Lobbying, Innovation and Economic Growth*

Duc Nguyen
Amherst College

Nasir Hossein Dad
Boise State University

October 2026

Abstract

This paper studies how corporate lobbying affects firm innovation and aggregate productivity growth. Using U.S. firm-level data and an IV strategy exploiting exogenous variation in political access, we find that lobbying increases R&D expenditure but reduces the number of patents and forward citations. We develop an endogenous growth model consistent with the empirical evidence, in which heterogeneous firms invest in innovation to advance productivity and in lobbying to influence firm-specific distortions. We calibrate the model to the U.S. economy and find that eliminating lobbying raises R&D intensity and annual productivity growth by 3.36 and 0.16 percentage points, respectively. Productivity gains are mainly driven by the reallocation of R&D toward more productive firms, where successful innovations have larger contribution.

Keywords: Lobbying, innovation, R&D, misallocation, firm dynamics.
JEL classification: D24, D72, O31, O32, O41.

*This paper was previously circulated under the title "Lobbying, Innovation and Aggregate Productivity." We are grateful for the generous support and feedback from Diego Restuccia, Laurent Cavenaile, Murat Alp Celik, and Eugene Tan, and for useful comments from Ufuk Akcigit, Nir Jaimovich, Fatih Guvenen, Joseph Steinberg, Deepak Hegde, Loren Brandt, Mark Rempel, Poorya Kabir, Lin Shao, Ashantha Ranasinghe, Ceren Baysan, Min Fang, Till Gross, Youngmin Park, Kurt See, the MacDev group, and audiences at University of Toronto, Carleton University, the Bank of Canada, Federal Reserve Bank of Cleveland, Federal Reserve Bank of Richmond, Boise State University, International Monetary Fund and Statistics Canada. All remaining errors are our own. Hossein Dad and Nguyen gratefully acknowledge support from the Social Sciences and Humanities Research Council of Canada. We thank In Song Kim and the team at LobbyView for detailed data access. The views expressed herein are those of the authors and should not be attributed to any other person or institution. Contact: dnguyen@amherst.edu and nasirhosseindad@boisestate.edu.

1 Introduction

Technological innovation and political influence are two important channels that impact economic outcomes. A large literature establishes innovation as a fundamental driver of long-run economic growth (Grossman and Helpman, 1991; Aghion et al., 2005), while another studies how corporate lobbying influences policies which can impact the allocation of resources (Bombardini and Trebbi, 2020; Huneeus and Kim, 2024; Choi, 2025). Less is known about how political influence shapes firm's innovation decisions and their consequences for economic growth. We bridge this gap by studying how corporate lobbying impact firm's incentives to innovate and the aggregate implications for long-run growth.

How do lobbying activities impact firm's innovation decisions, and what are their macroeconomic consequences for economic growth? We combine U.S. firm-level evidence with a quantitative model of endogenous growth in which heterogeneous firms jointly choose lobbying and R&D. The empirical estimates indicate that lobbying increases research expenditure but reduces forward patent citations, suggesting a distinction between research inputs and innovation output at firm level. Motivated by this empirical finding, we develop the model in which lobbying expands firm scale through favorable policy treatment and reduces research efficiency. We calibrate the model to the U.S. economy to assess how these forces change firms' research decisions, the distribution of successful innovations, and aggregate productivity growth.

We first document empirical relationships between corporate lobbying and measures of innovation using U.S. firm-level data on lobbying expenditures, patents and forward citations. As firm's lobbying decisions may be endogenous to firm's primitives, to address the endogeneity issue, we follow Bertrand et al. (2014), Huneeus and Kim (2024), and Choi (2025) and exploit changes in political access arising when a member of Congress from a firm's headquarters state becomes chair of the House or Senate Appropriations Committee. Our IV estimates suggest that a 1% increase in lobbying expenditure is associated with a 0.30% increase in sales and a 0.19% increase in R&D expenditure. Ours findings suggest that lobbying activities

can expand firm's operations and, through this scale effect, increase the size of their R&D budgets. However, more R&D expenditure does not necessarily translate into more and better innovation outcomes. We explore this relationship by assessing how lobbying impacts future patent counts and forward citations. We find that a 1% increase in lobbying expenditure is associated with a 0.17% decline in patent counts and a 0.37% decline in five-year forward citations. We find that the elasticity of forward citations per dollar of R&D expenditure is -0.36. Taken together, ours findings highlight two potentially opposing mechanisms. On the one hand, through securing favorable policy treatments, lobbying can increase firm scale and thereby support larger R&D spending. But on the other hand, political influence through lobbying may weaken the incentives or effectiveness of productivity enhancing research, so that additional R&D expenditure may generate less innovation output. This fundamental distinction of how lobbying impacts the scale of research investment and its effectiveness motivates our quantitative framework, in which the distribution of lobbying innovation activities are key equilibrium objects.

Motivated by the empirical results, we develop a quantitative model of endogenous growth in which heterogeneous firms choose both their lobbying activities and R&D expenditures. Firms are heterogeneous along four dimensions: their production productivity, exogenous policy distortions, lobbying ability, and research ability. Lobbying requires a fixed access cost and variable expenditure, but allows firms to secure more favorable output wedges. By lowering effective marginal costs, these wedges can increase current sales without improving the underlying production technology. As in standard models of growth, R&D instead raises the probability of a future productivity improvement. We study the trade-off between the two activities: lobbying increases firm's profitability but reduces the effectiveness of research at a given R&D intensity. Lobbying raises the private returns and the marginal cost of technology upgrading through investment in innovation.

This trade-off yields a distinction between R&D expenditure and innovation output that is central to our mechanism. Theoretically, we show that larger lobbying efforts raises sales

and operating profits, but also raises the expenditure required to attain a given probability of successful innovation. A firm's optimal innovation probability falls even though its R&D expenditure can remain unchanged: the scale effect on spending can dominate the reduction in research intensity. The decision to lobby also depends on the firm's innovation opportunities. A firm with larger expected returns to innovation has more to give up by choosing political influence, whereas a firm with a particularly valuable policy advantage may prefer the immediate returns through lobbying activities. Lobbying participation is thus shaped by the opportunity cost of innovation, not simply by firm size as studied in the literature.

A key result of our paper is that the macroeconomic consequences of lobbying depends on their impact on the distribution of firms and their corresponding innovation activities. Successful innovations receive different weights in the aggregate growth rate according to the productivity of the firms undertaking them. We show that aggregate growth depends on type of innovations, rather than on the expected number of innovations alone. A second result characterizes the marginal contribution of R&D: holding the research budget and the firm distribution fixed, reallocating research toward firms with better innovative ideas, increases the innovation component of growth. These returns depend on research ability, existing expenditure, and lobbying exposure as well as productivity. The model therefore identifies a channel through which eliminating political influence can increase economic growth when aggregate R&D expenditure or the total number of successful innovations remain unchanged or even decreases in equilibrium.

We discipline the model with U.S. data on lobbying and innovation activities. The calibrated economy reproduces several salient features of the economy. We use the model as a laboratory to assess the macroeconomic effects of lobbying activities on the U.S economy. A complete elimination of lobbying activities in the benchmark economy, raises R&D intensity from 5.16 to 8.52 percent and annual log productivity growth from 2.73 to 2.89 percent, an increase of about 0.16 percentage point. We find that the expected probability of a successful innovation falls slightly, from 56.77 to 56.37 percent. However, even with a fall in successful

innovations, growth rises primarily because successful innovation moves toward firms with more impactful innovations. Productivity-weighted success rises from 64.09 to 66.91 percent; the most productive quintile of firms account for 95.1 percent of the increase in productivity-weighted successes. A decomposition of the growth difference attributes 0.189 percentage point to changes in innovation success conditional on productivity, partly offset by a 0.025-point arising from distributional effects. Therefore, eliminating lobbying may reduce the number of inventions in the economy, but it reallocate the successful inventions to those firms with higher quality inventions, which can raise economic growth even when the quantity of successful inventions fall.

Related literature. Our paper contributes to the literature on corporate lobbying and the economic consequences of special-interest politics. Grossman and Helpman (1994) study how organized interests influence policy, while Bombardini and Trebbi (2012) show how market structure shapes firms' incentives to lobby. Bertrand et al. (2014) distinguish the roles of political connections and issue-specific expertise in the U.S. lobbying market. More generally, Bombardini and Trebbi (2020) emphasize the importance of understanding how lobbying influences equilibrium policy choices and the economic distortions they generate. Our paper contributes to this literature by studying how policy distortions, which respond endogenously to lobbying activities, impact firm's incentives to innovate and their aggregate implication on long-run productivity growth. Our paper is particularly related to Bombardini et al. (2023), who show that firms further from the technological frontier increase lobbying in response to foreign competition, highlighting the interaction between political influence and technological incentives. We study a complementary question: how does lobbying impact the allocation of innovation across heterogeneous firms and its contribution to aggregate productivity growth? We model lobbying as an endogenous tool to improve policy distortions as in Huneeus and Kim (2024) and Arayavechkit et al. (2018) who study corporate lobbying and resource misallocation, and Choi (2025), who study lobbying and trade in a second-best

economy. These papers focus on how lobbying affects the allocation of resources through policy distortions, whereas we introduce endogenous innovation and study how lobbying impacts the future distribution of firm productivity. Our central contribution is to show that political influence can impact economic growth not only through firm's research expenditure, but also through the allocation of successful innovations across heterogeneous firms.

Two papers that are close to our work on the innovation mechanism are the papers of Akcigit et al. (2023) and Grotteria (2024). Akcigit et al. (2023) show that political connections favor firm expansion and survival while weakening innovation and creative destruction. Grotteria (2024) shows that competition over political rents exposes firms to political risk, raises their cost of capital, and can lower innovative investment. We study a different margin: lobbying can increase R&D spending while reducing the innovation output associated with that spending. This distinction is useful because observed research budgets alone cannot establish whether political influence promotes technological progress. Importantly for us, we build a quantitative framework that allows us to assess the impact of lobbying on the economic growth, through changes in the distribution of innovation, which captures both the quality and quantity margins of innovation.

We also connect to the literature on misallocation (Restuccia and Rogerson, 2008; Hsieh and Klenow, 2009) and to models in which the allocation of research across heterogeneous firms shapes economic growth (Atkeson and Burstein, 2010; Akcigit and Kerr, 2018; Acemoglu et al., 2018; Cavenaile and Roldan-Blanco, 2021; Dad, 2026). Whereas standard output wedges impact the allocation of current resources, endogenous lobbying in our setting also changes the productivity distribution through innovation. This distinction is related to the broader separation of private and social returns to research (Jones and Williams, 1998) and to the evidence that research spending is an imperfect measure of innovative output (Bloom et al., 2020; Hall et al., 2005; Kogan et al., 2017). The implication is that the cost of political influence cannot be assessed from lobbying expenditures or aggregate R&D alone. It also depends on which firms innovate and on how much those innovations contribute to future

productivity.

Section 2 presents the firm-level evidence. Section 3 develops the model and characterizes the links between lobbying, R&D, and growth. Section 4 describes the calibration and provides our quantitative results and transition dynamics. The final section concludes.

2 Empirical Evidence

We describe the data and political-access design, then show how lobbying relates to firm sales, R&D spending, and innovation output.

2.1 Data and Empirical Strategy

We study the relationship between lobbying, firm performance, and innovation using a panel of publicly traded U.S. firms from 1998 to 2015. We combine firm-level balance sheet data from Compustat with their lobbying expenditure that are available due to the Lobbying Disclosure Act (1995), and measures of innovation based on U.S. patents and their five-year forward citations. The lobbying records contain information on expenditures, legislative bills, and specific policy issues targeted by firms.

Lobbying is an endogenous choice. Firms with better ideas may have stronger incentives both to lobby and to innovate; firms may also lobby in anticipation of policy changes that may impact their R&D decisions. Following Bertrand et al. (2014), Huneeus and Kim (2024), and Choi (2025), we exploit changes in political access arising when a member of Congress from a firm's headquarters state becomes chair of the House or Senate Appropriations Committee. Such appointments can raise the return to lobbying. The identifying assumption is that, conditional on the specified controls and industry effects, this access changes firm outcomes only through lobbying activities.

We estimate the relationship between changes in lobbying expenditure and changes in firm outcomes, controlling for firm characteristics and four-digit SIC industry fixed effects.

Changes are measured as differences in period averages over time. We report both OLS and IV estimates, with standard errors clustered at the state level.

2.2 Lobbying, Sales, and R&D Expenditure

We begin by showing how lobbying expenditures impact firm sales and R&D expenditure. Lobbying can expand a firm's operations by securing favorable policy distortions, thereby increasing sales and profitability without necessarily improving its underlying productivity. In particular, a larger scale of operations can support more R&D expenditure even if the firm devotes a smaller share of its sales to research. Thus, lobbying may increase the resources allocated to R&D without necessarily improving the firm's incentives to innovate.

Table 1 reports the OLS and IV estimates. The OLS estimates show a positive relationship between lobbying expenditure and both firm sales and R&D expenditure. The IV estimates are substantially larger: a 1% increase in lobbying expenditure is associated with a 0.302% increase in sales and a 0.187% increase in R&D expenditure. These findings suggest that lobbying can increase research spending partly by expanding the scale of firm operations. Importantly, larger investments in R&D need not to reflect a stronger commitment to innovation, as implied with standard theories of innovation, but it may instead arise because firms operate at a larger scale.

The first-stage Kleibergen–Paap statistics are 12.46 for sales and 7.22 for R&D, and Anderson–Rubin tests reject the null of no effect in both specifications. Since the sales and R&D estimates are obtained from different samples, their magnitudes cannot be directly compared to infer the effect on R&D intensity. Overall, the evidence suggests that lobbying can increase the amount of resources allocated to research and development without necessarily increasing research intensity.

Table 1: Lobbying, sales, and R&D expenditure

Dependent variable	$\Delta \ln$ Sales		$\Delta \ln R\&D$	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Panel A. Second stage				
$\Delta \ln \text{Lobby}_{it}$	0.051***	0.302***	0.038***	0.187**
	(0.013)	(0.058)	(0.007)	(0.070)
Panel B. First stage and inference				
Political-access instrument		0.849***		0.850**
		(0.241)		(0.316)
KP-F		12.46		7.22
AR		14.17		4.68
AR p-value		< 0.01		0.031
Industry FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Observations	1,206	1,206	910	910

Notes: Standard errors clustered at the state level are reported in parentheses. The R&D sample requires positive observed R&D and sales in both periods. KP-F denotes the Kleibergen–Paap statistic. AR denotes the Anderson–Rubin statistic for the null of a zero coefficient. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

2.3 Lobbying and Innovation

Now we assess whether higher lobbying expenditure improves the outcomes of innovation. We use two measures of innovation; patent counts measure the quantity of patented inventions; citations received within five years measure their subsequent technological influence.

Table 2 presents the main empirical results. The OLS estimates show a weak relationship between lobbying and both measures of innovation outcomes. The IV estimates are negative for both patent counts and five-year forward citations: a one percent increase in lobbying expenditure is associated with 0.165 percent fewer patents and 0.364 percent fewer citations.

We further examine whether lobbying affects research productivity, measured by five-year forward patent citations per dollar of R&D expenditure. This measure captures the technological influence of patented innovations relative to the resources allocated to R&D. Although lobbying may expand firm's R&D budgets, more R&D expenditure may not translate into more influential innovations if R&D becomes less effective.

The IV estimate is -0.356, suggesting that a 1% increase in lobbying expenditure is associated with approximately 0.36% fewer forward citations per dollar of R&D.

Taken together, the evidence suggests that lobbying can increase research expenditure without a corresponding improvement in innovation output. This divergence motivates a novel feature of our model, in which lobbying expands firm scale while not directly improving the productivity of R&D.

Table 2: Lobbying, patent output, and research productivity

Dependent variable	$\Delta \ln P$		$\Delta \ln C$		$\Delta \ln(C/R)$	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Second stage						
$\Delta \ln \text{Lobby}_{it}$	0.007	-0.165^{**}	0.007	-0.364^{***}	-0.021	-0.356
	(0.009)	(0.063)	(0.016)	(0.130)	(0.016)	(0.278)
Panel B. First stage and inference						
Political-access instrument		0.873^{**}		1.029^{***}		0.946^{**}
		(0.427)		(0.308)		(0.459)
KP-F		4.18		11.15		4.25
AR		4.18		35.32		7.55
AR p-value		0.041		< 0.001		0.006
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	759	759	629	629	605	605

Notes: P denotes patent counts, C total five-year forward citations, and R real R&D expenditure. Dependent variables are differences in period averages of annual log outcomes. Annual zero outcomes are excluded. The patent and citation regressions require complete annual outcome coverage before retaining positive years. The citations-to-R&D regression instead uses available years with positive citations and R&D; its sample is not nested in the citation sample. All specifications include controls and four-digit SIC industry fixed effects. The first stage is re-estimated for each sample. Standard errors are clustered at the state level. KP-F is the Kleibergen–Paap statistic; AR is the Anderson–Rubin statistic for the zero-effect null. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. See Tables A2 and A3 for additional results.

2.4 Implications for the Model

Figure 1 summarizes our main empirical findings: lobbying increases firm sales and R&D expenditure while reducing patents, forward citations and lowers research productivity. We

interpret these results through two opposing forces. First, lobbying can secure favorable policy treatment that expands firm scale and profitability, increasing R&D expenditure even without a corresponding increase in research intensity. Second, lobbying may reduce the effectiveness with which research expenditures generate productivity enhancing innovations. Together, these forces can lead firms to invest more in R&D while producing fewer innovations. To examine these mechanisms and quantify their aggregate implications, we develop a general equilibrium model of endogenous growth in which heterogeneous firms choose their lobbying and R&D activities. The model allows us to study how lobbying impacts R&D, innovation and its effectiveness and allocation across firms and their implications for long-run economic growth.

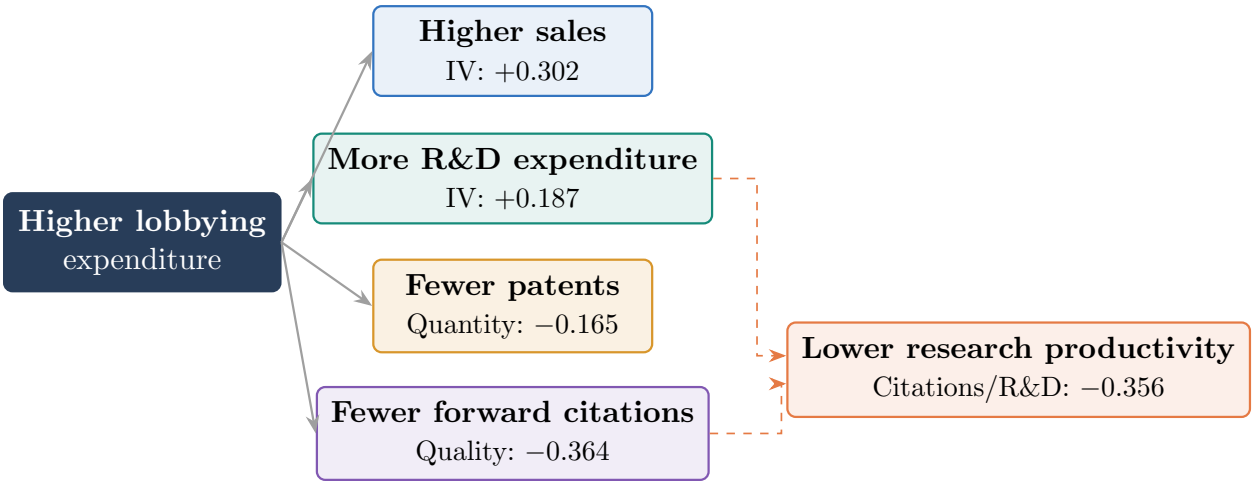

Figure 1: Summary of empirical findings

Notes: Values are outcome-specific IV coefficients. Dashed arrows show the components of citations per R&D dollar.

3 A Model of Lobbying and Innovation

We develop a general equilibrium growth model with firm heterogeneity in which innovation and lobbying activities are endogenous. We model lobbying as component of output distortions, that firms can invest towards as in Choi (2025); the firm-level R&D decision and productivity growth follow the step-by-step innovation and growth literature as in Atkeson and Burstein

(2010), Akcigit and Kerr (2018) and Cavenaile et al. (2026). Our focus will be on a balanced growth path equilibrium where all aggregate variables will be growing at the same rate. Now we will describe the details of the model starting with the economic environment.

3.1 Economic Environment

Households. There is a representative household of measure one with log preferences for consumption that discounts the future at rate r and supplies L units of labor inelastically, owns the firms, and receives lump-sum transfers. It maximizes lifetime consumption $\sum_{t=0}^{\infty} \beta^t \log C_t$ subject to their budget constraint as follows:

$$P_t C_t = w_t L + \Pi_t + T_t, \tag{1}$$

where P_t is the final-good price, w_t is the wage, Π_t is aggregate firm profit, and T_t is the transfer.

Final-good production. There is a unit measure of active firms, each will supply one differentiated intermediate good. There is a competitive final good producer which combines these intermediate goods with a CES technology as follows:

$$Y_t = \left[\int_0^1 y_{it}^{(\sigma-1)/\sigma} \mathrm{d}i \right]^{\sigma/(\sigma-1)}, \qquad \sigma > 1. \tag{2}$$

where σ is the elasticity of substitution. As is standard, the theoretical price index P_t for final consumption and the inverse demand functions for output are given by

$$P_t = \left[\int_0^1 p_{it}^{1-\sigma} \mathrm{d}i \right]^{1/(1-\sigma)}, \qquad y_{it} = \left(\frac{p_{it}}{P_t} \right)^{-\sigma} Y_t. \tag{3}$$

Firms and technology. Firm i produces a differentiated good using a linear production technology in labor n_{it}:

$$y_{it} = z_{it} n_{it}. \tag{4}$$

z_{it} is firm specific production productivity. We define aggregate productivity as the firm weighted CES average $A_t \equiv [\int_0^1 z_{it}^{\sigma-1} \mathrm{d}i]^{1/(\sigma-1)}$. Upon entry to the market, a firm draws their permanent exogenous distortions and abilities (τ_i, η_i, ϕ_i) from a joint distribution: an exogenous output wedge, lobbying ability, and R&D ability. Thereby, firms are heterogeneous along four key dimensions: exogenous distortions τ_i, lobbying ability η_i and their R&D ability ϕ, which pins down their firm-specific productivity z_i.

Firms will be faced with idiosyncratic output distortions τ_{it}^y as in Restuccia and Rogerson (2008) and Dad (2026). These output distortions can be interpreted as subsidies if τ_{it}^y is larger than one. Following Huneeus and Kim (2024) and Choi (2025), we model output distortions as having two components, one which is exogenous τ_i and a component that is endogenous to the firm's lobbying activities. Firms incur a fixed cost when they choose to engage in lobbying. In practice, the fixed cost captures the initial cost of hiring government affairs officer or retaining a lobbying firm, identifying relevant legislation and policymakers, and establishing procedures to comply with lobbying registration and disclosure requirements. In particular, once a firm has paid their fixed costs, they can now engage in lobbying activities such that they become relatively more subsidized or have access to favorable policy treatments. Let b_{it} be effective lobbying input, with $b_{it} = 0$ for a non-lobbyist and $b_{it} \geq 1$ for a lobbyist firm. Output distortions are comprised of both exogenous and endogenous components as follows:

$$\tau_{it}^y = \begin{cases} \tau_i, & b_{it} = 0, \\ \tau_i b_{it}^{\theta}, & b_{it} \geq 1, \end{cases} \qquad \theta > 0. \tag{5}$$

The parameter θ is the elasticity of the distortions with respect to effective lobbying input. In other words, it measures the effectiveness of lobbying activities in obtaining favorable policy

distortions. Values of τ_i^y above one favor the firm; values below one act like an output tax. Our modeling approach is consistent with Arayavechkit et al. (2018), who show firms lobby for tax-related purposes as well as Choi (2025) who interpret lobbying as an endogenous tool to improve policy distortions.

Production and sales. Taking aggregate demand, the wage, and its output wedge τ_{it}^y as given, firm i chooses its price and production labor to maximize operating profit:

$$\begin{aligned} \max_{p_{it},\, n_{it}} \quad & \tau_{it}^y p_{it} y_{it} - w_t n_{it} \\ \text{subject to} \quad & y_{it} = z_{it} n_{it}, \\ & y_{it} = D_t p_{it}^{-\sigma}. \end{aligned}$$

where $D_t \equiv Y_t P_t^{\sigma}$ is the aggregate demand shifter. Under monopolistic competition, the firm charges a constant markup $\mu \equiv \sigma/(\sigma-1)$ over its policy-adjusted marginal cost, $w_t/(z_{it}\tau_{it}^y)$. The optimal price, market revenue, operating profit, and production labor are therefore

$$p_{it} = \frac{\mu w_t}{z_{it}\tau_{it}^y}, \tag{6}$$

$$s_{it} \equiv p_{it} y_{it} = D_t \left(\frac{\mu w_t}{z_{it}\tau_{it}^y} \right)^{1-\sigma}, \tag{7}$$

$$\pi_{it}^o = \frac{\tau_{it}^y s_{it}}{\sigma}, \qquad n_{it} = \frac{\sigma-1}{\sigma} \frac{\tau_{it}^y s_{it}}{w_t}. \tag{8}$$

Market revenue, s_{it}, measures sales before the effects of the output distortions, whereas policy-adjusted revenue, $\tau_{it}^y s_{it}$, determines operating profit and labor demand. A higher τ_{it}^y lowers the firm's price and increases sales and employment without changing its physical productivity. Although the markup over policy-adjusted marginal cost remains μ, the ratio of price to physical marginal cost is μ/τ_{it}^y. Therefore, differences in observed firm size can reflect either productivity differences or variation in policy treatment.

Under the wage normalization $w_t = 1$, we define the rescaled demand shifter $D \equiv D_t A_t^{\sigma-1}$,

which is constant along the stationary equilibrium.

3.2 Lobbying and Innovation

Firms jointly choose lobbying and R&D, Lobbying raises sales and operating profits but lowers the probability of successful innovation at a given R&D intensity. This section describes lobbying costs and the innovation technology, then presents productivity dynamics and the incumbent firm's optimization problem.

Lobbying. At the beginning of each period, firms observe a fixed cost of accessing the market for lobbying activities, f_{it}, and decide whether to engage in lobbying. Firms can either operate without lobbying ($d = 0$, $b = 0$) or pay the fixed cost and choose an effective lobbying effort $b \geq 1$ ($d = 1$). Conditional on lobbying, firms incur a variable cost given by

$$c_\ell(b_{it}, \eta_i) = \frac{\kappa_\ell}{\gamma_\ell} \left(\frac{b_{it}}{\eta_i} \right)^{\gamma_\ell}, \qquad \gamma_\ell \geq 1. \tag{9}$$

where η_i captures firm-specific lobbying ability. Observed lobbying expenditure is defined as

$$\ell_{it} = \frac{b_{it}}{\eta_i}.$$

Firms with higher lobbying ability can therefore generate more effective lobbying influence for a given level of expenditure. The parameter κ_ℓ governs the scale of variable lobbying costs, while γ_ℓ determines their curvature.

Lobbying benefits firms by improving their output distortions, thereby lowering effective marginal costs, expanding sales, and increasing operating profits. Holding firm characteristics and aggregate prices fixed, equation (5) implies that operating profits conditional on lobbying satifies the following:

$$\pi_i^o(b) = \pi_i^o(1) b^{\sigma\theta}. \tag{10}$$

Thus, the elasticity of operating profits with respect to lobbying effort is $\sigma\theta$, reflecting both the direct benefit of favorable policy treatment and the resulting expansion in firm scale. Importantly, lobbying raises profitability without improving the firm's underlying productivity or changing its constant markup. These private benefits provide incentives to engage in lobbying activities, but must be weighed against its costs and its effects on the returns to innovation.

The fixed access cost captures the organizational expense of gaining access to the lobbying industry: hiring lobbying staff or outside counsel, monitoring legislation, and building relationships with policymakers. It is lognormally distributed:

$$\log f_{it} \sim \mathcal{N}(\log F_\ell, \sigma_f^2).$$

The draw is independent across years and is paid only when the firms decide to engage in lobbying activities. Importantly, past lobbying is not a state variable in our model; however, persistent firm characteristics can make lobbying participation persistent. The fixed cost generates an extensive margin, and the choice of b generates an intensive margin, thereby allowing our model to capture both dimensions of lobbying activities observed in the data.

Research and productivity dynamics. Firms invest in R&D to improve their productivity over time. Following Atkeson and Burstein (2010), we model R&D investment relative to firm sales. Let R_{it} denote a firm's R&D expenditure, measured in labor units under the wage normalization. We define R&D intensity as

$$x_{it} \equiv \frac{R_{it}}{s_{it}}, \tag{11}$$

where s_{it} denotes firm sales. This formulation allows research expenditure to vary with firm scale, while allowing us to separate the resources allocated to innovation from their effectiveness in generating productivity improvements.

R&D investment generates stochastic productivity improvements. In each period, a firm innovates successfully with probability

$$\nu_i(x_{it}, b_{it}) = 1 - \exp\left\{-\phi_i \left(\frac{x_{it}}{\kappa_R}\right)^{\alpha} \left(\frac{\tau_{it}^y(b_{it})}{\tau_i}\right)^{-\xi}\right\}, \qquad 0 < \alpha < 1, \quad \xi > 0. \tag{12}$$

The parameter ϕ_i captures firm-specific research ability, κ_R governs the cost of generating innovations, and α determines the elasticity of innovation arrival intensity with respect to R&D intensity. We restrict α to be bounded between 0 and 1, which implies diminishing returns to research investment.

The parameter ξ governs how lobbying activities impact the productivity of R&D. In particular, lobbying improves a firm's output wedge but reduces the effectiveness of research in generating successful innovations. Since $\tau_{it}^y/\tau_i = b_{it}^{\theta}$ for lobbying firms, the innovation arrival intensity is reduced by the factor $b_{it}^{-\theta\xi}$. This captures a trade-off between expanding firm operations through favorable policy treatment and improving productivity through innovation.

Importantly, lobbying activities also impact R&D expenditure through firm scale. Because $R_{it} = s_{it}x_{it}$, an increase in sales can raise total research spending even if R&D intensity remains unchanged. At the same time, lobbying lowers the probability of successful innovation for a given research intensity. Taken together, lobbying can increase observed R&D expenditure while still allowing for a reduction toward innovation output, consistent with the empirical patterns documented in section 2.

Following the step-by-step innovation literature (Aghion and Howitt, 1992; Akcigit and Kerr, 2018; Cavenaile and Roldan-Blanco, 2021), a successful innovation raises firm log productivity by a fixed amount $\lambda > 0$. Conditional on survival, productivity evolves according

to;

$$\log z_{i,t+1} = \rho_z \log z_{it} + (1-\rho_z)\log A_t + \epsilon_{i,t+1} + \begin{cases} \lambda, & \text{with probability } \nu_i(x_{it}, b_{it}), \\ 0, & \text{otherwise.} \end{cases} \tag{13}$$

where A_t denotes aggregate productivity. The parameter $\rho_z < 1$ governs the persistence of firm productivity relative to the aggregate frontier. In the absence of innovation and idiosyncratic shocks, firms with productivity above the aggregate level experience gradual mean reversion, while less productive firms converge toward it.

When $\rho_z = 1$, productivity follows a simple stochastic growth process:

$$\log z_{i,t+1} = \log z_{it} + \epsilon_{i,t+1} + \begin{cases} \lambda, & \text{with probability } \nu_i(x_{it}, b_{it}), \\ 0, & \text{otherwise.} \end{cases} \tag{14}$$

Absent idiosyncratic shocks, a successful innovation permanently increases firm productivity by the factor e^{λ}, while unsuccessful research leaves productivity unchanged.

In addition to productivity improvements arising from successful innovation, firms face idiosyncratic productivity shocks that capture changes in productive efficiency which is independent of R&D activities. These shocks may reflect learning-by-doing, improvements in managerial practices, organizational changes, or unexpected disruptions to production. Specifically, we assume

$$\epsilon_{i,t+1} \sim \mathcal{N}\big(-\tfrac{1}{2}(\sigma-1)\sigma_\epsilon^2, \sigma_\epsilon^2\big)\,. \tag{15}$$

where σ_ϵ governs the dispersion of productivity shocks across firms. The mean is normalized such that $\mathbb{E}[e^{(\sigma-1)\epsilon_{i,t+1}}] = 1$, ensuring that these shocks do not mechanically increase the aggregate productivity growth. This normalization allows us to isolate the contribution of innovation to aggregate productivity growth from the direct effects of other productivity shocks.

Idiosyncratic shocks play an important role in firm dynamics. They allow productivity to rise or fall even in the absence of successful R&D, generating heterogeneity in productivity trajectories among otherwise similar firms. By changing firm's relative productivity, these shocks also impact their future scale, profitability, and incentives to invest in lobbying and innovation. Together with endogenous R&D decisions and firm entry and exit, they shape the evolution of the productivity distribution.

The incumbent's problem. Firms make dynamic lobbying and R&D decisions to maximize the value of their firm. To characterize these decisions along a balanced growth path, we normalize firm productivity by aggregate productivity, $\tilde{z}_{it} = z_{it}/A_t$. The firm's state is $\Omega = (\tilde{z}, \tau, \eta, \phi)$, which includes its relative productivity, exogenous output distortion, lobbying ability, and research ability. At the beginning of each period, the firm observes a transitory fixed cost of lobbying access, f, and decides whether to engage in lobbying. A non-lobbying firm chooses $d = 0$ and $b = 0$, whereas a lobbying firm chooses $d = 1$ and an effective lobbying effort $b \geq 1$. Conditional on this decision, the firm optimally chooses its lobbying effort and R&D intensity before the realization of innovation and productivity shocks.

Given aggregate demand D and productivity growth g, the value of operating under lobbying choice $d \in \{0, 1\}$, excluding the fixed access cost, is

$$V_d(\Omega; D, g) = \max_{\substack{b \in \mathcal{B}_d \\ x \geq 0}} \Big\{ \pi^o(\Omega, b; D) - s(\Omega, b; D)x - d\, c_\ell(b, \eta) + \beta(1-\delta)\mathbb{E}[V(\Omega'; D, g) \mid \Omega, b, x] \Big\}, \tag{16}$$

where $\mathcal{B}_0 = \{0\}$ and $\mathcal{B}_1 = [1, \infty)$. The first term captures current operating profits, while the second and third represent expenditures on R&D and lobbying, respectively. The final term is the expected continuation value, discounted by β and the probability of survival, $1 - \delta$. Expectations are taken over innovation outcomes and idiosyncratic productivity shocks, with next period's value incorporating a new realization of the lobbying access cost.

The firm's lobbying and innovation choices are jointly determined. Lobbying increases

current profitability by improving the firm's output wedge and expanding its scale of operations. However, it also reduces the effectiveness of R&D in generating future productivity improvements. Firms therefore balance the immediate gains from favorable policy treatment against the costs of lobbying and its consequences for future innovation.

A firm chooses to lobby whenever the additional value of lobbying exceeds the realized fixed access cost:

$$V_1(\Omega; D, g) - V_0(\Omega; D, g) \geq f. \tag{17}$$

This condition determines the extensive margin of lobbying. Firms with greater potential gains from political influence are more likely to lobby, whereas firms facing higher access costs may optimally remain non-lobbyists. Integrating over the distribution of fixed costs, the firm's expected value before observing f is

$$\begin{aligned} V(\Omega; D, g) = V_0(\Omega; D, g) \\ + \mathbb{E}_f[\max\{V_1(\Omega; D, g) - V_0(\Omega; D, g) - f,\, 0\}]\,. \end{aligned} \tag{18}$$

The second term captures the option value of engaging in lobbying activities. This value varies across firms depending on their individual state $\Omega = (\tilde{z}, \tau, \eta, \phi)$.

Defining $\Delta V(\Omega) = V_1(\Omega) - V_0(\Omega)$ and letting F_f denote the cumulative distribution of fixed access costs, the probability that a firm engages in lobbying is

$$\chi_1(\Omega) = F_f(\Delta V(\Omega))\,, \qquad \chi_0(\Omega) = 1 - \chi_1(\Omega), \tag{19}$$

where $F_f(a) = 0$ for $a \leq 0$. The optimal policies $(b_d(\Omega), x_d(\Omega))$ determine firm sales s_d, R&D expenditure $R_d = s_d x_d$, and innovation probability ν_d. Since the fixed cost impacts only the extensive margin of lobbying, firms with the same state Ω choose identical lobbying and R&D policies conditional on lobbying.

3.3 Stationary Equilibrium

We characterize a balanced-growth equilibrium in which aggregate productivity grows at a constant rate and the distribution of firm productivity relative to the aggregate remains stationary. In equilibrium, firm's lobbying and R&D decisions determine their productivity dynamics and the allocation of resources across firms, which in turn determine economic growth.

Entry and firm distribution. At the end of each period, incumbent firms exit exogenously with probability δ and are replaced by new entrants, keeping the total measure of firms normalized to one. Surviving firms retain their permanent characteristics (τ, η, ϕ), while their productivity evolves through innovation and idiosyncratic shocks.

Along a balanced growth path, aggregate productivity grows according to $A_{t+1} = e^g A_t$, where g denotes the endogenous growth rate. Normalizing firm productivity by the aggregate index, $\tilde{z}_{it} = z_{it}/A_t$, the law of motion for surviving firms becomes

$$\tilde{z}_{i,t+1} = e^{-g} \tilde{z}_{it}^{\rho_z} \exp\left(\epsilon_{i,t+1} + \lambda I_{i,t+1}\right), \tag{20}$$

where $I_{i,t+1} \in \{0, 1\}$ indicates a successful innovation, with probability $\nu_i(x_{it}, b_{it})$. The evolution of relative productivity thus depends on innovation, idiosyncratic shocks, and the growth of aggregate productivity. In particular, a successful innovation improves a firm's position relative to the aggregate, whereas aggregate growth reduces its relative productivity in the absence of sufficiently large firm-level improvements.

Exiting firms are replaced by entrants that draw permanent characteristics (τ, η, ϕ) from their joint distribution and begin with productivity equal to the aggregate level, $\tilde{z}_E = 1$. Entry and exit therefore introduce firm dynamics into the firm distribution, while innovation and productivity shocks generate mobility among surviving firms.

Let Γ denote the stationary distribution of firms over states $\Omega = (\tilde{z}, \tau, \eta, \phi)$, and let

$P_d(\Omega, B)$ denote the probability that a surviving firm in state Ω transitions to a set B under lobbying choice d. Integrating over lobbying participation, the stationary distribution satisfies

$$\Gamma(B) = (1-\delta)\int \sum_{d=0}^{1} \chi_d(\Omega) P_d(\Omega, B)\, \mathrm{d}\Gamma(\Omega) + \delta\Gamma_E(B), \quad \text{for every measurable set } B, \tag{21}$$

where Γ_E denotes the distribution of entrants.

The stationary distribution reflects the interaction of endogenous innovation, lobbying decisions, and firm dynamics. Although the measure of firms remains fixed, their relative productivity evolves as firms invest in innovation, obtain favorable policy treatment, and experience productivity shocks.

Market clearing and balanced growth. In equilibrium, goods and labor markets clear. Policy-induced transfers and private lobbying payments are rebated to the representative household. Combining the household, firm, and government budget constraints, goods-market clearing requires

$$P_t C_t = \int \sum_{d=0}^{1} \chi_d(\Omega) s_d(\Omega)\, \mathrm{d}\Gamma(\Omega). \tag{22}$$

Labor is allocated between production and R&D activities. Lobbying impacts firm's resource allocation decisions through output distortions and innovation incentives but does not directly absorb labor. Normalizing aggregate labor supply to one, labor-market clearing requires

$$\int \sum_{d=0}^{1} \chi_d(\Omega) \big[n_d(\Omega) + R_d(\Omega) \big]\, \mathrm{d}\Gamma(\Omega) = 1. \tag{23}$$

Aggregate productivity is defined as the CES average of firm productivity. Consequently, the stationary distribution of relative productivity must satisfy

$$\left[\int \tilde{z}^{\sigma-1}\, \mathrm{d}\Gamma(\Omega) \right]^{1/(\sigma-1)} = 1. \tag{24}$$

This condition determines the equilibrium growth rate consistent with firms optimal policy

functions and the stationary distribution.

To characterize aggregate growth, we define the expected probability of successful innovation for a firm in state Ω as follows

$$\bar{\nu}(\Omega) \equiv \sum_{d=0}^{1} \chi_d(\Omega)\nu_d(\Omega), \tag{25}$$

where $\nu_d(\Omega)$ denotes the innovation probability under the optimal policies associated with lobbying choice d.

Combining the firm productivity law of motion with the stationary distribution and the entry process gives us the following formulation:

$$1 = \delta + (1-\delta)e^{-(\sigma-1)g} \int \tilde{z}^{(\sigma-1)\rho_z} \Big[1 + \bar{\nu}(\Omega)(e^{(\sigma-1)\lambda} - 1)\Big] \, \mathrm{d}\Gamma(\Omega). \tag{26}$$

Equation (26) highlights how firm-level innovation maps into aggregate productivity growth. Importantly, the contribution of innovation depends not only on the probability of success but also on the productivity of the firms undertaking it. Successful innovations at more productive firms receive more weight toward growth rate of aggregate productivity. Therefore, changes in the allocation of innovation across firms can directly impact the aggregate growth even when the total number of successful innovations do not change. Now we characterize a definition for our stationary balanced-growth path equilibrium.

Definition 1 (Stationary balanced-growth equilibrium).

A stationary balanced-growth equilibrium is a collection $(D, V, \{b_d, x_d\}_{d=0}^{1}, \chi_1, \Gamma, g)$ consisting of an aggregate demand shifter D, firm value function V, optimal lobbying and R&D policies (b_d, x_d), lobbying participation probabilities χ_1, a stationary firm distribution Γ, and an aggregate productivity growth rate g, such that:

(i) *Firm optimization.* Given D and g, firms optimally choose production, lobbying, and R&D according to the incumbent's problem.

(ii) *Household and final-good optimization.* The representative household maximizes utility subject to its budget constraint, and the final-good producer minimizes costs under the CES technology.

(iii) *Market clearing.* The government budget is balanced, and goods and labor markets clear according to equations (22) and (23).

(iv) *Stationary distribution.* The firm distribution Γ is invariant under optimal policies, productivity dynamics, and entry and exit, as characterized by equation (21).

(v) *Balanced growth.* Aggregate productivity grows at the constant rate g, and the distribution of relative productivity satisfies equation (24).

3.4 Model Implications

The empirical evidence raises a central question: how can lobbying increase R&D spending while reducing innovation output? We isolate four mechanisms: firm scale, selection into lobbying, responses to lobbying costs, and the allocation of innovation. Holding fixed the aggregate conditions, firm distribution and a fixed research budget, we characterize the key implications of the model.

Firm scale and innovation. Lobbying improves a firm's output wedge, lowering its effective marginal cost and expanding sales. With a constant CES markup, operating profit also rises:

$$s(b) = s(1)b^{(\sigma-1)\theta}, \qquad \pi^o(b) = \pi^o(1)b^{\sigma\theta}. \tag{27}$$

Yet firm expansion does not need to imply a direct technological progress. Lobbying raises the sales over which R&D intensity is measured and directly lowers research efficiency. Define $H(\nu) = -\log(1-\nu)$ and $\zeta = \theta[\alpha(\sigma-1)+\xi] > 0$. The expenditure required for successful

innovation probability $\nu \in (0,1)$ is

$$R(\nu, b) = \kappa_R s(1) \phi^{-1/\alpha} b^{\zeta/\alpha} H(\nu)^{1/\alpha}. \tag{28}$$

Here $b = 1$ gives the non-lobbying research technology and sales, although choosing to lobby at $b = 1$ still comes with lobbying costs.

Proposition 1 (Scale and innovation)**.** *Lobbying raises sales and profit, increases the expenditure needed for a given innovation probability, and reduces the optimal success probability:*

$$\begin{aligned} \frac{\partial \log s}{\partial \log b} &= (\sigma - 1)\theta > 0, & \frac{\partial \log \pi^o}{\partial \log b} &= \sigma\theta > 0, \\ \left.\frac{\partial \log R}{\partial \log b}\right|_{\nu} &= \frac{\zeta}{\alpha} > 0, & \frac{\partial \nu^*}{\partial \log b} &= -\frac{\zeta(1-\nu^*)H(\nu^*)}{\alpha H(\nu^*) + 1 - \alpha} < 0. \end{aligned} \tag{29}$$

The key distinction is between the firm's scale and effectiveness of R&D. Higher sales can support a larger R&D budget, even as the lobbying-induced efficiency penalty makes successful innovation less likely. Therefore, in our theory larger R&D spending does not need to imply more innovations in the economy as in standard models of growth.

Selection into lobbying. In standard models of firm dynamics, firm size is typically a sufficient statistic in determining the participation margin of firm dynamics. However, in our theory the incentive to participate in lobbying activities depends on more than firm size. A favorable policy distortion raises current profits, but it also trades-off some of the returns to future research. Let $\mathcal{V}(\Omega) > 0$ denote the discounted continuation-value gain from successful innovation. The optimized research surplus is

$$\mathcal{G}(b; \Omega) = \max_{0 \leq \nu < 1} \{\mathcal{V}(\Omega)\nu - R(\nu, b)\}.$$

Since lobbying raises the cost of achieving any given ν, $\mathcal{G}(b;\Omega) \leq \mathcal{G}(1;\Omega)$ for $b \geq 1$. The pre-access-cost value gain from lobbying is

$$\Delta V(\Omega) = \max_{b\geq 1} \Big\{ \underbrace{\pi^o(1)(b^{\sigma\theta}-1)}_{\text{Profit gain}} - \underbrace{c_\ell(b,\eta)}_{\text{Lobbying cost}} - \underbrace{[\mathcal{G}(1;\Omega)-\mathcal{G}(b;\Omega)]}_{\text{Research opportunity cost}} \Big\}. \tag{30}$$

Proposition 2 (Lobbying selection)**.** *A firm lobbies if and only if $f \leq \Delta V(\Omega)$, so its participation probability is*

$$\chi_1(\Omega) = F_f(\Delta V(\Omega)), \qquad F_f(a) = 0 \text{ for } a \leq 0. \tag{31}$$

At a differentiable interior optimum, the effect of research ability is

$$\frac{\partial \Delta V}{\partial \phi} = \frac{R_1^* - R_0^*}{\alpha\phi} + (\nu_1^* - \nu_0^*)\frac{\partial \mathcal{V}}{\partial \phi}. \tag{32}$$

In particular, if $R_1^* \leq R_0^*$ and $\partial\mathcal{V}/\partial\phi \geq 0$, greater research ability weakly discourages lobbying.

This creates a selection margin: firms with valuable research opportunities may be less willing to sacrifice innovation for political gains, whereas firms with large immediate lobbying benefits may still participate. In Figure 2 we show this condition graphically through a fixed-cost cutoff and a sorting pattern conditional on research ability.

Higher lobbying costs. Consider an additional tax on lobbying t that multiplies private lobbying costs by $1+t$. Conditional on remaining a lobbyist, changes in the fixed access cost do not affect intensive-margin decisions. We now show how changes in lobbying costs can impact R&D effort and innovation probability.

Proposition 3 (Lobbying costs and R&D)**.** *Suppose the optimal R&D payoff is strictly concave. A marginal increase in the lobbying tax t lowers lobbying effort and raises innovation probability:*

$$\frac{\mathrm{d}\log b^*}{\mathrm{d}\log(1+t)} < 0, \qquad \frac{\mathrm{d}\nu^*}{\mathrm{d}\log(1+t)} > 0. \tag{33}$$

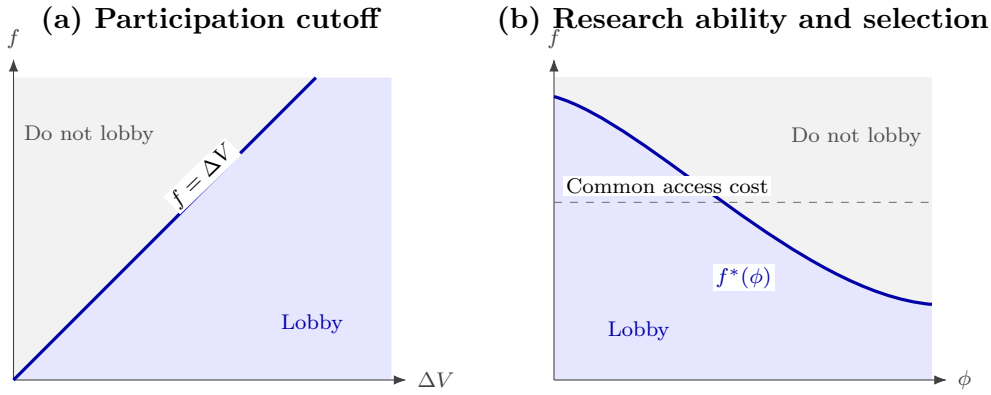

Figure 2: Lobbying selection and research opportunities

Notes: Panel (a) shows the exact rule: a firm lobbies if its fixed access cost f does not exceed the value gain $\Delta V = V_1 - V_0$. Panel (b) illustrates a *conditional* case in which stronger research opportunities or abilities can reduce this gain.

Its effect on R&D expenditure is

$$\frac{\mathrm{d}\log R^*}{\mathrm{d}\log(1+t)} = \frac{\zeta[H(\nu^*)-1]}{\alpha H(\nu^*)+1-\alpha}\frac{\mathrm{d}\log b^*}{\mathrm{d}\log(1+t)}. \tag{34}$$

Thus R&D expenditure rises if $\nu^* < 1 - e^{-1}$*, falls if* $\nu^* > 1 - e^{-1}$.

A tax on lobbying activities shifts incentives from lobbying toward innovation. Reduced lobbying makes a given success probability cheaper to obtain, but the firm also chooses a higher success probability. When initial success is relatively unlikely, the stronger incentive to innovate raises R&D expenditure; when success is already likely, the cost saving dominates and spending falls. A permanent tax on lobbying can additionally change the participation margin and the firm distribution.

Innovation allocation and growth. In our model, economic growth depends not only on the number of successful innovations but also on which firms innovate. Because productivity improvements at more productive firms have a larger effect on the aggregate productivity, the allocation of innovation across firms matters for growth.

To formalize this result, we define $w(\Omega) = \tilde{z}^{(\sigma-1)\rho_z}$ as firm's productivity weight in aggregate

growth, and define

$$B = \int w \, \mathrm{d}\Gamma, \qquad S = \int \bar{\nu} \, \mathrm{d}\Gamma, \qquad Q = \int w\bar{\nu} \, \mathrm{d}\Gamma. \tag{35}$$

where B captures the productivity distribution carried forward before new innovations, S measures the expected number of successful innovations per firm, and Q measures productivity-weighted innovation, which assigns more importance to innovative successes at more productive firms. We can now define stationary equilibrium growth as follows:

$$g = \frac{1}{\sigma - 1} \log \left[B + (e^{(\sigma-1)\lambda} - 1)Q \right]. \tag{36}$$

This expression separates the contribution of existing firm productivity from that of new innovations. Importantly, the contribution of innovation depends on Q, rather than simply on the number of successful innovations, S. To see this, note that

$$\frac{Q}{B} = S + \frac{\mathrm{Cov}_\Gamma(w, \bar{\nu})}{B}. \tag{37}$$

The covariance term captures the sorting of innovation across firms. Holding the productivity distribution fixed, shifting successful innovations toward more productive firms raises Q and aggregate growth, even if the total number of innovations remains unchanged.

The allocation of research expenditure also matters. Firms differ in their productivity, research ability, and exposure to endogenous distortions through lobbying, which generate differences in the marginal returns to R&D. For a firm that chooses to participate in lobbying d, define $a_d = \kappa_R^{-\alpha} \phi (\tau_d^y / \tau)^{-\xi}$. The productivity-weighted marginal contribution of R&D expenditure to innovation is

$$\begin{aligned} M_d(\Omega) &= w(\Omega) \frac{\partial \nu_d}{\partial R_d} \\ &= w(\Omega) \frac{\alpha a_d}{s_d} \left(\frac{R_d}{s_d} \right)^{\alpha - 1} \exp \left[-a_d \left(\frac{R_d}{s_d} \right)^{\alpha} \right]. \end{aligned} \tag{38}$$

The term $M_d(\Omega)$ measures the additional productivity-weighted innovation generated by marginal increase in R&D expenditure. It is higher when research is more productive but declines with existing R&D investment because of diminishing returns.

Proposition 4 (Research Allocation and Aggregate Growth)**.** *Suppose, we fix distribution of firms, lobbying policy functions, and the aggregate R&D expenditure $\bar{R} > 0$. Consider a finite collection of firm groups $k = 1, \ldots, K$, each with positive mass μ_k, whose innovation probabilities are strictly concave in R&D expenditure, with $0 < \alpha < 1$. Let M_k denote the productivity-weighted marginal return to R&D defined in equation (38).*

(i) Reallocation and growth. A marginal transfer ε of aggregate R&D expenditure from group j to group i changes productivity-weighted innovation by

$$\frac{\mathrm{d}Q}{\mathrm{d}\varepsilon} = M_i - M_j. \tag{39}$$

Reallocating R&D toward firms with higher productivity-weighted marginal returns increases aggregate productivity growth.

(ii) Optimal research allocation. The allocation that maximizes productivity-weighted innovation subject to holding the R&D expenditure fixed is unique and satisfies

$$M_i = M_j \qquad \text{for all } i, j. \tag{40}$$

(iii) Private and social returns. Given the private optimum,

$$M_i = \frac{w_i}{\mathcal{V}_i}, \tag{41}$$

where w_i is the firm's productivity weight and $\mathcal{V}_i$ is the discounted private value of a successful innovation. The decentralized research allocation attains the conditional growth-maximizing allocation if and only if $w_i/\mathcal{V}_i$ is equalized across firms.

Proposition 4 shows that aggregate growth depends not only on how much firms invest in R&D, but also on how research resources are distributed across firms. Reallocating research from a firm with a low marginal return to one with a higher marginal return increases the productivity gains generated by a given research budget. Importantly, more productive firms do not necessarily have higher marginal returns to R&D, as these also depend on research ability, existing investment, and the effectiveness of research.

The proposition also highlights a distinction between private and aggregate incentives to innovate. Firms choose R&D based on the expected increase in their own future profits, whereas the aggregate return depends on the contribution of successful innovations to economy-wide productivity. These incentives do not need to be exactly aligned, potentially leading to an inefficient allocation of research. Lobbying can influence this allocation by changing firm's profitability, research incentives, and innovation efficiency. We quantify these effects in a quantitative general equilibrium model of growth in Section 4.

4 Quantitative Analysis

Our main goal in this paper is to understand the static and dynamic implications of lobbying activities on innovation and economic growth. To quantify these channels we calibrate the model to the U.S micro and macro data and ensure the model is consistent with salient features of the economy. We validate the model by showing that we are able to reproduce key features of the economy without directly targeted those moments. We then conduct counterfactual experiments by completely shutting down and taxing lobbying activities. We conclude by providing an assessment of the transition dynamics from a reasonable tax on lobbying activities.

4.1 Calibration Strategy

We calibrate the model at an annual frequency, and set the consumer discount rate to 4%. We now have 21 parameters to calibrate in the model. We first calibrate 6 parameters externally through normalization or values consistent with the literature. We calibrate the remaining 15 parameters jointly through a moment-matching procedure, by ensuring the distance between model-generated moments and their empirical counterparts are minimized. In particular, we target a combination of aggregate and firm-level moments on lobbying, innovation, growth and correlations of abilities and distortions across firms. Table 3 summarizes the parameter values and exact calibration targets.

Externally assigned parameters. We normalize the measure of active firms, aggregate labor supply, and the wage to equal 1. Following Hsieh and Klenow (2009) and Choi (2025), we set the elasticity of substitution across differentiated goods to $\sigma = 3$. The annual discount factor is $\beta = 0.96$, and the exogenous firm exit probability is $\delta = 0.025$, implying an expected firm lifetime of 40 years. Following Acemoglu et al. (2018), we set the R&D elasticity to $\alpha = 0.5$, implying diminishing returns to research investment. We set the elasticity of the output distortions with respect to lobbying effort to $\theta = 0.08$, following the estimates of lobbying and firm-specific subsidies in Choi (2025).

Internally calibrated parameters. We jointly calibrate the remaining 15 parameters to match moments of firm size, lobbying participation and expenditure, R&D investment, and aggregate productivity growth. These parameters govern the costs of lobbying and innovation, the size of productivity improvements, and heterogeneity in firm's underlying characteristics.

The fixed lobbying access cost, F_ℓ, primarily disciplines the share of firms engaging in lobbying. Conditional on participation, the variable cost parameters $(\kappa_\ell, \gamma_\ell)$ determine lobbying expenditure and how it varies with firm size. The R&D cost parameter κ_R governs research intensity, while the innovation step λ determines the productivity gain from successful

innovation and helps discipline aggregate growth.

Three additional parameters govern the dynamics of firm heterogeneity: productivity persistence ρ_z, the standard deviation of idiosyncratic productivity shocks σ_ϵ, and the dispersion of fixed lobbying access costs σ_f. These parameters determine the persistence and dispersion of firm productivity and, together with permanent firm characteristics, the dynamics of lobbying participation, which is the extensive margin of interest.

To assess these choices, we construct additional moments using firms observed in both 2007 and 2008. The data exhibit an adjacent-year TFPQ correlation of 0.93 and a standard deviation of TFPQ growth of 0.69. Among surviving firms, the lobbying entry rate is 3.38%, while the continuation rate is 86.92%, which is consistent with empirical moments.

The parameter ξ governs the decline in research efficiency associated with lobbying. We set $\xi = 3.94$ using a conditional mapping from our IV estimates of forward citations, R&D expenditure, and sales.

The remaining six parameters characterize heterogeneity in firm's exogenous output wedges, lobbying and research abilities. Their dispersions, $(\sigma_\tau, \sigma_\eta, \sigma_\phi)$, help determine the cross-sectional variation in sales, lobbying expenditure, and R&D intensity. The correlations $(\rho_{\tau\eta}, \rho_{\tau\phi}, \rho_{\eta\phi})$ govern how these characteristics are jointly distributed across firms and therefore influence the selection into lobbying and innovation. We discipline these parameters using the corresponding empirical correlations between firm productivity, lobbying expenditure, and R&D intensity.

Calibration fit. Table 3 presents the results of our calibration exercise. Panel A reports the parameter values that are externally calibrated, and Panel B reports the internally calibrated parameter values and their corresponding results in terms of moment matching. The model manages to replicate the targeted moments well.

Empirical discipline of research productivity. The parameter ξ captures the effect of lobbying on research productivity. We discipline this parameter using our IV estimates of

Table 3: Calibration of the Benchmark Economy

Panel A. Externally assigned parameters

Parameter	Value	Source or basis
Labor supply and wage (L, w)	1	Normalizations
Elasticity of substitution (σ)	3.00	Hsieh and Klenow (2009); Choi (2025)
Discount factor (β)	0.96	Annual discount rate: 4.17%
Firm exit probability (δ)	0.025	Expected firm lifetime: 40 years
R&D curvature (α)	0.50	Acemoglu et al. (2018)
Lobbying wedge elasticity (θ)	0.08	Choi (2025)

Panel B. Internally calibrated parameters

Parameter	Value	Target moment	Data	Model
Lobbying				
Fixed lobbying cost (F_ℓ)	0.0086	Lobbying participation (%)	19.34	19.74
Lobbying cost scale (κ_ℓ)	3.78×10^9	Lobbying/sales (bp)	1.27	1.38
Lobbying cost curvature (γ_ℓ)	2.85	Lobbying–sales elasticity	0.36	0.37
Fixed-cost dispersion (σ_f)	0.75	Lobbying transitions (%)	3.38	3.15
Innovation and growth				
R&D cost scale (κ_R)	0.0323	R&D/sales (%)	5.09	5.13
Innovation step (λ)	0.07	Annual log TFP growth (%)	2.74	2.73
Productivity persistence (ρ_z)	0.98	TFPQ persistence	0.93	0.98
Productivity shock s.d. (σ_ϵ)	0.25	TFPQ growth dispersion	0.69	0.68
Research-efficiency penalty (ξ)	3.94	IV-implied R&D-efficiency elasticity	−0.315	−0.315
Firm heterogeneity				
Wedge dispersion (σ_τ)	0.71	S.d. log sales	2.50	2.63
Lobbying-ability dispersion (σ_η)	2.29	S.d. log lobbying	1.67	0.61
Research-ability dispersion (σ_ϕ)	1.29	S.d. log R&D intensity	1.97	1.71
Wedge–lobbying corr. $(\rho_{\tau\eta})$	0.22	Corr(TFPQ, log lobbying)	0.39	0.42
Wedge–research corr. $(\rho_{\tau\phi})$	−0.77	Corr(TFPQ, log R&D intensity)	−0.55	−0.52
Lobbying–research corr. $(\rho_{\eta\phi})$	−0.78	Corr(log lobbying, log R&D intensity)	−0.15	−0.14

Notes: Panel A reports externally assigned parameters. Panel B reports the 15 jointly calibrated parameters and their corresponding data and model moments. Lobbying expenditure and R&D intensity moments are calculated among firms with positive reported values. Lobbying/sales is expressed in basis points; R&D/sales is expressed in percent.

lobbying's effects on forward patent citations, sales, and R&D expenditure.

In the model, R&D intensity is $x = R/s$, where R denotes research expenditure and s denotes sales. For lobbying firms, $b = \eta\ell$, where ℓ is lobbying expenditure and η is lobbying ability. Combining equations (5) and (12) yields

$$\log[-\log(1-\nu)] = \text{constant}(\eta) + \log\phi - \xi\theta\log\ell + \alpha(\log R - \log s). \tag{42}$$

This expression isolates lobbying's direct effect on innovation efficiency, $-\xi\theta$, from its effects on research expenditure and firm scale.

To connect the model to the data, we assume expected forward citations are proportional to innovation arrival intensity, and that the measurement error in log citations is orthogonal to the instrument. Under the IV exclusion restriction, the estimated coefficients satisfy

$$-\xi\theta = \beta_{C/R} + \alpha\beta_{\text{sales}} + (1-\alpha)\beta_R, \tag{43}$$

where the coefficients measure lobbying's effects on citations per R&D dollar, sales, and R&D expenditure, respectively.

Using a common sample of firms, the corresponding IV estimates are -0.356, 0.125, and -0.044, respectively. With $\alpha = 0.5$, these imply $-\xi\theta = -0.315$. Given $\theta = 0.08$, we obtain $\xi = 3.94$. Thus, a 1% increase in lobbying expenditure reduces innovation arrival intensity by approximately 0.315%, holding research intensity and firm abilities fixed.

Untargeted model validation. We next evaluate the model's ability to reproduce salient features of the economy that we do not directly target in our calibration exercise. The validation exercise is particularly important because the macroeconomic effects of lobbying depend on which firms engage in lobbying and R&D, and how research is distributed across the firm size distribution. Table 4 summarizes untargeted moments, while Figures 3 to 5 compare the distributions of sales, research expenditure, and lobbying activities.

Firm size and concentration. The model captures the substantial concentration of economic activity among large firms in the U.S economy. As shown in Table 4 and Figure 3, the largest 10% of firms account for 82.15% of sales in the model, compared with 79.77% in the data. The model also reproduces the concentration of R&D among large firms: the largest sales decile accounts for 68.62% of reported R&D in the model, compared with 75.52% in the data.

Our model is also able to capture the dispersion of firm productivity. The standard deviation of log TFPQ is 1.21 in the model, compared with 1.83 in the data. We also capture the lobbyist share of sales and R&D in the model, while we slightly over-estimate the concentration of sales among large lobbying firms.

Table 4: Untargeted Firm-Level Moments

Moment	**Data**	**Model**
Firm size and concentration		
Top 1% share of sales (%)	37.48	41.98
Top 10% share of sales (%)	79.77	82.15
Top 1% share of reported R&D (%)	31.10	27.64
Top 10% share of reported R&D (%)	75.52	68.62
Standard deviation of log TFPQ	1.83	1.21
Lobbying and research allocation		
Lobbyists' share of sales (%)	68.94	77.04
Lobbyists' share of reported R&D (%)	63.60	41.02

Notes: These are untargeted moments that capture salient features of the economy. Sales shares are calculated by ranking all firms by sales. R&D shares are calculated among firms reporting R&D, also ranked by sales. Lobbyists' share of reported R&D is calculated within the R&D-reporting population.

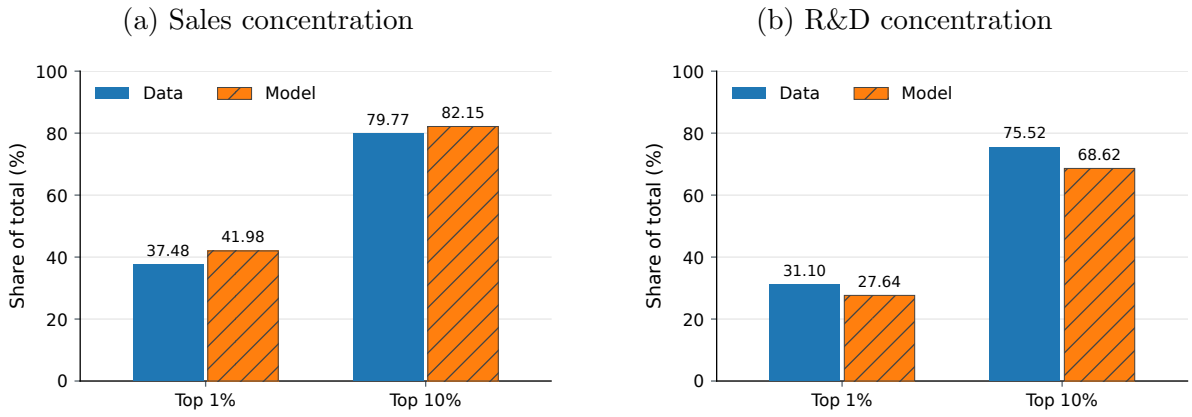

Figure 3: Concentration of Sales and R&D among Large Firms

Notes: Firms are ranked by sales. Panel (a) reports the shares of aggregate sales accounted for by the largest 1% and 10% of firms. Panel (b) reports the corresponding shares of total R&D expenditure among R&D-reporting firms.

R&D investment across firm sizes. Figure 4 examines how R&D intensity varies with firm size. Both the data and the model exhibit a strong negative relationship between R&D expenditure relative to sales and firm size. The model closely matches the R&D intensity of the largest firms, at 4.75% compared with 4.71% in the data. The model also generates an R&D intensity of 16.58%, compared with 23.24% in the data for the second sales quartile, while the corresponding values in the third quartile are 10.74% and 8.36%. The largest difference occurs in the smallest quartile, where R&D intensity is 26.43% in the model and 101.24% in the data. However, these firms account for less than 0.1% of total sales among firms with positive R&D expenditures, which limits the impact on aggregate R&D intensity.

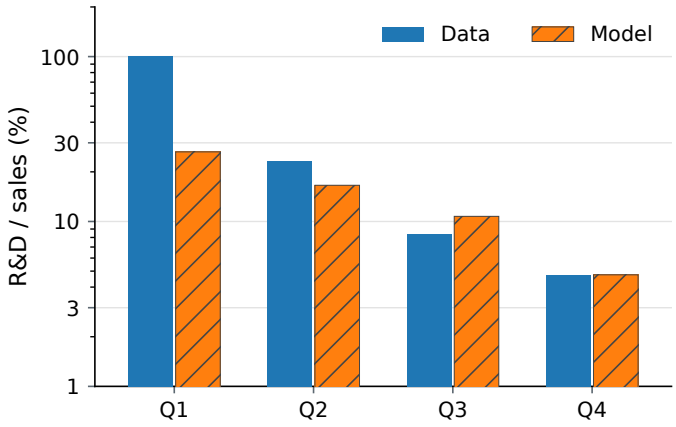

Figure 4: R&D Intensity by Firm Size

Notes: Firms with positive sales and nonnegative reported R&D are divided into sales quartiles. R&D intensity is calculated as total R&D expenditure divided by total sales within each quartile. The vertical axis is logarithmic. Firms in the smallest quartile account for 0.096% of reporter sales in the data and 0.091% in the model.

Lobbying participation and expenditure. Figure 5 compares lobbying participation and expenditure across firm-size quartiles. The model reproduces the sharp decline in lobbying expenditure relative to sales as firm size increases. Among lobbying firms, the expenditure-to-sales ratio falls from 125.53 basis points in the smallest quartile to 1.26 basis points in the largest, closely matching the corresponding data values of 121.49 and 1.18 basis points.

The model captures the positive relationship between firm size and lobbying participation, with lobbying concentrated among larger firms. However, it understates participation among smaller firms. In the lowest sales quartile, 8.43% of firms lobby in the data, compared with only 0.014% in the model. One dimension absent from our framework is indirect political representation through lobbying associations, which allows firms to pursue collective lobbying without individually bearing the fixed costs of political access. We abstract from this channel given its relatively small share of total lobbying expenditure. Thus, while the model reproduces the broad relationship between firm size and lobbying participation, it does not fully capture lobbying activity among smaller firms. However, the smaller firms have limited effects on innovation, due to non-positive R&D expenditures.

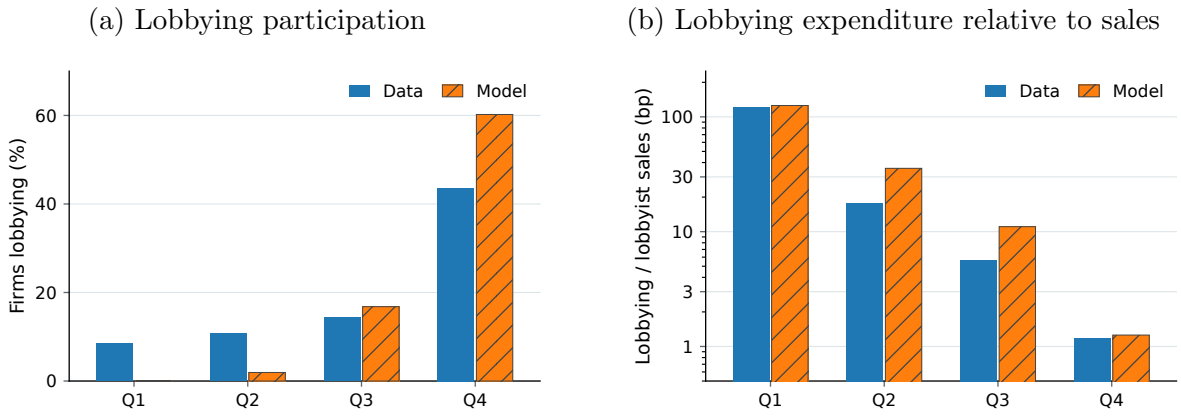

Figure 5: Lobbying Participation and Expenditure by Firm Size

Notes: Firms are ranked into sales quartiles separately in the data and the stationary model. Panel (a) reports the share of firms engaging in lobbying. Panel (b) reports lobbying expenditure relative to sales among lobbying firms, expressed in basis points on a logarithmic scale. Model moments are weighted by stationary firm mass and lobbying participation probabilities. The smallest-quartile spending rate in the model is based on a very small mass of lobbyists.

4.2 Complete Lobbying Shutdown

We now are ready to address the central questions of our paper: how does lobbying impact innovation and economic growth? What are the implications for policy intervention and transition dynamics? We begin by quantifying the long-run consequences of eliminating lobbying. We compare the benchmark economy with a counterfactual in which lobbying is prohibitively costly, so that no firm lobbies.

Table 5 reports the results. Eliminating lobbying raises annual productivity growth from 2.73% to 2.89%, an increase of 0.164 percentage point. Aggregate R&D expenditure relative to sales rises from 5.16% to 8.52%. Absent of lobbying, there will be less concentration in the market, as the top 1% sales share will decrease by 3.07 percentage points. A key result is that growth accelerates even though the average probability of successful innovation falls by 0.40 percentage point. Therefore, to achieve a higher growth rate, it's not sufficient to only increase successful innovations, but the type of innovation and as a result, who does the innovation matters. Now we will show that shutting down lobbying will lead to a reallocation of innovation toward more productive firms, rather than simply an increase in the total

number of successful innovations.

Table 5: Aggregate effects of eliminating lobbying

Outcome	Benchmark	No lobbying	Change
Annual log productivity growth ($100g$)	2.729	2.894	+0.164 pp
R&D/sales, all firms (%)	5.160	8.522	+3.362 pp
Expected successes per firm (%)	56.77	56.37	−0.40 pp
Productivity-weighted successes (Q/B, %)	64.09	66.91	+2.82 pp
Top 1% sales share (%)	41.98	38.91	−3.07 pp
Top 1% share of R&D, ranked by sales (%)	27.59	37.69	+10.10 pp

Notes: Columns report separately solved stationary balanced-growth equilibria with the benchmark being our calibrated model and the no lobbying with a model absent of lobbying activites. R&D/sales covers all firms with positive expenditure and sales. Q/B measures their productivity-weighted incidence as defined in equation (35).

Research and innovation. Removing lobbying eliminates the direct penalty on research efficiency and changes firm's incentives to invest in R&D. Although aggregate R&D intensity increases substantially, the average innovation-success probability declines from 56.77% to 56.37%. This is because research has diminishing returns and innovation opportunities differ across firms: higher aggregate spending need not produce more successes when its allocation changes. In contrast, productivity-weighted successes, Q/B, rise from 64.09% to 66.91%. To improve economic growth, it is important to address who conducts successful innovations and not simply how many successful innovations occur.

Decomposing the growth effect. To distinguish changes in innovation decisions from changes in the firm distribution, let F denote the stationary distribution of relative productivity $\tilde{z} = z/A$, and let $\bar{\nu}(\tilde{z})$ be the average innovation-success probability conditional on $\tilde{z}$. Define

$$B(F) = \int \tilde{z}^{(\sigma-1)\rho_z} \, \mathrm{d}F,$$

$$Q(F, \bar{\nu}) = \int \tilde{z}^{(\sigma-1)\rho_z} \bar{\nu}(\tilde{z}) \, \mathrm{d}F,$$

$$M(F) = \int \tilde{z}^{\sigma-1} \, \mathrm{d}F.$$

Here $B(F)$ measures the pre-innovation productivity, $Q(F, \bar{\nu})$ weights expected successes by firm's productivity, and $M(F)$ is the CES aggregate productivity. The growth identity can be written as:

$$g(F, \bar{\nu}) = \frac{1}{\sigma - 1} \log \left[\frac{(1 - \delta) \left[B(F) + \left(e^{(\sigma-1)\lambda} - 1 \right) Q(F, \bar{\nu}) \right]}{M(F) - \delta} \right]. \tag{44}$$

In each stationary equilibrium $M(F) = 1$; retaining this term allows us to evaluate counterfactual combinations of the two economies distributions and innovation policy functions. The conditional profile $\bar{\nu}(\tilde{z})$ reflects both research policies and the composition of firm types at each productivity level.

We decompose the growth difference by replacing the productivity distribution F and the conditional success profile $\bar{\nu}(\tilde{z})$ with their no-lobbying counterparts, averaging across the two possible replacement orders. Table 6 gives

$$\Delta g \simeq \underbrace{\Delta g_{\bar{\nu}}}_{+0.189} + \underbrace{\Delta g_F}_{-0.025} \simeq +0.164 \quad \text{percentage points per year.} \tag{45}$$

The increase in productivity growth reflects two effects:

1. **Innovation effect ($\Delta g_{\bar{\nu}}$).** Changes in the probability of successful innovation across productivity levels, holding the productivity distribution fixed. Eliminating lobbying shifts innovation toward more productive firms, increasing annual growth by 0.189 percentage points.

2. **Distribution effect (Δg_F).** Changes in the distribution of firms across productivity levels, holding the conditional innovation policy functions fixed. This adjustment reduces annual growth by 0.025 percentage points, partially offsetting the innovation effect.

Changing innovation-success probabilities conditional on productivity contributes 0.189 percentage point to annual growth. The change in the productivity distribution offsets 0.025 point, leaving a net increase of 0.164 percentage point in economic growth .

Table 6: Decomposition of the productivity-growth gain

Component	Annual log percentage points
Innovation success conditional on productivity	+0.189
Productivity distribution	−0.025
Total growth gain	+0.164

Notes: Contributions average the two orders of replacing F and $\bar{\nu}(\tilde{z})$ in equation (44). The first term, which is the conditional innovation success, holds the productivity distribution fixed by allows policy functions to respond to no lobbying, whereas the productivity distributions holds policy functions fixed by allows the distribution of firm types to endogenously respond. Components use the continuum growth identity; the total growth gain is the difference between solved stationary growth rates.

Which firms innovate? Figure 6 illustrates how eliminating lobbying reallocates innovation across firms. We divide firms into productivity quintiles using the benchmark distribution and retain the same boundaries in the counterfactual. Following the lobbying shutdown, the bottom quintile's share of firm mass increases by 1.4 percentage points, while the top quintile's share declines slightly. However, innovation probabilities move in the opposite direction: the probability of success falls by 4.6 percentage points in the bottom quintile and rises by 2.4 percentage points in the top quintile.

The underlying mechanism operates through changes in firm's incentives to innovate. Lobbying allows firms to expand through favorable policy treatment without improving their underlying productivity, while simultaneously reducing the effectiveness of R&D. Eliminating lobbying removes these distortions and changes the relative returns to research across firms. In equilibrium, successful innovations become more concentrated among productive firms, even as innovation declines among less productive firms. Because productivity improvements at more productive firms contribute more to aggregate productivity, this reallocation raises economic growth despite a decline in the overall number of successful innovations.

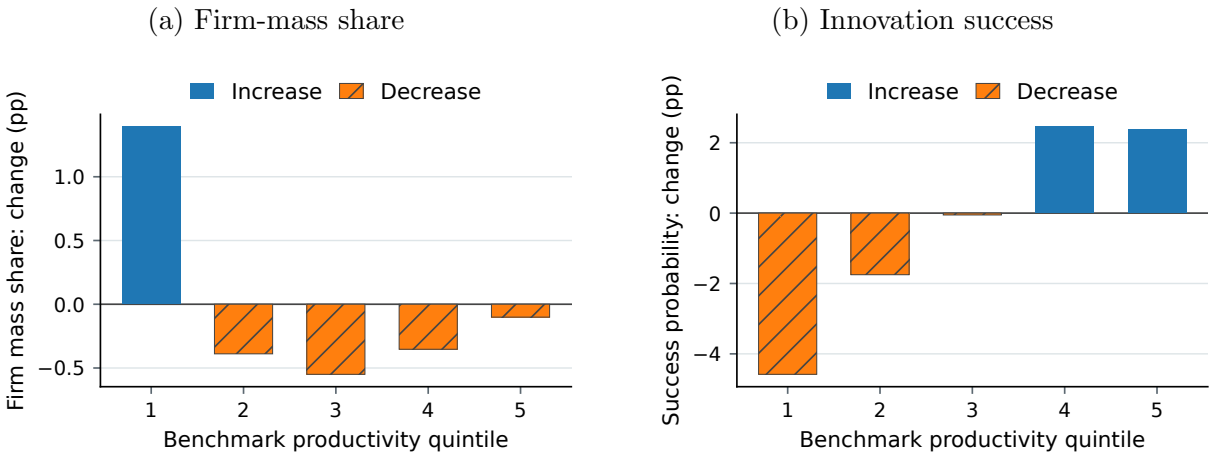

Figure 6: Changes in the firm distribution and innovation after lobbying shutdown

Notes: Productivity quintiles contain equal benchmark firm mass and retain the same boundaries in both equilibria. Bars report counterfactual minus benchmark, in percentage points. Panel (a) shows changes in firm-mass shares; panel (b) shows changes in conditional innovation probabilities. For the decomposition in Table 6 we use the full productivity distribution rather than quintile averages.

Figure 7 illustrates how changes in R&D investment contribute to aggregate productivity growth. Panel (a) shows that R&D intensity increases most among highly productive firms but declines in the lowest productivity quintile. Panel (b) quantifies the contribution of different firms to the increase in productivity-weighted innovation. Importantly, the most productive 10% of firms account for 0.162 percentage points, or 83.7%, of the total 0.193 percentage-point increase in this component. The remaining firms contribute just 0.031 percentage points.

These findings reinforce our key mechanism: eliminating lobbying reallocates innovative activity toward more productive firms, where successful innovations have a larger impact on aggregate productivity. Importantly, the 0.193 percentage-point increase measures the innovation component of growth, rather than the total growth effect. After accounting for changes in the stationary productivity distribution and other components of economic growth, the net increase in annual growth is 0.164 percentage points.

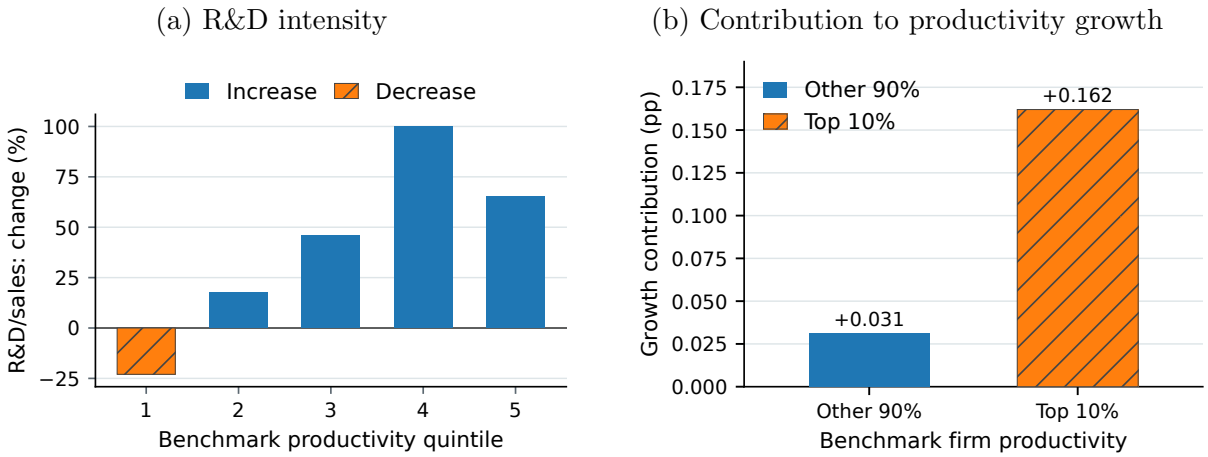

Figure 7: Research investment and the contribution of innovation to growth

Notes: Panel (a) reports percentage changes in aggregate R&D expenditure relative to sales within benchmark-productivity quintiles. Panel (b) decomposes the change in the productivity-weighted innovation component across benchmark-productivity deciles using exact log-mean weights.

Overall, eliminating lobbying raises productivity growth primarily by improving the allocation of successful innovations, rather than increasing their total number. By removing the favorable treatment associated with lobbying and its unintended consequences on research efficiency, the counterfactual shifts innovation toward more productive firms which results in larger effects on economic growth.

Our first counterfactual illustrates the potential gains from eliminating lobbying altogether. However, a complete prohibition may be difficult to implement, particularly when firms have strong incentives to obtain favorable policy distortions. A more feasible alternative is to discourage lobbying by increasing its private cost and allowing firms to adjust their participation and lobbying intensity. We therefore consider a tax on lobbying costs as advocated by Senator Elizabeth Warren and study whether more moderate policy interventions can generate similar gains in innovation and economic growth.

4.3 Taxing Private Lobbying Costs

Although eliminating lobbying generates sizable gains in productivity growth, a complete shutdown may be difficult to implement as it is a form of free speech and a protected right to petition the government as part of the first amendment. We therefore consider a less restrictive policy that discourages lobbying by increasing its private cost through taxation policy. This experiment allows us to examine whether the gains from reducing lobbying arise gradually or depend on eliminating lobbying altogether.

Specifically, we introduce a permanent tax t on both variable lobbying costs and fixed access costs, increasing these costs increase by a factor of $1 + t$, where $t \in \{0, 0.25, 0.5, 1, 2, 5, 10\}$. The additional payments, $t[c_\ell(b, \eta) + f]$, are rebated lump sum to households. We solve for a new stationary equilibrium at each tax rate, holding all other parameters and the entry process fixed. Unlike the complete shutdown, these policy interventions still allow firms to engage in lobbying activities, thus they can adjust both their participation and lobbying intensity.

Table 7: Impact of Lobbying Taxation on Macroeconomic Aggregates

Outcome	**0%**	**100%**	**500%**	**1,000%**	**Shutdown**
Lobbying firms (%)	19.74	16.54	11.55	9.07	0.00
Lobbying expenditure/sales (bp)	1.066	0.752	0.411	0.285	0.000
R&D/sales (%)	5.160	5.350	5.725	5.973	8.522
Annual log productivity growth (%)	2.729	2.772	2.828	2.851	2.894
Normalized output (Y/A)	0.3965	0.3993	0.4041	0.4069	0.5100
Tax revenue/sales (%)	0.000	4.560	7.692	8.560	—

Notes: Each tax policy rate corresponds to a separately solved stationary equilibrium. A tax t increases both variable lobbying costs and fixed access costs by a factor of $1 + t$. Additional payments are rebated lump sum to households. Lobbying expenditure/sales is measured in basis points relative to aggregate sales, while R&D/sales covers all firms. Normalized output is Y/A; Complete shutdown is a separate counterfactual without a lobbying tax. Taxation introduces no additional labor or resource costs.

Aggregate effects. Table 7 and Figure 8 show that higher lobbying regulations through taxation reduce lobbying activities, increase R&D investment and productivity growth. A 100% tax on lobbying reduces lobbying participation from 19.74% to 16.54% and increases

normalized output by 0.70%. Larger tax policies generate larger macroeconomic gains, but the response remains modest relative to complete shutdown. Even a tax policy as large as 1,000% tax on lobbying raises normalized output by only 2.62%, compared with 28.64% when lobbying is completly eliminated.

The difference reflects the persistence of lobbying among firms with the strongest incentives to obtain favorable policy treatment. Even when firms are subject to 1000% lobbying taxes, 9.07% of firms continue to lobby, accounting for 63.25% of aggregate sales, compared with 77.04% in the benchmark. These firms retain favorable output distortions, limiting the extent to which higher lobbying costs eliminate the underlying distortions. The innovation response is also substantially smaller than under complete lobbying shutdown. At the 1,000% lobbying tax , aggregate R&D intensity reaches 5.97%, compared with 8.52% without lobbying, while annual productivity growth rises to 2.85%, compared with 2.89% under shutdown. Thus, although taxing lobbying improves economic outcomes, substantial gains remain unrealized as long as firms still have the incentive to lobby for policy distortions.

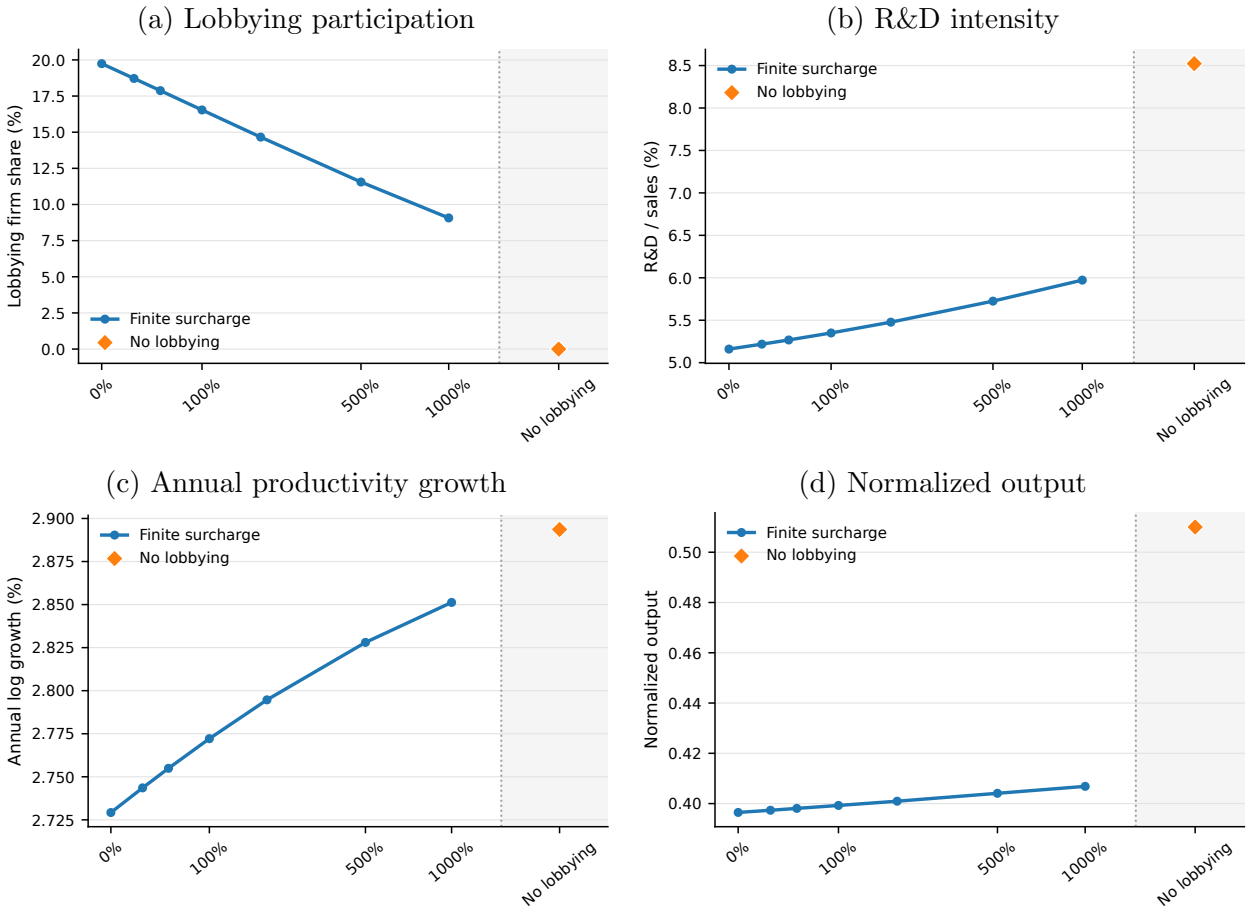

Figure 8: Effects of Tax on Lobbying

Notes: Blue points represent stationary equilibria under tax rates of 0%, 25%, 50%, 100%, 200%, 500%, and 1,000%, plotted against $\log(1+t)$. The orange dot represents complete lobbying shutdown, shown separately from the finite-tax schedule.

4.4 Transition Dynamics

In our first set of counterfactuals we characterize the long-run effects of higher lobbying costs through complete shutdown and taxation policy. We now examine how firms and aggregate productivity adjust following a policy change, distinguishing the immediate response of lobbying and R&D from the gradual accumulation of productivity gains.

We start from the baseline calibrated balance growth-path equilibrium. We introduce an unexpected and permanent 25% tax on both variable lobbying costs and fixed access costs. In this exercise, firms will now re-optimize their lobbying, production, and R&D decisions along a perfect-foresight transition path, taking into account the anticipated evolution of aggregate conditions as given. Labor markets clear, the aggregate productivity index remains correctly normalized, and the household budget constraint holds in each period. Consistent with logarithmic household utility, the nominal discount factor is $\beta E_t/E_{t+1}$, where $E_t = P_t C_t$ denotes aggregate sales. As in the stationary experiments, lobbying payments and tax revenues are treated as transfers.

Short-run adjustment and long-run gains. In the short run, the tax policy has an immediate adjustment effect in firm's decisions. On impact, lobbying participation falls from 19.74% to 18.64%, while aggregate R&D intensity increases from 5.160% to 5.216%. Most of the adjustment in these decisions occur on impact, reflecting firm's endogenous responses to the higher cost of lobbying activities. Aggregate productivity growth also responds quickly, increasing from 2.729% to 2.759% on impact, temporarily exceeding its new long-run balance growth path rate of 2.744%. Growth subsequently converges toward the taxed stationary equilibrium as the distribution of firm productivity continuously adjust over time. While changes in lobbying and research incentives are largely immediate, their effects on aggregate productivity accumulate over time.

To quantify these gains, we compare the transition with the unchanged-policy balanced-growth path, $Y_t^0 = Y_0^0 e^{g_0 t}$, starting from the same initial aggregate technology. The resulting

percentage difference in real output is

$$\Delta Y_t = 100 \left(\frac{Y_t^{\text{tax}}}{Y_t^0} - 1 \right). \tag{46}$$

As shown in Figure 9, the output gain is initially small, reaching 0.036% on impact and 0.582% after 20 years. After 100 years, real output is 1.80% higher than along the unchanged-policy path. These results highlight how even modest changes in annual productivity growth can generate meaningful differences in output over time.

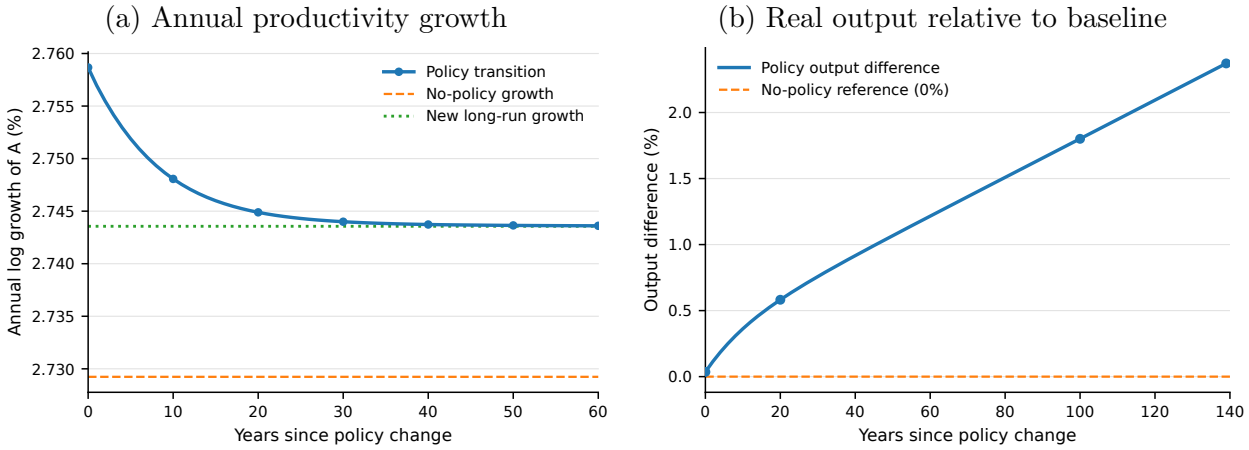

Figure 9: Transition Dynamics: 25% Lobbying Tax

Notes: The economy begins at the baseline calibrated stationary equilibrium, and the policy change is unanticipated at $t = 0$. Panel (a) reports annual productivity growth over the first 60 years, together with the initial and new stationary growth rates. Panel (b) reports the percentage difference in real output relative to the unchanged-policy balanced-growth path over 140 years. Both paths start from the same initial aggregate technology. Importantly here we do not interpret output differences as welfare measures.

5 Conclusion

We examine how corporate lobbying affects firm innovation and aggregate productivity growth using U.S. firm-level data and a quantitative model in which heterogeneous firms jointly choose lobbying and R&D. Empirically, an instrumental-variable strategy based on political access indicates that lobbying increases sales and research expenditure while reducing forward patent citations. Quantitatively, eliminating lobbying raises annual productivity growth by 0.16

percentage point and aggregate R&D intensity by 3.36 percentage points. The growth gain is driven primarily by successful innovations becoming more concentrated among productive firms, where technological improvements contribute more to aggregate productivity. Growth therefore increases despite a slight decline in the total number of successful innovations. Our analysis shows that lobbying impacts long-run productivity growth through the allocation of R&D innovations across firms. Further work would benefit from linking lobbying to specific policies, such as R&D subsidies and entry barriers, and examine how political influence shapes the direction of future innovation.

Appendix

A Data and Additional Empirical Results

We give the specification and sample details behind the empirical estimates. We then report matched-sample results and additional patent-output measures that help interpret the main-text evidence.

A.1 Empirical Specification and Matched Samples

For our empirical specification, we average annual data observations over 1998–2003 and 2004–2009 and take the change between the two period means. For example, for any variable V_{it} of our interest, we allow ΔV_i to denote the difference between these two period averages. For outcome Y, the key estimating equation we assess is:

$$\Delta Y_i = \beta_Y \Delta \ln \text{Lobby}_i + X_i' \gamma_Y + \delta_{j(i)} + u_{iY}. \tag{A1}$$

Suppose that we are interested in the number of patents issued which is $Y = \ln P$, then in that case we will define ΔY_i as a change in the mean of annuallog patent counts, not the logarithm of a period mean. In the data, we may observe some firms that do not engage in lobbying in some particular years, in which case annual log lobbying is set to zero when reported expenditure is zero. The key instrument that we leverage is the change in the period mean of a binary indicator for whether a member of Congress from the firm's headquarters state chairs the House or Senate Appropriations Committee. For example, if Senator Ted Cruz from Texas, chairs a particular committee, then a company such as Tesla whom has headquarters based in the state of Texas will have incentives to lobby that particular congressional committee.

The set of control variables that we include are changes in corporate income taxes, job-creation tax credits, investment tax credits, R&D tax credits, property-tax abatements,

federal transfers, and state-industry wages, together with initial lobbying status and four-digit SIC fixed effects. We implement standard errors which are clustered by state level. We report the Kleibergen–Paap statistic and Anderson–Rubin tests in addition to conventional IV inference to test for statistical significance.

Table A1 compares sales, R&D, and R&D/sales on the same 910 firms with positive observed sales and R&D expenditure In particular, we do not include non-innovating firms, in particular, firms with zero R&D expenditure are excluded from our log regression specifications; we do not report missing R&D expenditure to be recoded and equal to zero. Unlike our main empirical results, the R&D/sales coefficient exactly equals the R&D coefficient minus the sales coefficient in this specification with common sample analysis. The matched-sample first stage has KP-$F = 7.22$, compared with 12.46 for the broader sales regression in Table 1.

Table A1: Lobbying, sales, R&D expenditure, and R&D intensity

Dependent variable	$\Delta \ln$ Sales		$\Delta \ln R\&D$		$\Delta \ln(R\&D/\text{Sales})$	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Second stage						
$\Delta \ln \text{Lobby}_{it}$	0.061***	0.311***	0.038***	0.187**	−0.023**	−0.124*
	(0.013)	(0.112)	(0.007)	(0.070)	(0.012)	(0.089)
Panel B. First stage and inference						
Political-access instrument		0.850**		0.850**		0.850**
		(0.316)		(0.316)		(0.316)
KP-F		7.22		7.22		7.22
AR		8.28		4.68		3.20
AR p-value		< 0.01		0.031		0.074
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	910	910	910	910	910	910

Notes: All specifications use the same sample of 910 firms with positive observed sales and R&D expenditure in both periods. Dependent variables are differences in period averages of annual log outcomes. The R&D intensity coefficient equals the difference between the R&D expenditure and sales coefficients estimated on the common sample; its standard error is estimated directly. All specifications include controls and four-digit SIC industry fixed effects. Standard errors clustered at the state level are reported in parentheses. KP-F denotes the Kleibergen–Paap statistic, and AR denotes the Anderson–Rubin statistic for the null of a zero coefficient. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

A.2 Alternative measures of innovations

We now describe ome alternative measures of innovation efforts beyond R&D expenditure. Patent outcomes use annual $\log Y$ without an added constant. We establish outcome-specific coverage, remove annual zeros, average the remaining annual logs within each period, and to for variables to be included we ensure they have positive values across time periods. In particular, our current samples describe the intensive margin of innovation efforts. The patent, citation, and citation-weighted samples differ, so coefficients should not be subtracted across those outcome-specific samples. The citations-per-patent regression instead constructs $\log C - \log P$ on the same positive-citation annual observations, making its coefficient exactly the same-sample difference. The pure-log citations/R&D regression instead keeps available annual observations with both positive citations and positive R&D, without the complete-citation-coverage screen used for total citation output. Its 605-firm sample and the 629-firm citation sample overlap for 543 firms; neither is nested within the other. The ratio sample spans 37 state clusters, compared with 40 for citation output. First stages are therefore estimated on different firm and state samples. For the patent-output transformation check, we estimate four log and log-plus-offset specifications for each of patent counts, forward citations, citation-weighted output, and patent value: 16 IV tests in total. Holm adjustment of their Anderson–Rubin p-values gives 0.363 for the positive-log patent-count specification and less than 0.001 for the positive-log forward-citation specification in Table 2. This adjustment applies to this specified transformation family, not to every outcome that we study in the paper. We also implement Poisson specifications to model levels, retain zeros, and use R&D as an exposure. They are robustness checks rather than equivalents of equation (A1).

Table A2: Additional patent-output estimates and citation decomposition

Dep.	$\Delta \ln P$		$\Delta \ln C$		$\Delta \ln(C/P)$		$\Delta \ln W$	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Second stage								
$\Delta \ln \text{Lobby}_{it}$	0.007	−0.165**	0.007	−0.364***	0.008	−0.213	0.012	−0.385**
	(0.009)	(0.063)	(0.016)	(0.130)	(0.011)	(0.137)	(0.013)	(0.147)
Panel B. First stage and inference								
Political-access instrument		0.873**		1.029***		1.029***		0.928***
		(0.427)		(0.308)		(0.308)		(0.298)
KP-F		4.18		11.15		11.15		9.71
AR		4.18		35.32		5.74		25.25
AR p-val.		0.041		< 0.001		0.017		< 0.001
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	759	759	629	629	629	629	687	687

Notes: P is the patent count, C is total five-year forward citations, C/P is citations per patent, and $W = P + C$ is citation-weighted patent output. The C/P columns use the same positive-citation observations as columns 3–4. Here $\Delta \ln X$ abbreviates the change between the two period averages of annual $\ln X$, as defined in Appendix A. Every specification includes the controls and fixed effects described in Appendix A. Standard errors are clustered by state. KP-F is the Kleibergen–Paap statistic; AR is the Anderson–Rubin zero-null statistic. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A3: Additional patent-output-per-R&D estimates

	$\Delta \ln(P/R)$		$\Delta \ln(C/R)$		$\Delta \ln(W/R)$	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Second stage						
$\Delta \ln \text{Lobby}_{it}$	−0.025***	−0.027	−0.021	−0.356	−0.016	−0.264
	(0.009)	(0.098)	(0.016)	(0.278)	(0.012)	(0.288)
Panel B. First stage and inference						
Political-access instrument		0.868*		0.946**		0.872*
		(0.471)		(0.459)		(0.471)
KP-F		3.40		4.25		3.43
AR p-value		0.763		0.006		0.120
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	650	650	605	605	649	649

Notes: P is the patent count, C is total five-year forward citations, R is real R&D expenditure, and $W = P + C$ is citation-weighted patent output. Here $\Delta \ln X$ abbreviates the change between the two period averages of annual $\ln X$. These outcomes require positive annual output and R&D in both periods. Every specification includes the controls, fixed effects, and sample rules described in Appendix A. Standard errors are clustered by state. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

B Derivations and Proofs

In this section, we first prove the four model implications in Section 3.4. They establish how lobbying changes firm scale, selection, the cost of innovation, how a change in lobbying cost affects research choices, and when research is allocated efficiently across firms at a fixed budget. We then conclude by discussing the micro-foundations for lobbying and innovation activities in a general framework.

B.1 Proof of Proposition 1

We note that the first three derivatives of Proposition 1 directly follow Equations (27) and (28) . Now to derive the final derivative of Proposition 1, we specify the discounted gain from a successful innovation, $\mathcal{V} = \beta(1-\delta)\mathbb{E}[V(\Omega'_{\text{success}}) - V(\Omega'_{\text{failure}})] > 0$, is therefore independent of current lobbying efforts, b. The firm chooses ν to maximize $\mathcal{V}\nu - R(\nu, b)$. We differentiate the expenditure function in (28) which gives us following interior condition:

$$\mathcal{V} = \frac{R(\nu^*, b)}{\alpha(1-\nu^*)[-\log(1-\nu^*)]}. \tag{B1}$$

Suppose we fix $\mathcal{V}$ and differentiate the function above, gives us the following condition:

$$\frac{\partial \log[-\log(1-\nu^*)]}{\partial \log b} = -\frac{\theta[\alpha(\sigma-1)+\xi]}{\alpha[-\log(1-\nu^*)]+1-\alpha} < 0. \tag{B2}$$

Since $\mathrm{d}\nu = (1-\nu)[-\log(1-\nu)]\,\mathrm{d}\log[-\log(1-\nu)]$, this gives the final derivative in Proposition 1.

B.2 Proof of Proposition 2

Consider a firm that enters the economy with a particular state Ω and let $\mathcal{V}(\Omega) > 0$ be the discounted value gain from a successful innovation. For a given lobbying effort b, define

$$\mathcal{G}(b;\Omega) = \max_{0\leq\nu<1} \left\{\mathcal{V}(\Omega)\nu - R(\nu,b)\right\}.$$

The gain from choosing to engage in lobbying activities, before paying the fixed access cost, is

$$\Delta V(\Omega) = \max_{b\geq 1} \Big\{\pi^o(1)(b^{\sigma\theta}-1) - c_\ell(b,\eta) + \mathcal{G}(b;\Omega) - \mathcal{G}(1;\Omega)\Big\}. \tag{B3}$$

Given the value of the firm and the fixed cost of engaging in lobbying activities, a particular firm participates in lobbying if and only if the value-added is sufficiently larger than the fixed cost.

$$\Delta V(\Omega) \geq f.$$

Recall that we assume f is drawn from the distribution F_f, the participation probability is therefore

$$\chi_1(\Omega) = F_f\big(\Delta V(\Omega)\big).$$

We next characterize the effect of research ability on lobbying incentives. From equation (28), holding ν and b fixed,

$$\frac{\partial R(\nu,b)}{\partial \phi} = -\frac{R(\nu,b)}{\alpha\phi}.$$

We apply the envelope theorem to the optimized research surplus, which gives the following

equation:

$$\frac{\partial \mathcal{G}(b;\Omega)}{\partial \phi} = \nu^*(b)\frac{\partial \mathcal{V}}{\partial \phi} + \frac{R^*(b)}{\alpha\phi}.$$

Suppose, the lobbying optimum is an interior solution, which means at the differentiable interior lobbying optimum, the envelope theorem will imply

$$\begin{aligned}\frac{\partial \Delta V}{\partial \phi} &= \frac{\partial \mathcal{G}(b^*;\Omega)}{\partial \phi} - \frac{\partial \mathcal{G}(1;\Omega)}{\partial \phi} \\ &= \frac{R_1^* - R_0^*}{\alpha\phi} + (\nu_1^* - \nu_0^*)\frac{\partial \mathcal{V}}{\partial \phi}. \end{aligned} \tag{B4}$$

Because lobbying raises the expenditure required to achieve any given innovation probability, optimal research choices satisfy $\nu_1^* \leq \nu_0^*$.

Therefore, if

$$R_1^* \leq R_0^*, \qquad \frac{\partial \mathcal{V}}{\partial \phi} \geq 0,$$

then

$$\frac{\partial \Delta V}{\partial \phi} \leq 0.$$

Since F_f is a non-decreasing probability function, then it is the case that a higher research ability weakly reduces the probability of lobbying participation.

B.3 Proof of Proposition 3

We characterize the response of lobbying effort, innovation probability, and R&D expenditure to a change in lobbying costs. Importantly, the changes in lobbying costs do not impact the extensive margin of lobbying, i.e the participation margin of lobbying.

Suppose $k = 1 + t$ is the tax-adjusted multiplier on lobbying costs.

Optimal research choice. Given a lobbying effort $b \geq 1$, the lobbying expenditure that is required to get an innovation probablity ν is

$$R(\nu, b) = \kappa_R s(1) \phi^{-1/\alpha} b^{\zeta/\alpha} H(\nu)^{1/\alpha}, \tag{B5}$$

where

$$H(\nu) = -\log(1-\nu), \qquad \zeta = \theta[\alpha(\sigma-1)+\xi] > 0.$$

Let $\mathcal{V} > 0$ be the value gain from a successful innovation. Conditional on lobbying effort, a particular firm solves

$$\max_{0 \leq \nu < 1} \{\mathcal{V}\nu - R(\nu, b)\}. \tag{B6}$$

Since $0 < \alpha < 1$, the research expenditure function is strictly convex in ν. Therefore, as a result the optimal choice of research effort is an interior solution and therefore it is unique.

The first-order condition is

$$\mathcal{V} = \frac{R(\nu^*, b)}{\alpha(1-\nu^*)H(\nu^*)}. \tag{B7}$$

Taking logarithms and differentiating with respect to $\log b$, holding $\mathcal{V}$ fixed, gives

$$\frac{\mathrm{d}\log H(\nu^*)}{\mathrm{d}\log b} = -\frac{\zeta}{\alpha H(\nu^*) + 1 - \alpha}. \tag{B8}$$

Using $\mathrm{d}\nu = (1-\nu)H(\nu)\,\mathrm{d}\log H(\nu)$, we get

$$\frac{\mathrm{d}\nu^*}{\mathrm{d}\log b} = -\frac{\zeta(1-\nu^*)H(\nu^*)}{\alpha H(\nu^*) + 1 - \alpha} < 0. \tag{B9}$$

Therefore, we have shown that more lobbying effort reduces the optimal innovation probability, given a firm's state and value functions.

Optimal lobbying choice. First, we define the optimized research surplus for a particular firm as follows

$$\mathcal{G}(b;\Omega) = \max_{0\leq\nu<1} \{\mathcal{V}\nu - R(\nu, b)\}. \tag{B10}$$

Let $q = \log b$. Conditional on a firm engaging in lobbying activities, we can define the lobbying objective function, once research effort is optimized as follows

$$J(q;k) = \pi^o(e^q) + \mathcal{G}(e^q;\Omega) - kc_\ell(e^q,\eta). \tag{B11}$$

Using the envelope theorem, we derive

$$\frac{\partial \mathcal{G}}{\partial q} = -\frac{\zeta}{\alpha}R^*. \tag{B12}$$

From the lobbying technology and variable cost function,

$$\frac{\partial \pi^o}{\partial q} = \sigma\theta\pi^o, \qquad \frac{\partial c_\ell}{\partial q} = \gamma_\ell c_\ell.$$

We can derive the FOC for optimal lobbying activity as follows

$$\sigma\theta\pi^o(b^*) - \frac{\zeta}{\alpha}R^* - k\gamma_\ell c_\ell(b^*,\eta) = 0. \tag{B13}$$

The intuition from the FOC is intuitive, the marginal benefit of lobbying equals the sum of its direct marginal cost and the marginal reduction in optimized research surplus.

Suppose the object function (once firms optimize research effort) satisfies second-order condition, in particular:

$$J_{qq}(q^*;k) < 0. \tag{B14}$$

Differentiating the lobbying first-order condition with respect to $\log k$ gives us

$$J_{qq}(q^*;k)\frac{\mathrm{d}q^*}{\mathrm{d}\log k} - k\gamma_\ell c_\ell(b^*,\eta) = 0. \tag{B15}$$

$$\frac{\mathrm{d}\log b^*}{\mathrm{d}\log(1+t)} = \frac{(1+t)\gamma_\ell c_\ell(b^*,\eta)}{J_{qq}(q^*;1+t)} < 0. \tag{B16}$$

A key result we have shown here is that a higher lobbying tax reduces optimal lobbying effort. Combining this result with equation (B9) gives us the result that a higher lobbying tax increases the optimal probability of innovation

$$\frac{\mathrm{d}\nu^*}{\mathrm{d}\log(1+t)} = \frac{\mathrm{d}\nu^*}{\mathrm{d}\log b^*}\frac{\mathrm{d}\log b^*}{\mathrm{d}\log(1+t)} > 0. \tag{B17}$$

How does R&D expenditure respond? How does R&D expenditure respond to an increase in lobbying costs? We start from the research expenditure function,

$$\log R^* = \log\left(\kappa_R s(1)\phi^{-1/\alpha}\right) + \frac{\zeta}{\alpha}\log b^* + \frac{1}{\alpha}\log H(\nu^*). \tag{B18}$$

Differentiating with respect to $\log b$ gives

$$\begin{aligned}\frac{\mathrm{d}\log R^*}{\mathrm{d}\log b} &= \frac{\zeta}{\alpha} + \frac{1}{\alpha}\frac{\mathrm{d}\log H(\nu^*)}{\mathrm{d}\log b} \\ &= \frac{\zeta}{\alpha} - \frac{\zeta}{\alpha[\alpha H(\nu^*)+1-\alpha]} \\ &= \frac{\zeta[H(\nu^*)-1]}{\alpha H(\nu^*)+1-\alpha}.\end{aligned} \tag{B19}$$

$$\frac{\mathrm{d}\log R^*}{\mathrm{d}\log(1+t)} = \frac{\zeta[H(\nu^*)-1]}{\alpha H(\nu^*)+1-\alpha}\frac{\mathrm{d}\log b^*}{\mathrm{d}\log(1+t)}. \tag{B20}$$

Since $\zeta > 0$, $0 < \alpha < 1$, and $\mathrm{d}\log b^*/\mathrm{d}\log(1+t) < 0$, the response of R&D expenditure therefore is conditional on $H(\nu^*) - 1$.

In particular,

$$\begin{aligned}\nu^* < 1 - e^{-1} &\implies \frac{\mathrm{d}\log R^*}{\mathrm{d}\log(1+t)} > 0, \\ \nu^* > 1 - e^{-1} &\implies \frac{\mathrm{d}\log R^*}{\mathrm{d}\log(1+t)} < 0.\end{aligned}$$

At $\nu^* = 1 - e^{-1}$, the local response of R&D expenditure to an increase in lobbying costs is zero.

B.4 Proof of Proposition 4

Consider $K < \infty$ groups with masses $\mu_i > 0$, productivity weights $w_i > 0$, and innovation technologies

$$\nu_i(R_i) = 1 - \exp(-A_i R_i^{\alpha}), \qquad A_i > 0, \quad 0 < \alpha < 1, \tag{B21}$$

where $A_i = a_i / s_i^{\alpha}$ and R_i is the per-firm R&D expenditure. Define

$$Q(\mathbf{R}) = \sum_{i=1}^{K} \mu_i w_i \nu_i(R_i), \qquad M_i(R_i) = w_i \nu_i'(R_i).$$

(i) Research reallocation and growth. Consider a transfer that is budget neutral ε from group j to group i, such that

$$R_i(\varepsilon) = R_i + \frac{\varepsilon}{\mu_i}, \qquad R_j(\varepsilon) = R_j - \frac{\varepsilon}{\mu_j}.$$

For a feasible and small enough transfer, we can differentiate and get

$$\left.\frac{\mathrm{d}Q}{\mathrm{d}\varepsilon}\right|_{\varepsilon=0} = w_i \nu_i'(R_i) - w_j \nu_j'(R_j) = M_i - M_j. \tag{B22}$$

Let $c_\lambda = e^{(\sigma-1)\lambda} - 1 > 0$. Fixing the distribution of firm types, we can characterize the aggregate growth as follows

$$\widehat{g}(\mathbf{R}) = \frac{1}{\sigma - 1} \log\left[B + c_\lambda Q(\mathbf{R})\right].$$

Since B is fixed,

$$\left.\frac{\mathrm{d}\widehat{g}}{\mathrm{d}\varepsilon}\right|_{\varepsilon=0} = \frac{c_\lambda}{(\sigma-1)(B + c_\lambda Q)}(M_i - M_j). \tag{B23}$$

The multiplicative term is strictly positive. Therefore, the transfer must increases aggregate growth if and only if $M_i > M_j$.

(ii) Optimal research allocation. First, we fix the aggregate R&D expenditure $\bar{R} > 0$, and consider

$$\begin{aligned} \max_{\{R_i \geq 0\}_{i=1}^K} \quad & Q(\mathbf{R}) \\ \text{subject to} \quad & \sum_{i=1}^K \mu_i R_i = \bar{R}. \end{aligned} \tag{B24}$$

For $R_i > 0$,

$$\begin{aligned} \nu_i''(R_i) = \alpha A_i R_i^{\alpha-2} e^{-A_i R_i^\alpha} \\ \times \left[(\alpha - 1) - \alpha A_i R_i^\alpha\right] < 0. \end{aligned} \tag{B25}$$

Thus, Q must be strictly concave. The feasible set is nonempty, compact, and convex which ensures that a unique global maximizer therefore must exist

Suppose,

$$\lim_{R_i \to 0} M_i(R_i) = +\infty.$$

Since $\bar{R} > 0$, any allocation with $R_i = 0$ for some group i can be improved by transferring an arbitrarily small amount of R&D from a group with positive expenditure to group i. The unique maximizer is therefore interior.

The Lagrangian first-order conditions imply

$$\mu_i \big[M_i(R_i^*) - \Lambda\big] = 0, \qquad i = 1, \ldots, K. \tag{B26}$$

Since $\mu_i > 0$,

$$M_i(R_i^*) = \Lambda \qquad \forall i. \tag{B27}$$

Strict concavity establishes that these conditions, together with the budget constraint, are necessary and sufficient for the unique global maximum.

(iii) Private and aggregate returns. A particular firm in group i solves

$$\max_{R_i \geq 0} \{\mathcal{V}_i \nu_i(R_i) - R_i\},$$

where $\mathcal{V}_i > 0$ is the discounted private gain from a successful innovation, taken as given.

The unique interior private optimum satisfies

$$\mathcal{V}_i \nu_i'(R_i^*) = 1. \tag{B28}$$

$$M_i(R_i^*) = w_i \nu_i'(R_i^*) = \frac{w_i}{\mathcal{V}_i}. \tag{B29}$$

By Part (ii), the decentralized allocation maximizes Q conditional on its fixed aggregate R&D expenditure if and only if

$$\frac{w_i}{\mathcal{V}_i} = \frac{w_j}{\mathcal{V}_j} \qquad \forall i, j. \tag{B30}$$

If these ratios differ, the decentralized allocation fails to maximize productivity-weighted innovation given the aggregate R&D level constraint.

C Microfoundations of Lobbying and Research Efficiency

This section provides a microfoundation for the two channels through which lobbying impacts firm outcomes in our main paper: favorable policy treatment and reduced research efficiency. We consider a political-influence mechanism in which firms invest in lobbying to impact policy decisions, while the implementation of favorable policies competes with innovation for limited managerial attention. Our micro foundations are motivated by the political-influence literature, particularly Grossman and Helpman (1994) and Bombardini and Trebbi (2020). We do not explictly model electoral competition or bargaining between organized interest groups. Instead, we characterize a policymaker's optimal response to lobbying and show how

this response generates the functional forms that we use in our model.

C.1 Political Influence and Endogenous Output Distortions

Consider a firm with exogenous output wedge $\tau_i > 0$. At the beginning of the period, the firm decides whether to participate in lobbying. A non-lobbying firm receives its baseline policy treatment τ_i. A participating firm pays a fixed access cost f_i and chooses effective lobbying input $b_i \geq 1$.

Let $q_i \geq 0$ measure the improvement in policy treatment relative to what the firm would have gotten had they not engaged in lobbying, therefore the lobbying treatment premium:

$$q_i \equiv \log\left(\frac{\tau_i^y}{\tau_i}\right). \tag{C1}$$

The policymaker can observe the lobbying input and chooses q_i to maximize

$$\max_{q_i \geq 0}\left\{\varpi(\log b_i)q_i - \frac{\kappa_P}{2}q_i^2\right\}, \qquad \varpi, \kappa_P > 0. \tag{C2}$$

The first term captures the political support associated with giving away favorable treatment to a firm with lobbying access. The second represents the increasing political and institutional cost of preferential treatment through lobbying.

The objective is strictly concave in q_i. Its unique solution is

$$q_i^*(b_i) = \frac{\varpi}{\kappa_P}\log b_i. \tag{C3}$$

We define

$$\theta \equiv \frac{\varpi}{\kappa_P} > 0,$$

and substituting into equation (C1), we obtain

$$\tau_i^y(b_i) = \tau_i \exp(q_i^*(b_i)) = \tau_i b_i^\theta. \tag{C4}$$

For non-lobbying firms, political access is limited and we normalize $q_i^* = 0$, implying $\tau_i^y = \tau_i$. The resulting policy rule which maps lobbying effort to distortions is

$$\tau_i^y = \begin{cases} \tau_i, & b_i = 0, \\ \tau_i b_i^\theta, & b_i \geq 1, \end{cases} \tag{C5}$$

which coincides with equation (5) in the main text.

The parameter θ measures the responsiveness of policy treatment to lobbying input. It increases with the political value of influence, ϖ, and decreases with the institutional cost of preferential treatment, κ_P.

C.2 Lobbying Costs and Firm Participation

Firms differ in their ability to convert lobbying services into effective political influence. Let ℓ_i denote lobbying input purchased by firm i, and suppose

$$b_i = \eta_i \ell_i, \qquad \eta_i > 0. \tag{C6}$$

The marginal private cost of engaging in lobbying activities is

$$p_\ell(\ell_i) = \kappa_\ell \ell_i^{\gamma_\ell - 1}, \qquad \gamma_\ell \geq 1.$$

Summing up the schedule of marginal costs gives us

$$\begin{aligned} c_\ell(b_i, \eta_i) &= \int_0^{b_i/\eta_i} p_\ell(u)\,\mathrm{d}u \\ &= \frac{\kappa_\ell}{\gamma_\ell} \left(\frac{b_i}{\eta_i}\right)^{\gamma_\ell}. \end{aligned} \tag{C7}$$

Thus, we can interpret the convex lobbying cost function in the main text as the cost of acquiring effective political influence through lobbying activities. The fixed access cost

captures the organizational costs of establishing political relationships and maintaining access to policymakers. Given the policymaker's response, the firm anticipates that a higher lobbying input improves its output wedge but entails higher private lobbying costs.

C.3 Managerial Attention and Research Efficiency

We now explain why favorable policy treatment may reduce the effectiveness of R&D as we model in our main text. Suppose successful innovation requires both research expenditure and managerial attention. Each firm has a fixed endowment of managerial attention, normalized to one. This endowment is firm-specific and cannot be traded across firms. As firms pursue and attempt to get preferential policy treatment through lobbying activities, this creates administrative, regulatory, and organizational tasks associated with implementing the policy advantage. These tasks naturally compete with innovation projects for managerial attention.

Let q_i denote the policy concession defined in equation (C1). Suppose government-facing tasks arrive to each unit of managerial attention according to a Poisson process with intensity q_i.

A managerial unit is available for supervising research only if it receives no such task. The fraction of managerial attention available for R&D is

$$m_i = \Pr(N_i = 0 \mid q_i) = e^{-q_i}, \qquad N_i \sim \text{Poisson}(q_i). \tag{C8}$$

This setup naturally explains the opportunity cost of pursuing favorable policy treatment through lobbying, which is that a larger policy advantage requires more managerial involvement in implementing that advantage, leaving fewer resources for research supervision.

We now characterize the firm's innovation decisions. Suppose a firm generates potential research ideas according to a Poisson process with intensity

$$h_i^0 = \phi_i \left(\frac{x_i}{\kappa_R} \right)^{\alpha}, \qquad 0 < \alpha < 1, \tag{C9}$$

where $x_i = R_i/s_i$ is R&D intensity and ϕ_i measures research ability.

Each potential idea becomes a successful innovation with probability m_i^{ξ}, where $\xi > 0$ governs the importance of managerial attention for research outcomes.

The number of successful innovations has Poisson intensity

$$h_i = \phi_i \left(\frac{x_i}{\kappa_R}\right)^{\alpha} m_i^{\xi}. \tag{C10}$$

As in the main model, a firm receives one productivity improvement whenever at least one innovation succeeds during the period. The probability of successful innovation is therefore

$$\nu_i(x_i, m_i) = 1 - \exp\left[-\phi_i \left(\frac{x_i}{\kappa_R}\right)^{\alpha} m_i^{\xi}\right]. \tag{C11}$$

Using equations (C3) and (C8), the managerial attention available for R&D among lobbying firms is

$$m_i(b_i) = e^{-\theta \log b_i} = b_i^{-\theta}. \tag{C12}$$

Substituting into the innovation probability, we obtain

$$\nu_i(x_i, b_i) = 1 - \exp\left[-\phi_i \left(\frac{x_i}{\kappa_R}\right)^{\alpha} b_i^{-\theta\xi}\right]. \tag{C13}$$

Equivalently, since $\tau_i^y/\tau_i = b_i^{\theta}$,

$$\nu_i(x_i, b_i) = 1 - \exp\left\{-\phi_i \left(\frac{x_i}{\kappa_R}\right)^{\alpha} \left(\frac{\tau_i^y}{\tau_i}\right)^{-\xi}\right\}. \tag{C14}$$

For non-lobbying firms, $q_i = 0$ and $m_i = 1$. Thus, the same expression applies to both participation choices and coincides with equation (12) in the main text.

C.4 Micro implications

A key implication of the microfoundations is two potential opposing effects of lobbying.

First, higher lobbying input increases the firm's scale and current operating profits as we have derived in the main text:

$$\frac{\partial \log s_i}{\partial \log b_i} = (\sigma - 1)\theta > 0, \qquad \frac{\partial \log \pi_i^o}{\partial \log b_i} = \sigma\theta > 0. \tag{C15}$$

Second, lobbying reduces innovation efficiency. Let h_i denote the innovation intensity in equation (C10). Holding R&D intensity fixed,

$$\left.\frac{\partial \log h_i}{\partial \log b_i}\right|_{x_i} = -\theta\xi < 0. \tag{C16}$$

Since $x_i = R_i/s_i(b_i)$, and holding total R&D expenditure fixed gives us

$$\left.\frac{\partial \log h_i}{\partial \log b_i}\right|_{R_i} = -\theta\left[\alpha(\sigma - 1) + \xi\right] < 0. \tag{C17}$$

The first component of the equation captures the decrease in research intensity due to firms getting larger. The second component captures the decrease in managerial attention available for R&D innovations.

We can invert the innovation probability and derive the R&D expenditure that is needed to recieve the target probablity of innovation: $\nu_i \in (0, 1)$ is

$$R_i(\nu_i, b_i) = \kappa_R s_i(1)\phi_i^{-1/\alpha} b_i^{\zeta/\alpha}[-\log(1 - \nu_i)]^{1/\alpha}, \tag{C18}$$

where

$$\zeta = \theta[\alpha(\sigma - 1) + \xi] > 0.$$

This formulation reproduces the exact R&D expenditure function that we used in the theoretical propositions of the main text.

C.5 Discussion of Microfoundations

The microfoundation interprets lobbying as an investment in political influence that creates a trade-off between current profits and future innovation. Lobbying secures favorable policy treatment and increases firm's size, but to implement such policies it diverts managerial attention from R&D activities. Therefore, we think of lobbying activities as reducing the effectiveness of R&D is through organizational and managerial time constraints rather than a direct change in research technology.

References

Daron Acemoglu, Ufuk Akcigit, Harun Alp, Nicholas Bloom, and William R. Kerr. Innovation, reallocation, and growth. *American Economic Review*, 108(11):3450–3491, 2018. doi: 10.1257/aer.20130470.

Philippe Aghion and Peter Howitt. A model of growth through creative destruction. *Econometrica*, 60(2):323–351, 1992. doi: 10.2307/2951599.

Philippe Aghion, Nicholas Bloom, Richard Blundell, Rachel Griffith, and Peter Howitt. Competition and innovation: An inverted-U relationship. *Quarterly Journal of Economics*, 120(2):701–728, 2005. doi: 10.1093/qje/120.2.701.

Ufuk Akcigit and William R. Kerr. Growth through heterogeneous innovations. *Journal of Political Economy*, 126(4):1374–1443, 2018. doi: 10.1086/697901.

Ufuk Akcigit, Salomé Baslandze, and Francesca Lotti. Connecting to power: Political connections, innovation, and firm dynamics. *Econometrica*, 91(2):529–564, 2023. doi: 10.3982/ECTA18338.

Tanida Arayavechkit, Felipe E. Saffie, and Minchul Shin. Capital-based corporate tax benefits: Endogenous misallocation through lobbying. Working paper, 2018.

Andrew Atkeson and Ariel Tomás Burstein. Innovation, firm dynamics, and international trade. *Journal of Political Economy*, 118(3):433–484, 2010. doi: 10.1086/653690.

Marianne Bertrand, Matilde Bombardini, and Francesco Trebbi. Is it whom you know or what you know? an empirical assessment of the lobbying process. *American Economic Review*, 104(12): 3885–3920, 2014. doi: 10.1257/aer.104.12.3885.

Nicholas Bloom, Charles I. Jones, John Van Reenen, and Michael Webb. Are ideas getting harder to find? *American Economic Review*, 110(4):1104–1144, 2020. doi: 10.1257/aer.20180338.

Matilde Bombardini and Francesco Trebbi. Competition and political organization: Together or alone in lobbying for trade policy? *Journal of International Economics*, 87(1):18–26, 2012. doi: 10.1016/j.jinteco.2011.11.011.

Matilde Bombardini and Francesco Trebbi. Empirical models of lobbying. *Annual Review of Economics*, 12:391–413, 2020. doi: 10.1146/annurev-economics-082019-024350.

Matilde Bombardini, Olimpia Cutinelli Rendina, and Francesco Trebbi. Lobbying behind the frontier. In Ufuk Akcigit and John Van Reenen, editors, *The Economics of Creative Destruction*, pages 533–557. Harvard University Press, 2023.

Laurent Cavenaile and Pau Roldan-Blanco. Advertising, innovation, and economic growth. *American Economic Journal: Macroeconomics*, 13(3):251–303, 2021. doi: 10.1257/mac.20180461.

Laurent Cavenaile, Murat Alp Celik, and Xu Tian. Are markups too high? competition, strategic innovation, and industry dynamics. *Review of Economic Studies*, 2026. doi: 10.1093/restud/rdag110. Advance online publication.

Jaedo Choi. Lobbying, trade, and misallocation. *Journal of International Economics*, 155:104086, 2025. doi: 10.1016/j.jinteco.2025.104086.

Nasir Hossein Dad. Financial frictions, systematic distortions and innovation. *Journal of Macroeconomics*, 90:103819, 2026. doi: 10.1016/j.jmacro.2026.103819.

Gene M Grossman and Elhanan Helpman. Trade, knowledge spillovers, and growth. *European economic review*, 35(2-3):517–526, 1991.

Gene M. Grossman and Elhanan Helpman. Protection for sale. *American Economic Review*, 84(4): 833–850, 1994.

Marco Grotteria. Follow the money. *Review of Economic Studies*, 91(2):1122–1161, 2024. doi: 10.1093/restud/rdad041.

Bronwyn H. Hall, Adam Jaffe, and Manuel Trajtenberg. Market value and patent citations. *RAND Journal of Economics*, 36(1):16–38, 2005.

Chang-Tai Hsieh and Peter J. Klenow. Misallocation and manufacturing TFP in China and India. *Quarterly Journal of Economics*, 124(4):1403–1448, 2009. doi: 10.1162/qjec.2009.124.4.1403.

Federico Huneeus and In Song Kim. The effects of firms' lobbying on resource misallocation. Working paper, September. Available at https://web.mit.edu/insong/www/pdf/misallocation.pdf, 2024.

Charles I. Jones and John C. Williams. Measuring the social return to R&D. *Quarterly Journal of Economics*, 113(4):1119–1135, 1998. doi: 10.1162/003355398555856.

Leonid Kogan, Dimitris Papanikolaou, Amit Seru, and Noah Stoffman. Technological innovation, resource allocation, and growth. *Quarterly Journal of Economics*, 132(2):665–712, 2017. doi: 10.1093/qje/qjw040.

Diego Restuccia and Richard Rogerson. Policy distortions and aggregate productivity with heterogeneous establishments. *Review of Economic Dynamics*, 11(4):707–720, 2008. doi: 10.1016/j.red.2008.05.002.