuring changes in stock market uncertainty and changes in political uncertainty, but none of the approaches reported significant results. The estimated coefficients for the monthly changes in the probability of success of presidential candidates are almost zero and statistically insignificant in all of the models. This insignificance of the coefficients of the main variable of interest means that there is no conclusive evidence in support of the hypotheses. The results from this study are in line and in contrast with studies from the past which are conducted on similar lines.

Looking forward, there are other empirical methodologies which can be implemented to examine the effects of political uncertainty on stock market uncertainty. In my viewpoint, using a relatively short-termed approach might be a good one, like the approach used by (Gemmill, 1992), following the assumption that the effects of political uncertainty would be more prominent when the outcome of the event is expected to be soon. In his paper, he measures changes in the probability of a conservative win from the polling data of 1987 British elections and its effect on stock and option prices. Using this short-term approach, his study starts taking measurements in the week prior to the election date. As previously discussed, a lot of literature in the past has examined for the association between political uncertainty and stock market uncertainty using different methodologies and those methodologies could be implemented to further test if there exists a relationship between stock market uncertainty and political uncertainty using the sample used in this study. The pre-election polls-based approach for measuring the changes in political uncertainty has been used previously by (Li & Born, 2006) and

(Gemmill, 1992), and they both documented that an increase in political uncertainty during the election year results in increased stock market volatility. Another very frequently used approach for measuring change in political uncertainty is the Economic Policy Uncertainty index developed by (Baker, Bloom, & Davis, 2012). It could be a good potential proxy for measuring changes in political uncertainty. Due to the constraints regarding the time, it is not possible to continue this study further by implementing these alternative approaches, but I believe it could provide more evidence in support for the results obtained in this study.

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Appendix

A1

Overview of the past seven U.S. presidential elections.

Election year	Election cycle	Candidates	Parties	Winner
1996	1	Bill Clinton Bob Dole	Democratic Republican	Bill Clinton
2000	2	Al Gore George W. Bush.	Democratic Republican	George W. Bush
2004	3	John Kerry George W. Bush	Democratic Republican	George W. Bush
2008	4	Barack Obama John McCain	Democratic Republican	Barack Obama
2012	5	Barack Obama Mitt Romney	Democratic Republican	Barack Obama
2016	6	Hillary Clinton Donald Trump	Democratic Republican	Donald Trump
2020	7	Joe Biden Donald Trump	Democratic Republican	Joe Biden

This table provides information about the competition in the past seven U.S. presidential elections. As evident from the table, there are two main parties that contest every four years to win the presidency seat. This table shows which candidates were chosen to represent their party for the presidential elections and therefore, the presidency too.

A2

Descriptive Statistics

	1996		2000		2004		2008		2012		2016		2020	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
%ΔVIX.	4.71%.	20.29%	2.34%	14.91%	-1.12%	12.67%	12.13%	35.56%	1.16%	19.59%	-1.45%	18.58%	12.72%	42.81%
%ΔVIXX.	392.6%	622%	205.5%	178.3%	145.7%	144.1%	1285%	2586%	346.7%	511.7%	312.7%	361.44%.	1811%	3898%
%ΔVIXXX	30.53%	12.56%	-6.1%	13.99%	3.43%	8.48%	113.3%	103.46%	-28.49%	9.42%	-1.63%	15.87%	132.6%	60.9%
%ΔPU	6.11%.	6.72%	-6.92%	34.45%	9.28%	28.67%	6.24%	11.02%	6.77%	19.4%	-6.65%	37.87%	5.35%	10.25%
%ΔPUU	6.11%	6.72%	14.25%	51.68%	9.28%	28.67%	6.24%	11.02%	6.77%	19.4%	6.07%	22.58%.	5.35%	10.25%
%ΔPUUU	27.35%	20.29%	217.1%	411.8%	1814%	5484%	44.62%	92%	36.01%	80.99%	41.1%	127.44%	30.04%	67.1%
%ΔSNP	1.34%	2.55%	-0.11%	4.78%	0.32%	1.98%	-3.65%	6.36%	0.54%	3.34%	1.14%	2.44%	0.7%	7.6%

This table reports the descriptive statistics for the variables used in the empirical analysis. The sample consists of monthly observations of the variables between February and November for the presidential election years 1996, 2000, 2004, 2008, 2012, 2016, 2020. %ΔVIX is the monthly measure of change in the stock market uncertainty using approach (i), %ΔVIXX is the monthly measure of change in the stock market uncertainty using approach (ii), %ΔVIXXX is the monthly measure of change in the stock market uncertainty using approach (iii). %ΔPU is the monthly measure for change in political uncertainty using approach (i), %ΔPUU is the monthly measure for change in political uncertainty using approach (ii), %ΔPUUU is the monthly measure for change in political uncertainty using approach (iii). %ΔSNP is the monthly measure for change in the S&P 500 index.

A3

Pairwise correlations

	%ΔPU	%ΔPUU	%Δ PUUU	%ΔVIX	%ΔVIXX	%ΔVIXXX	%ΔSNP
%ΔPU	1.0000						
%ΔPUU	-0.2587	1.0000					
%ΔPUUU.	0.1662	0.1762	1.0000				
%ΔVIX	-0.0007	-0.0025.	-0.0822	1.0000			
%ΔVIXX	-0.0068	-0.0386.	-0.0366	0.7509	1.0000		
%ΔVIXXX.	0.1151	-0.0421.	-0.0796	0.4309	0.4272	1.0000	
%ΔSNP	-0.0479	-0.1176.	0.0088	-0.7103	-0.4108	-0.4639	1.0000

The table reports the correlation coefficients between monthly changes in the variables used in the regressions. %ΔPU is the monthly measure for change in political uncertainty using approach (i), %ΔPUU is the monthly measure for change in political uncertainty using approach (ii), %ΔPUUU is the monthly measure for change in political uncertainty using approach (iii). %ΔVIX is the monthly measure of change in the stock market uncertainty using approach (i), %ΔVIXX is the monthly measure of change in the stock market uncertainty using approach (ii), %ΔVIXXX is the monthly measure of change in the stock market uncertainty using approach (iii) %ΔSNP is the monthly measure for change in the S&P 500 index.