Mitigating Policy Uncertainty: What Financial Markets Reveal About Firm-Level Lobbying

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Abstract. Elections can lead to significant changes in policy and, thus, are a significant source of policy uncertainty. Firms can respond to such uncertainty by lobbying, but it is hard to quantify whether they do so and, if so, how much lobbying benefits them. We construct a new dataset and firm-level measure of exposure to policy uncertainty using investors' expectations of variability in stock returns in the aftermath of the 2020 US presidential election. We show that lobbying reduces policy uncertainty, and that this result holds even after controlling for selection into lobbying and for sectoral heterogeneity. We then develop and quantify a model of heterogeneous firms with endogenous lobbying. We find that affecting policy through lobbying is costly and the returns from it are highly skewed and rapidly diminishing. Thus, while lobbying expenditures reduce the impact of policy risk, few firms anticipate sufficient gains to invest in it.

Keywords: Firm-Level Lobbying, Policy Uncertainty, Electoral Risk, Financial Data, Corporate Non-Market Strategy

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We are grateful to participants at various seminars and conferences. Any remaining errors are our own.
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1. Introduction

Policy uncertainty has negative effects on economic and financial outcomes, such as growth, stock prices, yields, investments, and employment (Baker and Bloom, 2013; Baker et al., 2016; Gulen and Ion, 2016; Pástor and Veronesi, 2013; Kumar et al., 2022). At the firm-level, a particularly salient source of policy uncertainty is electoral. When elections are highly competitive, their outcomes are (ex-ante) less predictable: firms cannot fully anticipate future policies that will be implemented by the winners.

But firms do not sit idly by when faced with such risks: for example, they can actively lobby to navigate policy risks that may impact their operations. Indeed, several authors argue that lobbying has increasingly become an important strategy to mitigate political risk (Lux et al., 2011; Hadani and Schuler, 2013; Mellahi et al., 2016; Hadani et al., 2017; Abdurakhmonov et al., 2022; Brown et al., 2022), especially in times of heightened aggregate policy uncertainty (e.g., wars, crises, etc., see Ban et al., 2019). However, because policy benefits and uncertainty are hard to observe, it is difficult to quantify how lobbying may mitigate policy uncertainty at the *firm*-level, which may be the most prevalent form of uncertainty that firms face (Hassan et al., 2019).

Is lobbying effective in mitigating firm-level policy uncertainty borne from electoral turnover? If so, why? This paper investigates these questions by studying the role of lobbying in mitigating uncertainty associated with changes in regulation or public policy and future government actions. Focusing on the 2020 U.S. election—a period marked by substantial social, health, and economic challenges—we examine how corporate lobbying efforts during this time might have shielded firms from the risks associated with policy uncertainty. We rely on pre-electoral option prices, rather than realized post-electoral volatility, to assess investors' expectations of variability in stock returns in the election's aftermath. Using these option-derived risk expectations, we can then compare how market-driven assessments of political risk expectations vary across lobbying and non-lobbying firms.

Our main result is that such (implied) policy uncertainty is significantly lower for lobbying firms relative to non-lobbying firms. This result holds even after accounting for selection and sector/firm heterogeneity. More specifically, we first examine the relationship between lobbying and anticipated post-electoral equity volatility at the individual firm-level. Using data from close to 2,500 publicly traded companies, we analyze the difference between short-dated and long-dated options' implied volatilities (i.e., the market's expectation of price movements), commonly referred to as the volatility spread, to assess the electoral risk premium embedded in option prices.[1] A higher volatility spread indicates that the market anticipates more significant price swings in the short term (e.g., immediately following the election) compared to the long term. We can use this information to test whether the market views firms that engage in lobbying as effective in mitigating election-induced regulatory and policy risk. We carry out this test by examining whether lobbying firms exhibit smaller volatility spreads. Such measures are both firm-specific and available before uncertainty is realized.

To illustrate the intuition behind our argument, consider two prominent firms in the solar energy sector at the time of the 2020 U.S. election, SunPower (SPWR) and First Solar (FSLR). The ordinate values in Figure 1 show the companies' daily volatility spreads, calculated using 30- and 60-day standardized at-the-money-forward (ATMF) call options prices from OptionMetrics' IvyDB standardized dataset.[2] A window of seven trading days centered on the 2020 United States general election (October 29th-November 6th) is identified in the horizontal axis as -2,-1, 0, 1, 2, with day zero denoting November 3rd, election day. The graph reveals that the volatility spread for both firms increased as the election approached and then dropped once the election outcome was revealed and its effects were assimilated into stock prices. Notably, SunPower (denoted by a grey line) had a volatility spread of 37% on November 2nd, indicating that the market expected a high degree of short-term uncertainty for the company. In contrast, First Solar (denoted by a black line) had a much lower volatility spread of approximately 10% on the same date. This significant difference suggests that the market viewed SunPower as more exposed to election-related risks than First Solar. Both firms are leading players in the solar energy sector, with a focus on advanced photovoltaic technologies, and both have a major global presence. They had also recently reported their latest quarterly results.[3] First Solar, however, spent $480,000 on lobbying activities in the lead-up to the election, whereas SunPower reported no such expenditures. If lobbying can effectively help firms mitigate election-related policy risks, the market may have perceived First Solar as less vulnerable to potential policy shifts, leading to its lower volatility spread.

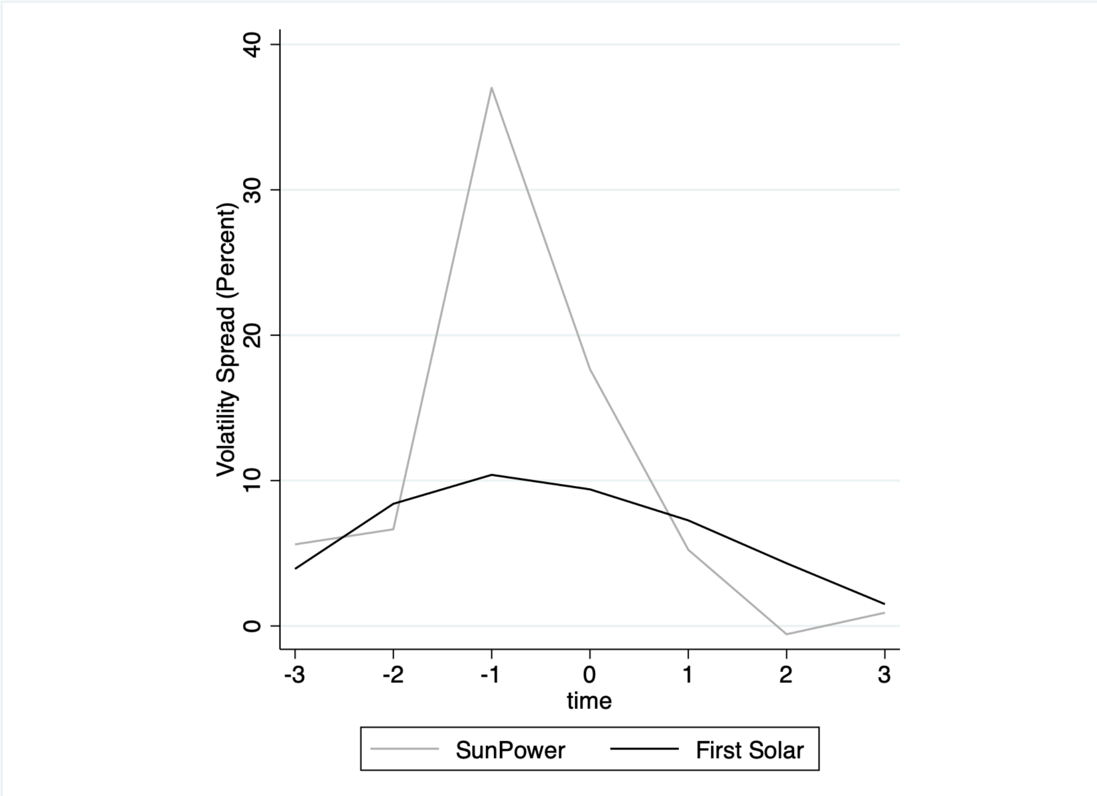
The patterns in Figure 1 are, of course, merely illustrative. Differences in perceived policy (e.g., regulatory) variability between firms may result from their approaches to

[1] Options are tradable instruments whose value depends on the realized price of an underlying asset at a specific future date. Implied volatility, derived from option prices, reflects the market's forecast of likely price movements.

[2] A call option is a contract that gives the holder the right, but not the obligation, to buy an asset (such as stocks, commodities, or currencies) at a predetermined value, called the strike price, by a certain date. At-the-money-forward (ATMF) refers to options with a strike price very close to the forward price of the underlying asset.

[3] SunPower released its fourth-quarter earnings on October 27, and First Solar on October 28, 2020.

FIGURE 1. Volatility Spread of SunPower and First Solar



Notes: The window of seven trading days centered on the 2020 United States Federal election (October 29th-November 6th) is identified in the horizontal axis as -3, -2, -1, 0, 1, 2, 3 with day zero denoting November 3rd, election day). The volatility spreads are calculated using 30- and 60-day standardized options data from OptionMetrics.

political engagement, such as varying lobbying expenditures, but they could also be influenced by other factors like business models, financial health, and market positions. Importantly, lobbying is a strategic decision; firms lobby only if they believe it will be beneficial. Therefore, the comparison is only valid for similar firms. Nevertheless, our first empirical results demonstrate that the patterns in Figure 1 hold more generally, even when accounting for selection into lobbying. This evidence is drawn from modeling—within a simultaneous equation system (Heckman, 1978)—the effects of lobbying and selection into lobbying as functions of firm-level observable and unobservable characteristics. Our results indicate that the market anticipates greater post-electoral variance in stock returns for firms that do not engage in lobbying compared to their lobbying counterparts. This finding suggests that firms without proactive political engagement are seen as more vulnerable to electorally-induced regulatory and policy risks. In contrast, lobbying appears to mitigate these risks, as evidenced by the smaller volatility spreads for lobbying firms, which is consistent with existent qualitative evidence (LaPira and Thomas, 2017).

Not all firms, however, engage in lobbying, raising a crucial question: what factors influence a firm's decision to lobby? Is this mostly from the cost or benefit side? To address these issues, we develop and estimate an equilibrium model of heterogeneous firms with endogenous lobbying. In the model, there is a mass of firms that can differ both in terms of fundamental productivity and efficiency of lobbying activity (e.g., different firms may have different capabilities in lobbying, related to connections, access, firm size, existing regulations, etc.). Firms have incentives to lobby in order to shape future policies and protect themselves from the risks to profits tied to policy uncertainty. The returns to lobbying may not be linear, and the firm will also have to pay a fixed and variable cost to lobby. Ultimately, only firms that see lobbying as advantageous will engage in it.

Our analysis reveals that a combination of high variable costs in influencing policies, positive fixed costs of lobbying, and a highly skewed distribution of firms' returns in lobbying result in only a small set of firms engaging in lobbying activities. This finding aligns with evidence that barriers to entry, such as initial costs and the need for relationship-building with policymakers, play a crucial role in determining which firms engage in lobbying (Kerr et al., 2014). It also partially explains why only a limited number of firms choose to lobby (Ansolabehere et al., 2003).

Importantly, our model estimates explain how lobbying reduces the impact of policy risk on firm valuations. This provides another reason for lobbying beyond gaining access to politicians (Cotton, 2009; Kalla and Broockman, 2016), facilitating information transmission (Austen-Smith, 1993; Austen-Smith and Wright, 1994), or influencing policy changes (Grossman and Helpman, 1994). Finally, our analysis has implications for the welfare consequences of policies that restrict lobbying. Such restrictions, by increasing regulatory uncertainty, could lead to more volatile earnings for firms. Consequently, shareholders might experience diminished investment value due to increased stock price volatility and lower stock prices.

2. Related Literature

This study relates to various strands of the extensive literature on lobbying.[4] Specifically, it builds on research examining how firms engage in lobbying to secure private benefits, including favorable regulation (Richter et al., 2009; Kang, 2016; Kim, 2016; Brown and Huang, 2020), privileged access to licenses or procurement contracts (Goldman et al., 2013; Agca et al., 2019; Agca and Igan, 2022), and reduced market competition (Faccio and Zingales, 2022). Our argument that lobbying serves as a strategic tool

[4]See De Figueiredo and Richter, 2014; Bombardini and Trebbi, 2020 for recent overviews.

for firms to protect themselves from a wide scope of potential policy changes aligns with the broader literature (e.g., Baumgartner and Berry, 2009; Drutman, 2015).[5]

Some recent work highlights the possibility that lobbying may be done to decrease policy uncertainty. LaPira and Thomas (2017), in particular, provides extensive qualitative evidence draw from biographies and interviews indicating that revolving-door lobbyists are hired to insure against unpredictable governments, rather than the more conventional arguments about access. The authors examine the demand for insurance against uncertainty to explain the predominance of revolving-door lobbyists (see Blanes-i Vidal et al. (2012)) and the use of their knowledge about the policy process. More quantitative support, though, often comes from indirect evidence, including the increased demand or use of lobbying (Liu, 2020; Shang et al., 2023), and increased payments to lobbyists (Ban et al. (2019)) during periods of heightened aggregate policy uncertainty. The latter is typically measured using the index of Baker et al. (2016). While certainly valuable, these measures cannot differentiate policy uncertainty from broader economic uncertainty and they often assume uniform firm responses to political risk (Kumar et al., 2023). We make progress on these dimensions by focusing on elections as an exogenous source of political transitions and using firm-level high-frequency financial data which captures firm-specific uncertainty (recently shown to account for most of the variation in risk exposure, Hassan et al., 2019).

Our work is closely related to Grotteria (2023) and Ho et al. (2024). The first combines empirical evidence with a theoretical model to demonstrate that lobbying may be a means to reduce risk as much as a source of political risk. While Grotteria (2023) focuses on the difference in the political-risk premium of high- versus low-lobbying firms, and how it endogenously affects R&D investments, our study emphasizes how firms manage their exposure to policy uncertainty—what he refers to as ex-ante political risk. While both our study and the findings in Ho et al. (2024) suggest that option investors anticipate the financial performance and stock returns of politically active firms to be less sensitive to political risk, our study addresses broader questions regarding the motives and consequences of firm-level lobbying. This includes determining whether observed financial-market outcomes result from selection effects or the lobbying itself, explaining why only a subset of firms engages in lobbying despite its potential benefits, and exploring the potential impact of policies that might restrict lobbying on investor welfare.

Our paper also relates to research examining why firms choose to lobby. Existing studies show that this decision is influenced by factors such as firm size, industry, geographic

[5] Also related to our work is Le Breton and Salanié (2003), which studies lobbying when the lobby is uncertain about the preferences of a unitary decision maker. Le Breton and Zaporozhets (2007) go a step further and replace the unitary decision maker with a legislature with multiple actors.

location, and exposure to policy risks (Ansolabehere et al., 2002; Ozer and Lee, 2009; Bombardini and Trebbi, 2012; Kerr et al., 2014). Relative to existing reduced-form studies (Hill et al., 2013; Akey and Lewellen, 2017; Christensen et al., 2020; Shang et al., 2023; Timbate et al., 2024), we further propose an explicit model of the relationship between policy uncertainty and lobbying activity among heterogeneous firms; we then take the model directly to the data. This approach builds on recent work by Huneeus and Kim (2021) on how lobbying affects resource allocation distortions across firms. It also aligns with recent work that uses model-based estimation to analyze rent-seeking in lobbying (Kang, 2016) or quantify the impact of lobbying on government contract allocation (Cox, 2022). However, we do not model how a firm's lobbying budget is spent (e.g., whether it is preferable to have a lobbyist with connections or better at information transmission, as in Bertrand et al., 2014) or lobbyists themselves (e.g., Blanes-i Vidal et al., 2012). Rather, we assume – in reduced-form – that lobbying affects the alternative policies (or government contracts) that may be realized after the election.

We also contribute to the infant literature that links political activism, firm-specific political risk, and asset prices. While the aggregate effects of political shocks have received considerable attention, recent work reveals that political exposure is largely a firm-specific phenomenon and firms use lobbying to address their individual rather than collective exposure to political risk (Hassan et al., 2019). For example,Timbate et al. (2024) finds that firm-level policy uncertainty is positively associated with corporate risk-taking, with this effect being stronger for firms that spend more on lobbying. Grotteria (2023) documents an annual return premium of 6-8% for stocks of high-lobbying firms, which he interprets as compensation for the political risks associated with lobbying. However, lobbying can lead to increased revenues, reduced costs, or improved competitiveness, all of which directly benefit shareholders. Therefore, these excess returns may be driven by value-enhancing activities rather than compensation for risk (Hill et al., 2013). The evidence in Gorbatikov et al. (2019) reveals that while investors typically demand higher returns for holding stocks with greater political risk, firms that actively manage this risk through political donations experience a reduced sensitivity of equity prices to political shocks. By using options (which are inherently forward-looking contracts), we can measure *ex-ante* uncertainty (Kelly et al., 2016).

Finally, we note that other forms of political engagement to mitigate political risk exist beyond lobbying (Hillman et al., 2004; Mellahi et al., 2016; Brown et al., 2022). For example, Pham (2019) reveals that political connections can effectively reduce the cost of equity during periods of standard political risk but are less effective during extreme partisan conflict. Christensen et al. (2020), in turn, finds that firms maintaining balanced political connections across both Republican and Democratic candidates experience reduced stock return volatility, particularly during high policy uncertainty.

3. Data and Stylized Facts

To examine the role of lobbying in mitigating policy uncertainty associated with the 2020 U.S. election, we combine firm-level data from various sources. First, we identify all US-listed firms with tradable options from OptionMetrics' Ivy DB database. We then merge these data with information on each firm's lobbying expenditures, as reported by *LobbyView* (Kim, 2018). Next, for each of the firms in our sample, we collect data on their characteristics from Compustat, including size, tangibility, return on assets, Tobin's Q, indebtedness, cash holdings, and R&D intensity.[6] To classify the firms into different sectors, we rely on their 4-digit SIC codes in Compustat and group them using the Fama-French 12-industry classification system. Finally, we obtain information on the exact dates of each firm's corporate events from LSEG Data & Analytics (formerly Refinitiv).[7]

3.1. Measuring Electorally-Induced Policy Uncertainty

Policy uncertainty is a complex and multifaceted concept that can be challenging to capture empirically. While stock prices are often used as a proxy for market sentiment and uncertainty, they are limited in their ability to capture investors' expectations of post-electoral variability in stock returns: stock prices usually reflect market sentiment *after* an event has occurred, as compared to our *ex-ante* focus. In contrast, options are a more effective way to capture the market's perception of election-induced policy uncertainty (hereafter, also called "policy risk" for convenience) before the uncertainty is resolved. First, options allow investors to separate the directional and volatility components of risk. Second, they are intrinsically forward-looking contracts, providing an ex-ante assessment of the market's expectations about future price movements.[8]

Building on these insights, we develop an ex-ante measure of firm-level policy risk that leverages the unique properties of options pricing data. This approach draws on established financial theories and practices, particularly those related to how equity volatility

[6]For more details on the data assembly, see Appendix A.1.

[7]Available online at `https://www.lseg.com/en/data-analytics/products/workspace`

[8]In addition, as Kelly et al. (2016) note, investors can use options to hedge against unfavorable election outcomes. The authors develop a model in which stock prices respond to political signals. In its original version, the government decides which policy to adopt and investors are uncertain about the future policy choice. Kelly et al. (2016) interpret the model as one of democratic elections with investors who are uncertain about who will be elected.

responds to pre-scheduled news releases.[9] We first examine each firm's total observed option-implied variance before the election and decompose it into two components: (1) baseline variance, reflecting potential information arrival on an average, non-event day; and (2) excess variance in the aftermath of the election.[10] Specifically, for firm i, the variance implied by the price of an option that expires T calendar days in the future, quoted on day t prior to the election, can be formally expressed as:

$$\sigma^2_{i,t,T} = \sigma^2_i + T^{-1}\sigma^2_{E_i}, \tag{3.1}$$

where σ^2_i represents firm i's baseline implied variance in annualized units, T is the number of trading days until the option's maturity, and $\sigma^2_{E_i}$ captures the anticipated post-electoral variance in stock returns for firm i (see Appendix C for more details).

Neither the baseline volatility σ_i, nor the term σ_{E_i} can be directly observed. However, we can estimate the latter using the prices of options with different maturities traded before the November 3, 2020 election. The reason is that major news events, such as elections, tend to impact asset prices, prompting investors to bid up the prices of options linked to those assets prior to the event. After the event passes, market volatility subsides, and implied volatility drops. The size of the expected decline in volatility depends on the amount of return variation investors expect the event to create. This magnitude can be measured and adjusted for by analyzing the difference in implied volatilities between short- and long-dated options just before the event (Patell and Wolfson, 1979; Patell and Wolfson, 1981; Barth and So, 2014; Dubinsky et al., 2019).[11] With a window t very close to the election, all movement in volatilities is coming from the second term of equation (3.1).

For each firm and day, OptionMetrics calculates the implied volatility for standardized ATMF 30- and 60-day options. Focusing on pre-election day t, the expected post-electoral variance in a firm i's stock returns can be estimated via:

$$\hat{\sigma}^2_{E_i} = \frac{\sigma^2_{i,t,30} - \sigma^2_{i,t,60}}{\frac{252}{30} - \frac{252}{60}}, \tag{3.2}$$

[9]These pre-scheduled news releases include: (i) earning announcements (Patell and Wolfson, 1979; Patell and Wolfson, 1981 Ederington and Lee, 1996; Dubinsky et al., 2019); (ii) Federal Open Market Committee (FOMC) meetings (Clements et al., 2007; Vähämaa and Äijö, 2011; Gospodinov and Jamali, 2012); as well as (iii) monthly employment, CPI, and PPI report dispatches (Nikkinen and Sahlström, 2004). Similar to these events, national elections usually have a predictable schedule. In this case, an important source of uncertainty is the electoral outcome, which is only revealed with certainty after the election concludes (Gemmill, 1992; Mnasri and Essaddam, 2021; Kelly et al., 2016).

[10]We use the squared terms of an option's implied volatilities and thus refer to them as measures of variance or implied variances.

[11]This is closely related to the term-structure measure of Dubinsky et al. (2019) and the excess variance measure of Iselin and Van Buskirk (2023) in studies that capture anticipated event-induced return variation.

where $\sigma^2_{i,t,30}$ and $\sigma^2_{i,t,60}$ are firm i's annualized implied variances of the 30-day and 60-day options, respectively; and the denominator accounts for the term structure of the options.

To reduce measurement error associated with low liquidity in the option market, we use the five-day averages of $\sigma^2_{i,t,30}$ and $\sigma^2_{i,t,60}$ on trading days $t-4$ to t, where day t is the election day (i.e. November 3, 2020).[12] We also average the call and put implied volatilities to mitigate microstructure noise and improve estimate accuracy.[13] Finally, for ease of interpretation, we convert the estimate in equation 3.2 to a daily basis using the number of trading days to option maturity, and express it in standard deviation units,

$$Daily(\hat{\sigma}_{E_i}) = \sqrt{\frac{\hat{\sigma}^2_{E_i}}{21}}. \tag{3.3}$$

To provide a concrete example, consider the case of SunPower (SPWR) discussed above. The five-day averages of the implied volatilities of the standardized ATMF options expiring in 30 and 60 days were 119.07% and 112.92%, respectively, which suggests that the anticipated size of the post-electoral price movement for SunPower was 4.02%. In contrast, the average volatility spread of First Solar (FSLR) was just 2.96%, indicating that the market expected a significantly smaller post-electoral variance in the firm's stock prices, at 2.03%.

The estimated average policy risk in our sample is 3.01%, indicating that the 2020 US general election had a significant impact on market uncertainty.[14] To place this excess risk into context, the standard deviation of the daily returns for the firms in our sample during the third quarter of 2020 was 4.8%. Therefore, even in a year marked by extreme market fluctuations due to the global pandemic's economic impacts, the anticipated additional variation in stock prices in the aftermath of the election was considerable. Furthermore, we find that the expected magnitude of election-related price changes varied significantly across firms: those in the top quartile of the policy risk distribution have values that are approximately 2.25 times higher than firms in the bottom quartile. This substantial disparity underscores the significant heterogeneity in the policy risk measures across firms,

[12] The standardized options in the IvyDB database are interpolated from available option price data and are only included if there is sufficient data to ensure accuracy.

[13] Given our focus on the election's impact, we exclude any observations with post-electoral spreads larger than their pre-electoral counterparts from our sample. We also restrict our analysis to firms whose options do not require significant price movements to support their price, as they are likely to be the most representative of overall market expectations. This approach leads to a conservative estimate of the effect of lobbying on policy risk.

[14] The null hypothesis that the average policy risk in our sample is zero is strongly rejected by a two-tailed one-sample t-test (t = 42.598, p = 0.0000). Note that this estimate is likely conservative, as Jensen's inequality implies that the average of the standard deviations (used here) is less than the square root of the average of the variances.

indicating that some of them were much more exposed to the 2020 US general election than others.

3.2. Firms' Lobbying Activities in the Lead-up to the 2020 Election

The Lobbying Disclosure Act (LDA) of 1995 requires firms to disclose their lobbying expenses to the Secretary of the Senate's Office of Public Records.[15] Given this disclosure requirement, we collect lobbying data from the third quarter of 2019 through the second quarter of 2020, as compiled by *LobbyView* (Kim, 2018). This data source provides detailed information on the amount each firm spends on lobbying, along with their unique 6-digit alphanumeric code assigned to each company by Compustat (GVKEY), which enables us to link firms' lobbying expenditures to the OptionMetrics data. We were able to successfully match this information with our policy risk estimates for 98.7% of the US-listed firms with tradable options described above.[16] Therefore, our sample includes 2,492 observations. Because the LDA has strong enforcement, we consider that firms without entries in *LobbyView* —approximately 68.2% of the firms in our sample—did not engage in reportable firm-level lobbying at the federal level in the lead-up to the 2020 election.[17]

For each firm, we create a binary variable measuring its lobbying activity at the extensive margin. This variable takes the value of 1 if a firm reported spending a strictly positive amount on lobbying, and 0 otherwise. Table 1 presents the distribution of firms' lobbying activity in the lead-up to the 2020 US general election across various sectors. The data indicate that Utilities, Chemical and Allied Products, Consumer Non-Durables (Food, Tobacco, Textiles), and Manufacturing have the highest percentages of firms that engage in lobbying. These findings are consistent with evidence showing that these industries are most likely to be affected by government regulation in developed countries (DellaVigna et al., 2016). They are also in line with historical patterns, as similar industries have been found to be among the top lobbying sectors in previous studies. For instance, Tobacco, Defense, and Chemicals were among the leading lobbying sectors in Hill et al. (2013)'s analysis of lobbying activity from 1999 to 2011. The similarities between our sample of US-listed firms with tradable options and those in previous studies

[15]As of 2021, firms must file with the U.S. Senate Office of Public Records if their in-house lobbying expenditures exceed $14,000 in a quarter or if a lobbying firm's expenditures on their behalf exceed $3,000. Once a registration is filed, firms must submit a quarterly report until they notify that lobbying activities have ceased.

[16]To ensure accurate matching, we also employ a fuzzy matching algorithm to match firms by name and subsidiary names, in addition to using the GVKEY identifier. See Appendix A.2 for details.

[17]Thirty firms in our data have lobbying reports, but do not have expenditures exceeding $5,000$. For these firms, the lobbying amount is reported as zero, but it's possible a firm had small, but positive lobbying expenditure. We code these firms as non-lobbying; our results are robust to instead excluding these firms.

give us confidence that our data are representative of the broader population of lobbying firms, at least with regard to lobbying activity across sectors. Furthermore, the consistency of these findings across different time periods and datasets suggests that certain sectors are more prone to lobbying due to their high levels of government regulation, competition, and economic importance.

TABLE 1. Lobbying Activity Across Sectors

Sector	# Firms	# Lobbying	% Lobbying
Consumer Nondurables (Food, Tobacco, Textiles)	103	35	33.98
Consumer Durables (Cars, Appliances, Furniture)	72	21	29.17
Manufacturing (Machinery, Trucks, Planes)	218	74	33.94
Energy (Oil, Gas, Coal Extraction)	83	26	31.33
Chemicals and Allied Products	60	29	48.33
Business Equipment (Computers, Software)	465	130	27.96
Telephone and Television Transmission	54	18	33.33
Utilities	59	38	64.41
Retail, Wholesale, Restaurants	168	43	25.60
Healthcare, Medical Equipment, and Drugs	357	115	32.21
Finanancial Services	538	156	29.00
Other	315	108	34.29
Total	2492	793	31.82

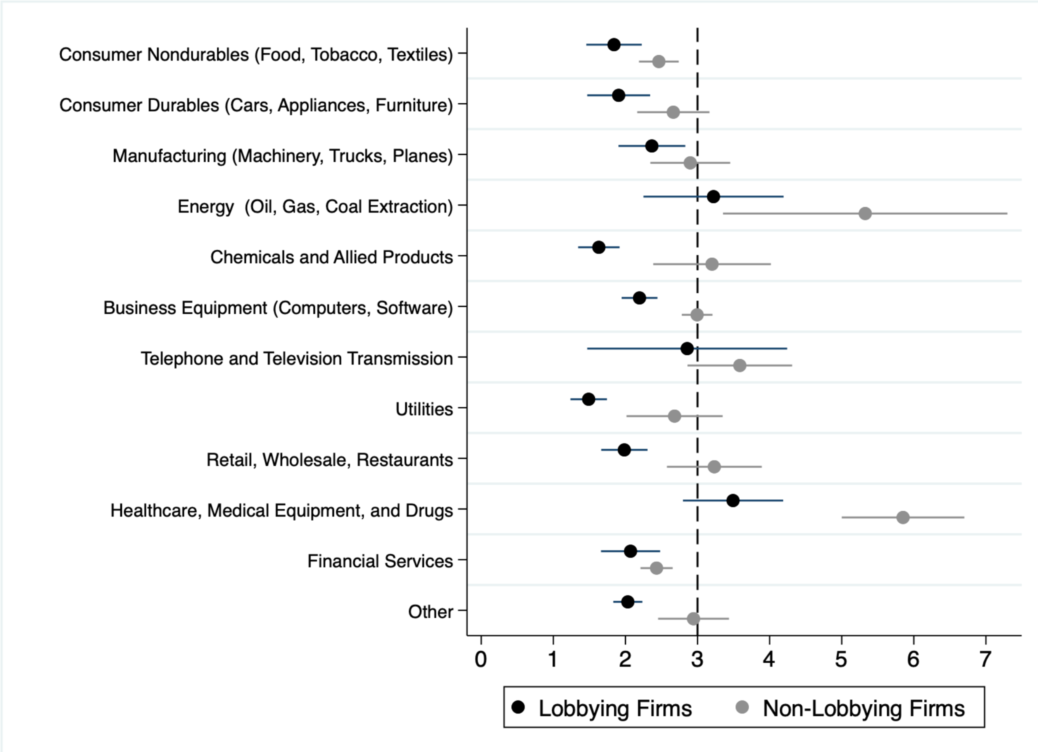
Note: We group the firms in our sample using the Fama-French 12-industry classification system.

3.3. Lobbying versus Non-Lobbying Firms

The significant variation in policy risk measures across firms, along with the tendency for firms in certain industries to engage more in lobbying, suggests that lobbying activity may be associated with firms' policy risk. Figure 2 shows the estimated average policy risk measure associated with the 2020 US general election for lobbying and non-lobbying firms across sectors. The measures are reported with their 95% confidence intervals. The y-axis represents the sector, and the x-axis indicates the average policy risk measure, which is expressed in daily standard deviation units.

The results show that there is considerable cross-sectional variation in the average policy risk: some sectors have much larger anticipated post-election price changes than others. Within each sector, non-lobbying firms tend to have higher average policy risk measures than lobbying firms, suggesting that lobbying activity may be associated with lower policy risk. This pattern is particularly evident in the Healthcare, Medical Equipment, and Drugs, and the Retail, Wholesale and Restaurants sectors. The former results

FIGURE 2. Policy Risk by Sectors and Lobbying



Notes: We group the firms in our sample using the Fama-French 12-industry classification system. The dashed line represents the average policy risk in our sample.

may be due to the emphasis on healthcare policy and potential changes to the Affordable Care Act during the 2020 US general election.[18] Similarly, partisan disagreements over trade policy and potential changes to tariffs may have affected the Retail, Wholesale and Restaurants sector.[19] Nevertheless, the data suggests that most of the variation in measured policy risk appears to play out at the level of the firm, rather than the level of sectors or the economy as a whole. This is evident from the significant overlap between lobbying and non-lobbying firms across many sectors.

To further examine the sources of heterogeneity in policy risk, we gathered financial and market data from Compustat for each firm in our sample. We focused on firm size,

[18]As Koijen et al. (2016) note, the healthcare sector is particularly sensitive to changes in government policies and regulations. Their study documents a "medical innovation premium" in stock returns for healthcare and pharmaceutical companies, estimated at 4-6% per year above standard risk-adjusted returns. The authors interpret this premium as compensation for government-induced profit risk in the healthcare sector.

[19]At the time, the Trump administration's "go-it-alone" approach to trade policy led to the imposition of tariffs on Chinese imports, which had significant and heterogeneous effects on prices and welfare across different industries and firms (Amiti et al., 2019). Democratic candidate Joe Biden indicated that he would consult with allies on the future of US tariffs on China, potentially leading to changes in trade policy (Spetalnick and Hunnicutt, 2020).

TABLE 2. Differences between lobbying and non-lobbying firms

	Non-Lobbying		Lobbying		Difference	
	N	Mean	N	Mean	Difference	p-value
Lobbying expenditures (USD Mill.)	1,699	0	793	11.19	11.19	0.0000
Size						
Market Value (USD Mill.)	1,634	7,874.51	787	31,326.74	23,452.23	0.0000
Total Assets (USD Mill.)	1,690	19,088.31	792	49,720.1	30,631.79	0.0000
Sales (USD Mill.)	1,689	4,506.15	792	14,378.68	9,872.53	0.0000
Number of Employees (Thousands)	1,645	11.47	789	31.46	19.99	0.0000
Net Income (US Mill.)	1,689	344.31	792	1,303.65	959.33	0.0000
Income Taxes (USD Mill.)	1,689	114.19	792	278.94	164.75	0.0000
Dividends - Total (USD Mill.)	1,681	178.21	790	585.11	406.90	0.0000
Other Observable Indicators						
Tangible Assets/Assets	1,607	0.22	777	0.25	0.03	0.0088
Return on Assets	1,689	-0.044	792	0.011	0.054	0.0000
Tobin's Q	1,629	2.39	787	2.29	-0.10	0.4290
Debt Ratio	1,686	0.29	790	0.35	0.06	0.0000
Cash Holdings/Assets	1,690	0.20	792	0.15	-0.06	0.0000
R&D Expenditures/Assets	1,009	0.097	414	0.067	-0.029	0.0009
Earnings Announcements						
In 30-Day Window (Percent)	1,699	51.62	793	40.10	-11.52	0.0000

tangibility, returns on assets, indebtedness, cash holdings, and R&D intensity following existing research (Borghesi and Chang, 2015; Unsal et al., 2016; Abdurakhmonov et al., 2022).

U.S. elections occur during a period when firms publicly reveal their third-quarter financial results. A large body of research has shown that earnings announcements are associated with significant and rapid equity price reactions. Our measure of policy risk captures anticipated price changes as reflected in options maturing 30 days after the election. Therefore, if a firm's expected earnings announcement date falls within this 30-day window, our estimate of election-induced policy risk may be overstated. To address this concern, we collected data on the exact date of firms' earnings news announcements and created a binary variable that takes the value of 1 if a firm's earnings announcement date fell in the 30-day window following the 2020 US general election, and 0 otherwise. This allows us to capture another dimension of firm-level heterogeneity that may confound the relationship between lobbying and policy risk.

Table 2 shows the differences in these observable indicators between lobbying and non-lobbying firms. The data reveals significant differences across them and, thus, different financial and operational characteristics. Lobbying firms tend to be larger, more profitable, and have more resources than non-lobbying firms. They also have higher levels of tangible assets, return on assets, and debt ratio, but lower levels of cash holdings and R&D expenditures. We also observe that a higher percentage of lobbying firms held their earnings announcement calls outside of the 30-Day Window following the November 3, 2020 election. While this may reflect idiosyncratic factors and/or correlated decisions within industries, we will control for such timing.

3.4. Lobbying and Policy Uncertainty

With our data ready, we now seek to understand what drives the anticipated post-electoral variance in stock returns. To do so, we run different model specifications which are presented in Table 3. Columns (1)-(4) show the results from Ordinary Least Square (OLS) estimates of linear regressions of our firm-level measure of policy risk on firm characteristics and lobbying decisions. We begin with a simple specification without control variables in Column (1). In Column (2), we add industry fixed-effects to the model. The addition of the variable *30-Day Window* in Column (3) captures the timing of firms' earnings news announcements relative to the 2020 US general election. Following the existing literature, in Column (4), we augment the specification in (3) with the inclusion of two observable measures to account for firm size: the number of employees (logged), and the ratio of tangible assets to total assets (cf. Kerr et al., 2014).[20] The dependent variable, policy risk, represents the anticipated size of the post-electoral price movement, expressed in daily standard deviation units. In all the models, we cluster the standard errors by sector using the Fama-French 12 industry classification.

The results reveal that the point estimate on *Lobby* is quite stable across the specifications in columns (1)-(3). They also indicate that lobbying is negatively correlated with anticipated post-electoral volatility. For example, according to model (1), the size of the anticipated post-electoral price movements of lobbying firms is 1.02p.p. lower than for non-lobbying firms. The estimated coefficient on *30-Day Window* in Column (3) is positive and statistically significant, indicating that firms that announced their earnings during the 30-day window following the 2020 US general election experienced higher

[20] As an alternative approach, we use the actual number of employees, but exclude from the analysis 9 firms that are significant outliers (i.e. they have more than 430,000 employees). We also rely on other measures of firm size, such as the logarithms of sales and market value. We do not include all these indicators simultaneously in the same specification as they are highly correlated with one another. The results are qualitatively similar.

TABLE 3. Lobbying and Policy Uncertainty[a]

	(1)	(2)	(3)	(4)	(5)	(6)
		Least Squares			Outcome Equation	
	Panel A: Anticipated Post-Electoral Volatility					
Lobby	-1.025***	-1.019***	-0.889***	-0.506***	-2.560***	-2.306***
	(0.270)	(0.264)	(0.226)	(0.162)	(0.587)	(0.531)
30-Day Window			1.079***	0.913***		1.027***
			(0.151)	(0.102)		(0.115)
Employees (Logged)				-0.471***		
				(0.095)		
Tangible Assets/Assets				1.217*		
				(0.568)		
Constant	3.338***	2.982***	2.444***	2.868***	3.528***	2.989***
	(0.448)	(0.090)	(0.057)	(0.293)	(0.208)	(0.164)
	Panel B: Selection Equation - Lobbying					
Employees (Logged)					0.365***	0.360***
					(0.027)	(0.027)
Tangible Assets/Assets					-0.089	-0.080
					(0.223)	(0.224)
Constant					-1.123***	-1.116***
					(0.101)	(0.101)
ρ					0.303***	0.278***
					(0.022)	(0.021)
Observations	2,492	2,492	2,492	2,337	2,337	2,337
FE	NO	YES	YES	YES	YES	YES
R-squared	0.018	0.092	0.114	0.142		

[a] Panel A reports least squares estimates associating lobbying to post-electoral volatility. Panel B, columns 5 & 6 summarize the maximum likelihood first stage estimates for the simultaneous equations model. The estimate of the correlation of the treatment-assignment and outcome errors, denoted by ρ, is positive and statistically different from zero. The sector fixed effect results are not shown. The omitted category in columns (2)-(5) is "Other." Standard errors are clustered by the Fama–French 12 industry classification and shown in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

levels of excess variance. Note that, when we control for firm size, the estimated coefficient on lobbying decreases to -0.506. This finding suggests that much of the observed relationship between lobbying and electorally-induced policy risk may be driven by differences in firm characteristics, including differences in tangible assets and in firm size (measured by the number of employees).

Whether a firm decides to lobby or not, however, is unlikely to be exogenous. In general, firms that expect to benefit from lobbying undertake it, while those that do not anticipate benefits, do not. To explore the role of selection into lobbying, we consider a simultaneous equations model with two equations. In the first stage, a probit model is estimated to predict the probability of a firm lobbying as a function of observable firm/sector characteristics (i.e. treatment assignment). In the second stage a linear regression model is estimated via OLS to predict the outcome variable – post-electoral volatility– based on the predicted probability of lobbying and the control variables. The model also includes a set of auxiliary parameters, including the correlation between the treatment-assignment errors and the outcome errors, the variance of the outcome errors, and the variance of the treatment-assignment errors. We estimate the model by maximum likelihood, with standard errors clustered by sector based on the Fama-French 12 industry classification. The likelihood function is given by the joint probability density function of the outcome variable and the treatment variable, conditional on the covariates (Heckman, 1978).

The results of the model estimation are presented in Columns (5) and (6) of Table 3. Panel B provides the estimates for the selection equation (i.e., predicting lobbying as a function of firm observables). The estimates show that larger firms (i.e., with more employees and higher market value) are more likely to lobby. Furthermore, the estimated correlation of the treatment-assignment and outcome errors, denoted by ρ, is positive and statistically significant, indicating that the unobserved factors that affect the treatment assignment are positively correlated with the unobserved factors that affect the outcome variable. The positive value of ρ also suggests that the estimates in Columns (1)-(4) are likely underestimating the effect of lobbying, as they attribute some of the electorally-induced policy risk of lobbying firms to the treatment, rather than to the unobserved factors. By accounting for selection, the results in Panel B serve a dual purpose, measuring selection into lobbying while allowing us to correct for self-selection in the outcome regression. Once selection is taken into account (Panel A, Column (5)), the estimated coefficient on lobbying is larger, at -2.560 and still statistically significant. The point estimate is qualitatively similar when we control for earnings announcements during the 30-day window following the 2020 US general election.

Overall, the analysis in Table 3 suggests that firms were able protect themselves against the policy uncertainty associated with the 2020 US general election through lobbying, and that the firms likely to benefit most from lobbying (e.g., larger firms) were more likely to select into it. The findings in Table 3, however, are only suggestive of our proposed mechanism: while they show that electorally-induced policy uncertainty is smaller for lobbying firms, we cannot interpret Panel A as evidence indicating that firms engage in lobbying to mitigate their political risk expiosure. In addition, we cannot attribute the results in Panel B – that larger firms are more likely to lobby – to productivity or higher profits, as we do not directly observe either productivity or profits. For both of these questions, as well as to perform counterfactual exercises and inform policy decisions, we propose and estimate a theoretical model.

4. Model

We build a model of heterogeneous firms that choose production levels and lobbying endogenously. In it, both firms and financial market participants face uncertainty about how future policy will be different from current policy. This uncertainty is due to potential changes in government policies post-election (e.g., whether Trump tariffs will be kept, what will be the majority in Congress and how that impacts firm-specific benefits, such as tax breaks, etc.). Firms make both production and lobbying decisions in the face of this uncertainty. While firms may dislike this uncertainty, lobbying may both shift policies in their favor and reduce the amount of uncertainty they face.

4.1. Heterogeneous Firms with Endogenous Lobbying

The model adapts Huneeus and Kim (2021), emphasizing the role of lobbying related to policy uncertainty, but simplifying it along other dimensions, as we outline below. Because our focus is on the impact of lobbying, we relegate the consumer side of the model as well as firm production decisions to Appendix B.1.

4.1.1. **Set-up.** A mass M of firms is distributed across the economy. We assume there is only one industrial sector – thereby focusing on lobbying activity per sector.

Each firm i produces a unique variety ω using capital k and labor n, but can also choose to lobby, l. The demand for each imperfectly-substitutable variety is induced by consumer preferences.[21] Finally, there is a continuum of investors who play the role of participants in the financial sector: while they do not affect consumers or firms, they buy options—which are affected by the firms' choices—in a perfectly competitive market. These market participants will be discussed in Section 4.1.6.

[21]See Section B.1.1 for details on the consumption side of the model.

4.1.2. **The Firm's Problem.** Firms are heterogeneous along three dimensions. This heterogeneity is parametrized by the triple $\phi_i = \left(\phi_i^P, \phi_i^L, \phi_i^D\right)$, where ϕ_i^P is the productivity draw; ϕ_i^L is the term reflecting the returns to a given lobbying expenditure, detailed below; and ϕ_i^D is an exogenous distortion term, microfounded below. All three elements of ϕ_i are observed by the firm, but unobservable in a dataset.

Each firm, i, has the following profit function:

$$\pi(\phi_i) = py(\phi_i) + \eta_i - w \cdot n(\phi_i) - p_K \cdot k(\phi_i) - l(\phi_i) - f^P q - f^L q - f^E q \tag{4.1}$$

where p is the price, $y(\cdot)$ is output, w is the wage, $n(\cdot)$ is labor, p_K is price of capital, $k(\cdot)$ is capital, and $l(\cdot)$ is both the amount of lobbying and the cost of lobbying. Meanwhile, $f^P q$ is the fixed cost of production, $f^L q$ is the fixed cost of lobbying, and $f^E q$ is the fixed cost that must be paid to receive a productivity draw.[22] Fixed costs are expressed in terms of the unit cost of production, q, so that they do not induce any distortion in production choices.

The remaining term in firm i's profit is a firm-specific random variable, η_i, capturing policy uncertainty: a higher realization of η_i is interpreted as the realization of a policy that will benefit the firm. It can be interpreted as the realization of economic shocks, a sectoral policy, or a firm-specific policy (e.g., government contracts or a firm-specific subsidy).

The firm will choose the triple of capital, lobbying and labor (k, l, n), but does not know η_i when they do so: it believes that, with probability p_e, the policy will not change. If the policy does not change, η_i remains at some status-quo (firm-specific) value, $q_{e,i}$ (e.g., grants, tax breaks or tariffs are kept). However, with probability $(1 - p_e)$, the policy will change, but how it will change is uncertain. The firm believes that, if there is a change, policies can be such that $\eta_i \sim N(\mu(l_i), \sigma^2(l_i))$. Hence, the election may affect policies in an imperfectly predictable way, but these potential changes can be mitigated through lobbying. Indeed, both the mean and variance of proposed and approved alternative policies may differ (e.g., as found in Kang (2016)). Subsection 4.1.7 microfounds these effects.

We choose to be flexible and allow firms to be risk-neutral (i.e., maximize expected profits) *or* risk-averse with CARA preferences (i.e., have an insurance motive, as in LaPira and Thomas, 2017):

$$v_i(\pi(\eta)) = -\frac{e^{-\alpha\pi(\eta)}}{\alpha}. \tag{4.2}$$

[22]We do not need a free entry condition to close the model of distortions. For simplicity, then, we assume that firms have to pay an entry cost in order to get a draw for ϕ_i^P, but the draws of ϕ_i^L and ϕ_i^D are costless.

that are increasing in profits, $\pi(\cdot)$, where profits are given by equation (4.1). Thus, if $\alpha = 0$, we are in the standard problem of maximizing expected profits. If $\alpha > 0$, the firm is risk-averse.[23]

In this setting, the solution to the problem of choosing (k, l, n) by maximizing (4.2) is equivalent to maximizing the certainty equivalent of (4.2). That value, as perceived *before the election* for a firm i with CARA preferences facing normally distributed policy uncertainty, is:[24]

$$\begin{aligned} \pi^{CE}(\phi_i) = \quad & py(\phi_i) + p_e q_{e,i} + (1-p_e)\mu(l_i) - \frac{\alpha(1-p_e)^2\sigma^2(l_i)}{2} \\ & - w \cdot n(\phi_i) - p_K \cdot k(\phi_i) - l(\phi_i) - f^P q - f^L q - f^E q. \end{aligned} \tag{4.3}$$

The firm's lobbying problem is therefore equivalent to maximizing the certainty equivalent (4.3). When the firm is risk-neutral (i.e., $\alpha = 0$), then it only cares about the mean of η_i, and not the variance of profits.

Relative to a standard profit maximizing function, the somewhat novel part of (4.3) is:

$$\tau(\phi) \equiv p_e q_{e,i} + \left((1-p_e)\mu(l_i) - \frac{\alpha(1-p_e)^2\sigma^2(l_i)}{2} \right), \tag{4.4}$$

which, following Huneeus and Kim (2021), we call the distortion function. The distortion function is comprised of exogenous distortions ($\phi_i^D = p_e q_{e,i}$) and those due to endogenous lobbying choices. The exogenous term captures the existing policies and the ex-ante chance they remain, while the endogenous term is affected by lobbying, as lobbying will affect the mean and variance of future policies if there is a change. Notice that the distortion function is additively separable, and its form flows out of our functional form assumptions earlier in this section.[25]

[23]The latter captures the feature that Chief Executives and other senior leaders have a significant portion of their compensation linked to performance. This performance is usually gauged by quarterly earnings, stock prices, or other relevant criteria. As discussed above, when investors assess the potential influence of electoral outcomes on a firm's market valuation, they take into account the firm's managerial involvement in political affairs. From their point of view, lobbying provides information about the potential impact of election results on the firm's value. Hence, the firm's Board and CEO possess strong incentives to internalize the cost-of-capital consequences associated with investors demanding a compensation for bearing policy risk.

[24]Note that η_i is the only source of uncertainty in profits (4.1), so the other terms only affect the mean of that function.

[25]In Huneeus and Kim (2021), $\tau(\cdot)$ multiplies the price and therefore acts as an ad-valorem tax or subsidy that distorts production decisions. Here, the additively separable specification follows directly from our assumptions on policy uncertainty.

Following the firm's decision, there is an election and η_i and, thus, firm profits, are realized.[26] As a result, before the election, the firm believes

$$\eta_i \sim N(p_e q_{e,i} + (1-p_e)\mu(l_i), (1-p_e)^2\sigma^2(l_i)).$$

Afterwards, $\eta_i = q_{e,i}$ or $\eta_i \sim N(\mu(l_i), \sigma^2(l_i))$. The realization of this policy variable generates a jump in stock prices, as it affects the mean and the variance of the profit function (4.1). Thus, each firm i faces uncertainty over policies, as they are unsure about who will win the election and which policies will be implemented ex-post. However, they are able to affect the alternative policies through lobbying: they can move the latter's mean in the desired direction, as well as decrease its variance, but marginally decreasing returns means it is too costly—relative to a constant marginal cost—to secure their optimal policy with certainty.

4.1.3. **Intensity of Lobbying.** We follow Huneeus and Kim (2021) in parametrizing the endogenous distortions term as $(\phi^L l(\phi))^\delta$, where $0 < \delta < 1$. Hence, the total amount of distortions in firm choices due to lobbying and policy uncertainty is given by:

$$\tau(\phi, l(\phi)) = \underbrace{\phi^D}_{Exogenous\ Distortions} + \underbrace{(\phi^L l(\phi))^\delta}_{Endogenous\ Distortions}, \tag{4.5}$$

where $\phi_i^D = p_e q_{e,i}$ and $(\phi^L l(\phi))^\delta = (1-p_e)\mu(l_i) - \frac{\alpha(1-p_e)^2\sigma^2(l_i)}{2}$.

That is, the total distortion includes both an exogenous component (ϕ^D) and an endogenous component that is a function of both resources allocated to lobbying ($l(\phi)$)[27] and a measure of the firm-specific returns to lobbying (ϕ^L). The parameter δ captures the decreasing marginal returns to lobbying in profits. Meanwhile, ϕ_i^L parameterizes returns – or capabilities – of lobbying. Our preferred interpretation is that ϕ_i^L reflects i's benefit from keeping privileges. Hence, firms with more privileges to lose (and better possibilities at keeping them) have an increased marginal benefit from lobbying and are more likely to obtain/preserve more favorable policies. They engage in the lobbying sector to mitigate the effects of potential policy shifts on their operations. Hereafter, we call ϕ_i^L i's "lobbying favorability."

In order to lobby, a firm must pay a fixed cost $f^L q$: this determines which firms select into lobbying. If a firm selects into lobbying, it will choose $l(\phi)$ by comparing extra revenue from the distortion τ^L to the variable cost of lobbying, $l(\phi)$. Firms for whom the

[26]Hence, it is a static model in the sense that agents only play once. We interpret this as a model holding around the election, so that the main source of uncertainty is electoral.
[27]We assume, for simplicity, that these are collected as revenue and rebated lump-sum to consumers.

fixed cost of lobbying is too high relative to ϕ_i^L stay out of the sector altogether and are content with full risk exposure.[28]

Inserting equation (4.5) into the firm objective function in Equation (4.1), we see that firms who choose positive levels of lobbying optimally equate the marginal revenue of lobbying to the marginal cost of lobbying, which is 1. The optimal level of lobbying is therefore

$$l_i^*(\phi_i) = \left(\frac{1}{\delta(\phi_i^L)^\delta}\right)^{\frac{1}{\delta-1}}, \tag{4.6}$$

which only depends on the firm's lobbying favorability ϕ_i^L and δ, the parameter that governs the curvature of the distortions-to-lobbying function.

4.1.4. **Entry into Lobbying.** If a firm wants to participate in lobbying, it must pay a fixed cost in addition to the variable cost of the resources devoted to lobbying. Thus, a firm will only devote a strictly positive quantity of resources to lobbying if the benefits of lobbying outweigh both the variable and fixed costs. Given optimal choice of the intensive margin of lobbying, firm i of type ϕ will lobby if

$$[\phi_i^L l_i^*]^\delta - l_i^* - f^L q \geq 0 \tag{4.7}$$

Substituting from Equation (4.6), the cutoff for a firm to lobby is

$$\bar{\phi}^L = (f^L q)^{\frac{1-\delta}{\delta}} \left(\delta^{\frac{\delta}{1-\delta}} - \delta^{\frac{1}{1-\delta}}\right)^{\frac{\delta-1}{\delta}}. \tag{4.8}$$

Only firms with $\phi_i^L \geq \bar{\phi}^L$ will lobby. Notice that neither ϕ_i^P nor ϕ_i^D enter into this extensive margin decision.

4.1.5. **Equilibrium.** In the main text, we analyze the partial equilibrium implications of firms' choices: firms are the only actors in the lobbying model, and each firm's payoffs from lobbying is only a function of its own lobbying choices, the fixed cost of lobbying, its lobbying favorability ϕ^l, and δ. Lobbying and production decisions are independent of each other, and consumer choices only affect production decisions. Equilibrium in this partial equilibrium lobbying model requires that the firm (1) optimally chooses whether to pay the fixed cost of lobbying to enter the lobbying sector, and (2) conditional on entering the lobbying sector, chooses the amount of lobbying $l_i^*(\phi^L)$ expenditure to maximize profits as given by Equation 4.1. In Appendix B.1, we consider the general equilibrium counterpart of this model, where equilibrium requires that each of the mass of M firms satisfies these same two requirements.

[28]We allow flexible correlations between productivity draws, ϕ_i^P and lobbying draws, ϕ_i^L, so that it can be completely possible that highly productive firms are also comparatively good at lobbying.

4.1.6. **Incorporating Option Traders.** We complete our model by introducing investors who engage in option trading. Firms do not explicitly consider option prices in their choices, as their objectives are simply to maximize (preferences over) profits. However, investors can use these financial derivatives to hedge against or speculate on potential electorally-induce stock price changes. As a result, firms' decisions will influence their own value, which will in turn affect the choices of option traders. As we discussed in Section 3.1, the expected equity return volatility can be decomposed into two components: the firm's baseline volatility and the incremental volatility associated with an anticipated information event (Patell and Wolfson, 1979).

In Appendix C, we extend the Black-Scholes option-pricing formula to incorporate a single, predictably-timed price jump on the first trading day after the election. Our essential innovation is to posit that the excess variance attributed to the election in equation (3.1) depends on firms' endogenous lobbying choices.

From equation (4.1), it can be seen that the only change to profits around the election is the change due to the realization of η_i. In addition, Sections 4.1.3 and 4.1.4 reveal that the production side of the model links the firm's decisions on lobbying, l_i^* in equations (4.6) and (4.7) to firm types. We can thus link the variance implied by option prices on pre-election day t to each firm's endogenous lobbying choices through:

$$\sigma_{i,t,T}^2 = \sigma_i^2 + T^{-1} b^2 (1 - p_e)^2 \sigma^2(l_i), \tag{4.9}$$

where σ_i^2 represents firm i's baseline implied variance in annualized units, T is the number of trading days until the option's maturity, b is a scaling factor that determines how stock prices respond to changes in profit expectations, p_e is the probability that η_i will remain at some status-quo (firm-specific) value, and $\sigma_i^2(l_i)$ captures the expected election-induced variance in returns, given firm i's lobbying expenditures l_i (see Appendix C for more details).

From an empirical standpoint, the decreased policy risk due to lobbying discussed in Section 3.1 can now be interpreted through this lens, as long as the parameters of the model are identified. We tackle this below.

4.1.7. **Model Discussion.** The model makes two main contributions. First, it provides a clear pathway to understand the regression results in Tables 2 and 3: firms anticipate that elections can change policies in unknown ways, and they react accordingly by lobbying. This depends on firms' lobbying favorabilities, the effects of lobbying on policies, and the fixed and variable costs of lobbying. Second, the model provides a tight link between these parameters and observable data. For example, the model explains how our policy risk measure can be written in terms of firm's choices and their effects on policy outcomes.[29] Finally, we will be able to decompose which of these mechanisms (favorability, costs, returns) drive selection and the returns from lobbying.

Before turning to quantification, it is worth highlighting some aspects of the model. First, we interpret ϕ_i^L as lobbying favorability. This is consistent with existing literature, where some firms that have more favorable regulation (e.g., Dal Bó, 2006), better political connections (e.g., Fisman, 2001; Faccio, 2006; Akcigit et al., 2020) or access to politicians (e.g., Cotton, 2009; Kalla and Broockman, 2016) may have better returns to their lobbying efforts. In the model, they would endogenously choose higher levels of lobbying. As we will show empirically below, ϕ_i^L correlates with firm size and asset tangibility.

Second, our model is based on firm-specific uncertainty. As shown in Hassan et al. (2019), among others, most of the recent research indicates that individual firms exhibit unique political risk profiles. This evidence suggests that firms use lobbying practices to handle their individual exposure to policy risk, rather than to address collective risk. Furthermore, firms often involve themselves in lobbying to ensure more favorable results for their own benefit, as opposed to the broader public interest. While our assumptions simplify the exposition relative to a model with multiple lobbying firms and explicit effects on policy through agenda setting, they arise naturally when we consider an appropriate extension of our theoretical environment based on Judd (2022). We present such a discussion in Appendix B.2, where firms in a sector can bargain with one another to decide which policies to lobby. As we discuss, this approach delivers equilibrium predictions where firms are able to affect both the mean and variance of policies through lobbying.

Finally, the additivity of the distortion term implies that neither productivity ϕ_i^P or the level of production impact the lobbying decision in contrast to Huneeus and Kim (2021). As we have assumed that firms are not required to produce in order to lobby or to lobby in order to produce, lobbying decisions and production decisions are independent of each other.

[29] As such questions do not depend on production or consumer choices, we do not pursue identification of consumer-specific or production-specific parameters.

5. Quantifying the Model

5.1. Identification and Estimation

We are interested in quantifying which mechanisms (lobbying favorability, fixed costs, concavity of returns) drive selection into and the returns from lobbying. While the model is simple, we can still fit it to showcase which parameters seem to best explain the data.

In the data, we observe each firm i's decision to lobby, $d_i \in \{0, 1\}$, and how much they spend in lobbying close to the election, l_i^*. In the model, the former is determined as a function of parameters $(\phi_i^L, f_L q, \delta)$ through equation (4.7), while the latter is determined via equation (4.6). Recall that we also observe firm characteristics, denoted z_i, which include the (log) number of employees, the ratio of tangible assets to total assets, and Fama-French sector fixed effects to account for sector-level heterogeneity (see Table 1).

We assume the following two conditions which allow us to identify $\{\phi_i^L, f_L q, \delta\}$ using the model's mappings.

Assumption 1 (Parametrization): Let $\log(\phi_i^L) \sim_{iid} N(m + z_i'\beta, \sigma_\phi^2)$.
(i.e., ϕ_i^L is lognormally distributed across firms).

Assumption 2 (Location Normalization): $m = 0$.

Assumption 1 imposes a parametric assumption on the heterogeneity of firm-level lobbying favorability/privileges. The parametric choice of lognormal is standard, and it has the benefit of allowing thicker tails for unobserved heterogeneity. We allow both observable and unobservable heterogeneity in lobbying productivities, as the unobserved component is normally distributed with mean 0, while the observable part has a linear index specification.

Assumption 2 is a location normalization, normalizing the mean of ϕ_i^L when $z_i = 0$: i.e., a firm with no employees and no market value would have 0 favorability in lobbying. This allows us to separately identify the fixed cost ($f_L q$) from the mean of ϕ_i^L, as both parameters affect the decision to enter lobbying in a similar way.

Under these assumptions, the distribution of lobbying spending is a Truncated Normal distribution, with mean, variance and lower bound that are a function of the parameters of interest - see equation (D.2) in the Appendix. Lemma 5.1 summarizes that they are separately identified - pinned down from the observed distribution of lobbying spending across different firms and their characteristics. The proof is in Appendix D.

Lemma 5.1. *Under Assumptions 1-2, $(\delta, \sigma_\phi^2, f_L q, \beta)$ are identified. Furthermore, $\sigma(l_i)$ is identified.*

The identification of the first set of parameters only requires firm-level characteristics and lobbying expenditures. They can be estimated consistently via Maximum Likelihood, given the known distribution (Truncated Normal), given in equation (D.2).

Finally, we can use data on the cross-section of *realized*/post-electoral implied volatilities for lobbying firms to identify $\sigma(l_i)$, which governs the role of lobbying in reducing policy uncertainty due to the 2020 election. As the identification does not rely on further assumptions, these parameters can be estimated nonparametrically in a regression counterpart of (4.9).

5.2. Results

We present the Maximum Likelihood estimates of $(\delta, \sigma_\phi, f_L q)$ across four specifications in Table 4 below. The specifications only differ in the variables used for observed heterogeneity of ϕ_i^L in Assumption 1. In particular, Columns (1)-(2) use different variables for observed heterogeneity in lobbying favorabilities, which are the same as those in Section 3.4: Column (1) only uses a measure of firm size (log number of employees), while Column (2) augments it with Tangible Assets/Assets (like in Table 3). Meanwhile, Columns (3)-(4) introduce fixed effects for each Fama-French sector category. Our results are robust across these specifications. Standard errors are computed by the bootstrap.

The results show that marginal returns to lobbying decrease strongly, as captured by δ. Indeed, we estimate that parameter to be close to 0.4, significantly away from 1 (which would reflect constant returns). The bootstrapped confidence intervals are tight, such that $\delta \in [0.363, 0.376]$ for Column 3.

In addition, we find that larger firms are also those that have higher favorabilities from lobbying, suggesting a positive correlation across lobbying and productive activities. Indeed, the coefficient on the number of employees is positive and statistically significant across specifications, even conditional on sector-level heterogeneity. This is consistent with such firms having larger privileges from maintaining existing policies, or from having more political connections or access, which enhance the returns from lobbying expenditures on policy.

Meanwhile, we find positive and statistically significant fixed costs for lobbying, consistent with the barriers to entry arguments (e.g., Kerr et al., 2014). The fixed costs are estimated to be approximately US$$11,800$ (in 2020 values). This value is fully consistent with market values, when those are available. For instance, LobbyIt, an existing lobbying firm in Washington D.C., summarizes pricing in the lobbying industry in 2023 as “Most lobbying firms charge as much as $\$15,000$ as a minimum retainer, with the entire process reaching $\$50,000$ per month or more for full advocacy services, with many of their

TABLE 4. Parameter Estimates of $(\delta, \sigma, f_L q, \beta)$ Across Specifications

Parameter	(1)	(2)	(3)	(4)
δ	0.374 (0.004)	0.352 (0.004)	0.369 (0.003)	0.367 (0.003)
σ_ϕ	3.701 (0.186)	4.074 (0.219)	3.775 (0.188)	3.816 (0.203)
$f_L q$	11734.19 (2457.76)	12872.61 (2741.39)	11968.01 (2504.11)	12056.97 (2570.32)
β - Log Number of Employees	9.720 (0.086)	10.411 (0.105)	9.569 (0.087)	9.359 (0.097)
β - Tangible Assets/Assets		1.517 (0.011)		1.488 (0.010)
Sector Fixed Effects	No	No	Yes	Yes
Number of Firms that Lobby	714	700	714	700

Standard errors in parentheses, computed using 999 bootstrap replications. The covariates are the same as in Table 3. Lobbying spending is based on firms spending positive values in Q2 of 2020. The number of firms depends on the availability of data for the covariates.

"billed-for" activities remaining largely undefined."[30] The minimum retainer is consistent with our estimates for the fixed cost, while our model also has marginal costs depending on the extent that one lobbies.

The combination of heterogeneity in firms' returns from lobbying (due to both observed and unobserved differences across firms, including privileges from keeping policies) and a large fixed cost is how our model explains why only 32% of firms in our data lobby. This is not an assumption, but rather an empirical result. After all, the model could also generate a small number of firms lobbying with much lower fixed costs, but with a distribution of ϕ_i^L which had a lower mean and variance. However, this fixed cost and heterogeneity in lobbying types is required to fit both lobbying entry as well as observed heterogeneity in lobbying expenditures.

We now turn to examining the impact of lobbying on financial volatility. As discussed in Section 4.1.6, the function $\sigma(l_i)$ capturing the relationship between lobbying expenditures

[30] See https://lobbyit.com/pricing/#top, retrieved January 24, 2023.

and policy variance in our model also affects options' implied volatility. Therefore, we can quantify the impact of lobbying on financial volatility by fitting the post-electoral implied volatility (over 30 days) to lobbying expenditures using a local-linear non-parametric estimator. We present two specifications: with and without sector fixed effects.[31] The results are shown in Table 5 below.

The average derivative of $\sigma(l_i)$ in lobbying is negative and statistically significant across specifications. It is also robust to outliers in lobbying spending (e.g., firms spending over US$50 million per year) and still holds even if we restrict it to firms spending at least US$100,000 per year. Hence, lobbying can affect post-election policies and, thus, implied volatility. This indicates that lobbying mitigates electoral risk, allowing us to go beyond the associations found in Section 2. The magnitude of these coefficients is that an increase of US$1 million in lobbying spending per year (over an average baseline of US$24 million for lobbying firms) implies an average decrease of 1.5% (0.740 divided by the mean of 49.5) of the 30-day annualized implied volatility through decreasing policy variance.[32]

This evidence is inferred directly from financial data, rather than relying on proxies as in other papers proposing that lobbying mitigates electoral risk (e.g., payments to lobbyists, as in Ban et al. (2019)). Furthermore, such volatility is driven by strictly electoral and firm-level considerations, rather than being measured by a proxy (e.g., the data from Baker et al. (2016)). Indeed, our measure is driven by the equilibrium behavior of investors for specific firms.

5.3. Further Robustness

The changes in stock market valuations that we examine may not fully reflect the underlying effects of interest if the electoral results were somehow anticipated or if the timing of their public revelation coincided with the release of other financially-relevant news. Therefore, a potential threat, given the model, would be that ε_i is not i.i.d. because it is capturing other explanations of effects for policy change. Nonetheless, we believe that our findings are not driven by unaccounted confounders for several reasons. First, our analysis takes advantage of the unpredictability of the 2020 electoral outcomes. Second, by looking at option-implied price jumps using the spread between short-dated and long-dated options in the five trading days before the election results are revealed, we adopt a sufficiently narrow event window to reduce the presence of contaminating information. Finally, by excluding any observations where the post-electoral spread is

[31] Firm-level heterogeneity is already accounted for in the model through its effects on the decision to lobby/how much to lobby.

[32] The effect of lobbying expenditures on policy risk reduction may appear to be quantitatively small, but it is significant and relevant for investors. It is also small enough to be consistent with evidence that lobbying can affect policy (e.g., Kang, 2016), although this is an average over heterogeneous effects.

TABLE 5. Estimates of $\sigma(l_i)$

Parameter	Specification 1	Specification 2
Average Derivative of $\sigma(l_i)$ in l_i	-0.740 (0.263)	-0.693 (0.274)
Sector Fixed Effects	No	Yes
Number of Firms that Lobby	716	716

Standard errors in parentheses, computed using 999 bootstrap replications. An Epanechnikov kernel is used, with bandwidth computed by cross-validation. For interpretability, without loss, we measure l_i in this table as millions of dollars spent in lobbying per year.

larger than its pre-electoral counterpart, we further minimize the potential influence of other economic and political shocks on asset prices.

6. Conclusion

Lobbying is widely observed in the U.S. Typically, it is thought to either influence policy or transmit information, which may benefit firms. However, we proposed and provided evidence that lobbying can reduce policy uncertainty associated with electoral turnover by making post-election policies resemble those that were already in place. This can be observed from differential jumps in option prices for lobbying and non-lobbying firms, and it holds even when accounting for selection into lobbying.

As a result, at least from the point of view of (risk-averse) investors, there is a mechanism by which policies restricting lobbying may yield welfare losses. After all, they may induce increased exposure to risk for investors, as the firm would no longer be able to react to heightened uncertainty. Such a mechanism may need to be accounted for in discussions about lobbying reform and the benefits of lobbying restrictions (e.g., Ellis and Groll, 2020).

Finally, a long-standing puzzle in the literature on lobbying in the U.S. is that the amount of money in U.S. politics appears small relative to the realized gains from lobbying activity. On one hand, our reduced-form finding that lobbying can serve to reduce policy uncertainty makes this finding even more puzzling. On the other hand, our model estimates provide some progress by demonstrating that (1) the costs of affecting policy through lobbying are quite high, (2) fixed costs are positive and significant, (3) the returns to lobbying diminish rapidly; and (4) the distribution of lobbying productivities is quite skewed. This implies that few firms anticipate enough benefits to merit paying a fixed cost and large variable costs in the lobbying sector. Future research could explore what underlies such heterogeneity.

References

Abdurakhmonov, M., J. W. Ridge, A. D. Hill, and L. Holly (2022). Strategic risk and lobbying: Investigating lobbying breadth as risk management. *Journal of Management 48*(5), 1103–1130.

Agca, M. S., M. D. O. Igan, F. Li, and M. P. Mishra (2019). *Doing more for less? New evidence on lobbying and government contracts*. International Monetary Fund.

Agca, S. and D. Igan (2022). The lion's share: Evidence from federal contracts on the value of political connections. *Available at SSRN 4280166*.

Akcigit, U., S. Baslandze, and F. Lotti (2020). Connecting to power: political connections, innovation, and firm dynamics. Technical report, National Bureau of Economic Research.

Akey, P. and S. Lewellen (2017). Policy uncertainty, political capital, and firm risk-taking. *Political Capital, and Firm Risk-Taking (March 22, 2017)*.

Amiti, M., S. J. Redding, and D. E. Weinstein (2019). The impact of the 2018 tariffs on prices and welfare. *Journal of Economic Perspectives 33*(4), 187–210.

Ansolabehere, S., J. M. De Figueiredo, and J. M. Snyder Jr (2003). Why is there so little money in us politics? *Journal of Economic perspectives 17*(1), 105–130.

Ansolabehere, S., J. M. Snyder, and M. Tripathi (2002). Are pac contributions and lobbying linked? new evidence from the 1995 lobby disclosure act. *Business and Politics 4*(1), 75–106.

Austen-Smith, D. (1993). Information and influence: Lobbying for agendas and votes. *American Journal of Political Science*, 799–833.

Austen-Smith, D. and J. R. Wright (1994). Counteractive lobbying. *American Journal of Political Science*, 25–44.

Baker, S. R. and N. Bloom (2013). Does uncertainty reduce growth? using disasters as natural experiments. Technical report, National Bureau of Economic Research.

Baker, S. R., N. Bloom, and S. J. Davis (2016). Measuring economic policy uncertainty. *The quarterly journal of economics 131*(4), 1593–1636.

Ban, P., M. Palmer, and B. Schneer (2019). From the halls of congress to k street: Government experience and its value for lobbying. *Legislative Studies Quarterly 44*(4), 713–752.

Barth, M. E. and E. C. So (2014). Non-diversifiable volatility risk and risk premiums at earnings announcements. *The Accounting Review 89*(5), 1579–1607.

Baumgartner, F. R. and J. M. Berry (2009). *Lobbying and Policy Change: Who Wins, Who Loses, and Why*. University of Chicago Press.

Bertrand, M., M. Bombardini, and F. Trebbi (2014). Is it whom you know or what you know? an empirical assessment of the lobbying process. *American Economic Review 104*(12), 3885–3920.

Blanes-i Vidal, J., M. Draca, and C. Fons-Rosen (2012). Revolving door lobbyists. *The American Economic Review 102*(7), 3731.

Bombardini, M. and F. Trebbi (2012). Competition and political organization: Together or alone in lobbying for trade policy? *Journal of International Economics 88*(1), 16–27.

Bombardini, M. and F. Trebbi (2020). Empirical models of lobbying. *Annual Review of Economics 12*, 391–413.

Borghesi, R. and K. Chang (2015). The determinants of effective corporate lobbying. *Journal of Economics and Finance 39*(3), 606–624.

Brown, J. R. and J. Huang (2020). All the president's friends: Political access and firm value. *Journal of Financial Economics 138*(2), 415–431.

Brown, L. W., A. A. Rasheed, and R. G. Bell (2022). How and why? a review of corporate political activity predictors and actions. *Group & Organization Management 47*(2), 440–484.

Christensen, D., D. S. Dhaliwal, S. Boivie, and S. D. Graffin (2020). Hedging on the hill: Does political hedging reduce firm risk? *Journal of Accounting and Economics 70*(1), 101331.

Clements, A. et al. (2007). S&p 500 implied volatility and monetary policy announcements. *Finance Research Letters 4*(4), 227–232.

Cochrane, J. H. (2005). *Asset Pricing*. Princeton University Press.

Cotton, C. (2009). Should we tax or cap political contributions? a lobbying model with policy favors and access. *Journal of Public Economics 93*(7-8), 831–842.

Cox, C. (2022). Lobbying for government appropriations. *Rand Journal of Economics*.

Dal Bó, E. (2006). Regulatory capture: A review. *Oxford review of economic policy 22*(2), 203–225.

De Figueiredo, J. M. and B. K. Richter (2014). Advancing the empirical research on lobbying. *Annual review of political science 17*, 163–185.

DellaVigna, S., R. Durante, B. Knight, and E. La Ferrara (2016). Market-based lobbying: Evidence from advertising spending in italy. *American Economic Journal: Applied Economics 8*(1), 224–56.

Drutman, L. (2015). *The Business of America is Lobbying: How Corporations Became Politicized and Politics Became More Corporate*. Oxford University Press.

Dubinsky, A., M. Johannes, A. Kaeck, and N. J. Seeger (2019). Option pricing of earnings announcement risks. *The Review of Financial Studies 32*(2), 646–687.

Ederington, L. H. and J. H. Lee (1996). The creation and resolution of market uncertainty: the impact of information releases on implied volatility. *Journal of Financial and Quantitative Analysis 31*(4), 513–539.

Ellis, C. J. and T. Groll (2020). Strategic legislative subsidies: Informational lobbying and the cost of policy. *American Political Science Review 114*(1), 179–205.

Faccio, M. (2006). Politically connected firms. *American economic review 96*(1), 369–386.

Faccio, M. and L. Zingales (2022). Political determinants of competition in the mobile telecommunication industry. *The Review of Financial Studies 35*(4), 1983–2018.

Fisman, R. (2001). Estimating the value of political connections. *American economic review 91*(4), 1095–1102.

Gemmill, G. (1992). Political risk and market efficiency: tests based in british stock and options markets in the 1987 election. *Journal of Banking & Finance 16*(1), 211–231.

Goldman, E., J. Rocholl, and J. So (2013). Politically connected boards of directors and the allocation of procurement contracts. *Review of Finance 17*(5), 1617–1648.

Gorbatikov, E., L. van Lent, N. Y. Naik, V. Sharma, and A. Tahoun (2019). Is firm-level political exposure priced?

Gospodinov, N. and I. Jamali (2012). The effects of federal funds rate surprises on s&p 500 volatility and volatility risk premium. *Journal of Empirical Finance 19*(4), 497–510.

Grossman, G. and E. Helpman (1994). Protection for sale. *American Economic Review 84*(4), 833–50.

Grotteria, M. (2023). Follow the money. *Review of Economic Studies 91*(2), 1122–1154.

Gulen, H. and M. Ion (2016). Policy uncertainty and corporate investment. *The Review of Financial Studies 29*(3), 523–564.

Hadani, M., J.-P. Bonardi, and N. M. Dahan (2017). Corporate political activity, public policy uncertainty, and firm outcomes: A meta-analysis. *Strategic organization 15*(3), 338–366.

Hadani, M. and D. A. Schuler (2013). In search of el dorado: The elusive financial returns on corporate political investments. *Strategic Management Journal 34*(2), 165–181.

Hassan, T. A., S. Hollander, L. Van Lent, and A. Tahoun (2019). Firm-level political risk: Measurement and effects. *The Quarterly Journal of Economics 134*(4), 2135–2202.

Heckman, J. J. (1978). Dummy endogenous variables in a simultaneous equation system. *Econometrica*, 931–959.

Hill, M. D., G. W. Kelly, G. B. Lockhart, and R. A. V. Ness (2013). Determinants and effects of corporate lobbying. *Financial Management 42*(4), 931–957.

Hillman, A. J., G. D. Kleim, and D. Schuler (2004). Corporate political activity: A review and research agenda. *Journal of Management 30*(6), 837–857.

Ho, T., A. Kagkadis, and G. Wang (2024). Is firm-level political risk priced in the equity option market? *Review of Asset Pricing Studies 14*(1), 153–191. Received March 25, 2022; editorial decision September 18, 2023 by Editor Hui Chen.

Huneeus, F. and I. S. Kim (2021). The effects of firms' lobbying on resource misallocation.

Iselin, M. and A. Van Buskirk (2023). The relative importance of information events: An ex ante perspective. *Contemporary Accounting Research 40*(1), 1–26.

Judd, G. (2022). Access to proposers and influence in collective policymaking. *Journal of Politics, forthcoming*.

Kalla, J. L. and D. E. Broockman (2016). Campaign contributions facilitate access to congressional officials: A randomized field experiment. *American Journal of Political Science 60*(3), 545–558.

Kang, K. (2016). Policy influence and private returns from lobbying in the energy sector. *The Review of Economic Studies 83*(1), 269–305.

Kelly, B., L. Pástor, and P. Veronesi (2016). The price of political uncertainty: Theory and evidence from the option market. *The Journal of Finance 71*(5), 2417–2480.

Kerr, W. R., W. F. Lincoln, and P. Mishra (2014). The dynamics of firm lobbying. *American Economic Journal: Economic Policy 6*(4), 343–379.

Kim, I. S. (2016). Political cleavages within industry: Firm level lobbying for trade liberalization. *American Political Science Review 111*(1), 1–20.

Kim, I. S. (2018). Lobbyview: Firm-level lobbying & congressional bills database. Working Paper available from `http://web.mit.edu/insong/www/pdf/lobbyview.pdf`.

Koijen, R. S., T. J. Philipson, and H. Uhlig (2016). Financial health economics. *Econometrica 84*(1), 195–242.

Kumar, S., Y. Gorodnichenko, and O. Coibion (2022). The effect of macroeconomic uncertainty on firm decisions. Technical report, National Bureau of Economic Research.

Kumar, S., Y. Gorodnichenko, and O. Coibion (2023). The effect of macroeconomic uncertainty on firm decisions. *Econometrica 91*(4), 1297–1332.

LaPira, T. M. and H. F. Thomas (2017). *Revolving door lobbying: Public service, private influence, and the unequal representation of interests*. University Press of Kansas.

Le Breton, M. and F. Salanié (2003). Lobbying under political uncertainty. *Journal of Public Economics 87*(12), 2589–2610.

Le Breton, M. and V. Zaporozhets (2007). Legislative lobbying under political uncertainty. *Mimeo, Available at SSRN 1024686*.

Liu, H. (2020). Policy uncertainty and demand for revolving-door lobbyists. *Interest Groups & Advocacy 9*(4), 470–494.

Lux, S., T. R. Crook, and D. J. Woehr (2011). Mixing business with politics: A meta-analysis of the antecedents and outcomes of corporate political activity. *Journal of* *management 37*(1), 223–247.

Mellahi, K., J. G. Frynas, P. Sun, and D. Siegel (2016). A review of the nonmarket strategy literature: Toward a multi-theoretical integration. *Journal of management 42*(1), 143–173.

Mnasri, A. and N. Essaddam (2021). Impact of us presidential elections on stock markets' volatility: Does incumbent president's party matter? *Finance Research Letters 39*, 101622.

Nikkinen, J. and P. Sahlström (2004). Impact of the federal open market committee's meetings and scheduled macroeconomic news on stock market uncertainty. *International Review of Financial Analysis 13*(1), 1–12.

Ozer, M. and S. H. Lee (2009). When do firms prefer individual action to collective action in the pursuit of corporate political strategy? a new perspective on industry concentration. *Strategic Management Journal 30*(11), 1187–1208.

Pástor, L. and P. Veronesi (2013). Political uncertainty and risk premia. *Journal of financial Economics 110*(3), 520–545.

Patell, J. M. and M. A. Wolfson (1979). Anticipated information releases reflected in call option prices. *Journal of accounting and economics 1*(2), 117–140.

Patell, J. M. and M. A. Wolfson (1981). The ex ante and ex post price effects of quarterly earnings announcements reflected in option and stock prices. *Journal of Accounting Research 19*(2), 434–458.

Pham, A. V. (2019). Political risk and cost of equity: The mediating role of political connections. *Journal of Corporate Finance 56*, 64–87.

Richter, B. K., K. Samphantharak, and J. F. Timmons (2009). Lobbying and taxes. *American Journal of Political Science 53*(4), 893–909.

Shang, L., J.-C. Lin, and W. Saffar (2023). Does economic policy uncertainty drive the initiation of corporate lobbying? *Journal of Corporate Finance 78*, 102150.

Spetalnick, M. and T. Hunnicutt (2020, October). Exclusive: Biden, if elected, would consult allies on future of u.s. tariffs on china.

Timbate, L., D. Kim, D. Asrat, and H. Sungjun (2024). Firm-level political uncertainty, corporate lobbying and risk-taking. *Humanities and Social Sciences Communications 11*(1), 1–15.

Unsal, O., M. K. Hassan, and D. Zirek (2016). Corporate lobbying, ceo political ideology and firm performance. *Journal of Corporate Finance 38*, 126–149.

Vähämaa, S. and J. Äijö (2011). The fed's policy decisions and implied volatility. *Journal of Futures Markets 31*(10), 995–1010.

Online Appendix for *Mitigating Policy Uncertainty: What Financial Markets Reveal About Firm-Level Lobbying*

Appendix A. Additional Information on the Data and Empirics

A.1. Additional Information on Data Matching

Here we supplement the high-level overview of the data assembly process in Section 3 with additional details on our matching procedure.

A.1.1. **OptionMetrics and Lobbyview.** By statute, the lobbying information contained in Lobbyview should contain the universe of firms who lobby the U.S. government above a very minimal threshold. If our process that matches OptionMetrics firms to Lobbyview firms is thorough, we can confidently claim that we have no lobbying firms that are miscategorized as non-lobbying firms (i.e., false negatives).

We take the following approach to the match between OptionMetrics and Lobbyview. First, we match on firm tickers. Since Lobbyview does not have tickers, we first match ticker information to Lobbyview firms using the variable gvkey and the Wharton Research Data Services gvkey-ticker correspondence file. We are able to match 823 firms through this process.

We then run a fuzzy name matching algorithm between the unmatched OptionMetrics firms and Lobbyview; here, we find an additional 109 matches.[33] Next, we repeat the fuzzy matching procedure on the still-unmatched firms, this time using the Wharton Research Data Services' list of firm subsidiaries to make an additional 86 matches, for a total of 1,018 of the 3,129 OptionMetrics firms having lobbying records in Lobbyview.

A.1.2. **OptionMetrics and Compustat.** We next turn to finding firm financial information in Compustat for each OptionMetrics firm. We are able to match all but four OptionMetrics firms to a record in Compustat through the following process.

We first use the Compustat firm identifier gvkey that is present in both Computstat and OptionMetrics, resulting in 843 matches. We then use the Compustat identifier CUSIP, which finds another 2,167 firms. Next, we turn to the ticker, which matches another 73 firms. Finally, we compile a list of changes in ticker from 2018 to 2022 from www.stockanalysis.com, which allows us to match 42 more firms.

[33] Since Lobbyview did not have gvkey matches for firms with IPOs after 2018, we investigated whether this could lead to false negatives. We compiled a list of IPOs after 2018 from www.stockanalysis.com, and our fuzzy name matching algorithm was able to find the vast majority of these firms. We therefore kept the firms with post-2018 IPOs in our sample.

A.2. Additional Information on the Sample

We use the following criteria to construct our sample of firms, presenting descriptive statistics for three key characteristics of firms in Table A1 for each main stage of our selection process. Column (1) corresponds to the publicly-traded firms included in the Compustat database for the years 2019 or 2020. In column (20, we exclude the firms from column (1) that do not have tradable options. Next, in column (3), we further restrict our attention to the subset of firms in column (2) for which our estimator of policy risk is defined and that also satisfy the criteria discussed in Footnote 13 in Section 3.1. Our final sample in column (4) consists of the subset of firms included in column (3) without missing data on the two main size characteristics that we use in our analysis (Number of Employees and Tangible Assets). Compared to the full set of publicly-traded firms in Compustat, the firms in our final sample are about 60% larger in terms of employees and about three times larger in terms of market value. There is no appreciable difference in terms of tangible assets.

TABLE A1. Firms' characteristics by selection criteria

Firm Characteristics	(1) Compustat	(2) Options	(3) Filters	(4) Final Sample
Number of Employees (Thousands)	11.46 (48.99)	16.59 (59.29)	17.95 (63.30)	18.64 (64.51)
Tangible Assets / Assets (USD Mill.)	0.254 (0.289)	0.231 (0.249)	0.229 (0.244)	0.230 (0.243)
Market Value (USD Mill.)	5,267 (31,231)	13,004 (52,609)	15,498 (59,514)	15,934 (60,975)
Observations	11,616	3,390	2,492	2,337

Sample averages. Standard errors in parentheses.

In Table A2, we provide information about the attrition of the firms with options in column (2) of Table A1 once we consider whether our estimator of policy risk is defined and the criteria discussed in Section 3.1 are satisfied (column (3) of Table A1), as well as the missing data on the two main size characteristics that we use in our analysis (column (4) of Table A1). Note, first, that of our 1,018 matched lobbying firms, 32 of these firms do not have tradable options, and so are already removed when we move to column (2)

TABLE A2. Sample attrition by lobbying and non-lobbying firms

	Non-Lobbying		Lobbying		All	
	N	Percent	N	Percent	N	Percent
Firms with Options	2437	100	953	100	3390	100
Policy risk measure not defined	2171	89	895	94	3066	90
Post-election spread > pre-election spread	1814	74	807	85	2621	77
Price-movement condition on Delta	1699	70	793	83	2492	74
Missing Data on Size Indicators	1563	64	774	81	2337	69

of Table A1. We also reclassify 33 firms as non-lobbying firms that are in the Lobbyview data, but who do not report strictly positive lobbying expenditure. Finally, a further 19 firms do not have data for the key Compustat variables for size and so are screened out between columns (3) and (4) of Table A1.

Each row in Table A2 shows a subset of observations that meet the specified criteria, with fewer observations meeting the criteria in each subsequent row. Across the three conditions that we apply to move from column (2) to column (3) of Table A1, approximately 70 per cent of non-lobbying firms satisfy these conditions, compared to 83 percent for the lobbying firms in our sample. Our final sample, once the observations with missing size data are removed, includes approximately 64 per cent of the non-lobbying firms with options, compared to 81 percent of the lobbying firms with options.

Appendix B. Additional Information on the Model

B.1. Firm Production and Consumer Choices

B.1.1. **Consumers.** A representative consumer supplies labor and receives firm profits and government revenues. The representative consumer's consumption decisions also sets the demand curve that producers face.

We assume aggregate demand is determined by the equation

$$Y = \left[\int_{\omega} c(\omega)^{\frac{\sigma-1}{\sigma}} d\omega\right]^{\frac{\sigma}{\sigma-1}}$$

Since each variety ω is the product of an associated firm with ϕ, the optimal consumption of firm ϕ's variety is $c(\phi) = p(\phi)^{-\sigma} D$ with $D = EP^{\sigma-1}$. Here, $E = wN + p_K K + T$ is aggregate expenditure and the aggregate price index is $P = \left[\int p(\phi)^{1-\sigma} M d\hat{G}_p(\phi)\right]^{\frac{1}{1-\sigma}}$. M is the endogenous mass of firms, and $\hat{G}_p$ is the endogenous probability function over firm states after selection into production. The model is closed by assuming that aggregate expenditure equals aggregate income; i.e. $E = I$ so that $Y = \frac{E}{P}$.

B.1.2. **Production Decisions.** As argued above, the additive distortion function means that government policies, and therefore lobbying choices, won't affect prices or the quantities produced.

We assume that producers use Cobb-Douglas, constant returns to scale technology. That is, $y(\phi)$ from Equation 4.1 is defined by

$$y(\phi) = \phi^P n(\phi)^{\alpha^N} k(\phi)^{\alpha^K}$$

where $\alpha^N + \alpha^K = 1$.

Conditional on entry into production, the firm's optimal production/pricing decision implies that

$$p(\phi) = \frac{\sigma}{\phi^P(\sigma-1)} q \tag{B.1}$$

where $q = \left(\frac{w}{\alpha^N}\right)^{\alpha^N} \left(\frac{p_K}{\alpha^K}\right)^{\alpha^K}$ is the raw unit cost. Hence, in this simple monopolistically competitive market, firms charge a fixed markup over marginal costs. Notice that the production decision is independent of both ϕ^D and ϕ^L.

B.1.3. **Firm Entry into Production.** As is standard in heterogeneous firms models, we assume firms have to pay an entry cost $f^E q$ in order to get their ϕ^P draw. For simplicity, we assume that the draws of ϕ^D and ϕ^L are free. We then have the free entry condition

$V^E = \mathbb{E}\left[\bar{V} - f^E q\right] = 0$, where V^E $(\bar{V})$ is the expected net (gross) value of entry. $\bar{V} = \bar{\pi}$, where $\bar{\pi}$ is the average profit of firms in the entry period.

Firms that pay the entry cost receive a draw from G, the exogenous probability function over firm states, and then decide whether or not to produce. If they choose to produce, they must pay the fixed cost $f^P q$. Firms will produce if a positive level of production leads to non-negative profit (net of lobbying activity and the sunk entry cost). We can therefore determine the cutoff ϕ^{P^*} for producing as follows:

$$p(\phi^P)y(\phi^P) + \phi^D - wn(\phi^P) - p_K k(\phi^P) - f^P q = 0 \tag{B.2}$$

$$\frac{r(\phi^P)}{\sigma} - f^P q + \phi^D = 0 \tag{B.3}$$

$$\frac{(\frac{\mu}{\phi^P} q)^{1-\sigma} D}{\sigma} - f^P q + \phi^D = 0 \tag{B.4}$$

$$\phi^{P*}(\phi^D) = \frac{\sigma q}{\sigma - 1}\left[(f^P - \phi^D)\frac{\sigma}{D}\right]^{\frac{1}{\sigma-1}} \tag{B.5}$$

where Equation B.4 uses $r(\phi^P) = p(\phi^P)^{1-\sigma} D$ from the demand side. This cutoff endogenously determines the distribution of firms who enter production, $\hat{G}_p$.

B.2. Discussion on how Lobbying can Affect Mean and Variance of Policies

As in the main text, suppose that the choice of lobbying expenditures l_i^* happens before the election. Let us now outline an extended subgame occurring in our "after election period" if replacement occurs (if there is a change in government). This subgame is dynamic and follows Judd (2022).

Assume that there are left/middle/right politicians, who are recognized randomly to propose a policy, and who bargain over a policy on the real line. Elected politicians bargain over policy, but firms that have $l_i^* > 0$ are able to influence them. Each firm's probability of meeting politicians (i.e., access) is proportional to l_i^*.

Hence, higher-spending firms have more access and possibility to affect policies. If access is available, they offer a binding contract of policy x and a transfer m. If the politician that is being accessed accepts the policy, it is kept. If (s)he rejects, (s)he proposes another policy and keeps the transfer. Multiple firms may try to affect policies after the election, but l_i^* is what guarantees that possibility *for each firm*. The proposed policy (whether affected by the firm or not) must receive a majority to pass. Judd (2022) shows that, in this environment, the presence of multiple firms' access to politicians (i.e., $l_i^* > 0$ for multiple i) is enough to affect policy: equilibrium policies have a smaller support than when $l_i^* = 0$. Hence, the set of possible policies under lobbying is smaller the set of policies in the absence of lobbying, with both the mean and variance being affected.

Appendix C. Option Pricing with Jumps

Here we expand on the financial side of the model - i.e., how investors price firm i's options when i is subject to uncertainty over policies, η_i. As in Dubinsky et al. (2019), we consider an extension of the Black-Scholes model with a single price jump occurring immediately after the election. Equation (4.1) indicates that the change in firm i's profits associated with the election outcome is solely driven by the realization of η_i, which follows a normal distribution with mean $p_e q_{e,i} + (1 - p_e)\mu(l_i)$ and variance $(1 - p_e)^2\sigma^2(l_i)$.

As the market updates its expectations of firm i's future profitability in response to the new information, the firm's stock returns will also be affected by the realization of η_i. The price adjustment, however, may have a different order of magnitude than the change in profit expectations. This can be represented by the linear function $f(\eta_i) = b\eta_i$, where b is a constant scaling factor that determines the extent to which the price adjustment responds to changes in profit expectations.[1]

Using the linearity property of expectation:

$$E[f(\eta_i)] = b \cdot [p_e q_{e,i} + (1 - p_e)\mu(l_i)],$$

and the variance scales by the square of the constant:

$$Var(f(\eta^i)) = b^2 \cdot (1 - p_e)^2\sigma^2(l_i)$$

Let T_e be the election date, and Z_e a random variable representing the jump size of the log stock price after the outcome of the election is revealed. The distribution of the log-returns of firm i's stock price between times t and $T > T_e$ can be expressed as

$$\log\left(\frac{S_T^i}{S_t^i}\right) \sim N\left(\left(r - \frac{\sigma^2}{2}\right)(T - t) + b[p_e q_{e,i} + (1 - p_e)\mu(l_i)], \sigma^2(T - t) + b^2(1 - p_e)^2\sigma^2(l_i)\right),$$

where r is the constant risk-free rate, σ is the baseline volatility, T is the maturity date, and t is the current time ($t < T_e < T$).[2]

The martingale condition requires $E[e^{Z_e}] = 1$.[3] As Z_e depends on the realization of η_i, we would need:

$$e^{b[p_e q_{e,i} + (1-p_e)\mu(l_i)] + b^2(1-p_e)^2\sigma^2(l_i)/2} = 1.$$

Taking the natural log:

$$b[p_e q_{e,i} + (1 - p_e)\mu(l_i)] + \frac{b^2(1 - p_e)^2\sigma^2(l_i)}{2} = 0$$

[1]See Cochrane (2005) for a discussion of scaled payoffs in the context of asset pricing theory.

[2]Notice that if the policy will not change, $p_e = 1$, and η_i remains at some status-quo (firm-specific) value, $q_{e,i} = 0$, then the distribution of log returns reduces to a standard Black-Scholes model without jumps.

[3]If the expected size of the jump is zero, then, $E[e^0] = 1$.

The term $\frac{b^2(1-p_e)^2\sigma^2(l_i)}{2}$ is always positive for $b \neq 0$, $0 < p_e < 1$, and real $\sigma(l_i)$. Normalizing $q_{e,i} = 0$, we can solve for $\mu(l_i)$:

$$\mu(l_i) = -\frac{1}{2}b(1-p_e)\sigma^2(l_i). \tag{C.1}$$

This result has several implications: (1) the expected value of the jump component is negative; (2) the magnitude of $\mu(l_i)$ increases as p_e decreases (i.e., as $(1-p_e)$ increases); (3) $\mu(l_i)$ is proportional to the square of $\sigma(l_i)$; (4) as p_e approaches 1, $\mu(l_i)$ approaches 0; (5) as b approaches zero (i.e. prices respond very little to the new information regarding firm i's profits), then $\mu(l_i)$ approaches 0; (6) when $b > 0$, the negative $\mu(l_i)$ compensates for the positive contribution of the variance term $\frac{(1-p_e)^2\sigma^2(l_i)}{2}$, maintaining the overall expected value of the jump factor at 1.

As long as the martingale condition in equation (C.1) holds, the implied volatility of a European option that expires T calendar days in the future, quoted on day t prior to the election, on the stock of firm i, can be represented by the following function:

$$\sigma_{i,t,T} = \begin{cases} \sqrt{\sigma_i^2 + \sigma_E^2(l_i)} & \text{if } 0 \leq \text{t} \leq T_e \\ \sigma_i & \text{if } T_e < t \leq T, \end{cases} \tag{C.2}$$

where σ_i^2 is firm i's baseline implied variance in annualized units, and T_e denotes the election date.[4] The expected election-induced variance in firm i's stock returns, $\sigma_E^2(l_i)$, is given by:

$$\sigma_E^2(l_i) = T^{-1}b^2(1-p_e)^2\sigma^2(l_i), \tag{C.3}$$

where b is the scaling factor that determines how prices respond to changes in profit expectations, p_e is the probability that $\eta^i = q_{e,i}$, and T is the number of trading days until the option's maturity.

An examination of equation (C.2) reveals that the implied volatility continuously increases prior to the release of new information associated with the election, and then it discontinuously drops immediately after. Furthermore, equation (C.3) indicates that the implied variance increases at a rate proportional to T^{-1} as the event approaches, implying that the term structure of implied volatilities slopes downward. This is because, for a fixed time t before the election, $\sigma_E^2(l_i)$ decreases as T increases, resulting in lower implied volatilities for options with longer maturities.

Building on this insight, Dubinsky et al. (2019) propose an estimator to measure the amount of return variation created by pre-scheduled news releases, as anticipated by

[4] We assume that implied volatility reverts to baseline volatility on the day after the election (i.e. total implied volatility, $\sigma_{i,t,T} = \sigma_i$). While this simplification is made for ease of implementation and intuition, the analysis in Dubinsky et al. (2019) indicates that the term estimator derived from equation C.2 remains valid even though implied volatility may not immediately revert to its baseline level after an event.

investors and reflected in option prices. Given two options maturing at $T_1 < T_2$ after the election day, if $\sigma^2_{i,t,T_1} > \sigma^2_{i,t,T_2}$, the expected election-induced variance in firm i's stock returns can be estimated via:

$$\hat{\sigma}^2_E(l_i) = \frac{\sigma^2_{i,t,T_1} - \sigma^2_{i,t,T_2}}{b^2(1-p_e)^2(T_1^{-1} - T_2^{-1})}, \tag{C.4}$$

Equation (C.4) is analogous to the term-structure measure in Dubinsky et al. (2019), $(\sigma^{\mathbb{Q}}_{j,term})^2$, except for the adjustment by $b^2(1-p_e)^2$ to account for the effect of the election on firm i's profits. The estimator is well defined when the expression in the numerator is non-negative, and the denominator is non-zero. The first condition will be satisfied as long the hypothesis of a decreasing term structure is not violated (i.e., $\sigma^2_{i,t,T_1} - \sigma^2_{i,t,T_2} \geq 0$). The second condition requires that $b \neq 0$ (i.e. that the prices react to expected changes in profits) and $p_e \in [0, 1)$.[5]

[5] Note that, under the normalization of $q_{e,i} = 0$, the value of η_i will be zero whenever $p_e = 1$, implying that the numerator should also be zero. Therefore, even in the boundary case where $p_e = 1$ the estimator is well-defined whenever $\sigma^{\mathbb{Q}}_{j,term} = 0$.

Appendix D. Proof of Statistical Identification

Proof of Lemma 5.1. Let us first rewrite the equation defining equilibrium lobbying levels for those that choose interior values (equation (4.6)), as:

$$\text{(D.1)} \qquad \log(l_i^*) = -\frac{1}{\delta-1}\log(\delta) - \frac{\delta}{\delta-1}\underbrace{(z_i'\beta + \varepsilon_i)}_{\log(\phi_i^L)}, \text{where} \quad \varepsilon_i \sim_{iid} N(0, \sigma_\phi^2).$$

If $l_i^* > 0$ for every firm, then Assumption 1 would imply that $\log(l_i^*) \sim N(-\frac{1}{\delta-1}\log(\delta) - \frac{\delta z_i'\beta}{\delta-1}, \left(\frac{\delta}{\delta-1}\right)^2 \sigma_\phi^2)$. However, we only observe lobbying for firms with $\log(\phi_i^L) > \log(\bar{\phi}^L)$, i.e., with a lower truncation. Hence, conditional on z_i:

(D.2)

$$\log(l_i^*) \sim Truncated\, Normal\left(-\frac{1}{\delta-1}\log(\delta) - \frac{\delta z_i'\beta}{\delta-1}, \left(\frac{\delta}{\delta-1}\right)^2 \sigma_\phi^2, -\frac{1}{\delta-1}\log(\delta) - \frac{\delta\log(\bar{\phi}^L)}{\delta-1}, \infty\right).$$

While identification of the parameters of a Truncated Normal is well-studied, the parameters in which we are interested are functions of the Truncated Normal parameters.

We first note that the three parameters of the Truncated Normal distribution of interest are identified. This is because the truncation point is known from the support of the distribution, while the first two (the mean and variance of the original Normal distribution) are identified from its truncated counterpart. However, this is not the same as identification of $(\delta, \sigma_\phi^2, f_L q, \beta)$.

To see that (δ, β) are identified, first note that under Assumption 2, the mean of $\log(l_i^*)$ is a known function of δ, β and z_i.

Now, β is identified by the variation of z_i and how that affects lobbying. To see this, take three sets of firms with different values of z_i, labeled z_1, z_2, z_3 and with positive lobbying. This exists because of variation in each z_i (Section 3) and Assumption 1. Then, the change in (mean) lobbying expenditures between the firms with characteristics z_1, z_2 is given by:

$$\begin{aligned}\Delta_{1,2} &= \left(-\frac{1}{\delta-1}\log(\delta) - \frac{\delta z_1'\beta}{\delta-1}\right) - \left(-\frac{1}{\delta-1}\log(\delta) - \frac{\delta z_2'\beta}{\delta-1}\right) \\ &= -\frac{\delta(z_1-z_2)'\beta}{\delta-1}.\end{aligned}$$

Hence, the ratio between changes in lobbying expenditures between firms with characteristics z_1 and z_2, and z_2 and z_3 is given by:

$$\text{(D.3)} \qquad \begin{aligned}\frac{\Delta_{1,2}}{\Delta_{2,3}} &= \frac{(z_1-z_2)'\beta}{(z_2-z_3)'\beta} \\ \Rightarrow 0 &= (\Delta_{1,2}(z_2-z_3)' - \Delta_{2,3}(z_1-z_2)')\beta,\end{aligned}$$

which is a linear equation whose only unknown is β. Hence, with variation in each dimension of z_i, β is identified. Given $z_i'\beta$, mean (log) lobbying only depends on δ. Then, δ is identified.

σ^2_ϕ is then identified because the variance of $log(l_i^*)$ (for firms that lobby) is identified, and the latter is a known function of only δ, σ^2_ϕ. Since δ is identified, so is σ^2_ϕ. Finally, the left truncation point is a known function of $\bar{\phi}^L$ (since δ is identified), but by definition, $\log(\bar{\phi}^L)$ is a known function of $f^L q$ and δ. Hence, $f_L q$ is also identified.

Let us move on to $\sigma(l_i)$. Recall that we observe firm-level implied volatilities after the election is realized. Thus, $\sigma^2(l_i)$ is identified as the post-election implied volatility for firms post-election using the latter's cross-section. Note that this data does not depend on b or p_e because it is after the election, and after prices adjust.

Now, we will prove that $\mu(l_i)$ is identified up to α and p_e. Recall the parametrization $(1-p_e)\mu(l_i) - \frac{\alpha(1-p_e)^2\sigma^2(l_i)}{2} = (\phi^L l(\phi))^\delta$. The distribution of the right-hand side is known from Lemma 5.1, as is $\sigma^2(l_i)$. Then, $\mu(l_i)$ is identified up to a constant. $\square$