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Follow the Money

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I study, both empirically and theoretically, the economic and financial consequences of corporate lobbying. Firms lobby politicians to increase their share of government contracts, but political competition creates firm-level risk, inflating their cost of capital and reducing their incentive to invest in research and development (R&D). I document an annual 6–8% return premium for stocks of high-lobbying firms, which compensates investors for political risk. An estimated model in which firms can lobby and innovate and investors are risk averse replicates key features of corporate lobbying in the U.S., including the well-established paradox that lobbying contributions are small relative to the policies at stake. The model predicts that if investors ceased seeking compensation for political risk, R&D investment would increase by 6% and the innovation rate by 0.4% points. The risk-premium costs of lobbying are quantitatively and economically important even if the resources "wasted" on lobbying are objectively small.

Key words: Lobbying, Expected returns, Imperfect competition, Strategic interaction

JEL codes: G12, G32, L10, L22

1. INTRODUCTION

It is a well-established fact that the amount of money spent by corporations on lobbying is relatively modest (Tullock, 1972). Corporations report spending $4 billion a year on lobbying, which pales in comparison to the trillions of dollars on public policy interventions or government contracts. Given that firms spend so little, is corporate lobbying economically irrelevant?

Not necessarily. One theory suggests that when politicians fiercely compete for contributions or when there is greater dispersion of views among voters over ideological issues, policies may be largely distorted even if contributions are small (Grossman and Helpman, 1996). In this paper, I propose a further possibility: corporate lobbying may be costly for the firms, even when the direct costs are small. The basic idea is that corporate lobbying creates a winner-take-all contest, which in equilibrium creates risks for firms. When investors pricing the equity of firms are risk averse, this risk manifests in financial markets, rendering capital costlier, reducing firms' incentives to make other investments, such as in research and development (R&D), and ultimately reducing overall innovation.

This insight is important in light of the following facts in the data: (1) High-political-risk firms lobby more, as documented in great detail by Hassan *et al.* (2019). (2) A larger fraction of high-lobbying firms' revenues come from government contracts (Agca and Igan, 2019). (3) These firms are also among the firms with the largest R&D efforts and (4) highest markups

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in the economy.[1] (5) More importantly, they earn higher returns and are riskier. A zero-cost portfolio that goes long in high-lobbying firms and short in low-lobbying firms generates an annual premium of about 6%. This relation is robust to controlling for firm characteristics known to be related to the cross section of stock returns.

I propose a model to evaluate the real impact of the political-risk premium as measured by the difference between stock returns of high- and low-lobbying firms. This framework, centrally featuring the interaction between financial and real markets, does the following: (1) simultaneously accounts for these five facts; (2) quantitatively matches key moments of lobbying firms, for example, that lobbying expenses are tiny relative to sales; (3) yields additional testable predictions on the characteristics of lobbying companies; and (4) can be used to study counterfactual situations and quantify the economic costs of the political-risk premium.

My framework is an extension of the workhorse endogenous-growth model proposed by Aghion and Howitt (1992) and Aghion *et al.* (2005). Their theory of competition and innovation allows me to study both the process of adopting new technologies and the way new technologies interact with the competitive pressures within an industry. Relative to Aghion *et al.* (2005), (1) I allow firms to lobby, where lobbying serves to procure unwarranted monetary gains as in the classical rent-seeking frameworks of Tullock (1967) and Krueger (1974) and (2) I introduce an aggregate source of risk, and risk-averse investors pricing the equity of firms.

In the model, a government agency assigns contracts to heterogeneous firms. Firms compete with each other and optimally devote resources to innovation and lobbying to gain and preserve monopolistic rents.[2] Whereas innovation serves to reduce the cost of production, lobbying serves as a means for firms to obtain political power and unduly gain a larger share of government contracts. In equilibrium, firms that currently enjoy large rents choose to lobby more in order to protect their privileged position.

To derive implications about the firms' cost of capital, I introduce a source of priced risk coming from the government and affecting all firms' profits. This source of risk within my framework can be thought of in multiple ways, for example, time-varying profit tax (Croce *et al.*, 2012), time-varying government policy's impact (Pástor and Veronesi, 2012, 2013), or time-varying restrictions on prices firms can charge, which is common in the pharmaceutical industry (Koijen *et al.*, 2016). This paper does not propose a new form of priced government risk but shows that lobbying competition among firms endogenously modifies each firm's exposure to such a risk.

Lobbying efforts are informative about the cross section of stock returns because of the novel "rent-risk channel" that endogenously arises in the model. Two ingredients are necessary. First, through lobbying, a firm can become the industry leader and extract larger rents, but, due to (lobbying) competition among firms, leadership is a precarious position. Second, at any point in time, the government can intervene; for instance, the government can increase the corporate tax rate, temporarily reducing profits of all firms.

Because both the shock to the government policy variable (*e.g.* tax rate) and industry leadership are expected to last only a few periods, the big risk for shareholders is that the government intervenes exactly when their company is the industry leader. The direct effect of lobbying is the

1. Some examples of high-lobbying companies are Lockheed Martin in the defence industry, Emergent BioSolutions in the pharmaceutical industry, and Science Applications International Corporation in information technology.

2. As noted by Tullock (1987, p. 147) and frequently suggested by others, "the activity of creating monopolies is a competitive industry."

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protection of a firm's profits, but in equilibrium, lobbying competition creates risk that affects firms heterogeneously, raising leaders' exposure to the priced government risk.[3]

Higher exposure to government shocks demands a higher risk premium if the government restriction occurs in periods of high marginal utility for investors, which is in line with the previous literature cited above, for example, Croce *et al.* (2012) or Koijen *et al.* (2016). Although dollars spent on lobbying signal a firm's willingness to maintain monopolistic rents, stock returns incorporate investors' expectations about a firms' ability to maintain those rents. My framework predicts that Tullock-type rent-seeking games hurt innovation not only because they reduce the expected profits of leading firms (Schumpeter, 1934), but also, and more importantly, because the endogenous rate investors use to discount those profits increases.

I extend this framework to permit innovation not only within an industry but also on the set of goods the government buys. With some probability, the government stops buying one good, and the firms producing it cease to exist (displacement risk). Such a shock redistributes profits from existing firms to new firms. This feature has purely quantitative implications.

I estimate this model using firm-level data, which crucially include asset-pricing data. Cross-sectional asset-pricing moments are more sensitive to the parameters of the lobbying and innovation technology, which makes them key to the estimation. The reason is that the distribution of firms is an equilibrium object depending on the lobbying and innovation technology parameters. My estimates show that a large lobbying efficiency is necessary to generate dynamics that qualitatively and quantitatively match the lobbying and R&D behaviour of firms, as well as asset-pricing moments.

Within this framework, I then analyse the real impact of the political-risk premium measured by excess returns. I do so by examining how firms' investment decisions change once the difference in returns disappears. I propose two separate thought experiments. First, I solve the model for an economy in which the aggregate variables hold at constant levels, effectively removing all aggregate risk (both government-induced profit risk, *i.e.* tax risk, and government-induced displacement risk). Removing aggregate risk has two effects: (1) the risk premium vanishes and (2) firms' expected profits change. Second, I keep government risk the same as in the main model, but I assume investors are no longer averse to it, so they stop requiring a compensation. In both experiments, firms choose their optimal lobbying and R&D allocation to maximise their values under the new prevailing stochastic discount factor (SDF) and beliefs. The lobbying and R&D policies from the benchmark framework are no longer value-maximising, and are abandoned.

I solve both counterfactual economies and show that in both experiments, R&D spending increases by 6% relative to the benchmark setting, and the innovation rate goes up by 0.4% points. Both counterfactuals illustrate clearly that the political-risk premium indeed distorts firms' incentives to invest in R&D. Moreover, that the results are similar in the two exercises shows the key role of the political-risk premium in the firms' investment decisions. By negatively affecting industry leaders, the political-risk premium negatively impacts their R&D investments: it lowers the value of being an industry leader and so the incentives of leaders to innovate. More importantly, the model shows the political-risk premium also has an indirect negative effect on the followers' R&D investments. The reason is that even for followers, the benefits of investing in R&D are related to the value of becoming an industry leader, which is decreasing in the political-risk premium. Both counterfactual experiments stress the importance of considering (1) the endogeneity of the cost of capital and (2) the interaction between the different investments that firms can use to gain a competitive advantage. Both experiments reveal the significance of

3. That industry leaders are endogenously more exposed to government policy shocks is proven formally in Section 4, where I propose a three-period version of my model that is amenable to analytical solution.

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the risk-premium cost of lobbying even in contexts in which the resources "wasted" on lobbying are objectively small.

The remainder of this study is organised as follows. Section 2 describes the relation to the previous literature. Section 3 offers the stylised facts motivating the theoretical analysis. Section 4 proposes a basic three-period version of the model, which I use to characterise analytically the key theoretical results. Section 5 extends the basic model to make it suitable to map to the data. Section 6 conducts the quantitative analysis and evaluates the innovation cost of political risk. The final section summarises and concludes. The Online Appendix contains more details on lobbying companies in the U.S., a series of empirical robustness tests, and model extensions.

2. LITERATURE REVIEW

To the best of my knowledge, this paper is the first to develop a unified framework to study corporate political activity in financial economics. My paper relates to different fields of the literature by merging insights from political economics, financial economics, and industrial organisation. However, it differs from previous works by analysing the joint determination of financial asset returns for those firms investing in political lobbying and the relation between lobbying and other investments that also serve to build a competitive advantage.

Indeed, a recent empirical finance literature has shown firms' stock prices react to shocks in the degree of firms' political influence (Fisman, 2001; Faccio, 2006; Faccio and Parsley, 2006; Akey, 2015). Scholars have argued firms that spend more on politics earn higher stock returns and have a higher profitability (Cooper *et al.*, 2010; Chen *et al.*, 2015; Borisov *et al.*, 2016). A contemporaneous paper by Gorbatikov *et al.* (2019) shows that, indeed, political risk is priced at the firm level, which, combined with the fact that high-political-risk firms lobby more (Hassan *et al.*, 2019), naturally implies high-lobbying firms are riskier and exhibit higher stock returns. However, a framework to study corporate political activity in financial economics is missing.

My model is built on the premise that the incentives for firms to become politically connected have multiple sources (Faccio, 2006). For some firms, lobbying is an investment in obtaining favourable regulation, obtaining new government contracts, or reducing market competition (Faccio and Zingales, 2018).[4] For others, lobbying helps protect against downside risk.[5] An influential line of the political science research has indeed established that the main purpose for firms to engage in lobbying is to protect themselves against profound unexpected policy changes (*e.g.* Baumgartner *et al.*, 2009, p. 242). These ideas, when applied to competitive lobbying environments among firms, give rise to the famous Washington adage "if you are not at the table, you are on the menu."[6]

Following Kang (2016), I model lobbying as a game of heterogeneous interests in which firms compete (and, in the Online Appendix, cooperate) with each other. I add the possibility of investing in cost-reducing technologies as in Aghion *et al.* (2005). More importantly, I evaluate the financial effects of lobbying and show it is related to a higher cost of capital in equilibrium,

4. Increased access to credit (Johnson and Mitton, 2003; Cull and Xu, 2005), reduced regulatory supervision (Stigler, 1971; Djankov *et al.*, 2002), and tax breaks (De Soto, 1989) are among the most-cited privileges that well-connected firms enjoy. Furthermore, Faccio and Zingales (2018) show politically connected firms benefit from lower product market competition.

5. Faccio *et al.* (2006) and Adelino and Dinc (2014) document more frequent government bailouts for financially distressed firms that have stronger political connections. Igan *et al.* (2012) show banks that lobbied more aggressively before 2008 received more bailout dollars during the crisis.

6. Quoting Baumgartner *et al.* (2009), the "policy-making process in Washington is one in which it is not uncommon for a significant change to sweep aside years of equilibrium," and "if policy change is unlikely, but when it does come, 70% of the time it is catastrophic rather than marginal, that is enough to get one's attention."

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and the higher cost of capital reduces firms' incentives to invest in R&D. When decision-makers use the information encoded in market prices to make investment decisions (Hayek, 1945), in turn affecting firms' cash flows and values (Baumol, 1965), the financial and real effects of corporate lobbying must be jointly analysed.

This framework contributes to the vast literature documenting that government risk affects firms' economic activity and asset prices (Akey and Lewellen, 2016; Baker *et al.*, 2016; Gulen and Ion, 2016; Kelly *et al.*, 2016). In particular, it relates to those theoretical studies that characterise the risk premium from political uncertainty as a function of aggregate economic conditions (Pástor and Veronesi, 2012, 2013) and that suggest the government risk factor directly affects every firm in the economy and is priced in equilibrium. From the empirical observations of Hassan *et al.* (2019), I posit that the competitive position of firms and its dynamic evolution determines the firms' exposure to government risk. Lobbying spending and firms' risk exposures are both equilibrium outcomes. Lobbying is a way to modify the competitive environment and maximise firm value. Indirectly, however, lobbying is informative about the severity of the loss the firm would experience if its political rents disappeared. Optimal firm behaviour creates competition and an endogenous relation between lobbying spending, the risk of losing rents, and risk premia. My explanation provides an alternative to the idea that investors regularly misprice politically connected firms and highlights the prominence of the endogenous nature of lobbying spending and the cost of capital.[7]

This feature of my model connects my paper to a growing literature on the risk-return tradeoff in environments where firms can interact strategically (Garlappi, 2004; Aguerrevere, 2009; Carlson *et al.*, 2014; Bustamante, 2015; van Binsbergen, 2016; Bustamante and Donangelo, 2017; Corhay, 2017; Corhay *et al.*, 2020).[8] Drawing on the industrial organisational literature, and in particular on the seminal work of Ericson and Pakes (1995), I advocate a dynamic theory of lobbying as a rent-seeking game to investigate the relation between firms' strategic interaction and investors' risk-return considerations.

3. DATA AND STYLIZED FACTS

In this section, I offer some motivating evidence for my theoretical analysis.

3.1. *Data and variable construction*

I combine data from four different sources. I download a comprehensive database of lobbying contributions from Lobbyview.[9,10,11] The lobbying disclosure act (LDA) of 1995 became

7. Cross-sectional asset-pricing papers often face the challenge of distinguishing between risk compensation and mispricing. The empirical asset-pricing literature investigating the link between politics and firms' expected returns is not exempt from this problem (see, *e.g.* Cooper *et al.*, 2010; Belo *et al.*, 2013).

8. I broadly interpret market power as any source of rent that is not *ex ante* allocated by contracts and rules. In such an environment, economic agents will clearly try to exert pressure on regulatory, judiciary, and political bodies by lobbying with the aim of extracting and protecting their rents. In my model, market power endogenously evolves among heterogeneous agents. The more market power a firm has, the more it lobbies to protect or increase its power, which then raises its incentives to lobby even more. This response creates a pattern described by Zingales (2017) as the "de Medici vicious circle;" that is, "money is used to gain political power and political power is used to make money."

9. The database was accessed on 7 December 2019.

10. In Tables 14–16 in the Online Appendix, I repeat the analysis using data from the Centre for Responsive Politics, and the results are similar to the ones in the main text.

11. In a previous version of this paper, I meticulously constructed a comprehensive database of lobbying contributions from original xml files available from the Senate Office of Public Records (SOPR), similar to Kim (2017). Results were similar to the ones reported here.

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effective in 1999. The LDA requires any organisation that contributes more than $10,000 toward lobbying activities to register. A typical registration includes the "name, address, business telephone number, and principal place of business of the registrant, and a general description of its business or activities," as well as those for the client. The register also includes a statement of what issues the registrant expects to lobby for or has already lobbied for. The data are highly granular.

I collect and extract the "Risk Factors" section from firms' financial reports to compute a measure of political risk. This section became mandatory in 2006, and since then, companies have been required to list the most significant risks that applied to their business or their securities (not how those risks were addressed). Another proxy for political risk comes from Hassan *et al.* (2019). From the transcripts of all 175,797 conference calls held in conjunction with earnings releases between 2002 and 2016, Hassan *et al.* (2019) counted the frequency of bigrams referring to political topics within the ten words preceding or following a synonym for "risk" or "uncertainty."

I use data on government contracts from USASpending.gov. The data include details on the funding amount, the date of the transaction, the awarding and funding agency, sub-agency, the recipient firm, and the location of the performance of the contract.

Finally, I use standard data-sets such as Optionmetrics for firm-level data on options and CRSP and Compustat for monthly returns and quarterly firm accounting characteristics.[12] The main limitation of the lobbying-contribution data-set is the difficulty in linking firms' lobbying behaviour to their economic characteristics, because the reports contain no unique identifier for firms (other than their names). Following Kim (2017), researchers at Lobbyview parsed the original xml files available from the SOPR and matched the name of lobbying clients to Compustat identifiers. I end with 1691 unique firms whose returns are observed in the period after lobbying. The median amount spent on lobbying in a given year is $280,000, and the average is $1,329,446. Lobbying is a highly persistent activity. If a firm engages in lobbying activities in a given year, the firm has an 88% probability of lobbying in the next year (Table 1 in the Online Appendix)

To document cross-sectional differences between lobbying firms, I sort stocks of firms that lobby directly into quintiles based on their lobbying intensity and form five portfolios.[13] Lobbying intensity is defined as the total amount of lobbying expenditures in a given semester, scaled by the firm's average asset size in the same semester. Non-directly-lobbying firms, which also include firms that lobby through business network associations, such as the Chamber of Commerce, are reported separately. Non-directly-lobbying firms constitute about 82% of the firm-semester observations.[14] Firms are sorted by the date their lobbying report becomes public. The frequency of sorting is semi-annual (January–June, July–December). This latter choice is natural because, before 2007, firms were required to disclose their lobbying expenses only once every 6 months. Firms in the highest quintile, namely, those that spend more intensively to be part of the legislative process, are referred to as *persuasives*. Firms in the lowest quintile are referred to as *feebles*.

12. Data for the market factor and the risk-free interest rate come from Kenneth French's website (https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data˙library.html).

13. I exclude firm-quarters with non-positive sales or assets.

14. Lobbying is characterised by large up-front costs and barriers to entry that explain why lobbying tends to be a persistent activity and why non-lobbying firms tend to be smaller (Kerr *et al.*, 2014).

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3.2. *Stylized facts*

The following features of lobbying firms can be found in the data.

Fact 1: High-lobbying firms exhibit higher stock returns. The first row of Table 1 reports the annualised value-weighted average of stock returns for the lobbying portfolios in excess of the risk-free rate. The zero-cost strategy going long for persuasives and short for feebles produces an average return of 6.2%, which is as large as the average market excess return in the same time period from July 1999 to December 2018.

The premium for lobbying firms is economically large: for comparison, its magnitude is about twice as large as the size and the value premia in the same period, while non-lobbying firms in the same period earned an average return of 5.8%, which is about half the average return of high-lobbying firms. The model in this paper can capture this pattern for the stock returns of lobbying and non-lobbying firms.

I then investigate the return premium adjusting for the market risk factor. This exercise reinforces the significance of the data pattern, because the years of this analysis were characterised by large volatility in the aggregate stock market. I perform the time-series regression approach first proposed by Black *et al.* (1972). Monthly returns on stocks sorted by firms' lobbying intensity are regressed on the returns of a market portfolio of stocks. For each individual portfolio i, I regress its excess returns R^e_{it} on the contemporaneous excess returns of the market, R^e_{mt}, as proxied by the CRSP value-weighted return series net of the monthly risk-free rate. The regression is

$$R^e_{it} = \alpha_i + \beta_i R^e_{mt} + \varepsilon_{it}. \tag{1}$$

Table 1 reports the annualised αs, together with the Newey and West (1987) standard errors with twelve lags. The portfolio constructed for buying persuasives and selling feebles earns an annualised abnormal return, α, of about 8%. Abnormal returns exhibit a strong increasing pattern as lobbying intensity increases.[15] Again, as a comparison, non-lobbying firms earn an alpha close to zero.

In Table 1, I also report in brackets confidence intervals computed using non-parametric bootstrap. I randomly sample the time periods with replacement. For the bootstrapping on the time-series regression exercise, when I bootstrap a particular time period, I draw the entire cross section at that point in time so as to maintain the cross-sectional dependence in the data. The size of the resampled data is the same as the size of the original data, in order to capture the sampling uncertainty of the original sample. In each bootstrapped sample, I then estimate the average values, or run regression (1). I retain the distribution of estimates and present the 95% confidence intervals for each estimate. The confidence intervals from the bootstrap are symmetric and very similar to those implied by the Newey and West (1987) standard errors; significance levels remain largely unchanged.[16]

In the Online Appendix, I provide robustness tests across several dimensions for these results. First, I repeat the portfolio-level analysis excluding high-lobbying industries, as well

15. Portfolios of high-lobbying firms not only have highly significant α coefficients, but are also high-return portfolios with less market exposure; that is, they have lower βs, which again contradicts the predictions of CAPM. The beta for the high-lobbying firms is about 0.8, whereas the beta for the low-lobbying firms is about 1.1, which is similar to the CAPM beta of non-lobbying firms.

16. I run a second bootstrapping exercise at the firm level. In each period, I randomly sample lobbying firms with replacement. For all quarters, I match the size of the resampled data with the original data referring to that specific quarter. Having this new sample, I sort firms by lobbying, following the same procedure as described in the text. Then, I construct portfolios and run the same regressions as above. I repeat the procedure 1,000 times. I save the estimates. Also in this case, results are robust. Table 19 in the Online Appendix reports these results.

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TABLE 1
Portfolio excess returns and alphas

Coefficient	Non-lobbying	Feeble	L2	L3	L4	Persuasive	PMF
$E[R]-R_f$	5.77	3.64	4.61	4.06	8.47	9.86	6.23
	(4.34)	(4.55)	(3.95)	(3.45)	(4.04)	(3.98)	(2.74)
	[−2.072, 13.605]	[−4.846, 12.117]	[−1.755, 10.966]	[−1.843, 9.959]	[1.224, 15.710]	[3.488, 16.240]	[0.187, 12.270]
CAPM α	0.14	−1.96	0.15	−0.16	3.65	5.68	7.63
	(0.89)	(1.63)	(1.05)	(1.12)	(1.34)	(1.91)	(2.64)
	[−1.888, 2.166]	[−5.570, 1.659]	[−2.343, 2.652]	[−2.205, 1.879]	[0.383, 6.922]	[2.091, 9.263]	[2.203, 13.062]

Notes: This table reports time-series averages of value-weighted portfolio returns in excess of the risk-free rate and alpha coefficient estimates from the time-series estimation for the CAPM model. Average returns and alphas are annualised. Newey and West (1987) standard errors with twelve lags appear in parentheses. The 95% confidence intervals are based on the 2.5th and 97.5th percentiles of the bootstrapped estimates, as outlined in Section 3.2. Stocks with positive lobbying spending are assigned to one of five baskets based on lobbying intensity. Lobbying intensity refers to the total lobbying spending in a given semester scaled by the firm's average asset size in the same semester. Persuasives make up the top-lobbying quintile, and feebles make up the bottom quintile. PMF is the difference between persuasives and feebles. For each lobbying portfolio i, CAPM alphas are computed from the following regression:

$$R_{it}^{e} = \alpha_i + \beta_i R_{mt}^{e} + \varepsilon_{it},$$

where R_i^e and R_{mt}^e are, respectively, the excess returns for portfolio i and the market excess return. Data are from 1999 to 2018.

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TABLE 2
Textual analysis of political risk by lobbying intensity

Source	Non-lobbying	Feeble	L2	L3	L4	Persuasive
Financial reports	1.00	1.18	1.24	1.27	1.29	1.35
	[1.00, 1.00]	[1.16, 1.19]	[1.23, 1.26]	[1.25, 1.29]	[1.28, 1.31]	[1.33, 1.36]
Conference calls	1.00	1.27	1.11	1.24	1.28	1.65
	[0.99, 1.01]	[1.23, 1.32]	[1.07, 1.15]	[1.18, 1.28]	[1.23, 1.35]	[1.59, 1.73]

Notes: I perform a textual analysis of the "Risk factor" section of 10 K filings (financial reports). For each firm and year, I compute the fraction of sentences containing at least one word related to political risk and divide this number by the total number of sentences in the "Risk factor" section. See footnote 17 for the list of words. The conference-call measure is based on data from Hassan *et al.* (2019). For each firm and year, the authors compute a proxy for political risk from earnings conference-call transcripts between managers and analysts. The measure captures how focused the discussion is on risks associated with political topics. I split firms into quintiles based on lobbying intensity and compute the unweighted average of the two measures within each portfolio. Lobbying intensity is total lobbying spending in a given semester scaled by the firm's average asset size in the same semester. "Feeble" firms make up quintile 1, and "Persuasive" firms make up quintile 5. For each of the two political risk measures, I divide the average political risk of all portfolios by the average political risk of non-lobbying firms. The 95% confidence intervals are based on the 2.5th and 97.5th percentiles of the bootstrapped estimates. Data for financial reports are from 2006 to 2018, whereas data on conference calls span from 2001 to 2016.

as within high-lobbying industries (Tables 4 and 5). Second, I test the robustness of the abnormal returns to the inclusion of other common risk factors (Table 6). Finally, a panel-regression approach shows the robustness of the positive relation between lobbying intensity and individual future stock returns controlling for book-to-market, market capitalisation, CAPM β, investment ratio, profitability, R&D intensity, and financial leverage, as well as firm fixed effects to capture time-invariant omitted risk factors both including and excluding non-lobbying firms (Tables 7 and 8).

Fact 2: High-lobbying firms have higher political risk (Hassan et al., 2019). I use two measures of political risk. First, I use financial reports (10 K filings) from EDGAR. From firms' financial reports, I count the number of sentences in the "Risk Factors" section (Part 1A) that contain at least one word related to political risk and divide those sentences by the total number of sentences in the same section.[17] Second, I use the data on firm-level political risk computed by Hassan *et al.* (2019), whose measure captures how focused conference-call discussions are on risks associated with political topics. For both measures, I compute the average values for all lobbying portfolios and I scale those values by the corresponding average political risk of non-lobbying firms. In this way, each statistic is the ratio of the average political risk of each portfolio over the average political risk of non-lobbying firms. Table 2 documents a strong positive relation between lobbying intensity and either measure of political risk. In brackets, I report the 95% confidence intervals computed using non-parametric bootstrap.[18]

Fact 3: High-lobbying firms have a larger fraction of their revenues coming from government contracts (Agca and Igan, 2019). Agca *et al.* (2019) show firms are likely to intensify their

17. The list of words used to identify firm exposure to government risk follows that of Koijen *et al.* (2016): "congress," "congressional," "federal," "government(s)," "government-approved," "government-sponsored," "governmental," "law(s)," "legal," "legislation," " legislative," "legislatory," "political," "political reform(s)," "political risk(s)," "politics," "reimbursement(s)," "subsidy," and "white house."

18. At each bootstrap iteration and for each year, a random sample of the same size as the number of firms in that year is drawn, firms are sorted by their lobbying efforts, new portfolios are constructed, and the corresponding statistics are computed for each portfolio. I normalise all values by the average observed political risk of non-lobbying firms. I iterate the process 1,000 times, list the values of the statistics, and report the 2.5th and 97.5th percentiles as the 95% bootstrapped confidence interval.

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TABLE 3
Ratio of government contract value over revenues by lobbying intensity

	10th pct	90th pct	Average	Standard deviation
Non-lobbying	0.00	0.41	0.56	2.79
	[0.00, 0.00]	[0.38, 0.44]	[0.51, 0.61]	[2.54, 3.08]
Feeble	0.00	0.44	0.22	0.72
	[0.00, 0.00]	[0.37, 0.53]	[0.18, 0.29]	[0.59, 1.17]
L2	0.00	1.58	1.13	5.03
	[0.00, 0.00]	[1.31, 1.79]	[0.88, 1.44]	[3.75, 6.50]
L3	0.00	2.26	2.62	11.90
	[0.00, 0.00]	[1.94, 2.82]	[1.93, 3.39]	[8.34, 15.43]
L4	0.00	6.04	3.70	14.00
	[0.00, 0.00]	[4.47, 7.23]	[2.97, 4.44]	[11.43, 16.61]
Persuasive	0.00	42.48	11.37	30.80
	[0.00, 0.00]	[35.93, 48.07]	[10.08, 12.71]	[27.47, 34.09]

Notes: The table displays the 10th and 90th percentiles, the average value and the standard deviation of the ratio between the total federal contract obligations directed to a certain firm and its revenues (in percentage terms) by lobbying portfolios. If a firm has a missing value for federal contract obligations, I consider it as having zero federal contract obligations. The 95% confidence intervals are based on the 2.5th and 97.5th percentiles of the bootstrapped estimates. I split firms into quintiles based on their lobbying intensity, whereas I report non-lobbying firms separately. For each year, lobbying intensity refers to the total lobbying spending in the year scaled by the firm's asset size at the end of the same year. "Feeble" firms make up quintile 1, and "Persuasive" firms make up quintile 5. Results are winsorized at the 1st and 99th percentiles. Data are from 2001 to 2018.

lobbying efforts to improve their chances of procuring a larger share of the government-contract pie, and Agca and Igan (2019) show political connections are valuable for federal contractors, because governments award connected firms larger amounts in contracts.

For each firm, I compute the ratio between annual total federal contract obligations directed to that firm and the firm's annual revenues.[19] Table 3 shows the distribution of the ratio per each lobbying group. A very strong pattern between lobbying intensity and this ratio is observable. The average value of this ratio for the five lobbying portfolios increases monotonically from 0.2% to 11%, while, for instance, the 90th percentile of the cross-sectional distribution of each portfolio increases from 0.4% to over 40%. Each statistic is accompanied by the 95% confidence interval estimated using non-parametric bootstrap as in footnote 18. Firms in the high-lobbying-intensity quintile derive a larger portion of their revenues from government contracts.

Fact 4: High-lobbying firms tend to be innovative firms. High-lobbying firms spend more on R&D and on selling general and administrative (SG&A) expenses (Table 4). The average values for quarterly R&D and SG&A intensity are 0.24% and 2.26%, respectively, for feebles, whereas persuasives have values of 2.39% for R&D intensity and almost 6% for SG&A.[20] Moreover, while only about 18% of feebles invest in R&D, almost 60% of persuasives are active in R&D.[21]

19. From an accounting standpoint, sales or costs related to contracts can be reported in several ways, for example, percentage-of-completion cost-to-cost method. This fact implies the total federal contract obligations from USAspending.gov, which report the total value of the contracts assigned to a specific firm in a year, may not coincide with the value of contracts reported in net sales for that year.

20. Corporate expenses to develop patents or software are reported as R&D. SG&A, on the other hand, includes advertising to build brand capital or employee training to build human capital, among other expenses.

21. The reason lobbying and R&D are correlated in equilibrium is clear when one looks at individual lobbying reports. For instance, one can see firms lobbying for products not even legal at the time of lobbying (*e.g.* lobbying for marijuana-based drugs in 2015 or, more recently, for issues related to urban aviation ridesharing): complex discussions with regulators and policymakers might be required to achieve regulatory approval and give a firm an advantage in becoming the first company to sell an innovative product or service to the public. The strong connection between R&D and lobbying explains the optimal firm's behaviour in my theoretical framework.

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Each statistic is accompanied by the 95% confidence interval estimated using non-parametric bootstrap as in footnote 18.

Fact 5: High-lobbying firms are high-markup firms. Using the measure of markups by De Loecker *et al.* (2020), I find for the five lobbying quintiles, average markups monotonically increase with lobbying intensity. Markups increase from a value of 1.5 for bottom-lobbying firms to 2 for top-lobbying firms. Non-lobbying firms have an average markup estimate close to 1.7, which is the one of the third lobbying quintile. Results are reported in Table 4, together with the 95% confidence interval estimated using non-parametric bootstrap as described above.

4. INSPECTING THE MECHANISM IN A THREE-PERIOD MODEL

In this section, I describe a simple version of the model that illustrates the key properties analytically. These properties are preserved in the general setup I use in the quantitative analysis. This framework already allows me to offer a coherent rationale for the following four stylised facts: (1) Firms with greater government contracts lobby more; (2) firms with greater political risk lobby more; (3) firms that lobby more spend also more in innovation, and (4) firms that lobby more exhibit larger equity returns.

Figure 1 provides a graphical description of the timing of the three-period model, discussed below. A firm, namely, a government contractor, lives three periods.[22] Time periods are indexed by $t = 0, 1, 2$. Timing is as follows:

(a) Nature first assigns each firm an amount of government contracts K_t at time 0 and 1. Each draw of K_t is independent of the other and of the realisation of any other shock and drawn from a uniform distribution between $\underline{K}$ and $\overline{K}$.

(b) In the same periods (*i.e.* at time 0 and 1) but after observing K_t, the firm decides on its optimal lobbying and innovation efforts. Conditional on their lobbying and innovation, firms are able to generate profits next period. To maintain tractability, I assume the assignment and the decisions are made at time 0 and 1, whereas profits are realised in the periods after, that is, 1 and 2 (I will refer to those profits as Π_{t+1}).

Lobbying and innovation affect next-period profits as follows:

- *Lobbying*: The value of sales in the next period, $\tilde{S}_{t+1}$, may be the same as the value of assigned contracts, K_t, or it may be different. Specifically, if the firm lobbies l_t (where l_t is the expenditure on lobbying) at time t, it will be able to generate sales K_t with probability $\pi(l_t)$, or 0 otherwise; that is,

$$\text{Sales}_{t+1} = \tilde{S}_{t+1} = \begin{cases} K_t, & \pi(l_t); \\ 0, & 1 - \pi(l_t). \end{cases} \tag{2}$$

  In this model, lobbying serves only to ensure that the contracts nature assigned at time t are not lost and produce revenues at $t+1$. Realizations are fully idiosyncratic. To provide analytical solutions, I assume $\pi(l) = \frac{l}{1+l}$, so that $\pi(l)$ is increasing in l_t.

22. Even if, for narrative purposes, I discuss the case of government contracts, my model broadly applies to any risk of losing profits (not just contracts) coming from a failure to lobby.

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TABLE 4
Firm characteristics by lobbying investments

	Non-lobbying	Feeble	L2	L3	L4	Persuasive
R&D/assets (%)	1.32	0.24	0.44	0.62	0.91	2.39
	[1.30, 1.33]	[0.22, 0.25]	[0.41, 0.45]	[0.59, 0.64]	[0.88, 0.95]	[2.29, 2.50]
Fraction of firms investing in R&D (%)	34.71	18.01	29.76	36.44	42.32	59.64
	[34.51, 34.91]	[17.30, 18.75]	[28.98, 30.67]	[35.27, 37.18]	[41.55, 43.48]	[58.53, 60.53]
SGA/assets (%)	5.16	2.26	3.11	3.49	3.94	5.89
	[5.13, 5.18]	[2.19, 2.33]	[3.04, 3.18]	[3.41, 3.56]	[3.87, 4.03]	[5.78, 6.01]
Markups	1.72	1.50	1.55	1.70	1.83	2.01
	[1.71, 1.73]	[1.48, 1.52]	[1.53, 1.57]	[1.67, 1.72]	[1.80, 1.86]	[1.97, 2.04]

Notes: Stocks with positive lobbying spending are assigned to one of five quintiles based on lobbying intensity. Lobbying intensity refers to the total lobbying spending in a given semester scaled by the firm's average asset size in the same semester. "Feeble" firms make up quintile 1, and "Persuasive" firms make up quintile 5. R&D/assets is research and development expenses in a given quarter divided by assets. SGA/assets is the selling general and administrative expenses in a given quarter, minus R&D when included, over assets. Markups are estimated using the "production approach" method as in De Loecker *et al.* (2020). The 95% confidence intervals are based on the 2.5th and 97.5th percentiles of the bootstrapped estimates. Data are from 1999 to 2018, except from markups data ending in 2016.

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- *Innovation*: To speak about the relation between lobbying and innovation, I assume the firm incurs some variable production costs c_{t+1}, such that operating income is

$$\text{Operating income}_{t+1} = \begin{cases} K_t(1-c_{t+1}), & \tilde{S}_{t+1} = K_t; \\ 0, & \tilde{S}_{t+1} = 0. \end{cases} \tag{3}$$

  Production costs c_{t+1} are unknown *ex ante* and their realisation depends on the firm's innovation decision in period t. For tractability, I assume the firm has two choices regarding innovation: it can either spend zero or \$$w$ in innovation, where $w > 0$. Innovation is a binary decision, so I call n_t the choice variable equal to 1 if the firm chooses to innovate at time t, and 0 otherwise. If the firm spends nothing, next-period production costs will be $\bar{c}$ with certainty. If the firm spends \$$w$ in period t, it enters the following lottery: with 50% probability, c_{t+1} will be $\underline{c}$, and with 50%, c_{t+1} will be $\bar{c}$, where $1 > \bar{c} > \underline{c}$. The result of this lottery is fully idiosyncratic and independent of the outcome of lobbying.[23]

To speak about a firm's stock returns, I introduce an aggregate source of risk (θ) and risk-averse investors pricing the equity of firms. To keep this model as simple as possible, I assume θ_{t+1} is i.i.d. $\mathcal{N}(0,1)$ and its realisations are independent of the idiosyncratic realisations of a firm's lobbying or innovations.[24] Let σ be the volatility, then firm's profits, Π_{t+1} are equal to

$$\Pi_{t+1} = \text{Operating income}_{t+1} \times e^{\sigma\theta_{t+1}}. \tag{4}$$

The key purpose of this framework is to illustrate the conditions under which high-lobbying firms have larger excess returns, so I regard $e^{\sigma\theta_{t+1}}$ as a generic measure of aggregate risk. In the model of Section 5, I talk directly about aggregate risk coming from time-varying tax rates, I write down a different functional form such that the codomain is between 0 and 1, and I calibrate the model to that risk. However, the intuition developed in this section remains unaffected in the general framework.

Therefore, it follows that the firm's profits are given by

$$\Pi_{t+1} = \begin{cases} K_t e^{\sigma\theta_{t+1}}(1-c_{t+1}), & \tilde{S}_{t+1} = K_t; \\ 0, & \tilde{S}_{t+1} = 0. \end{cases} \tag{5}$$

I assume firms evaluate cash flows using investors' SDF $M_{t,t+1}$, which takes the following parsimonious form:

$$\log M_{t+1} = -R - x_\theta\theta_{t+1} - x_\theta^2/2, \tag{6}$$

where x_θ is the price of risk θ, $e^{-R} \in (0,1)$ the constant discount factor unrelated to the risk coming from innovations to θ, and $E_t[M_{t+1}] = e^{-R}$.

The model is solved via backward induction in Appendix A. Here, I discuss only the main results.

Lemma 1. *Ceteris paribus, a company that has more contracts to protect (i.e. larger K_t) has larger incentives to lobby and optimally lobbies more.*

Proof. See Appendix A. □

23. For the results in this section, I do not need production costs to be stochastic. I write them as such to make them closer to the larger literature on innovation and the model of the next section.

24. This case is extreme, but is simple to solve analytically. In the infinite-horizon economy, this assumption will be softened by assuming the aggregate component of firms' profits follows a mean-reverting process.

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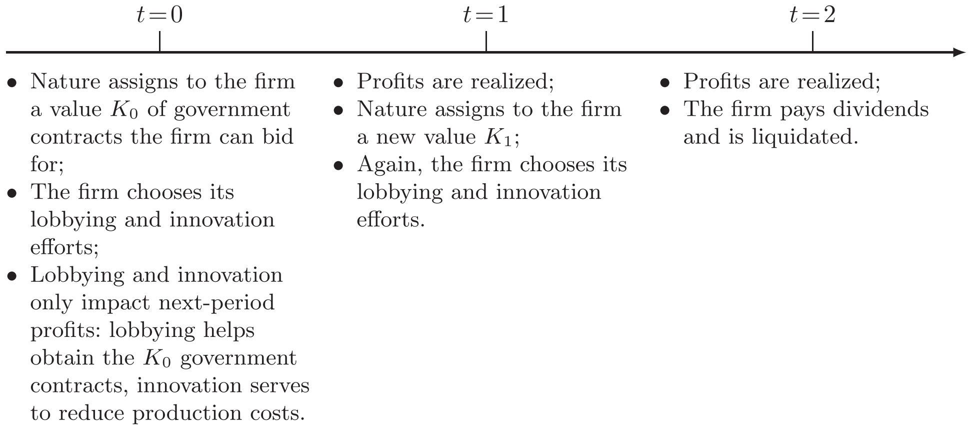

FIGURE 1

Graphical description of the timing of the three-period model

Keeping everything else constant, expected profits are an increasing function of K_t as well as the expected loss from not lobbying. Thus, the model matches fact (1); that is, firms with larger government contracts (both assigned contracts and expected contracts in equilibrium) lobby more.[25]

The direct complementarity between lobbying and innovation is also interesting; that is, if the firm innovates, it will optimally choose to lobby more. The two decisions are taken at the same time, and the marginal benefits of lobbying are higher if the firm does decide to innovate, because expected profits are higher.[26]

Lemma 2. *A K^* exists such that the firm innovates if the assigned contracts $K_t \geq K^*$.*

Proof. See Appendix A. □

At K^*, a jump discontinuity in the firm's optimal lobbying occurs, so that optimal lobbying on the right of K^*, that is, when the firm decides to spend on innovation, is larger than optimal lobbying on the left, when the firm does not spend on innovation. Again, note that lobbying enters also into the firm's decision to innovate, which is natural given that innovating is more profitable if in the next period the firm is more likely to receive K_t rather than zero. This mechanism makes the model match the stylised fact (3) that a firm that lobbies more has larger incentives to innovate.

Regarding political risk, two measures of such a risk can be computed in this framework. Political risk can be defined either as the expected loss if the firm does not lobby, which I call *ex-ante political risk*, or the expected loss if the firms does lobby optimally but his lobbying is unsuccessful, which I call *equilibrium political risk*. They both capture the downside risk a firm faces, but whereas the ex-ante political-risk measure captures the total downside risk if a firm did not lobby at all, the equilibrium political risk captures how much downside risk is left after lobbying: the direct effect of lobbying is to reduce ex-ante political risk until a point of optimality. In this setting, given that lobbying only helps determine next-period profits, ex-ante

25. That the model matches fact (1) can be seen using equations (A.2) and (A.7) in Appendix A.
26. If the firm innovates, expected profits are larger, as are the incentives to lobby and avoid losing those profits.

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political risk is equivalent to K_t, the value of revenues that will be lost if the firm does not lobby, while the equilibrium political risk (*i.e.* after lobbying) is $(1-\pi(l_t^*))K_t$.

Higher-lobbying firms have larger ex-ante political risk. Given that political risk before any lobbying is equal to K_t, and given that optimal lobbying was shown in Lemma 1 to be an increasing function of the contracts K_t the firm had to protect, this result is natural. The relation between firms' lobbying and equilibrium political risk, after the lobbying decision is taken, is instead non-monotonic in this three-period framework. Interestingly, within each region, namely, $[\underline{K}, K^*)$ and $(K^*, \overline{K}]$, equilibrium political risk does increase as lobbying increases: within each of those regions, firms with higher ex-ante political risk optimally choose to remain riskier in absolute terms. Nonetheless, around the threshold K^*, expected losses decrease discretely for an infinitesimal change of K. The reason is that the discrete change in lobbying determined by the change in innovation behaviour around the threshold dominates. This feature of the three-period model is an artefact of innovation being a binary choice and of the resulting discontinuity in lobbying, but more importantly, it highlights the effects of the strong interaction between innovation and lobbying: the discontinuity disappears in the full model.

Finally, expected stock returns between time 1 and time 2 (*i.e.* the last two periods of the model) are identical for all firms regardless of their contract assignment. Instead, in the first period, that is, time 0, I show dominant firms are always more exposed to aggregate shocks. Higher exposure to aggregate shocks does not necessarily lead to larger expected returns between time 0 and 1, $E_0[R_{0,1}]$. The next lemma provides the condition on the price of aggregate risk (x_θ) under which $E_0[R_{0,1}]$ are increasing in K_0.

Lemma 3. *A firm's expected returns between time 0 and 1, $E_0[R_{0,1}]$, are increasing in K_0 if and only if $x_\theta > 0$.*

Proof. See Appendix A. □

This condition, which makes the model match the stylised fact (4), implies negative news to a firm's profits must co-occur with a higher marginal utility for investors.[27] Indeed, whereas the profits of every firm are affected in the same proportion by aggregate shocks θ, the same is not true for firms' values. An equilibrium outcome is that firms with larger assigned government contracts at time 0 are more exposed to aggregate shocks. This result would not be true in a one-period model or if aggregate shocks were permanent. Being more exposed to aggregate shocks translates into higher returns because large-contract firms do relatively worse in states of the world where wealth is particularly valuable to investors.

What is the intuition behind this result? In this framework in which every firm is ex-ante identical in the last period (before the second contract assignment), a firm can only exhibit larger expected returns between time 0 and 1 if it has larger expected time-1 profits; that is, it is assigned larger contracts to protect at time 0 (equations (A.14) and (A.15)).[28]

27. The fact that negative news to a firm's profits must co-occur with a higher marginal utility for investors is not a statement on the cyclicality of fiscal policy, but implies the ε_θ shock carries a positive risk premium for firms in this model. Given that (1) a positive $\varepsilon_{\theta,t+1}$ is positive news to firms (higher profits) and (2) with $x_\theta > 0$ the SDF is lower following a positive $\varepsilon_{\theta,t+1}$, then this shock is said to carry a positive risk premium. Since investors attach a lower value to these states, they are willing to pay a lower price for a security that pays off in those states (firm) or, equivalently, they demand a positive risk premium.

28. Both equations (A.14) and (A.15) show the level of profits is not what matters, but rather the dynamics of profits, that is, the value of the next-period expected profits relative to the expected profits of the firm in the following periods (in this case, only one last).

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The risk for shareholders is that, exactly when nature assigns their firm large contracts (which investors do not know if they will be assigned again in the second draw), the government negatively surprises investors and increases the tax rate, temporarily reducing corporate profits. From an economic standpoint, this result highlights the importance of a risk that is intrinsic to monopolies: dominant positions are not permanent. This risk manifests in financial markets.

The exogeneous assumption on contracts being i.i.d. drawn every period is admittedly a shortcut to obtain that firms that were assigned large contracts in the first period are expected to have lower contracts in the second period, and that firms that were assigned small contracts in the first period are expected to have larger contracts in the second. This assumption keeps the model tractable while helping me demonstrate the importance of the "evolution of profits" for the firm's cost of capital.

In the model of the next section, market power will be contestable, and the dynamics of profits will be entirely determined in equilibrium as an endogenous outcome of lobbying competition. Unlike this model, two firms will lobby for a larger share of government contracts. Lobbying will lead to situations of large market power, which need to be protected with more lobbying (Zingales, 2017). Political competition creates risk in equilibrium. The (small) probability that every period the leader can lose its contracts would make its expected profits decrease with the horizon. On the other hand, follower firms, which have little current profits, that is, little to lose, will lobby less, and their profits are expected to increase because dominant firms are expected to lose their position 1 day. The different dynamics for future profits of followers and leaders results in substantial heterogeneity in the firms' cost of capital, which will eventually be key for the quantitative exercise on the innovation costs of political risk.

Finally, this three-period framework, although stylised, can also capture the profile of expected returns as a function of lobbying. An interesting finding in Table 1 is that non-lobbying companies have average equity returns that are lower than the ones of high-lobbying firms, and higher than the ones of low-lobbying firms. In Section 12 in the Online Appendix, I extend this three-period model to include firms whose revenues are guaranteed forever and do not need to lobby (which I call *non-lobbying firms*). I derive conditions under which these companies have equilibrium equity returns that are lower than the ones of high-lobbying firms, and higher than the ones of low-lobbying firms. These conditions are indeed conditions on the evolution of profits (*e.g.* Equation (12) in the Online Appendix).

5. THE GENERAL MODEL

I now describe a dynamic model extending the basic setup, which allows for a richer quantitative analysis and a more realistic model of firms' lobbying.

5.1. *Physical environment*

Consider an infinite-horizon, discrete-time, discrete-state economy. Time is indexed by $t \in Z_+$ and the time-t government policy variable, the first source of aggregate risk in the economy, is denoted by τ_t. This risk can be broadly regarded as risk coming from prevailing government policies on firms' profitability (Pástor and Veronesi, 2012, 2013). However, to be specific and to calibrate the variable dynamics, I treat τ_t as time-varying corporate income-tax rates à la Croce *et al.* (2012). Following Croce *et al.* (2012) I model the dynamics of τ as

$$\tau_t = \frac{1}{1+e^{\theta_t}}, \tag{7}$$

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so that a positive shock to θ implies a lower tax rate, which is positive news to firms.

The state θ_t follows a Markov chain that approximates the following AR(1) process:

$$\theta_{t+1} = (1-\rho_\theta)\mu_\theta + \rho_\theta\theta_t + \varepsilon_{\theta,t+1},$$

with $\varepsilon_{\theta,t+1}$ i.i.d. $\mathcal{N}(0, \sigma_\theta^2)$, μ_θ the unconditional average value, and ρ_θ the autocorrelation coefficient. This formulation guarantees the profit tax rate τ is positive and smaller than 1. The value of τ is common across firms and industries, and corporate after-tax profits are equal to pre-tax profits multiplied by $1-\tau$.

5.2. *Government-contract allocation*

An infinite number of industries exist. For simplicity, each industry relates to a unique product market. An agency is assigned to a product market j, and it is the only one with resources and expertise to allocate contracts/buy goods in that market. Only two firms are competing in a given industry. In what follows, I refer to the duopolists interchangeably as A and B or i and $-i$. I denote q_{Aj} and q_{Bj} as the goods produced by A and B in industry j, respectively, and p_{Aj} and p_{Bj} as the corresponding prices.

Let $\alpha \in (0,1)$ reflect the degree of substitutability between the goods, and let ωs represent the firms' political capital/connections. The agency chooses quantities q_{Aj} and q_{Bj} to maximise its "utility":

$$U_j = e^{\omega_{Aj}(1-\alpha)} q_{Aj}^\alpha + e^{\omega_{Bj}(1-\alpha)} q_{Bj}^\alpha, \tag{8}$$

subject to a budget constraint,

$$p_{Aj}q_{Aj} + p_{Bj}q_{Bj} = \overline{S}_j, \tag{9}$$

where $\overline{S}_j$ is the total government spending in product market j.[29] Such a formulation conveniently captures that political power affects the weight attributed to each firm in the assignment of government contracts.[30]

29. This reduced-form approach can be justified under asymmetric information in an agency-theoretic framework (Laffont and Tirole, 1991, 1993). The agency assigned to product market j is the only one with the resources and expertise to allocate contracts in industry j, which allows it to hide information away from the government. The government (principal) relies on information supplied by the agent and, as a simplifying assumption, has no machinery to monitor.

30. Lobbying is one of the many investments through which firms earn monopolistic rents. Lobbying and advertising share some similarities, which is probably the most prominent view in the literature. Scholars coined the term "Machiavellian marketing" to argue that lobbying and public affairs management are part of modern political marketing and communication. To quote Harris (2007), "shaping the external environment by influencing government through lobbying activities or corporate campaigning which is commonly referred to as public affairs is now typical of strategic marketing management practice, whether it be for business, public, or not-for-profit sectors." According to Hall and Reynolds (2012), "the most prominent view holds that lobbying is primarily about changing legislators' preferences over policies, specifically, to win the votes of undecided legislators when a bill comes to the floor (*e.g.* Rothenberg, 1992; Austen-Smith and Wright, 1994; Wright, 1996). Lobbying resources, whether financial or informational, will be deployed to this purpose." For some sectors, such as defense, lobbying is even more similar to advertising that is oriented toward government officials. Therefore, the model's predictions might extend to other forms of investments that help firms earn and maintain monopolistic rents. Table 17 in the Online Appendix presents results from sorting firms by SG&A intensity. This measure is a broad one including both legal expenses, such as lobbying costs and advertising, IT, and human resources. I find that firms spending more on SG&A have larger returns, unexplained by canonical factor models, but the spread is smaller and less significant. This finding is related to the definition of SG&A: SG&A includes a wide, probably too wide, set of different types of expenditures (see, related to this point, Eisfeldt and Papanikolaou (2014) or Peters and Taylor (2017), among others, who assume only 30% of SG&A spending is an investment in intangible capital). So lobbying spending might be considered a cleaner measure of the money spent to earn monopolistic rents (from politics).

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It follows that duopolist i in industry j faces the following demand function:

$$q_{ij} = \overline{S}_j \frac{e^{\omega_{ij}} p_{ij}^{\frac{1}{\alpha-1}}}{\sum_i e^{\omega_{ij}} p_{ij}^{\frac{\alpha}{\alpha-1}}}. \tag{10}$$

The choice between the two inputs is made considering both the price of the goods and the political connections of the duopolists. Political connections are distortionary in the sense that when the agency allocates contracts, it values features other than prices and the degree of substitutability between the two products.[31] Finally, without loss of generality, I let the index of political power ω be in the following ordered subset of positive integers $\{1, 2, 3, \ldots, \bar{\omega}\}$, where all elements are different, and $\bar{\omega}$ is the largest value in the set.

5.3. *The duopolists' static problem*

I assume firms can freely reset their price each period, which implies the pricing decision does not affect industry dynamics. Each firm produces a good in accordance with a constant-returns production function and takes the costs of production as given.[32] Let the unit cost of production of the two firms, i and $-i$, in an industry be defined by c_i and c_{-i} and independent of the quantities produced. Call k_{ij} the technology level of firm i in industry j. The cost of a unit of good is given by $c_{ij} = \gamma^{-k_{ij}}$, where γ is a constant larger than 1 that measures the size of a leading-edge innovation.

Call g_i the gap between the technology level of firm i and the technology level of firm $-i$; that is, $g_i = k_{ij} - k_{-i,j}$. Similar to the technological state in Aghion *et al.* (2005), that of the industry here is fully characterised by the pair of integers (k_{ij}, g_i), where k_{ij} is firm i's technology and g_i is the technology gap ($g_i = 0$; the two firms are neck and neck). So, overall, the state of an industry in this model is fully characterised by four values: two describing the technological state of an industry and two summarising the political power of each duopolist.

Under the previous assumption of constant government spending $\overline{S}_j$ for industry j and the demand function (10), one can prove that profits do not depend on the actual individual technology levels k, but only on the technology gap g_i between the two firms. When the level of both firms' technology goes up, the costs of both firms go down by the same proportion and the ratio between optimal prices remains the same. An equiproportional reduction in production costs in the industry leaves revenues and profits of both firms unaffected.

After accounting for corporate income taxes and ignoring the industry sub-index j, firm i in industry j solves the following static optimisation problem:

$$\Pi_{it} = \max_{p_{it}} \; q_i(p_{it}, p_{-i,t}; \omega_{it}, \omega_{-i,t})\,(p_{it} - c_{it})\,(1 - \tau_t). \tag{11}$$

Intra-period profit maximisation implies

$$\frac{p_i - c_i}{p_i} = \frac{1}{\eta_i}, \tag{12}$$

31. The distortionary role can be seen comparing (10) with the demand coming from a framework in which the agency has the following "utility": $\widetilde{U}_j = q_{Aj}^{\alpha} + q_{Bj}^{\alpha}$, subject to (9), and where $\alpha \in (0, 1)$ still reflects the degree of substitutability between the two goods in product market j. Equation (10) captures the possibility that political connections may divert public spending from an allocation that otherwise is not influenced by them.

32. I assume firms do not choose the physical capital used in the production process, which is set to a constant. Whenever needed, the constant physical capital will be assumed to be $\overline{S}_j$.

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where η is the elasticity of demand. According to the demand functions in (10), the elasticity of demand that firm i faces is $\eta_i = \frac{1-\alpha\lambda_i}{1-\alpha}$,where $\lambda_i = \frac{p_i q_i}{\overline{S}}$ is the firm's market share of government contracts. In equilibrium, the vector of prices for the two firms should satisfy the following system of equations:

$$p = \frac{\eta}{\eta - 1}c = \frac{1-\alpha\lambda}{\alpha(1-\lambda)}c. \tag{13}$$

It follows that profits at the optimum for each firm i in industry j at time t are given by

$$\Pi_{it} = \overline{S}(1-\tau_t)\frac{\lambda_{it}}{\eta_{it}} = \overline{S}(1-\tau_t)\frac{\lambda_{it}(1-\alpha)}{1-\alpha\lambda_{it}}. \tag{14}$$

Moreover, we can define a function ϕ such that at the optimum the profit function of firm i takes the following form:

$$\Pi_i = \overline{S}(1-\tau_t)\phi\left(g_i, \tilde{\omega}_i; \alpha\right), \tag{15}$$

where g_i is the difference between the two firms' technological level k_i and k_{-i}, and $\tilde{\omega}_i$ is the difference between ω_i and ω_{-i}. The equilibrium market share of firm A solves (B.11) in Appendix B, and the market share of firm B is 1 minus the market share of A. In the Online Appendix, I show that for values of α between 0 and 1, excluding the extreme cases of zero or perfect competition, a higher g_i or $\tilde{\omega}_i$ are always strictly beneficial to firm i's share in the government-contract market leading to larger markups and profits for the same firm.

5.4. *The intertemporal choices: innovation and lobbying*

Firms face two intertemporal decisions that are taken at the same time: they can innovate and lobby. Let n_i denote the R&D cost (in units of labour) of firm i. Let the wage rate paid by the firm for the R&D labour be w. The firm takes the wage rate as given. By spending $w\, n_i$, firm i will improve its production technology by one level with probability $1 - e^{-\nu n_i}$, where ν is the efficiency of R&D. Each period has three possible outcomes. The technology gap (1) remains the same if firms are both either successful or unsuccessful or (2) increases by one level if the technological leader is successful but the laggard is not, or (3) decreases by one level if the opposite occurs.[33] This modelling approach follows the gradualist (step-by-step) technological progress assumption made, among others, by Aghion *et al.* (1997, 2001, 2005). I assume firms have fully idiosyncratic realisations even when making identical R&D decisions; the realisations are independent of the realisations of other firm-level and aggregate variables.

Whereas innovation reduces the costs of production, lobbying helps firms obtain a larger share of the fixed pie. The lobbying technology works as follows. Firm i invests l_{it} at time t to shape the distribution of its political power ω_i, which is realised in the next period. Lobbying is successful when the firm is able to increase its political power by one level, from ω_{it} to $\omega_{it}+1$. When the firm is already at the top of the distribution ($\bar{\omega}$), lobbying is successful if its political power remains the same. The probability of successful lobbying is $\frac{\delta l_{it}}{1+\delta l_{it}}$, where δ measures the

33. I assume knowledge spillovers between the two firms in any industry are such that the maximum sustainable technological gap is $\bar{g}$.

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effectiveness of the lobbying investment. With the remaining probability, the firm loses all its political power. Formally, the probability mass function takes the following form:

$$\Pr(\omega_{i,t+1}=\widetilde{\omega}|\omega_{it},l_{it})=\begin{cases}\frac{\delta l_{it}}{1+\delta l_{it}}, & \widetilde{\omega}=\min(\omega_{it}+1,\bar{\omega});\\ \frac{1}{1+\delta l_{it}}, & \widetilde{\omega}=1.\end{cases} \tag{16}$$

I assume firms have fully idiosyncratic realisations even when making identical lobbying decisions; the realisations are independent of the realisations of other firm-level and aggregate variables.

The functional form assumed for $\Pr(\omega_{i,t+1}=\widetilde{\omega}|\omega_{it},l_{it})$ is similar to the one commonly used in the industrial organisation literature in different settings (*e.g.* Pakes and McGuire, 1994; Besanko and Doraszelski, 2004). However, relative to those works, the probability mass function includes extreme negative events ("catastrophes" in the language of political scientists and tail risk for financial economists). This modelling choice strictly follows the large political science literature suggesting the reason firms lobby is to protect themselves against profound unexpected policy changes (*e.g.* Baumgartner *et al.*, 2009; Drutman, 2015).[34]

5.5. *The stochastic discount factor and the duopolists' dynamic problem*

Before discussing the implications of the model, performing the calibration exercise, comparing the simulated samples with empirical patterns in the data, and quantifying the aggregate costs of the political-risk premium associated with lobbying competition, I add a second source of risk.

I assume innovation occurs also on the set of goods the government buys. With probability p_t, a good is substituted by a new one and both firms producing it disappear; that is, the industry as a whole is substituted ("displacement risk" as first proposed by Gârleanu *et al.*, 2012). Such a shock reallocates profits from existing firms to new firms. The value of p_t is common across firms and industries, but the realisation of displacement is specific to an industry.

Each period, the displacement probability changes following a Markov chain that approximates the following AR(1) process:

$$\log p_{t+1}=(1-\rho_p)\log\bar{p}+\rho_p\log p_t+\varepsilon_{p,t+1}, \tag{17}$$

where $\varepsilon_{p,t+1}$ is i.i.d. $\mathcal{N}(0,\sigma_p^2)$ and orthogonal to $\varepsilon_{\theta,t+1}$, $\log\bar{p}$ is the unconditional average value, and ρ_p is the autocorrelation coefficient. A positive shock to p implies a larger displacement probability, which is negative news to existing firms.

Firms evaluate cash flows using the SDF $M_{t,t+1}(\varepsilon_{\theta,t+1},\varepsilon_{p,t+1})$. Let the SDF take a parsimonious form:

$$\log M_{t,t+1}=-\log R-x_\theta\varepsilon_{\theta,t+1}-x_p\varepsilon_{p,t+1}-\log E_t[e^{-x_\theta\varepsilon_{\theta,t+1}-x_p\varepsilon_{p,t+1}}], \tag{18}$$

where R is the risk-free rate, x is the shock-specific risk-aversion parameter. Consistent with a large literature (*e.g.* Papanikolaou, 2011; Kogan and Papanikolaou, 2014; Gârleanu *et al.*, 2015; Loualiche, 2019), firms that have higher than average exposures to the shock (in absolute term)

34. Obvious examples include the (mis)allocation of government contracts, the process of evergreening pharmaceutical patents, or the fact that each time copyrights are about to expire, firms undertake massive lobbying efforts to ensure copyright terms are extended (Lessig, 2004). Beyond those, innumerous other cases seem minor to the general public, but they have catastrophic effects for some firms, even to the point of leading them to bankruptcy (*e.g.* the hundreds of small refineries in the West of the U.S. that lobbied hard but unsuccessfully under the Clinton administration against a change in the quantity of sulphur allowed in unleaded gasoline).

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earn lower than average returns.[35] The formula of the SDF can be easily extended to include other sources of risk, but I focus only on these two.

The manager of firm i chooses lobbying and R&D expenditures to maximise the value of the firm to its owners, which is equal to the present discounted value of all current and future expected cash flows. Define the term $1-p_t$ as the firm's survival probability: with probability p_t, the industry is substituted, government contracts are no longer assigned to that industry, and the value of the two firms serving that industry drops to zero. Calling $\tilde{M}_{t,t+1}=(1-p_t)M_{t,t+1}$, the Bellman equation for firm i is

$$V(\omega_{it},\omega_{-i,t},g_{it},\tau_t,p_t)=\max_{l_{it},n_{it}}\ \Pi(\omega_{it},\omega_{-i,t},g_{it},\tau_t)-l_{it}-w\,n_{it} + E_t[\tilde{M}_{t,t+1}V(\omega_{i,t+1},\omega_{-i,t+1},g_{i,t+1},\tau_{t+1},p_{t+1})], \quad (19)$$

subject to

$$l_{it}\geq 0,$$
$$n_{it}\geq 0,$$

where profits minus lobbying and R&D investments equal current dividends (Div_{it}).

5.6. *Inspecting the general model's results*

Individual states and payoffs are common knowledge across firms. I restrict attention to Markov perfect equilibria (MPE) in which the state variables are the political power of each firm, the industry-level technology gap, the tax rate, and the displacement-risk probability. Let vectors be denoted by the arrow notation. An MPE is a set of strategies $\{\boldsymbol{l_t},\boldsymbol{n_t}\}$ such that for each state $(\boldsymbol{\omega}_t,g_t,\tau_t,p_t)$, $l^{\star}_{it}$ and $n^{\star}_{it}$ solve the maximisation of firm i given the other firm's strategies $\{l_{-i,t},n_{-i,t}\}$. Moreover, because the horizon is infinite and the influence of the past is captured by the current states, the sub-games and states correspond one to one.

In equilibrium, all firms maximise their value given the distribution of future states, including the structure of the duopoly in the next period. Their optimal choices generate industry transition probabilities with the same distribution as the ones used in their optimisation problem. In what follows, I describe the first-order conditions of the model, which I then solve numerically. The firms jointly solve for the optimal lobbying and R&D expenditures.

To take the expectation required to determine its continuation value, each duopolist must have a perception of the likely future states of its competitors. In equilibrium, these perceptions

35. In equilibrium, asset risk premia are determined by the covariance of asset returns with the SDF. With positive x_θ and x_p, a positive $\varepsilon_{\theta,t+1}$ or $\varepsilon_{p,t+1}$ always cause a decrease in the SDF, namely, investors attach a lower value to these states. However, the two shocks have opposite effects on firms. Given that $\varepsilon_{\theta,t+1}$ is positive news to firms (higher profits) and the SDF is lower following a positive $\varepsilon_{\theta,t+1}$, then this shock is said to carry a positive risk premium. Since investors attach a lower value to these states, they are willing to pay a lower price for a security that pays off in those states (firm) or, equivalently, they demand a positive risk premium. Conversely, a positive $\varepsilon_{p,t+1}$ is a negative news to existing firms (higher probability of being displaced). Given that a positive $\varepsilon_{p,t+1}$ is a bad news to firms, but investors attach lower value to these states, investors are willing to pay a higher price for securities that are negatively correlated with $\varepsilon_{p,t+1}$ (firms), and thus $\varepsilon_{p,t+1}$ carries a negative risk premium for firms in my model.

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will be correct. Define

$$W_\omega(\omega_{i,t+1}) = \sum_{g_{t+1}} \sum_{\omega_{-i,t+1}} E_{\tau,p}\left[\tilde{M}_{t,t+1} V_{i,t+1} | \tau_t, p_t\right] \times \Pr(\omega_{-i,t+1}|\omega_{-i,t}, l_{-i,t}) \times \Pr(g_{t+1}|g_t, n_{it}, n_{-i,t}). \quad (20)$$

Optimal lobbying solves

$$l^\star_{it} = \frac{-1+\sqrt{\max(\,1\,,\delta(W_\omega(\omega_{it}+1)-W_\omega(1))\,)}}{\delta}. \quad (21)$$

Each firm knows the optimal lobbying and R&D strategy of its competitor and takes them into account when computing its expected next-period value. Optimal lobbying becomes a function of the expected gains the firm obtains if its political power increases by one level and the expected losses the firm avoids by lobbying. All expected values again depend on strategic interactions, because they depend on the optimal behaviour of the competitor.[36]

The solution for optimal R&D spending follows a similar approach. Call W_g the discounted expected value of firm i, taking into account the optimal behaviour of firm $-i$ (the competitor of firm i) and the optimal lobbying spending of firm i; that is,

$$W_g(g_{it}) = \sum_{\omega_{i,t+1}} \sum_{\omega_{-i,t+1}} E_{\tau,p}\left[\tilde{M}_{t,t+1} V_{i,t+1} | \tau_t, p_t\right] \times \Pr(\omega_{i,t+1}|\omega_{i,t}, l_{i,t}) \times \Pr(\omega_{-i,t+1}|\omega_{-i,t}, l_{-i,t}). \quad (22)$$

Define the probability that firm $-i$ is successful innovating $p_{-i}(1)$, and the probability that firm $-i$ is not successful innovating $p_{-i}(0)$ given its R&D spending. Solving for n_{it} implies

$$n^\star_{it} = \frac{\log(\nu/w)+\log(p_{-i}(0)W_g(g_{it}+1)+(p_{-i}(1)-p_{-i}(0))W_g(g_{it})-p_{-i}(1)W_g(g_{it}-1)\,)}{\nu}, \quad (23)$$

where g_{it} is the current technological gap in the industry.

The next question tackles how lobbying and innovation are related to each other. Two countervailing effects are present. First, by lobbying more, a firm expects to have a larger share of government contracts in the next period. Given that the benefits of a better technology (lower production costs) are proportional to market share, high-lobbying firms optimally allocate more funds to R&D as well. This mechanism was present in the three-period model in Section 4 and showed up as a complementarity between lobbying and R&D.

The second effect, which is novel to this environment, is a consequence of the results on the sensitivity of profits to political power or technology discussed in the Online Appendix Section 13: these sensitivities are larger when market share is equally split across firms. If an industry is dominated by one of the two firms, and this firm increases its lobbying activities, it reduces the chances of losing its political privileges, which in turn reduces its incentives to innovate

36. How is lobbying related to ω? As shown in the Internet Appendix, *ceteris paribus* profits of firm i increase as ω_i increases. For illustration, "assume" the higher the political power of firm i, the higher its value. The difference, $W_\omega(\omega_{it}+1)-W_\omega(1)$, is not only positive but also increasing with ω over the whole domain: the intuition is that the greater the firm's political power, the greater its profits and thus its value and potential value lost. This result is an extension to an infinite-horizon framework of what has been discussed in the context of the three-period model: the only difference is that here lobbying affects a firm's entire future.

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(because profits will be less sensitive to technology). In such an environment, regardless of its technological level, the dominating firm can always charge high markups and leave the demand for its product high: marginal gains coming from spending an extra dollar in innovation are lower. Instead, if a firm has less political power than the competitor and increases its lobbying activities, it also increases its probability of a more competitive industry in the next period. Two firms with the same political power should increase their R&D spending because technology is what can separate them. Higher expected product market competition encourages firms to innovate to *escape competition*. The first effect, that is, that higher political power translates into higher market share and higher incentives to invest in R&D, tends to dominate, but the combination of these two effects still produces a strong relation between lobbying and research spending, which has to be evaluated in light of the industry structure.

5.7. *Inspecting the cross section of risk premia*

Unconditionally, in the model, no cross-sectional spread in price-to-dividend ratios or average returns is present: all firms are identical in the long run. Nonetheless, political competition and the endogenous evolution of the industry structure generate conditional cross-sectional dispersion in risk premia. I first describe the mechanism of the model as if investors were neutral toward displacement risk; that is, $x_p = 0$. This discussion generalises the results in Section 4. Then, I discuss the effects of displacement risk in this framework, which instead extends the results of Section 4.

Already in a model with no displacement risk, high-lobbying firms are riskier because of two reinforcing mechanisms. The first one was present in the three-period model of Section 4. Because of political competition, in equilibrium, industry leaders' profits are expected to decline while followers' profits rise. The risk for shareholders is that the government intervenes (tax rates increase) exactly when their company has a large share of contracts. Their company has a competitive advantage and can temporarily extract rents. Moreover, the shock is not permanent. It follows that the value of industry leaders, compared with a firm that has small or no current profits but is expected to have larger profits far in the future, is more exposed to temporary tax shocks. The greater exposure comes from the fact that the effect of next-period shocks to tax rates disappears over time and so are expected to disappear the profits of the industry leader. As in the three-period model, having larger exposure to aggregate shocks does not necessarily lead to higher returns. Rather, the fact that a tax rate increase is associated with investors' high marginal utility ($x_\theta > 0$) makes investors require additional compensation to hold industry leaders in their portfolios.

The second mechanism is a reinforcing mechanism and appears only now because the lobbying decision now affects the entire future of a firm (and not just the one-period-ahead profits). When tax rates go up, profits are expected to remain low for several periods. All firms are incentivized to invest less in lobbying, which makes everyone more susceptible to losing their profits. However, for a firm that has zero or almost zero profits, losing the current profits is of little relevance: most of its value comes from the expectation of future larger profits, that is, when the current leader loses its position. Instead, this matters for the industry leader.[37]

Adding the displacement factor amplifies the asset-pricing results. Similar to the model featuring only tax risk, the heterogeneous exposure of firm values to displacement shocks naturally

37. Please note that in the model, lobbying has the direct effect of making firms safer not riskier. Only in equilibrium firms that lobby more are more exposed to the risk of losing rents, making lobbying a signal of risk in the cross section.

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arises in this framework. In fact, displacement risk favours firms whose current monopolistic power is low and that derive most of their value from potential future rents. Low-lobbying firms are attractive to investors despite their low average returns, because they appreciate in value more when displacement is less likely. Low-lobbying firms are valuable insofar as investors expect the leader to lose its position and these firms to become the leaders 1 day. This day is less likely to come after a positive shock to the displacement probability (increase in p_t). Therefore, low-lobbying firms load more on the displacement-risk factor. As with tax risk, the heterogeneity in the exposure to displacement risk does not necessarily lead to larger stock returns for high-lobbying firms. Nevertheless, the large price of risk associated with displacement make the displacement factor an important reinforcing mechanism.

5.8. *Calibration*

My model includes fifteen parameters, listed below in Tables 5 and 6. I separate parameters into three categories. A first group of two parameters is set to values that are common in the literature. For a second group of eleven parameters, I run my model several times to calibrate them to match target data moments. Finally, the last group of two parameters that define the lobbying and innovation technology are estimated using the simulated method of moments (SMM).

I start the discussion from the top panel. On the investors' side, R is set to 2% per annum, consistent with the average annualised return on a 1-month bill (from Kenneth French's website) in the period of my analysis, namely, about 1.7%.[38] The parameter describing the risk aversion to tax shocks (x_θ) is set to 10 as in Croce *et al.* (2012), from whom I also borrow the formulation of tax risk. The risk-aversion parameter against displacement risk (x_p) is set to 2 consistent with Gârleanu *et al.* (2012) and Garlappi and Song (2017).

Following Chari *et al.* (2007) and Croce *et al.* (2012), the parameters on the tax-rate dynamics are set to mimic a stationary (mean-reverting) process. In particular, they are set to mimic U.S. data on average corporate taxation, as measured by McGrattan and Prescott (2005). I follow the procedure outlined by McGrattan and Prescott (2005) and compute the average corporate tax rate for the period from January 1948 to October 2018. The average value μ_θ is set to capture an average tax rate of 28.4%. The volatility σ_θ serves to match the volatility of the quarterly changes in the corporate tax rate of 1.5%. The autocorrelation coefficient ρ_θ matches the autocorrelation of the corporate tax-rate series, 0.983.

For the displacement-risk process, I calibrate μ_p so that my model generates realistic average profits-to-price ratios for lobbying firms. For the autocorrelation and conditional volatility of the displacement-risk process, I follow Loualiche (2019) and use micro-level data on establishments by industries from the Quarterly Census of Employment and Wages (QCEW) from the Bureau of Labour Statistics. For each three-digit NAICS level, I compute the number of establishments at a quarterly frequency and estimate quarterly entry rates by industries. Following Corhay *et al.* (2020), I detrend entry rates for each industry using the Christiano and Fitzgerald (2003) band-pass filter. The average standard deviation of the detrended series across industries is 0.9%, and the autocorrelation estimate is 0.82. If one focuses on the four 3-digit NAICS code that include pharmaceutical and medicine manufacturing, manufacturing of military armoured vehicles, tanks, aircrafts, guided missiles and space vehicles, oil and gas extractions, and tobacco,

38. R in this framework is a constant that I use to obtain excess returns. This model does not speak to the variation in the risk-free rate, which is why I do not distinguish between the real and nominal rate, and I simply use the same average nominal rate I used when computing the excess returns, that is, the 1-month bill rate from Kenneth French's data.

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TABLE 5
Calibrated or externally fixed parameters

Parameter	Value	Description	Target moment	Data	Model
Tax-rate dynamics					
μ_θ	1.02	Average tax dynamics	Average corporate tax	28.4%	29.2%
σ_θ	0.098	Vol. tax dynamics	Vol. Δ corporate tax (quarterly)	1.49%	1.98%
ρ_θ	0.987	Autocor. tax dynamics	Autocor. corporate tax (quarterly)	0.983	0.985
Displacement probability dynamics					
$\bar{p}$	0.035	Average displacement prob.	Average profit-to-market value	0.26	0.23
σ_p	0.11	Vol. log displacement prob.	Vol. net business formation (quarterly)	0.5%	0.7%
ρ_p	0.83	Autocor. log displacement prob.	Autocor. net business formation (quarterly)	0.83	0.83
Investors' preference parameters					
R	1.005	Risk-free rate	Average quarterly return 1-month bill	0.425%	0.5%
x_θ	10	Investor's risk aversion to tax risk	Croce *et al.* (2012)		
x_p	2	Investor's risk aversion to displacement risk	Garlappi and Song (2017)		
Firm parameters					
α	0.73	Degree of substitutability	Average markup—3rd quintile portfolio sorted on lobbying	1.70	1.77
w	$0.5\% \times \overline{S}$	Wage normalisation	Average R&D over profits—3rd quintile portfolio sorted on lobbying	6.75%	4.51%
γ	1.49	Cost-reduction parameter	Average R&D over sales—3rd quintile portfolio sorted on lobbying	3.70%	1.27%
$\overline{S}$	30×10^4	Market size normalisation			

Notes: For each parameter, the table reports the parameter symbol, numerical value, a description, the target moment or source, and if a target moment is used to calibrate the parameter, the table also shows the data and model-implied moment.

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TABLE 6
Simulated moments estimation

	Actual moments	Simulated moments	t-Statistics
A. Moments			
Average lobbying over sales	0.00075	0.00072	−0.52
Serial correlation of R&D over sales	0.9059	0.9039	−0.11
Returns (L5–L1)	0.0623	0.0208	−0.70
Annual gross profit-to-market value (L5–L1)	0.0473	0.0544	74.40
B. Parameter estimates			
Parameter	Value	SE	Description
ν	5.63	0.414	Efficiency of R&D
δ	18.33	1.732	Efficiency of lobbying

Notes: Panel A reports the description of the four moments used in the SMM procedure, the moment value in the data, the model-implied moment from simulated samples, and the t-statistics on the individual moment conditions. For each parameter, panel B reports the parameter symbol, point estimates, and standard errors from SMM estimation, and a description of the parameter.

that is, some of the industries in which most of the lobbying is concentrated, the average standard deviation of entry rates is 0.5% and the average autocorrelation 0.83.[39] Given my focus on lobbying, I target these latter estimates.

On the firm side, a degree of substitutability $\alpha = 0.73$ helps me match markups ratios, estimated using the data by De Loecker *et al.* (2020), for the third quintile portfolio of firms sorted by their lobbying intensity. For the same portfolio of lobbying firms, the values of w and γ help capture the average R&D to profits and the average R&D to sales (6.75% and 3.7%, respectively).[40]

I estimate the parameter of the lobbying technology (δ) and the efficiency of R&D investments (ν) via SMM. I use four moment conditions: the average lobbying to sales, the autocorrelation of R&D investments to sales, the excess returns of high- and low-lobbying quintiles, and the difference in profits-to-price ratios between high- and low-lobbying quintiles.[41] Having more moment functions than parameters implies the estimation makes use of a large amount of information, but all moment conditions are unlikely to be precisely satisfied.

Model parameters are estimated minimising the distance of the empirical moments from those estimated in a comparable simulation of the model. I weight the distance between the simulated and data moments using a diagonal matrix where each entry is equal to inverse of the standard error of the observed moment. Table 6, Panel A, reports the empirical moments, the simulated moments, and the t-statistic of the moment conditions. Table 6, Panel B, reports SMM point estimates and standard errors.

The low average of the ratio of lobbying to sales implies a large efficiency of lobbying technology. Nevertheless, in the region around the estimated values, this moment is not very sensitive to changes in parameters. Interestingly, the moments that are more sensitive to the parameters of the lobbying technology are actually asset-pricing moments, which makes them key to the estimation. Asset-pricing moments are so informative because the equilibrium distribution of firms depends on the parameters of lobbying and innovation technology.

39. The corresponding NAICS codes are 211, 325, 336, 424.

40. When solving the model I assume a maximum technological gap $\bar{g}$ of 2.

41. I restrict models to deliver an average R&D over profits greater than 5%. Moreover, for the model to be close to the empirical distribution of R&D across lobbying firms, I first sort firms by their lobbying intensity and then compute the average R&D intensity by lobbying quintile. I restrict models to deliver an average R&D intensity of firms in the third quintile smaller than 8% and smaller than 1.25 times the average R&D intensity of firms in the top quintile.

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TABLE 7
Model-implied firm-level moments

Sample	Feeble	L2	L3	L4	Persuasive
Panel A: Average portfolio excess returns					
Data	3.64	4.61	4.06	8.47	9.86
Model: Displacement risk not priced	7.89	9.15	9.41	9.58	10.10
Model: Displacement risk priced	5.48	6.64	6.90	7.06	7.56
Panel B: Annual R&D intensity					
Data	0.95	1.74	2.47	3.64	9.57
Model: Displacement risk not priced	0.24	2.02	2.35	2.45	2.08
Model: Displacement risk priced	0.24	2.06	2.39	2.49	2.11
Panel C: Markups					
Data	1.50	1.55	1.70	1.83	2.01
Model: Displacement risk not priced	1.50	1.60	1.77	2.08	2.84
Model: Displacement risk priced	1.50	1.60	1.77	2.08	2.84
Panel D: Annualized gross profit-to-market-value ratio					
Data	22.46	25.27	26.92	26.31	27.19
Model: Displacement risk not priced	21.46	24.89	25.62	26.07	27.41
Model: Displacement risk priced	19.55	22.53	23.34	23.73	24.99

Notes: This table reports time-series averages of annual excess returns (Panel A), annual R&D intensity (Panel B), markups (Panel C), and annual gross profit-to-market-value ratio (Panel D) for portfolios sorted by lobbying efforts in the model. Stocks are assigned to one of five quintiles based on the intensity of lobbying. Persuasives make up the top-lobbying quintile, and feebles make up the bottom quintile. Variables in the data are defined as follows. Annualized R&D intensity is research and development expenses in a given quarter times 4 divided by assets. Markups are estimated using the "production approach" method as in De Loecker *et al.* (2020). The annualised profit-to-market ratio is gross profits times 4 over market value of assets, defined as market value of equity plus book value of debt plus book value of preferred equity minus inventories and deferred taxes: the ratio is winsorized at the 0.5th and 99.5th percentiles. The sample period spans from 1999 to 2018. The model-simulated moments are computed from 2,000 simulated industries of 10,000 periods. The model is calibrated at a quarterly frequency. Tables 5 and 6 report the parameter values.

Overall, the estimation procedure delivers realistic moments for the aggregate variables and the cross section of firms. The model captures the average lobbying over sales ratio, the serial correlation of the R&D over sales ratio, and the dispersion in returns between high- and low-lobbying firms. Regarding the other moment, the model predicts a dispersion in annual gross profits-to-market value between high- and low-lobbying firms of 0.054 versus 0.047 in the data. Even if this difference is statistically significant, it is not economically significant. That the estimation procedure delivers realistic moments for aggregate variables and the cross section of firms is a necessary ingredient for the model to serve as a laboratory for studying the real impact of the political-risk premium.

Using the parameters described in this section for the model solution, I use an iterative procedure to jointly solve for the value and policy functions for each firm. I simulate 2,000 independent industries. The following results are based on simulations of the model.

6. QUANTITATIVE ANALYSIS

6.1. *Model-implied returns and R&D by lobbying*

Table 7 displays several statistics from the estimated version of the model. The first line of each panel reports the empirical counterparts, and the second and third rows are the results from simulating the general model in which displacement risk is not priced and in which it is priced, respectively.

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Table 7 (Panel A) shows how portfolios of firms sorted by lobbying spending have excess returns that are increasing in lobbying. Regardless of whether displacement risk is priced, both versions predict that returns are increasing in ω and thus are increasing in lobbying efforts. In the model in which displacement risk is priced, the spread between the stock returns of the different lobbying portfolios arises from the differential correlations of portfolios on both shocks ($\varepsilon_\theta, \varepsilon_p$). This framework predicts a two-factor model for expected returns, where the two factors are tax and displacement risk. However, it also suggests the difference between high- and low-lobbying firms is not sufficient to infer government shocks.

The model is able to capture that high-lobbying firms also innovate more (Panel B in Table 7). The non-monotonicity in the sorting happens because the innovation policy function grows with ω, but when a firm has very high political and technological power, it becomes flat or slightly downward sloping. Still, the model generates that firms in the top-lobbying quintile innovate substantially more than firms in the bottom lobbying quintile.

The model is also able to capture that top-lobbying firms have larger markups (Panel C in Table 7). This result naturally follows from the discussion in the Online Appendix Section 13, where I have shown that, *ceteris paribus*, a larger value of ω_i or a technology gap are related to larger markups for firm i in equilibrium. Given the strong relation between corporate lobbying and a firm's ω, the model naturally captures the pattern documented empirically between a firm's lobbying and its markups.[42,43,44]

6.2. *Additional empirical predictions*

The analysis of the model provides additional predictions with which the presented theory can be tested.

High-lobbying firms have large profits relative to their market value.

Regarding the relation between expected returns and the market-to-book ratio, I have fixed capital to a constant at the beginning of Section 5.3, so the market-to-book ratio is increasing with respect to either political or technological power, because market value is increasing. By looking at the market-to-book ratio of firms, we would categorise industry leaders as growth

42. As proven in the Internet Appendix Proposition 2, lower competition is related to higher industry profits. The fact that total industry profits go up as the industry becomes less competitive drives larger incentives to lobby and lies behind the negative relation between the degree of competition and lobbying in the model.

43. In unreported results, I have solved the model for five different levels of industry sizes ($\overline{S}=3{,}000{,}000$; 300,000; 30,000; 3000; 300), keeping everything else fixed. The spreads between the high-lobbying and the low-lobbying quintile from the largest to the smallest industry are 1.96%, 2.08%, 2.47%, 3.65%, 6.84%. The model relates to the optimality of the lobbying decision the prediction that in smaller industries there exists a larger spread among lobbying firms. The reason relies on the fact that a smaller industry is associated with lower incentives to lobby to protect the (now smaller) rents. Given that the probability of keeping rents is related to the dollar amount of lobbying, smaller industries feature dominant firms that are more risky. This insight highlights the importance of endogenizing lobbying and the optimal industry dynamics.

44. Within each contract market, the model predicts that top-lobbying firms should be larger. In equilibrium, firm size can be affected by several other factors that are outside the scope of the model. The model focuses on the relation between lobbying and expected returns, keeping all else equal, and predicts that within each industry, the firm lobbying more is the one with higher rents and thus has higher market value. For that reason, in the data, I show my results are robust to controlling for a series of characteristics that have been found in the literature to be related to stock returns (including size), as well as firm fixed effects to control for time-invariant omitted risk factors, and year fixed effects to account for shifts in the mean return over time. If it were simply a subset of firms always having higher excess returns, the firm fixed effects would capture it, and lobbying intensity would be insignificant upon the fixed-effects inclusion. Instead, I find the positive relation between lobbying and returns holds even with such panel regression, and results are highly statistically significant, which I interpret as "the same firm when increasing its lobbying is expected to earn higher stock returns in the future."

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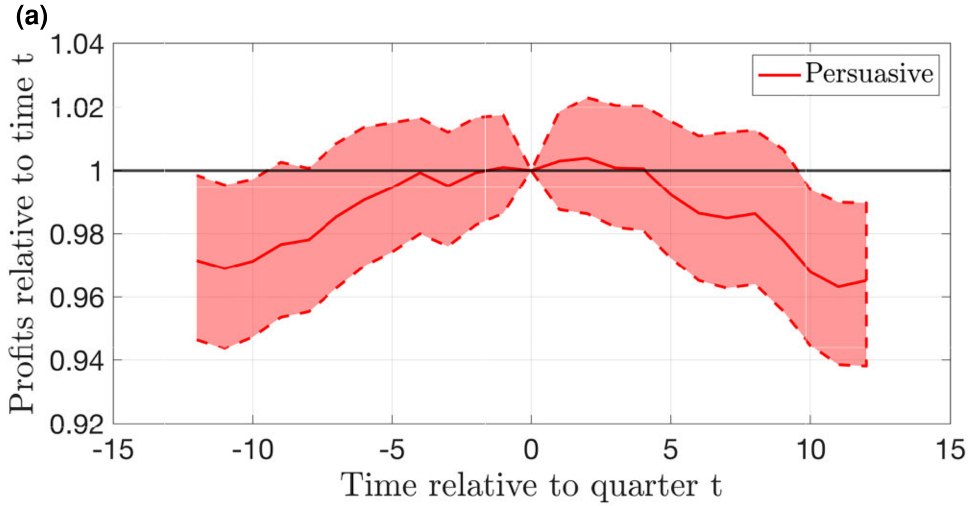
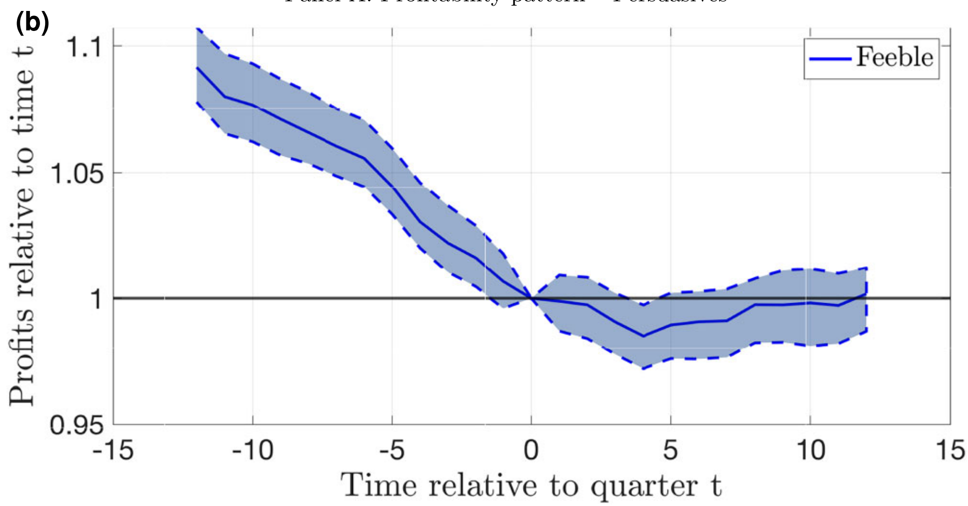


Panel A: Profitability pattern – Persuasives



Panel B: Profitability pattern – Feebles

FIGURE 2

Profitability pattern: Feebles versus Persuasives

Notes: The figure shows the average profitability pattern for the two extreme lobbying portfolios twelve quarters before sorting to twelve quarters after sorting. Profitability is calculated as gross profits over assets. Stocks with positive lobbying spending are assigned to one of five baskets based on the intensity of lobbying. Lobbying intensity refers to total lobbying spending in a given semester scaled by the firm's average asset size in the same semester. Persuasives make up the top-lobbying quintile, and feebles make up the bottom quintile. Time-0 profitability is standardised to 1. The 95% confidence intervals are computed using non-parametric bootstrap; that is, the 2.5th and 97.5th percentiles of the statistics computed in bootstrapped samples are used. Data on corporate lobbying spending are from 1999 to 2018.

rather than value firms. Nevertheless, the model suggests the importance of a measure of capital that includes the economic value of intangible assets (political and technological power). For this reason, when looking at the ratio between profits and market value, one sees high-lobbying firms are the ones with large profits relative to their market capitalisation.

All firms are identical in the long run and profits for industry leaders are relatively high today and expected to drop over time. High-lobbying firms are value rather than growth firms

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according to the cash-flow-to-market-ratio definition of value.[45] A higher level of ω is endogenously associated with higher short-term profits relative to the firm's market value: political power is precarious, and once the firm reaches the top, it can only fall. Firm value takes into account those potential losses, and the value of dominant firms is relatively depressed: dominant firms have high profit-to-market-cap ratios. Table 7, Panel D, shows that also in the data, high-lobbying firms have a high, rather than a low, profit-to-market ratio.[46] Thus, the model replicates the pattern in the data that high-lobbying firms have high returns and high profit-to-market-value ratios.

High-lobbying firms are at the peak of their profitability.

The model predicts that high-lobbying firms have a relatively higher profitability, which is expected to go down, whereas the opposite is true for low-lobbying firms. The corresponding data pattern is reported in Figure 2. Profitability is measured by the return on book assets. In each quarter, I sort firms by their lobbying intensity, and for each lobbying group, I compute the average profitability from 3 years before to 3 years after sorting. I then compute the average value across quarters. Time 0 is the time of sorting. For convenience, all values are scaled by the average time-0 profitability.

The figure also reports confidence intervals, computed using non-parametric bootstrap. At each bootstrap iteration and for each quarter, a random sample of the same size as the firms in that quarter is drawn. Firms are sorted by their lobbying efforts. New portfolios are constructed, and the corresponding profitability series are computed as above for the two extreme portfolios. I iterate the process 1,000 times, list the values of the statistics, and report the 2.5th and 97.5th percentiles as the 95% bootstrapped confidence interval.[47]

High-lobbying firms are, on average, more profitable than they were 3 years earlier, and their profitability on average declines. The opposite pattern appears for low-lobbying firms, which are, on average, significantly less profitable than they were 3 years earlier, but the data pattern after sorting is not as strong.

6.3. *First counterfactual: no government risk*

The estimation procedure delivers realistic moments for the aggregate variables and the cross section of firms, which is necessary for the model to serve as a laboratory for studying the real impact of the political-risk premium.

In this first thought experiment, I eliminate all government risk. Because risk is absent, the SDF M_{t+1} is now equal to R^{-1}, that is, investors are risk neutral, so all firms face the same cost

45. Please see also Santos and Veronesi (2010) for the use of the cash-flows-to-market ratio to define value/growth firms. Relative to their framework, mine is able to produce that high-cash-flow-to-market firms have higher returns. My model features a more standard CRRA utility, and as shown by Santos and Veronesi (2005), this assumption is actually enough to generate a value premium maintaining a framework similar to Santos and Veronesi (2010). This comes at the cost of not being able to generate returns volatile enough or with enough predictability (Santos and Veronesi, 2005). Unlike Santos and Veronesi (2005, 2010) find a growth premium because they focus on one important mechanism, namely, the external-habit-formation by Campbell and Cochrane (1999), which has featured prominently both in asset pricing and in the real-business-cycle literature. They show that non-linear external habit formation models have implications that are problematic and "that for this reason the success of the non-linear habit formation mechanism has to be put on hold." The reason the external-habit model by Campbell and Cochrane (1999) produces a growth rather than a value premium is also discussed in detail by van Binsbergen *et al.* (2012).

46. Annualized profits both in the model and in the data are computed multiplying quarterly profits by 4.

47. In the Online Appendix, I follow Dechow *et al.* (2004) and Weber (2018) and estimate a measure of equity duration at the firm level. I regress firm-level duration on lobbying intensity and a series of controls (book-to-market, market capitalisation, market leverage, R&D over assets, and SG&A over assets) including industry or firm fixed effects. I find high-lobbying firms have lower cash-flow duration.

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of capital R. The absence of aggregate government risk means the tax rate τ and the displacement probability p take constant values, *i.e.* $\tau_t = \tau$ and $p_t = p$. This change has implications for the distribution of firms and, more importantly, for the distribution of aggregate state variables, τ and p, which now are just constants. So, before moving to the counterfactual exercise, I compute the stationary distribution of firms-states from the general model of Section 5.5. I simulate a long time series (100,000 time periods) for a large cross section of 2,000 industries and compute the relative frequency of each event $\widehat{fr}(\{\omega_i, \omega_j, g_i, \tau, p\})$ in the simulated samples. I use these probabilities in the following exercises so that the results reflect only the change in the policy functions rather than distributional changes.

Let $n^{\mathrm{B}}(\omega_i, \omega_j, g_i, \tau, p)$ be the individual firm's R&D spending in state $\{\omega_i, \omega_j, g_i, \tau, p\}$ as implied by the benchmark model of Section 5.5. The integration of the firms' policy function n^{B} over the stationary distribution then determines the aggregate R&D spending implied by the benchmark model. I compute the new equilibrium policy functions in the economies with constant aggregate state variables. Let $n^{\mathrm{C}}(\omega_i, \omega_j, g_i, \tau, p)$ be the optimal R&D spending function in the counterfactual economy. The integration of n^{C} over the same stationary distribution then determines the aggregate R&D spending I use for comparison. Overall, my framework shows R&D spending increases by 6.12% relative to the benchmark. I also compare innovation rates as implied by the individual firms' policy functions in the two exercises (and the stationary distribution) and observe the aggregate innovation rate goes up by 0.41% points relative to the benchmark.

The caveat of this experiment is that a cash-flow and a discount-rate effect are combined. Although the risk premium associated with political risk disappears in the counterfactual economies, firms' expected cash flows are also different: some firms are born in an economy that enjoys a permanently low value of τ as others are born in an economy with a permanently high τ. The same can be said for p.[48] The change in expected cash flows sometimes amplifies the increase in firms' value produced by the disappearance of the risk premium, and sometimes offsets or even reverses the effect of a lower cost of capital. The effect on R&D investment follows from the effect on firms' values.

This finding is visible from Figures 7 and 8 in the Online Appendix. For both figures, I fix the value of p to 3.4%. However, whereas the value of τ is equal to 55% in Figure 7, I fix τ to 26.5% in Figure 8. Two patterns emerge. First, a larger difference between firms' political power within an industry, $|\omega_i - \omega_{-i}|$, or a larger technology gap imply larger changes in R&D spending in the counterfactual experiment. Second, and more importantly, when τ is permanently 26.5% (Figure 8), R&D increases as the industry becomes more and more concentrated. Nevertheless, when the tax rate is permanently doubled (Figure 7) the cash-flow effect dominates and R&D spending drops. However, as said above, when weighting the policy functions by the frequency implied by the stationary distribution of firms-states, the overall result is an increase of 6.12% in R&D spending relative to the benchmark, and a higher innovation rate by 0.41% points.

48. Some economists have a dogmatic view that political risk is inherently bad. The truth is that the alternative could be worse. Imagine a case in which regulations could not be modified or new government policies could not be implemented; we'd probably have even more pollution and no mechanism to impose coronavirus lockdowns. For the firms in my model, being stuck with too high values of tax rates τ is worse than facing government risk. I would like to thank one of the referees for this comment and the excellent examples.

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6.4. *Second counterfactual: no government risk premium*

In the new experiment, the economy is the same as the one described in Section 5.5; that is, the tax-rate and displacement variable are free to vary again as in the main model. The only difference is the value of the risk-aversion parameters x_θ and x_p, which are set to 0, implying aggregate shocks are no longer reflected in prices. The SDF M_{t+1} is equal to R^{-1}; that is, investors are risk neutral, so all firms face the same cost of capital R.

The values of both industry leaders and followers increase. Industry leaders' value increases because of the large drop in discount rates. Followers' values mostly increase because of the increase in leaders' values. Followers are firms that are expected to have low profits for a few periods. These firms are valuable insofar as they can become industry leaders. An increase in the value they expect when they become leaders causes an increase in their current value. Therefore, all firms, regardless of the current state of the economy or the state of the industry, spend more on innovation because becoming the leader is now rewarded more. This increase is even larger in less competitive industries driven by the higher R&D investments of the dominant firms.

Using the same relative frequency of events $\widehat{fr}$ described above, R&D spending in this counterfactual economy increases by about 6.06% relative to the benchmark, while the innovation rate increases by 0.42% points. The increase in R&D expenditures now occurs in all states of the economy (Figures 9 and 10 in the Online Appendix).[49] Moreover, the small difference between the two exercises indicates that the risk premium, and not the cash-flow effect featured in the first counterfactual, is key to the valuation of the innovation costs of political competition.

7. CONCLUSIONS

Despite the extant literature on corporate lobbying, little is known about its financial effects or about the relationship between the financial and economic consequences of corporate lobbying. Some scholars have argued we should "follow the money" because giving firms the possibility to buy their favourite policies implies large rich firms can extract enormous rents from politics. Other scholars continue to ignore corporate lobbying, because the amounts spent are small.

In this paper, I show the political-risk-premium cost associated with lobbying deserves attention. In fact, real and financial effects of corporate lobbying are closely related. Financial returns drive political competition (firms lobby to maximise their value), but in equilibrium, political competition affects the intra-industry dynamics of risk, increasing firms' opportunity cost of capital, and reducing their incentives to make other investments. This novel insight is particularly important because in the data, high-lobbying firms are riskier, with larger equity returns and are among the largest investors in R&D in key sectors of our economy. My quantitative analysis implies that if investors stopped requiring the larger equity returns for high-lobbying companies, R&D spending in the economy would increase by about 6% and aggregate innovation rate by 0.4% points.

APPENDIX

A. Solution of the three-period model

The model, all the assumptions, and the notation are described in Section 4. Let Π_t denote time-t profits, that is, $e^{\sigma\theta_t}\tilde{S}_t(1-c_t)$, where $\tilde{S}_t$ is the realised value of contracts, which may differ

49. This observation is important because, following Croce *et al.* (2012) or Koijen *et al.* (2016), the states in which the government-induced profit restrictions (tax rate, τ) tend to be higher are also the states in which investors' marginal utility of wealth is higher, which suggests the importance of the R&D gain caused by the absence of the political-risk premium could be even larger in a general equilibrium framework.

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from the value of contracts K_{t-1} that Nature assigned at $t-1$. When I define the firms' value V_t in this appendix, it will always be the firm time-t value of the time-$t+1$ sum of profits and continuation value net of time-t lobbying and R&D expenditures; that is, V_t defined in this way ignores time-t profits. I do so because (1) defining time-0 profits for the firms is not necessary and (2) profits realised at time t do not affect the maximisation problem of firms at time t.

Time 1 firm's optimal decisions

In period 2, the last period, the firm receives profits and dies. In period 1, the firm decides on its optimal lobbying efforts, and innovation expenditures to maximise the value of time-2 profits.

The time-1 value of time-2 profits net of time-1 lobbying and R&D expenditures is

$$\begin{aligned} V_1(K_1) &= \max_{l_1 \geq 0, n_1 \in \{0,1\}} -l_1 - wn_1 + E_1[M_2 \Pi_2] \\ &= \max_{l_1 \geq 0, n_1 \in \{0,1\}} -l_1 - wn_1 + E_1[M_2 e^{\sigma\theta_2} \tilde{S}_2 (1-c_2)] \\ &= \max_{l_1 \geq 0, n_1 \in \{0,1\}} -l_1 - wn_1 + E_1[M_2 e^{\sigma\theta_2}]\pi(l_1) K_1 (1 - \bar{c} + \pi(n_1)(\bar{c} - \underline{c})), \end{aligned} \tag{A.1}$$

where K_1 is the contract value that Nature assigned and is known at time 1 when the firm takes the decisions.[50]

Optimality condition with respect to lobbying (l_1) gives the optimal lobbying expenditures,

$$l_1^*(K_1) = \max\left(0, \sqrt{E_1[M_2 e^{\sigma\theta_2}]K_1(1 - \bar{c} + \pi(n_1^*)(\bar{c} - \underline{c}))} - 1\right) = \sqrt{E_1[M_2 e^{\sigma\theta_2}]\chi(n_1^*)K_1} - 1, \tag{A.2}$$

where $\chi(n_1^*) = (1 - \bar{c} + \pi(n_1^*)(\bar{c} - \underline{c}))$ is a measure of gross margin at the optimum. To simplify the discussion, in what follows, I assume

$$\underline{K} > \frac{1}{E_1[M_2 e^{\sigma\theta_2}](1-\bar{c})}, \tag{A.3}$$

so that in all cases, $l_1 > 0$.

To derive the condition under which the firm chooses to innovate, I first need to compute the value of the firm at the optimum both if it innovates and if it does not. The reason is that the decisions to lobby and innovate are taken jointly. If the firm does innovate (*i.e.* n_1=1), the maximum value as a function of K_1, $V_{1,\text{yes}}^*(K_1)$ is

$$V_{1,\text{yes}}^*(K_1) = 1 - w - 2\sqrt{E_1[M_2 e^{\sigma\theta_2}]\chi(1)K_1} + E_1[M_2 e^{\sigma\theta_2}]\chi(1)K_1. \tag{A.4}$$

If the firm does not innovate (*i.e.* n_1=0), the maximum value $V_{1,\text{no}}^*(K_1)$ is

$$V_{1,\text{no}}^*(K_1) = 1 - 2\sqrt{E_1[M_2 e^{\sigma\theta_2}]\chi(0)K_1} + E_1[M_2 e^{\sigma\theta_2}]\chi(0)K_1. \tag{A.5}$$

50. I am writing V_1 in this way because Π_1 does not affect the optimisation problem of the firm (is already realised when the firm takes the lobbying and innovation decision). This definition requires that we add back Π_1 when computing stock returns.

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Therefore, the firm decides to innovate when the benefits from innovating exceed the costs, that is, $V^*_{1,\text{yes}}(K_1) \geq V^*_{1,\text{no}}(K_1)$ or

$$2\sqrt{E_1[M_2 e^{\sigma\theta_2}]K_1}\left(\sqrt{\chi(0)}-\sqrt{\chi(1)}\right)+E_1[M_2 e^{\sigma\theta_2}]K_1\left(\chi(1)-\chi(0)\right)>w. \tag{A.6}$$

It follows that a K^* exists such that the firm innovates if $K_1 \geq K^*$.[51] Thus, it can be seen that the decision to innovate is increasing in K_1. So, the model predicts that higher-lobbying expenditure is associated with higher innovation expenditure.

Now, I compute the equilibrium expected sales and equilibrium political risk, as defined in Section 4. Let expected sales be

$$\pi(l_1^*)K_1 = K_1 - \frac{\sqrt{K_1}}{\sqrt{E_1[M_2 e^{\sigma\theta_2}]\chi(n_1^*)}}, \tag{A.7}$$

which is increasing in K_1 under the assumption stated in (A.3): higher $l_1^*(K_1)$ is associated with higher $\pi(l_1^*(K_1))K_1$.

The equilibrium political risk is equal to

$$K_1 - \pi(l_1^*)K_1 = K_1(1-\pi(l_1^*)) = \frac{\sqrt{K_1}}{\sqrt{E_1[M_2 e^{\sigma\theta_2}]\chi(n_1^*)}}, \tag{A.8}$$

which is always increasing in K_1 except at K^* (where a jump discontinuity occurs): the change in innovation behaviour determined by passing the threshold dominates, which makes expected loss decrease for an infinitesimal change around K^*.[52]

Finally, it can be shown that a value $\hat{K} > K^*$ exists such that the expected losses at $\hat{K}$ are equal to the expected losses at K^{*-}, that is, the value of K approaching K^* from the left. Assuming $\overline{K} > \hat{K}$, this fact implies firms with sufficiently large contract values ($K > \hat{K}$) are the companies with the largest political risk in the model.

Time-0 firm's optimal decisions

I now solve the optimisation problem for the firm one step backward:

$$V_0(K_0) = \max_{l_0 \geq 0, n_0 \in \{0,1\}} -l_0 - wn_0 + E_0[M_1 e^{\sigma\theta_1}]\pi(l_0)K_0\chi(n_0) + E_0[M_1 V_1^*(K_1)]. \tag{A.9}$$

The conditions for optimality for l_0 and n_0 are the same as for l_1 and n_1, because, by assumption, in this framework lobbying and innovation affect only next-period profits, and $E_1[M_2 e^{\sigma\theta_2}] = E_0[M_1 e^{\sigma\theta_1}]$.

Before providing an expression for V_0^*, I solve for $E_0[V_1^*(K_1)]$, given that in this case, $E_0[M_1 V_1^*(K_1)] = E_0[M_1]E_0[V_1^*(K_1)]$. As of t = 0, the continuation asset is riskless, because the covariance between time-1 aggregate shocks (θ_1) and $V_1^*(K_1)$ is 0. The aggregate shock is i.i.d. Moreover, *ex ante* (at time 0), the firm only knows the capital that nature assigned it at time 0, but it does not know the capital Nature will assign at time 1, and the realisation of K_1 is

51. When indifferent, the firm innovates.

52. This feature of the discontinuity in innovation disappears in the full-fledged model, in which equilibrium political risk will also have a monotonically increasing relation with lobbying.

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independent of the realisation of K_0:

$$E_0[V_1^*(K_1)] = 1 + \int_{\underline{K}}^{K^*} \frac{1}{\overline{K}-\underline{K}} \left(-2\sqrt{E_1[M_2 e^{\sigma\theta_2}]k\chi(0)} + E_1[M_2 e^{\sigma\theta_2}]k\chi(0)\right) \mathrm{d}k + \int_{K^*}^{\overline{K}} \frac{1}{\overline{K}-\underline{K}} \left(-2\sqrt{E_1[M_2 e^{\sigma\theta_2}]k\chi(1)} + E_1[M_2 e^{\sigma\theta_2}]k\chi(1)\right) \mathrm{d}k - w\frac{\overline{K}-K^*}{\overline{K}-\underline{K}}, \tag{A.10}$$

which simplifies to a positive constant C;

$$\begin{aligned} E_0[V_1^*(K_1)] &= C \\ &= 1 - w\frac{\overline{K}-K^*}{\overline{K}-\underline{K}} + E_1[M_2 e^{\sigma\theta_2}]\chi(0)\frac{\overline{K}+\underline{K}}{2} \\ &\quad + E_1[M_2 e^{\sigma\theta_2}]\left(\chi(1)-\chi(0)\right)\frac{\overline{K}^2 - K^{*2}}{2(\overline{K}-\underline{K})} \\ &\quad - \frac{2\sqrt{E_1[M_2 e^{\sigma\theta_2}]}}{\overline{K}-\underline{K}}\frac{2}{3}\left(\sqrt{\chi(0)}\left(K^{*3/2} - \underline{K}^{3/2}\right) + \sqrt{\chi(1)}\left(\overline{K}^{3/2} - K^{*3/2}\right)\right). \end{aligned} \tag{A.11}$$

$E_0[V_1^*(K_1)]$ is the same for all firms and equal to C, again because the realisation of K_1 is independent of the realisation of K_0.

So if $K_0 \geq K^*$,

$$V_0^*(K_0) = +1 - w - 2\sqrt{E_0[M_1 e^{\sigma\theta_1}]K_0\chi(1)} + E_0[M_1 e^{\sigma\theta_1}]K_0\chi(1) + E_0[M_1]C, \tag{A.12}$$

and if $K_0 < K^*$,

$$V_0^*(K_0) = +1 - 2\sqrt{E_0[M_1 e^{\sigma\theta_1}]K_0\chi(0)} + E_0[M_1 e^{\sigma\theta_1}]K_0\chi(0) + E_0[M_1]C. \tag{A.13}$$

Note that the firm's payout to its investors at time 1 is $\Pi_1 - l_1 - wn_1$, whereas firm's payout at time 2 is only Π_2 because the firm does not lobby or innovate in the last period. Given that V_1 as in (A.1) is the time-1 present value of time-2 profits net of time-1 lobbying and R&D expenditures, the sum of V_1 and Π_1 represents the cum-dividend value of the firm at time 1. Returns on firms' equity are therefore $R_{0,1} = \frac{\Pi_1+V_1}{E_0[M_1(\Pi_1+V_1)]}$, so that if $K_0 \geq K^*$,

$$E_0[R_{0,1}] = \frac{E_0[e^{\sigma\theta_1}]K_0\chi(1)\left(1 - \frac{1}{\sqrt{E_0[M_1 e^{\sigma\theta_1}]K_0\chi(1)}}\right) + C}{E_0[M_1 e^{\sigma\theta_1}]K_0\chi(1) - \sqrt{E_0[M_1 e^{\sigma\theta_1}]K_0\chi(1)} + E_0[M_1]C}, \tag{A.14}$$

whereas if $K_0 < K^*$,

$$E_0[R_{0,1}] = \frac{E_0[e^{\sigma\theta_1}]K_0\chi(0)\left(1 - \frac{1}{\sqrt{E_0[M_1 e^{\sigma\theta_1}]K_0\chi(0)}}\right) + C}{E_0[M_1 e^{\sigma\theta_1}]K_0\chi(0) - \sqrt{E_0[M_1 e^{\sigma\theta_1}]K_0\chi(0)} + E_0[M_1]C}. \tag{A.15}$$

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Within each region, equity returns are increasing in K_0 as long as $x_\theta > 0$. Moreover a discontinuity at K^* exists such that

$$\lim_{K_0 \to K^{*+}} E_0[R_{0,1}] \geq \lim_{K_0 \to K^{*-}} E_0[R_{0,1}],$$

as long as $x_\theta > 0$, and

$$E_0[M_1 e^{\sigma\theta_1}]K^* (\chi(1) - \chi(0)) + \sqrt{E_0[M_1 e^{\sigma\theta_1}]K^* \chi(0)} - \sqrt{E_0[M_1 e^{\sigma\theta_1}]K^* \chi(1)} > 0.$$

Under these conditions, expected returns are always increasing in K_0.

B. Solution dupolists' static problem Section 5.3

Let i be either of the two duopolists A and B in industry j. Firm i market share is equal to

$$\lambda_i = \frac{e^{\omega_i} p_i^{\frac{\alpha}{\alpha-1}}}{e^{\omega_A} p_A^{\frac{\alpha}{\alpha-1}} + e^{\omega_B} p_B^{\frac{\alpha}{\alpha-1}}}, \quad i = A, B. \tag{B.1}$$

The function ϕ_i as defined in Section 5.3 is

$$\phi_i(\cdot) = \frac{\lambda_i(1-\alpha)}{1-\alpha\lambda_i}, \quad i = A, B. \tag{B.2}$$

Also note that

$$p_i = \frac{1-\alpha\lambda_i}{\alpha(1-\lambda_i)} c_i, \quad i = A, B \tag{B.3}$$

and

$$\lambda_A + \lambda_B = 1. \tag{B.4}$$

Hereafter, wnlog, I focus on the firm A's problem. Let λ be λ_A, while $1-\lambda$ be λ_B. Rearrange λ as follows:

$$\lambda = \frac{1}{1 + e^{\omega_B - \omega_A} \left(\frac{p_B}{p_A}\right)^{\frac{\alpha}{\alpha-1}}}. \tag{B.5}$$

Using (B.3) and (B.4), I obtain

$$\frac{p_A}{p_B} = \frac{(1-\alpha\lambda)\lambda}{(1-\alpha(1-\lambda))(1-\lambda)} \gamma^{-g_A}. \tag{B.6}$$

From (B.5),

$$e^{\omega_B - \omega_A} \left(\frac{p_A}{p_B}\right)^{\frac{\alpha}{1-\alpha}} = \frac{1-\lambda}{\lambda}, \tag{B.7}$$

or equivalently,

$$\frac{p_A}{p_B} = \left(\frac{1-\lambda}{\lambda}\right)^{\frac{1-\alpha}{\alpha}} \left(e^{\tilde{\omega}_A}\right)^{\frac{1-\alpha}{\alpha}}. \tag{B.8}$$

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Equating (B.8) and (B.6), I obtain

$$\left(\frac{1-\lambda}{\lambda}\right)^{\frac{1}{\alpha}}\left(e^{\tilde{\omega}_A}\right)^{\frac{1-\alpha}{\alpha}}=\frac{1-\alpha\lambda}{(1-\alpha(1-\lambda))}\gamma^{-g_A} \tag{B.9}$$

or

$$(1-\lambda)(1-\alpha(1-\lambda))^{\alpha}\left(e^{\tilde{\omega}_A}\right)^{1-\alpha}=\lambda\,(1-\alpha\lambda)^{\alpha}\left(\gamma^{-g_A}\right)^{\alpha} \tag{B.10}$$

or by taking logs

$$\log\lambda+\alpha\log(1-\alpha\lambda)-\alpha g_A\log\gamma-\log(1-\lambda)-\alpha\log(1-\alpha(1-\lambda))-(1-\alpha)\tilde{\omega}_A=0. \tag{B.11}$$

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Supplementary Data

Supplementary data are available at *Review of Economic Studies* online.

Data Availability Statement

The data and code underlying this research are available on Zenodo at https://doi.org/10.5281/zenodo.7617222.

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