

Capital-Based Corporate Tax Benefits: Endogenous Misallocation through Lobbying

Tanida Arayavechkit
University of Pennsylvania

Felipe E. Saffie

University of Pennsylvania

Minchul Shin

University of Pennsylvania

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Abstract

The dominant issue of corporate lobbying in the U.S. is taxation. Firms that lobby are granted tax benefits and enjoy systematically lower effective tax rates than non-politically active firms, even after controlling by firm characteristics. Because most of these tax benefits are tied to capital holding, corporate lobbying could distort the allocation of capital in the economy. A heterogeneous firm dynamics model with endogenous lobbying decisions is presented to study the macroeconomic effects of capital-based tax benefits and their interaction with endogenous corporate lobbying behavior. The model is calibrated to U.S. firm-level data. The model suggests that the increase in corporate lobbying and the decrease in effective corporate tax rates between 1998-99 and 2010-11 are mostly due to the increase in the availability of political rents. Moreover, rent-seeking by firms explains more than 20% of the dispersion in the marginal product of capital, the main measure used in the literature to quantify the misallocation of capital.

Key words: Misallocation, Lobbying, Firm heterogeneity, Firm dynamics, Political economy, Rent seeking.

JEL classification: O40, O47, E02, D82, D83

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1 Introduction

The current U.S. tax system taxes corporate income at a statutory rate of 35%, the highest rate among the Organization for Economic Co-operation and Development (OECD) nations.^{1,2} The system, however, contains a number of deductions, exemptions, deferrals, and tax credits. The largest part of corporate tax benefits - also referred to as corporate tax expenditures - includes accelerated depreciation, the domestic production activities deduction, the deferral of income earned abroad, and credit for increasing research activities.³ These benefits affect firms unequally. For instance, the largest tax deduction is associated with depreciation of capital, and one of the most important tax credits is the Research and Experimentation Tax Credit, heavily used by large and capital intensive companies. These tax provisions imply that the effective tax rate paid by U.S. corporations is highly heterogeneous and well below 35% on average.⁴ Figure (1) illustrates the distribution of effective tax rates paid by U.S. corporations over the past decade. Effective tax rates vary significantly across firms, with the average fluctuating around 21.8%.

Nevertheless, the nature and extension of these tax benefits is not completely exogenous to the companies. In fact, some of those benefits are applicable to a very restrictive set of firms.⁵ This leaves room for corporate pressure by lobbying activity. While tax benefits cannot be negotiated on a case-by-case basis with companies because they must be incorporated into a tax code, many companies successfully lobby for the creation of tax benefits tailored to their profiles.⁶ Not surprisingly, lobbying expenditures for taxation purposes are among the top two issues of corporate

¹According to the law, the tax starts at 15% for income below \$50,000. It reaches 34% gradually for incomes between \$335,000 and \$10m, then it gradually increases to 35% for incomes above \$18.33m.

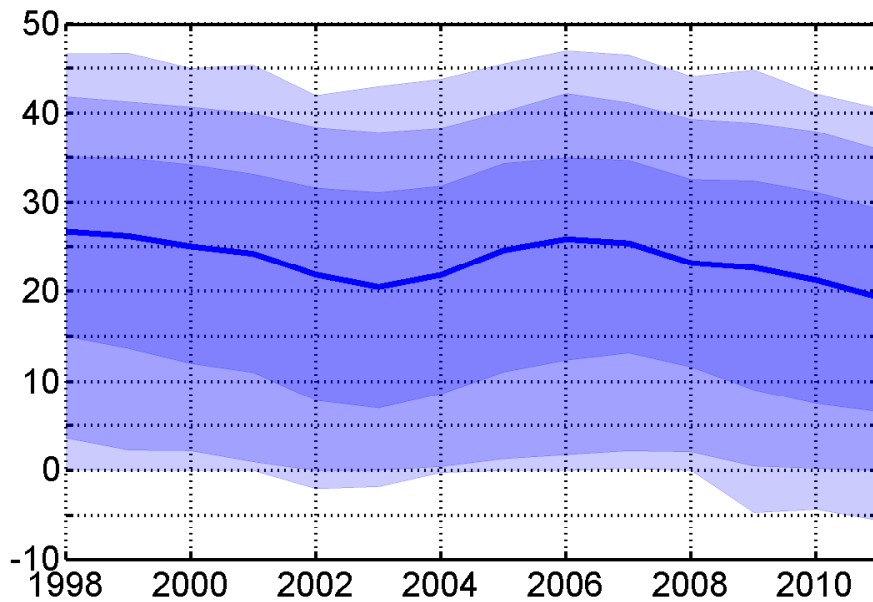
²See Appendix A for corporate income tax rates in OECD countries.

³Tax expenditures - special exemptions and exclusions, credits, deductions, deferrals, and preferential tax rates claimed by corporations - support federal policy goals to encourage certain types of behaviors and assist certain businesses but result in revenue forgone by the federal government. Source: U.S. Government Accountability Office.

⁴The effective tax rate for a corporation is the average rate at which its pre-tax profits are taxed. It is computed by dividing total tax expenses by the firm's earnings before taxes. In fact, the U.S. average effective tax rate is similar to the OECD weighted average, as reported in Gravelle and Marples (2014).

⁵For example, according to the Government Accountability Office (*GAO*, 2013), "in 2010 almost 12,000 organizations claimed the tax exemption for certain insurance companies owned by tax-exempt organizations (\$200 million in corporate tax revenue losses in 2011) while 5 corporations claimed the credit for energy efficient appliances (\$280 million in corporate tax revenue losses in 2011)."

⁶Case studies and journal articles are full of examples. See, for instance, Kocieniewski (2011) for "GE's strategies let it avoid taxes altogether," and McIntyre et al. (2011) for "Corporate taxpayers and corporate tax dodgers."



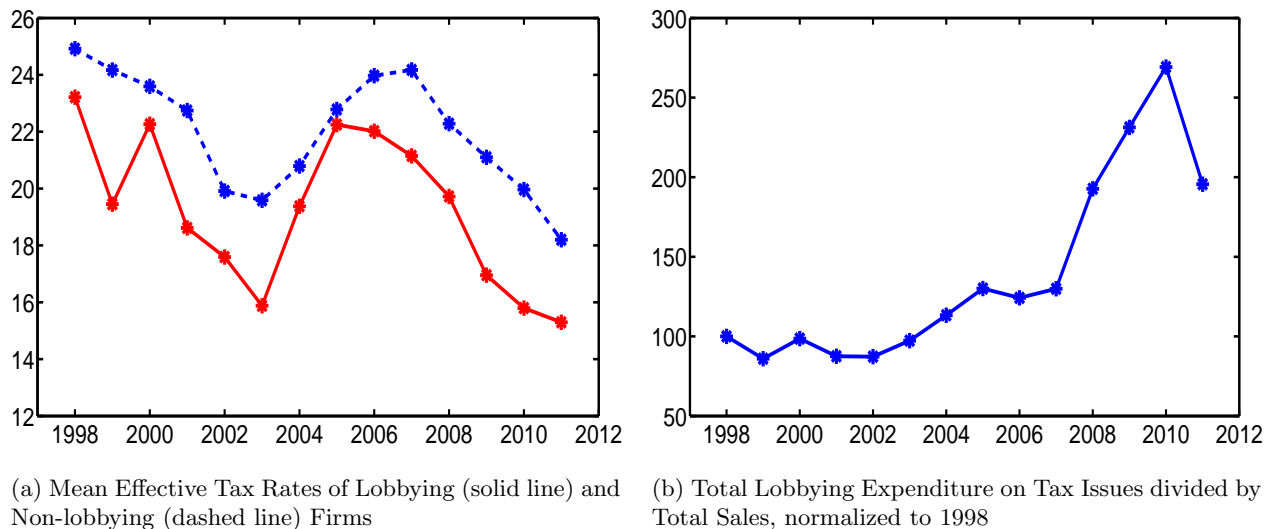
Source: Authors' calculation. 5%, 10%, 25%, 50%, 75%, 90%, and 95% quantiles of effective tax rate among all firms over time.

Figure 1: Effective Tax Rate Distribution

lobbying every single year in the U.S. The tax benefits of firms that lobby can be seen even in the raw data. As Figure (2a) shows, lobbying firms face consistently lower effective tax rates than non-lobbying firms⁷, and this gap is particularly important when corporate lobbying expenditure for taxation, Figure (2b), increases sharply.

This paper, thus, aims to study the macroeconomic effects of capital-based tax benefits and their interaction with endogenous corporate lobbying behavior. In particular, as this class of benefits distorts the marginal cost of capital differently across firms, it can potentially generate substantial capital misallocation in the economy. In a nutshell, if two firms face different costs of capital, the marginal productivity of capital between these firms will not be equalized, and, hence, a redistribution of the total existing capital from this distorted situation could potentially increase output in the economy. Moreover, the presence of political rents tied to lobbying can substantially amplify the gaps in the marginal product of capital among firms and, therefore, exacerbate the misallocation in the economy.

⁷ For the rest of the paper, the terms “lobbying firm” and “non-lobbying firm” are used to describe a firm’s lobbying status. For example, firm A is a lobbying firm in 2000 if it spent money on lobbying in 2000.



Source: Authors' calculation.

Figure 2: Effective Tax Rates and Lobbying Expenditures

To support the link between tax benefits and firms' political influence, which will be the central mechanism of interest, some empirical regularities on effective corporate taxation and lobbying behavior in the U.S. economy are documented. The lobbying data from the Center for Responsive Politics is matched with Compustat to obtain the firm characteristics that are necessary for calculating effective corporate tax rates.⁸ We first document that taxation is the dominant issue for corporate lobbying, and that, although less than 12% of the sample lobbies every year, these firms account for more than 50% of the capital holding in the sample. Then, we document three empirical regularities that motivate our model: i) capital intensity is associated with lower effective tax rates; ii) lobbying firms are large and capital intensive; iii) lobbying firms, on average, have lower effective tax rates.

To identify the mechanisms that link tax benefits and firms' lobbying activities to resource misallocation, we develop a dynamic model of heterogeneous firms with endogenous lobbying decisions. The framework is adapted from Hopenhayn (1992). In the model economy, firms use a decreasing returns to scale technology to transform capital and labor into output, and they face idiosyncratic productivity shocks. Firms decide on the level of inputs and on lobbying spending.

⁸ The Center for Responsive Politics data set is available starting in 1998.

In addition, there is a government, which grants tax benefits to firms as tax deductions associated with their capital holdings. A first component of these benefits is applied to all firms, while a second component can be influenced by lobbying activity, namely, a preferential tax treatment. However, because the government has limited resources for tax expenditures, the benefits are allocated sequentially, starting with the firms that value them the most. Hence, only a subset of the firms lobby in equilibrium.

In order to quantify the macroeconomic impact of tax benefits and corporate lobbying on capital allocation, we calibrate the model to the U.S. economy during 2010-11. The benchmark calibration is able to successfully match every targeted moment. We evaluate the model calibration using a set of non-targeted moments. The model is able to mimic closely the empirical distribution of the marginal product of capital, for both lobbying and non-lobbying firms. Moreover, it generates 70% of the persistence in lobbying status observed in the data, as well as the signs of all conditional correlations between lobbying activities and effective tax rates documented in the empirical section. The success of the model relies on the fact that highly productive firms with low capital that decide optimally not to participate in lobbying face a higher effective tax rate than low-productivity firms that over-accumulate capital in order to maximize their tax benefits from lobbying.

After validating the calibrated model, we conduct two counterfactual exercises. First, we examine whether an increase in the fraction of revenue losses from tax expenditures can explain the differences between 1998-99 and 2010-11. To this end, we compare the benchmark to a counterfactual calibration, where the only change is that the fraction of revenue losses from tax expenditures is set to 1998-99. In the model, the increase in the proportion of tax benefits generates a decrease in the effective tax rate of lobbying and non-lobbying firms, with lobbying firms experiencing a larger decrease. It also increases the fraction of lobbying firms and the amount of capital held by them. All these trends are present in the data. Moreover, the model captures fairly well the magnitudes of these changes. It generates 76% of the observed decrease in the average effective tax rate of the U.S. economy. The second exercise studies the effect of capital-based tax benefits and corporate lobbying on capital misallocation. To this end, we compare the benchmark model

to two counterfactuals, one where tax benefits are tied to capital but lobbying does not generate additional rents, and the other where there are neither standard capital-based benefits nor rents to be extracted by lobbying. Because, in an undistorted world, the marginal product of capital should be equalized among firms, the dispersion of the marginal product of capital reflects an inefficiency in allocation of resources. The impact of corporate lobbying on misallocation is substantial. Firms' political activity accounts for at least 20% and up to 70% of the dispersion. The remaining fraction is due to the standard tax benefits that apply evenly across firms. Therefore, the calibrated model suggests that an increase in the fraction of tax expenditures can explain a decrease in effective tax rates and an increase in corporate lobbying at both the extensive and intensive margins. This, in turn, worsens capital misallocation in the economy.

The paper is organized as follows. Section 2 summarizes some of the related literature on firms' political activity and corporate taxation. Section 3 presents our database and the main empirical findings of the paper. A dynamic model of heterogeneous firms with endogenous lobbying decisions is introduced in Section 4. Section 5 presents the quantitative exercises, including the model calibration and quantitative experiment. Finally, Section 6 concludes the paper.

2 Literature Review

The paper contributes to two strands of literature: corporate lobbying and resource misallocation. Firm-level empirical work on corporate lobbying has been done in several dimensions. Igan et al. (2012) find that lobbying was associated with more risk-taking during 2000-07. Kerr et al. (2014) explore lobbying behavior toward immigration-specific issues and document the persistence in lobbying status. Several accounting and finance papers have explored the link between lobbying expenditure and tax benefits. Birnbaum and Murray (2010) provide evidence of the pressure exerted by lobbyists in the Tax Reform Act of 1986 in the United States in order to grant specific benefits and exemptions to their clients. Kang (2013) quantifies the effect of lobbying expenditures on policy enactment in the energy sector. Among others, Richter et al. (2009), Meade and Li

(2012), Cooper et al. (2010), and Brown et al. (2013) find that political action by firms is positively correlated with firms' preferential treatment and profit. However, theoretical work is considerably less developed. The only area of study that is theoretically and empirically well developed is the literature on the influence of lobbying activity on trade policy by Grossman and Helpman (1994), Mitra (1999), Gawande and Bandyopadhyay (2000), Bombardini (2008), Bombardini and Trebbi (2012), and Kim (2012). Less attention has been drawn to tax lobbying, which accumulates more expenditure than trade issues for every single year in the data. Even so, little work has been done in looking at lobbying effort as an endogenously determined decision.

Recent literature emphasizes that input misallocation across firms is one of the main sources of aggregate total factor productivity (TFP) loss. Many factors are thought to be important sources of misallocation. Hopenhayn and Rogerson (1993) and Lagos (2006) and Guner et al. (2008) study the distortion created by taxes and government policy, which leads to resource misallocation and aggregate TFP loss. Another interesting factor is trade barriers as a source of misallocation, studied by Waugh (2010) and Epifani and Gancia (2011). However, the most studied source of misallocation is credit market imperfections. Erosa (2001), Amaral and Quintin (2010), Buera et al. (2011), and Midrigan and Xu (2010) have all estimated the effects of credit market imperfections on TFP through various channels. However, one key issue in this literature is that productivity differentials usually disappear once the establishments can overcome credit market constraints through self-financing. Instead of focusing on the channel which creates misallocation, Restuccia and Rogerson (2008) exogenously introduce idiosyncratic tax rates and examine the conditions under which the misallocation caused by these generic distortions leads to larger effects on aggregate TFP. In our paper, we propose a new source of misallocation which, to our knowledge, has not been explored. The distortion in our model is endogenously driven by capital-based tax benefits and firms' rent-seeking behavior, creating resource misallocation.

3 Data and Empirical Regularities

This section introduces the database used in this paper. We first document that taxation is the dominant issue in corporate lobbying. Then we document an expansion in lobbying activities, at both the intensive and extensive margins, during the 1998-2011 period. Finally, we document the main empirical regularities that motivate our modelling strategy.

3.1 Data: Lobbying for Taxation

The empirical analysis relies on two sources of data. Lobbying behavior data is obtained from the Center for Responsive Politics (CRP). This data is available due to the Lobbying Disclosure Act of 1995.⁹ This Act requires filers to disclose detailed information about lobbying expenditures above \$3,000 during a quarter.¹⁰ Lobbying activity is reported under one of 78 issue areas and the expenditure allocated to lobbying on a particular bill must be declared. The information on firm’s characteristics comes from Compustat. This database contains detailed information on sales, employment, assets, and tax expenditures, among other variables, for publicly traded companies in the U.S. economy. Table (1) summarizes the raw data for the period spanning 1998 - 2011.

Table 1: Lobbying Data and Compustat

	Lobbying data	Compustat	Lobbying in Compustat
# of obs. (firm-year)	72,110	159,111	4,978
Lobbying Expenditure (\$ million)	14,130	N/A	6,674 (47.2%)
Total Asset (\$ million)	N/A	873,200,000	289,000,000 (33.1%)

Although the CRP data contains not only corporate lobbying but also lobbying by organizations, individuals, and even foreign governments, lobbying firms account for 47% of the total lobbying expenditures in CRP. Therefore, most corporate lobbying activity is likely to be reflected

⁹This Act was strengthened by the Honest Leadership and Open Government Act of 2011. Because the law did not change the mandatory disclosure, we decided to use the complete data for this analysis. Nevertheless, our empirical analysis is robust to the exclusion of this part of the data.

¹⁰Firms with in-house lobbying activities are also required to report the relevant information. However, the CRP data do not include bribes, other under-the-table payments or firms’ illegal expenditures aiming to influence policy outcomes.

in our sample. In addition, lobbying firms account for 33% of the total asset values in Compustat. Therefore, given the relevance of actors involved in lobbying, lobbying behavior is likely to have a sizable impact on the aggregate economy. Moreover, the data shows that the primary purpose of lobbying is taxation.

Table 2: Percentage of Aggregate Expenditures by Issues (Top 10, 1998 – 2011)

Issue	%
Taxes	10.68
Health Issues	7.47
Energy/Nuclear	5.30
Budget/Appropriations	5.22
Medicare/Medicaid	5.02
Trade (Domestic & Foreign)	4.93
Defense	4.15
Telecommunications	3.81
Environmental/Superfund	3.77
Financial Institutions/Investments/Securities	3.53

As shown in Table (2), the percentage of total lobbying expenditures spent on taxation issues over the period of 1998-2011 is well above every other issue.¹¹ Appendix B presents this analysis for each year. Taxation ranks first every year except 2009.¹²

3.2 Lobbying at the Extensive and Intensive Margin

Table (3) and Figure (3) show descriptive statistics for lobby data.¹³ In our sample, the number of lobbying firms has increased over the years. In particular, the number of lobbying firms was practically constant at around 80 firms for the first five years, and then it has been increasing steadily, and double the number in the last year of the sample. This implies that lobbying participation increased by more than double during the past decade. The intensive margin

¹¹Each bill might contain multiple issues, so we discount the dollar amount by the number of issues. Then we build the total amount for every issue during the period and rank them accordingly. Ranking is based on the matched data set before sample selection.

¹²The health care reform in 2009 placed health issues at the top.

¹³Hereafter, we focus on lobby invoices that are issued for tax subjects. Appendix C describes the sample selection procedure, the removal of outliers and the basic variables of the data set used for the rest of this section.

also follows a similar pattern, i.e., the average lobbying expenditure almost doubled during the period. Introducing the median into the analysis, we see considerable inequality among lobbying expenditures, where few firms account for most of the expenditures. This inequality grows steadily over time. Finally, the dispersion in lobbying expenditure essentially doubles during the period. Figure (3) illustrates the trends in lobbying activities at both the intensive and extensive margins over time. The increasing trend is obvious for all variables: the total lobbying expenditure, the proportion of lobbying firms, the average lobbying expenditure, and the standard deviation of lobbying expenditure. In addition, each variable more than doubles over the period of 1998-2011.

Table 3: Descriptive Statistics for Lobby Data

year	# of firms	# of lob firms	% lob firms	lob exp per firm	median (lob exp)	SD(lob exp)	total exp
1998	2146	78	3.63	1.09	0.2	1.83	85.35
1999	1952	83	4.25	0.92	0.24	1.46	76.23
2000	1748	84	4.81	1.13	0.22	1.76	94.65
2001	1480	69	4.66	1.1	0.19	1.93	75.83
2002	1433	63	4.4	1.17	0.15	2.02	73.72
2003	1592	85	5.34	1.02	0.35	1.71	86.99
2004	1768	102	5.77	1.21	0.38	1.84	123.22
2005	1801	115	6.39	1.35	0.34	2.66	154.71
2006	1766	124	7.02	1.23	0.4	2.03	153.12
2007	1657	132	7.97	1.34	0.45	2.28	176.48
2008	1353	127	9.39	1.73	0.57	3.2	219.46
2009	1236	127	10.28	1.68	0.39	2.92	213.99
2010	1402	160	11.41	2.22	0.61	4.41	355.81
2011	1479	153	10.34	1.99	0.64	3.29	304.57
average	1629.5	107.29	6.83	1.37	0.37	2.38	156.72
sum	22813	-	-	-	-	-	2194.13
98-99 avg	2049	80.5	3.94	1.01	0.22	1.65	80.79
10-11 avg	1440.5	156.5	10.88	2.11	0.63	3.85	330.19

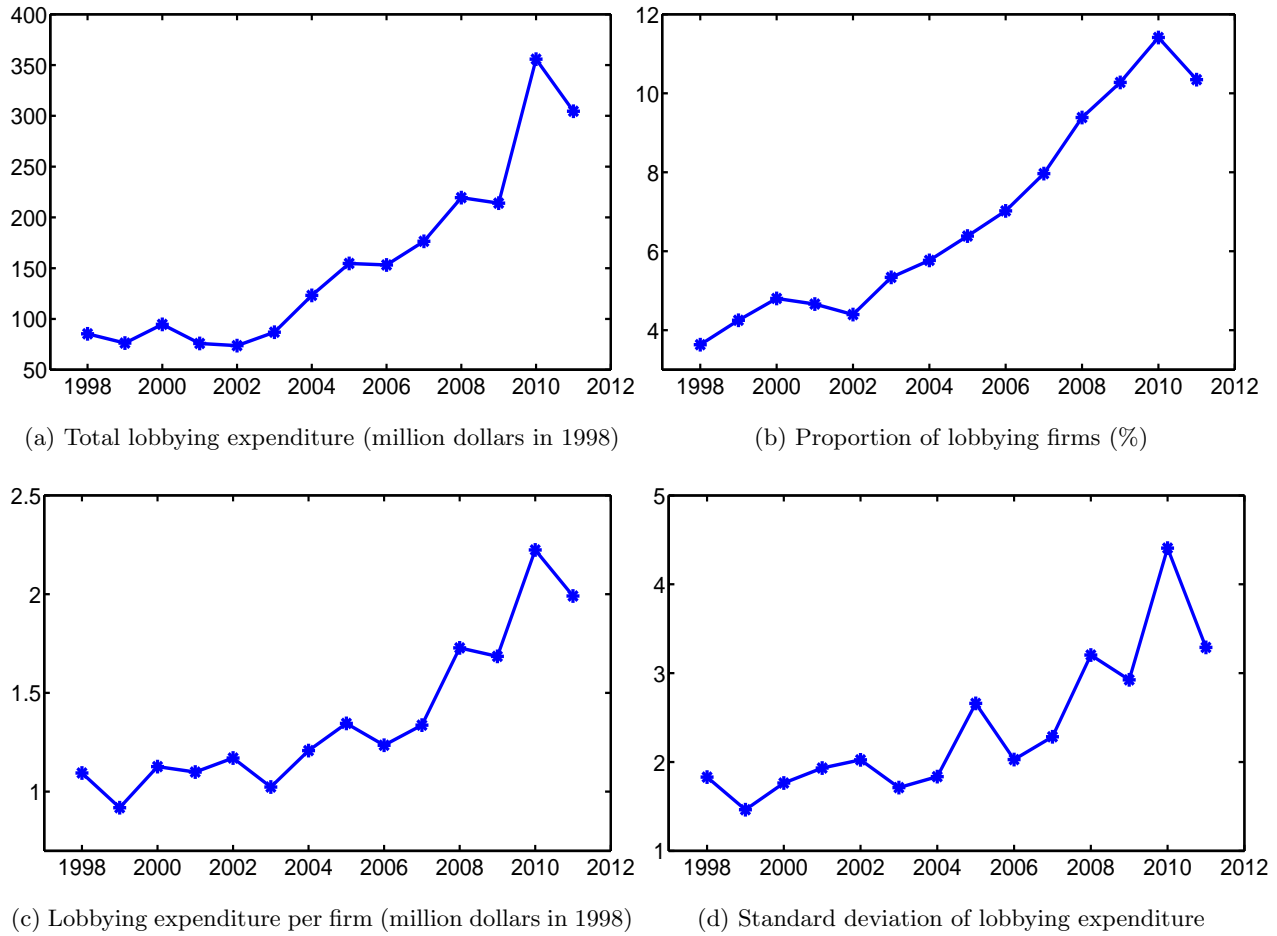
¹ Lobbying expenditure (million dollars) is deflated by the GDP deflator (index=100 at 1998).

² Lobbying expenditure per firm is the average lobbying expenditure among lobbying firms.

³ Lobbying statistics are based on bills that are issued for tax. Appendix C describes the sample selection procedure.

3.3 Conditional Correlations: Effective Tax Rate, Capital Intensity, and Lobbying Activity

The statutory corporate tax rate is generally flat at 35% in the U.S. economy for our sample. This is the highest corporate tax rate among the O.E.C.D. countries. Nevertheless, the effective tax rates actually paid by U.S. companies are well below this rate. We calculate effective tax rates in our sample following the definition of Richter et al. (2009). In a nutshell, the effective tax rate is



Source: Lobbying statistics and authors' calculation.

Figure 3: Lobbying Data Statistics

taxes paid divided by taxable income reported to stockholders. Each company's effective tax rate is computed using entries from Compustat as follows:

$$ETR = \frac{\text{Income Taxes Total} - \text{Deferred Taxes}}{\text{Pre-Tax Income} - \text{Equity in Earnings} - \text{Special Items} + \text{Interest Expense}}.$$

As mentioned above, firms in our sample on average pay an effective tax rate of 21.8%, considerably lower than the statutory tax rate. Moreover, there is considerable heterogeneity across firms with respect to their effective tax rate. Lobby data suggests that corporate lobbying seems to influence a potential pattern for this heterogeneity. In particular, the time-series of ETR conditional

on lobbying activity suggests that lobbying firms face consistently lower effective tax rates than their non-lobbying counterparts. This section provides more compelling evidence of the correlation between corporate lobbying activity and effective tax rates. Table (4) presents the results of five panel regressions estimated using random effects. The dependent variable in every specification is the effective tax rate. More details on variables can be found in Appendix D.

Table 4: Effective Tax Rate Panel Regression

	Reg (1)	Reg (2)	Reg (3)	Reg (4)	Reg (5)
if_lob_{t-1}	-0.014** (0.006)	-0.010** (0.005)			-0.006 (0.006)
$\log lob_{t-1}$			-0.020** (0.009)	-0.018*** (0.006)	-0.014* (0.007)
cap_int	-0.575*** (0.067)	-0.354*** (0.045)	-0.572*** (0.067)	-0.359*** (0.045)	-0.360*** (0.045)
$\log lob_{t-1} \times cap_int$				0.109 (0.080)	0.105 (0.079)
ETR_{t-1}		0.343*** (0.013)		0.343*** (0.013)	0.343*** (0.013)
lev	-0.196*** (0.010)	-0.142*** (0.008)	-0.195*** (0.010)	-0.142*** (0.008)	-0.142*** (0.008)
inv_int	1.432** (0.655)	1.165** (0.466)	1.447** (0.656)	1.162** (0.466)	1.159** (0.466)
$R\&D_int$	-0.675 (3.055)	0.346 (2.194)	-0.547 (3.063)	0.522 (2.206)	0.569 (2.207)
$size$	0.009*** (.001)	0.005*** (.001)	0.009** (.001)	0.005*** (.001)	0.005*** (.001)
Year dummy	Yes	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes
Random effect model	Yes	Yes	Yes	Yes	Yes
R2	0.140	0.344	0.140	0.344	0.344
# of observations	15743	15743	15743	15743	15743

¹ *** $p < 0.01$, ** $p < 0.05$, * $p < 0.01$.

² † Variable descriptions are provided in Appendix D.

Reg (1) and Reg (2) provide evidence on the correlation between effective tax rates and corporate lobbying activity at the extensive margin. Reg (1) confirms that the effective tax rate differential between lobbying firms and non-lobbying firms is significant even after controlling by capital intensity, leverage, investment intensity, R&D intensity, size, year and industry dummies.

In particular, just controlling for the extensive margin, we see that, on average, lobbying firms face effective tax rates 1.4% lower. As Reg (2) shows, this result is robust when the lagged effective tax rate is included in the regression. This result also holds at the intensive margin, as shown in Reg (3) and Reg (4). Firms that lobby more face lower effective tax rates. When including both extensive and intensive margins, Reg (5) shows that both effects maintain their signs, but only the intensive margin is statistically significant. Interestingly, capital intensity is associated with a lower effective tax rate in every specification. This points to the capital-based tax benefits that constitute most of the tax expenditures in the U.S. These results are in line with those of Richter et al. (2009) and Meade and Li (2012).

4 Model Economy

To study the mechanism that links tax benefits and firms' lobbying activities and its effect on resource misallocation, this section presents a dynamic model of heterogeneous firms with endogenous lobbying decisions to obtain tax preferential treatment. The model is adapted from Hopenhayn (1992). In the model, the industry is composed of a continuum of firms which produce a homogeneous product. Firms behave competitively, taking prices as given. They decide on the level of capital and lobbying spending. In addition, there is a government, which grants tax benefits to firms in the form of tax deductions or tax credits. A part of tax benefits is standard, applied to all firms, while the other part can be influenced by lobbying activity, namely, preferential tax treatment. However, the government has limited resources for tax expenditures. In the model, the benefits are allocated sequentially, starting with the firms that value them the most, until the total amount of funds available for tax benefits is reached. Therefore, in equilibrium, only a subset of the firms lobby.

4.1 Firms

An operating firm starts the period with capital k and debt b . It produces output using a production function that combines productivity z , capital k , and labor n . The production function has a decreasing return to scale:

$$y = f(z, k, n) = zk^\alpha n^\eta, \quad (1)$$

where $0 < \alpha + \eta < 1$ and $\alpha, \eta \in (0, 1)$. The productivity z follows

$$\ln(z_{t+1}) = (1 - \rho) \ln(\mu) + \rho \ln(z_t) + \epsilon_{t+1}, \quad \epsilon_{t+1} \sim \mathcal{N}(0, \sigma^2) \quad (2)$$

After producing and selling the output, the firm is subject to the statutory tax of τ on its net income. However, the government grants tax benefits to firms in the form of tax deductions or tax credits associated with the firm's capital stock. A part of tax benefits is standard, applying to all firms, while the other part can be influenced by lobbying activity. Because the government has limited resource to spend on tax credits, not every firm is granted those additional tax benefits in equilibrium. We assume that standard benefits are granted to every firm first. Then, if there are still resources to be allocated, those lobby-dependent tax benefits are granted. In particular, we assume that lobby-induced benefits are allocated sequentially, starting with the firms that are willing to lobby the most¹⁴. Note that, because the information is perfect, every agent knows in equilibrium what the order is. In the firm's problem, this is equivalent to the existence of a threshold of lobbying effort, \underline{l} , above which the firm receives preferential tax treatment. Therefore, the firm lobbies if and only if its non-strategic lobbying decision is above the threshold \underline{l} . In addition, the firm can accumulate capital over time. It finances the new capital k' and dividends d with after-tax profits net of debt payment and a new loan b' . However, the loan is subject to the collateral constraint such that there is no default.

The timing of the decision for an operating firm within each period is as follows. At the beginning of the period v , a fraction of firms exogenously exit. All surviving firms realize their

¹⁴This assumption is for tractability, as it allows us to have a single equilibrium associated with lobbying. It mimics the case that big corporations are allowed to negotiate before small companies.

idiosyncratic productivity z . A firm with capital k , debt b and productivity z makes the decision on labor and lobbying spending. It then chooses a new loan, capital for the following period, and dividends. At the end of each period, firms with negative values exit.

The firm value function is given by

$$V(k, b, z; \underline{l}) = \max \left\{ V^l(k, b, z; \underline{l}), V^{nl}(k, b, z; \underline{l}), 0 \right\}, \quad (3)$$

where

$$V^l(k, b, z; \underline{l}) = \max_{n, k', b', l \geq \underline{l}} d^l + \frac{1-v}{1+r} \mathbb{E}_{z'|z} V(k', b', z'; \underline{l}') \quad (4)$$

$$V^{nl}(k, b, z; \underline{l}) = \max_{n, k', b'} d^{nl} + \frac{1-v}{1+r} \mathbb{E}_{z'|z} V(k', b', z'; \underline{l}') \quad (5)$$

subject to a non-negative dividend condition given by

$$d^l = (1-\tau)\pi + \tau \mathcal{R}(l, \underline{b}, k) + (1-\delta)k - k' - b + \frac{1}{1+r} b' - \Gamma(l) \geq 0, \quad (6)$$

$$d^{nl} = (1-\tau)\pi + \tau \mathcal{R}(0, \underline{b}, k) + (1-\delta)k - k' - b + \frac{1}{1+r} b' \geq 0, \quad (7)$$

$$\pi = zk^\alpha n^\eta - wn. \quad (8)$$

$\mathcal{R}(l, \underline{b}, k)$ is the firm-specific tax deduction, which depends on the standard tax benefits \underline{b} , lobbying effort l , and capital k . Tax benefits reduce net income that is subject to tax. This function will be specified in the next section. Even though the firm decides not to lobby, it can still get the standard tax benefits. By making lobbying effort l , the firm receives extra tax benefits but incurs the cost of $\Gamma(l) = \frac{\gamma}{2} l^2$. Flows are discounted at the interest rate $1+r$ ¹⁵.

4.2 Government and Tax Policy

The government grants corporate tax benefits to reduce a tax burden. Mostly, firms obtain tax benefits, notably through research and experimentation credits and accelerated depreciation

¹⁵In this model, there is no aggregated risk; therefore, we can think of r as the long-run interest rate implied by the discount factor of a representative household owning every firm.

schedules tailored to specific types of capital equipment.¹⁶ As stated in the previous section, a firm-specific tax deduction follows the function $\mathcal{R}(l, \Omega, k)$, where

$$\mathcal{R}(l, \Omega, k) = \min \left\{ (\psi l^\varphi + \Omega) k^\phi, \chi\pi \right\} \quad 0 < \varphi, \phi < 1 \quad (9)$$

How much a firm can reap tax benefits depends on its capital k , in line with the fact that most tax benefits are tied to capital, either in the form of research activities or accelerated depreciation of machinery and equipment.¹⁷ Without any effort in lobbying, the tax burden decreases by $\tau\Omega k^\phi$. If a firm lobbies, it obtains preferential tax treatment, where the additional tax benefit is increasing in the lobbying effort. To ensure that, at least, a minimum amount of income tax is paid in spite of the legitimate use of deductions, the maximum tax deduction is limited by a firm's profit, $\chi\pi$.

Finally, the government can only forgo a limited fraction of its revenue on corporate tax expenditures.¹⁸ Because the amount of tax expenditures is limited, the government only grants preferential tax treatment to firms that put in more lobbying efforts, until it runs out of resources. Tax benefits, therefore, are partly determined by other firms' lobbying spending and the total amount of tax expenditures. There is a threshold \underline{l} such that firms receive preferential tax treatment according to their lobbying effort only if their lobbying effort is higher than this threshold. The government tax expenditure constraint is

$$\tau \int \mathcal{R}(l(k, b, z) \times \mathbf{1}\{l(k, b, z) \geq \underline{l}\}, \Omega, k) d\Psi(k, b, z) = \theta\tau \int (zk^\alpha n^\eta - wn) d\Psi(k, b, z). \quad (10)$$

That is, the government is willing to lose a θ fraction of its revenue on corporate tax expenditures.

¹⁶See Bartlett and Steele (1988), McIntyre and Nguyen (2000, 2004), and Richter et al. (2009).

¹⁷In 2011, accelerated depreciation of machinery and equipment and credit for increasing research activities accounted for 48% of corporate tax revenue losses.

¹⁸A corporate tax expenditure is a debatable issue for policymakers. Although it supports federal policy goals to provide incentives and assist certain businesses, estimated revenue loss due to corporate tax expenditures is relatively large.

4.3 Entrants

The problem for a potential entrant is simple in this model. All entrants enter with no debt. Capital collected from exiting firms is distributed equally among entrants, and their initial productivity is drawn from the ergodic distribution associated with Equation (2). Thus, the value for a potential entrant is given by

$$V^e(z) = V(\bar{k}_0, 0, z; \underline{l}), \quad (11)$$

where \bar{k}_0 is the capital distributed equally among entrants. To ensure that the mass of firms does not change, the mass of entrants must be the same as the mass of firms that exit, either exogenously or voluntarily.

4.4 Definition of Equilibrium

Definition 1. *Given a wage rate w and interest rate r , a stationary partial equilibrium under the tax policy rule \mathcal{R} is a set of value functions $\{V, V^l, V^{nl}, V^e\}$, decision rules $\{n(k, b, z), k'(k, b, z), b'(k, b, z), l(k, b, z)\}$, an exit decision, a threshold \underline{l} , and a distribution $\Psi(k, b, z)$ such that, given prices, the following conditions are satisfied:*

1. *Firms' value functions, their decision rules and exit decisions are consistent with (3)-(8), and (11).*
2. *A stationary distribution Ψ .*
3. *The government tax expenditure constraint (10) holds.*

5 Quantitative Exercise

In this section, we perform a quantitative exploration of the model introduced in Section 4 to assess the impact of capital-based tax benefits on resource misallocation in the economy and their

interaction with firms' rent-seeking behavior. In particular, we calibrate the model to the firm level data presented in Section 3 for the period 2010-11. We evaluate the calibrated model using two sets of non-targeted moments. The first test is to compare the distribution of the marginal product of capital that is implied by the model to its data counterpart. Despite its parsimony, the model is able to match the shape and the first two moments of the data-generated distribution fairly well. The second challenge faced by the model tests its ability to replicate the conditional correlation analysis in Section 3. The model-generated data, like the U.S. data, suggest that effective tax rates are negatively correlated with a firm's lobbying activities and capital intensity, and positively correlated with a firm's values. Moreover, we show that the empirically observed persistence in the lobbying status of the firms can be generated by the model through the interaction between tax benefits and capital holdings. In particular, because capital stock is endogenously persistent, it imparts this property to the lobby participation margin.

We then use the calibrated model to learn more about the lobbying process and its implications for the allocation of capital in the economy. In the first experiment, we show that an increase in the fraction of revenue loss from tax expenditures between 1998-99 and 2010-11 can explain a decrease in the overall effective tax rate and also can explain an increase in both the intensive and extensive margin of lobbying during the period. In the second experiment, we use the calibrated model to study the impact of lobbying and capital-based tax benefits on resource misallocation in the U.S. economy. We document that lobbying can account for at least 20% of capital misallocation, measured as the variance of the marginal product of capital.

5.1 Calibration

We calibrate our model to the U.S. economy. Parameters are grouped into two categories. The first category includes parameters for which the values are either taken from other literature or directly obtained from the data. The second category includes parameters chosen so that endogenous outcomes from the model match salient features of the U.S. firm-level data in 2010-11.

The productivity process is discretized following the method in Tauchen (1986). The number of grid points for z is set to 20. The productivity distribution of entrants is assumed to be the ergodic distribution obtained from the transition matrix. The parameters governing the productivity process are set to those estimated for the U.S. manufacturing sector by Cooper and Haltiwanger (2006). In particular, $\rho = 0.885$, $\mu = 1$, and $\sigma = 0.2$. The return to scale $\alpha + \eta$ is set to 0.85, as in Restuccia and Rogerson (2008). A standard value of the income share of labor is 0.64, implying $\alpha = 0.31$ and $\eta = 0.54$. The depreciation rate δ is taken from D’Erasmus and Moscoso Boedo (2012) in their firm dynamics model for the formal sector of the U.S. economy. The exogenous exit probability, v , is in the range used in the U.S. data, 3% – 6%.¹⁹ The maximum bound on tax benefits, χ , ensures that, at least, a minimum amount of income tax is paid in spite of the legitimate use of tax credits.²⁰ Finally, the taxation parameters, τ and θ , are taken directly from the statutory tax rate and tax credits in the U.S. In particular, the statutory corporate tax rate is 35% and the tax expenditure ratio is calculated from the IRS corporate income tax returns balance sheet.

Five internally calibrated parameters are those governing tax benefits and lobby spending: Ω , ϕ , φ , ψ , and γ . Although these parameters are calibrated jointly to match six targeted moments, each parameter value is mostly related to a particular moment. The base tax deduction that is independent of lobbying expenditure, Ω , pins down the average effective tax rate of the non-lobbying firms in the data. ϕ , which represents the link between the capital level of the firm and its tax deductions, is closely related to the fraction of total capital held by lobbying firms in equilibrium. The exponent of lobbying in the benefit function, φ , closely links to the average effective tax rate of lobbying firms in the economy. The scale of the benefit function, ψ , has a direct nexus to the minimum lobbying expenditure that allows for benefits, \underline{l} , and therefore it affects the fraction of lobbying firms in equilibrium. Lastly, the scale parameter of the lobbying cost function, γ , determines how firms allocate their profit to lobbying activities, so it is mostly related to the ratio of lobbying expenditure to sales in the economy. Table (5) summarizes all parameter values. The

¹⁹Its only role is to ensure the existence of a stationary distribution by preventing firms from accumulating capital without bounds.

²⁰This rules out highly negative effective tax rates. In the baseline calibration, this constraint binds for 10% of firms.

Table 5: Parameter Values

Value	Description	Source
Predetermined Parameters		
θ	0.33 Revenue loss by tax expenditure	IRS corporate tax returns balance sheet
α	0.31 Production function, capital	Income share, Restuccia and Rogerson (2008)
η	0.54 Production function, labor	Income share, Restuccia and Rogerson (2008)
δ	0.07 Depreciation of capital	D’Erasmus and Moscoso Boedo (2012)
τ	0.35 Statutory tax rate	U.S. statutory corporate tax rate
r	0.04 Interest rate	D’Erasmus and Moscoso Boedo (2012)
v	0.06 Exogenous exit rate	Restuccia and Rogerson (2008)
χ	1.5 Maximum benefit	Minimum ETR = 1st percentile ETR samples
ρ	0.89 Autocorrelation	Cooper and Haltiwanger(2006)
μ	1 Mean of productivity	Cooper and Haltiwanger(2006)
σ	0.2 Std Dev of stochastic component	Cooper and Haltiwanger(2006)
Calibrated Parameters		
\underline{b}	0.075 Tax benefit, base deduction	Mean ETR of non-lobbying firms
ϕ	0.35 Tax benefit, capital exponent	Fraction of capital held by lobbying firms
φ	0.04 Tax benefit, lobby exponent	Mean ETR of lobbying firms
ψ	2.5 Tax benefit, lobby scale	Fraction of lobbying firm
γ	41.6 Lobby cost, scale	Lobbying expenditure to sales

targeted moments are reported in Table (6).

The model-based counterpart of the data is based on the stationary distribution of the economy. Despite its parsimony, the model is able to successfully match the targets. The model does a good job of generating the small fraction of lobbying firms, which own more than half of the total capital. In particular, approximately 60% of capital is owned by lobbying firms, which only account for 10% of firms. The model also generates the result that lobbying firms, on average, pay lower effective tax rates. Although matching well the average effective tax rate of non-lobbying firms, the model

Table 6: Targeted Moments

	Moments	Data	Model
Average effective tax rate (%)	All firms	18.7	18.0
	Lobbying firms	15.5	10.8
	Non-lobbying firms	19.1	19.2
Lobbying firms (%)		10.9	13.5
Capital owned by lobbying firms (%)		60	64
Lobby expenditure over sales (%)		0.06	0.11

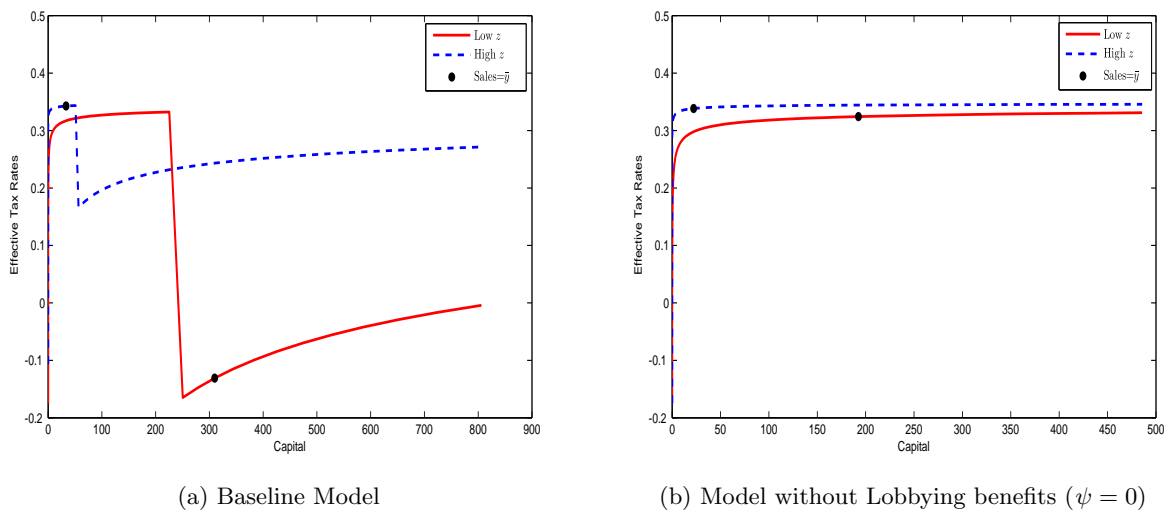


Figure 4: Effective Tax Rate Functions for Baseline Model and Model without Lobbying Benefits

underestimates the effective tax rate of lobbying firms.

5.2 Results and Non-Targeted Moments

Lobbying firms, on average, pay lower effective tax rates. This is mainly due to preferential tax treatment granted when they exert lobbying efforts. The right panel of Figure (4) shows that, without lobbying benefits, the effective tax rate is increasing in productivity and capital. This is because the standard deductions are tied only to capital, and with a decreasing return. Once lobbying benefits are introduced to the policy function, i.e. $\psi > 0$, large firms find it profitable to lobby and become entitled to additional deductions. The left panel of Figure (4) illustrates how lobbying effort can change the relative effective tax rate for lobbying firms and non-lobbying firms. For firms with the same level of productivity, large firms enjoy significantly lower effective tax rates when they decide to exert lobbying effort, compared to small, non-lobbying firms. However, lobbying benefits, measured by effective tax rates, seem to be less prominent for highly productive firms because the benefits are only tied to capital.

To make it clearer, the black dots in Figure (4) show two firms with the same amount of income.

Table 7: Marginal Product of Capital (MPK), Non-Targeted Moments

Moments		Data	Model
mean(MPK)	(Lobbying firms)/(All firms)	0.71	0.71
	(Non-lobbying firms)/(All firms)	1.04	1.04
std. dev.(MPK)	(Lobbying firms)/(All firms)	0.57	0.09
	(Non-lobbying firms)/(All firms)	1.04	1.07

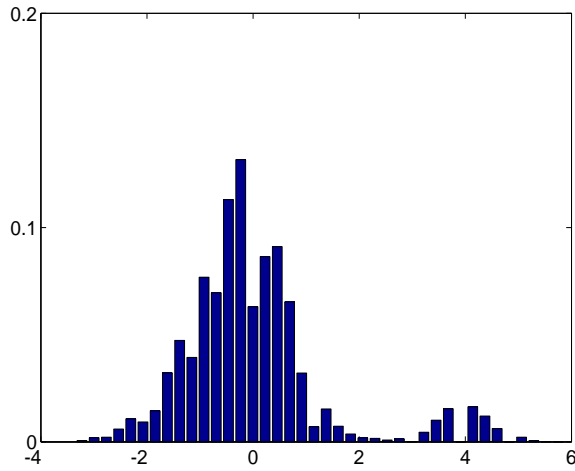
Effective tax rates faced by large, unproductive firms are substantially lower than those faced by small, productive firms in the baseline model, while the difference is less noticeable in the model without lobbying benefits. This obviously has implications for resource misallocation issues. On the one hand, large, unproductive firms enjoy tax benefits, encouraging them to accumulate more capital. On the other hand, small, productive firms face high effective tax rates, reducing their after-tax profit and preventing them from accumulating capital.

5.2.1 Marginal Product of Capital, Non-Targeted Moments

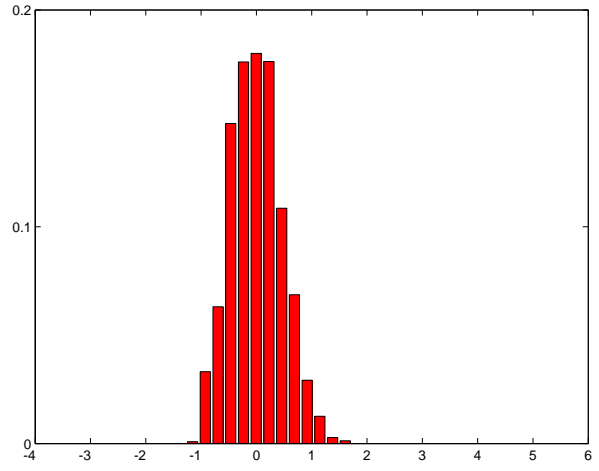
Because the model has a clear implication for resource misallocation and because further analyses will be conducted in Section 5.4 to explore how tax benefits and lobbying activities distort the allocation of capital, it is crucial to see how well the model can match the most common measure of resource misallocation, i.e., a dispersion of the marginal product of capital (MPK).

Table (7) reports four non-targeted moments: the relative mean and standard deviation of the marginal product of capital for both lobbying and non-lobbying firms. The data show that lobbying firms have, on average, lower marginal product of capital than the average firm, and that non-lobbying firms have, on average, higher marginal product of capital. The data also suggest that the marginal product of capital is two times less dispersed among lobbying firms than non-lobbying firms. Most of these facts are captured well by the model.

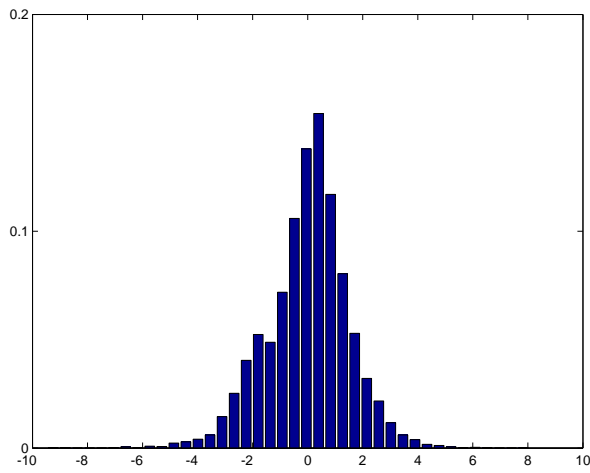
In the model, as suggested by the policy functions in Figure (4), lobbying firms hold large amounts of capital. The average amount of capital is even larger for less productive firms. The model, thus, naturally delivers the low average marginal product of capital among lobbying firms.



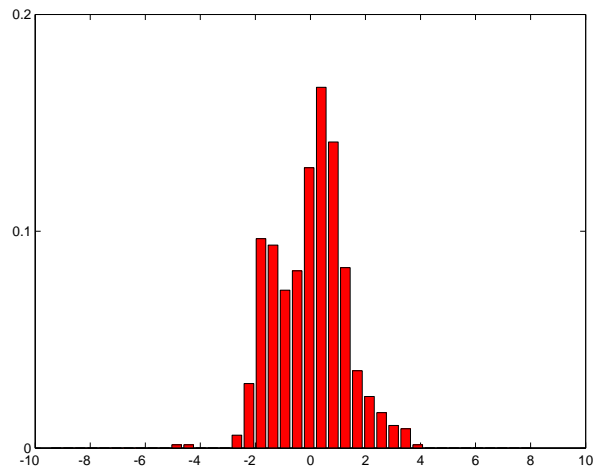
(a) Non Lobbying Firms (model)



(b) Lobbying Firms (model)



(c) Non Lobbying Firms (data)



(d) Lobbying Firms (data)

Figure 5: Distribution of $\ln(MPK)$

Figure (5) compares the model-implied distribution of the logarithmic marginal product of capital, in the top panel, to the actual distribution from the data for the period 2010-11, in the bottom panel. Note that the model is able to replicate the distribution of the marginal product of capital of both groups of firms. In fact, the support of model-implied demeaned distribution is very similar to the support of the demeaned distribution in the data. Moreover, just as in the data, the distribution of non-lobbying firms (left panel) is significantly more dispersed than the distribution of lobbying firms (right panel). Finally, the shapes of the distributions are also very similar; in

Table 8: ETR Regressions, Non-Targeted Moments

Variables		Reg (1)			Reg (3)		
Data [†]	Model	Data	Model	Same Sign	Data	Model	Same Sign
<i>if_lob_{t-1}</i>	$\mathbf{1}(l_{-1} > 0)$	-0.014**	-0.136	yes			
<i>log_lob_{t-1}</i>	$\log(l_{-1} + 1)$				-0.020**	-0.022	yes
<i>cap_int</i>	k/n	-0.575***	-0.003	yes	-0.572***	-0.003	yes
<i>lev</i>	b/k	-0.196***	-0.270	yes	-0.195***	-0.267	yes
<i>size</i>	$\log(V)$	0.009***	0.306	yes	0.009***	0.308	yes

¹ † Variable descriptions are provided in Appendix D.

² *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

³ See Table (4) for regressions with data.

fact, the only difference is in the non-lobbying distribution, where, in the model, there are some signs of a bimodal distribution. Therefore, because the model is able to capture the main features of the distribution of the marginal product of capital, it is well suited to study the misallocation of capital in the economy.

5.2.2 Lobbying and Effective Tax Rates, Non-Targeted Moments

When calibrating the model, the targeted moments are the average effective tax rates of lobbying firms and non-lobbying firms. To check the model performance, a conditional correlation between lobbying activities and effective tax rates from the model's predictions can be compared with the correlation from the data. In particular, the panel regressions (1) and (3) reported in Table (4) of Section 3 are compared to their model counterparts in a test performed with 100,000 simulated samples from the benchmark model.²¹ Table (8) reports the regression results from model-simulated observations along with those from the data for the period 1998-2011.

Although the model is calibrated to 2010-11 data, it yields correct predictions of the sign of all regression coefficients, including lobbying activities, capital intensity, leverage ratio, and total assets. Regression 1 shows the effect of lobbying at the extensive margin. Firms that engage in lobbying activity have, on average, lower effective tax rates. Regression 2 shows the effect of lobbying at the intensive margin. By spending a larger amount on lobbying activity, firms enjoy

²¹ Because there are no model counterparts for R&D intensity and inventories, these variables are dropped from the analysis.

lower effective tax rates. The higher capital intensity and leverage ratio the firm has, the lower effective tax rate the firm pays. This is because tax benefits are tied to capital. Capital intensive firms can claim higher tax benefits. The negative coefficient for the leverage ratio is influenced by small, unproductive firms that are highly leveraged but take large benefits from base deductions. These firms pay very low effective tax rates. Lastly, a proxy for the volume of assets is the firm's value. Firms with large volumes of assets pay higher effective tax rates. This prediction arises in the model from the fact that tax benefits are tied to capital with a decreasing return. Large firms, and, particularly, productive large firms, can then possibly face higher effective tax rates because of their large sales volume. Those that pay low effective tax rates are unproductive firms, which generally have lower values.

5.3 The Persistence of Lobbying

A resilient fact of corporate lobbying documented by Kerr et al. (2014) is that lobby status is highly persistent at the firm level. Before proceeding to the analysis of the calibrated model, it is interesting to see this moment delivered by the model. Tables (9a) to (9c) show the average transition probabilities in the data between lobbying and non-lobbying firms for three different periods. In line with the results from Kerr et al. (2014), lobbying decisions are highly persistent states. They suggest that this persistence is due mainly to the option value generated by the interaction between entry cost to lobby and returns to experience in lobbying.

Table (9d) shows the model-implied transition probability for the baseline calibration. The baseline model captures more than 70% of the persistence in lobby status without fixed entry cost to lobby or returns to political experience. The fact that tax benefits are tied to capital holdings and that capital is highly persistent implies that benefits from lobbying are also persistent. Therefore, at least for tax-related lobbying, this paper provides an alternative mechanism that can explain the persistence in firms' political activism.

Table 9: Transition Matrix of Lobbying Decision

(a) Data (1998 – 1999)			(b) Data (2010 – 11)		
	$lob_t = 0$	$lob_t = 1$		$lob_t = 0$	$lob_t = 1$
$lob_{t-1} = 0$	98.74	1.26	$lob_{t-1} = 0$	98.23	1.77
$lob_{t-1} = 1$	20.31	79.69	$lob_{t-1} = 1$	14.29	85.71

(c) Data (1998 – 2011)			(d) Model (Baseline Calibration)		
	$lob_t = 0$	$lob_t = 1$		$lob_t = 0$	$lob_t = 1$
$lob_{t-1} = 0$	98.45	1.55	$lob_{t-1} = 0$	92.67	7.33
$lob_{t-1} = 1$	14.59	85.41	$lob_{t-1} = 1$	38.1	61.9

5.4 Quantitative Experiment

5.4.1 Changes in Tax Expenditures: How do Lobbying and Tax Evolve from 1998?

The first experiment is to see how well the model can capture changes in lobbying activities and effective tax rates between 1998-1999 and 2010-11, the first and the final two years of the data set. Because the level of tax expenditures determined by the government is observed directly in the data, the only change to the baseline calibration is in θ . In 1998-1999, revenue losses from tax expenditures are 23%, compared to 33% in 2010-11.²² In particular, all targeted moments in the benchmark calibration are obtained for the model with benchmark parameters but with $\theta = 0.23$.

Table 10: Lobbying and Effective Tax Rate Moments in 1998-1999 and 2010-11

		1998-1999		2010-11		Change (%)	
		Data	Model	Data	Model	Data	Model
Effective tax rate (%)	All firms	24.4	21.9	18.7	18.0	-23.4	-17.8
	Lobbying firms	21.2	16.7	15.5	10.8	-26.9	-35.3
	Non-lobbying firms	24.6	22.3	19.1	19.2	-22.4	-13.90
lobbying firms (%)		4.0	7.0	10.9	13.5	172.5	92.8
Capital owned by lobbying firms (%)		28	59	60	64	114.3	8.5
Lobbying expenditures to sales (%)		0.07	0.09	0.06	0.11	-14.3	22.2

¹ Numbers in bold are targeted. They are reported in Table (6).

² All parameters but θ are common. $\theta = 0.23$ for the model replicating 1998-99.

²² IRS corporate tax returns balance sheet.

The first column of Table (10) shows the data moments from the period of 1998-99. Although several other parameters might have changed over the past decade, by adjusting only the fraction of tax expenditures, the model is able to qualitatively predict all changes observed in the data except the ratio of lobbying expenditures to sales. The last column of Table (10) compares the percentage changes observed in the data and those predicted by the model. In fact, other than under-predicting the change in capital owned by lobbying firms and over-predicting the change in lobbying expenditures over sales, the model quantitatively predicts all changes relatively well.

In the model, the increase in tax expenditures reduces the average effective tax rate for every group of firms, with lobbying firms experiencing a larger decrease. The rise in tax expenditures allows more firms to benefit from lobbying activities, resulting in a larger fraction of lobbying firms. Most of these new lobbying firms have low productivity but not high enough capital, so they were not able to spend a large enough amount on lobbying activities when preferential tax treatment was more limited. These firms' optimal lobbying spending is relatively lower but, once they are granted preferential treatment, their effective tax rates become substantially lower than those of existing lobbying firms, which generally have higher productivity and greater capital. As a result, the ratio of lobbying expenditures to sales decreases, and the average effective tax rate of lobbying firms falls substantially. For the group of non-lobbying firms, the only effect is that there is a lower proportion of firms with a large amount of capital, which, in general, have slightly higher effective tax rates, as discussed above. As a result, the average effective tax rate falls by a smaller percentage. Lastly, the share of the total capital owned by lobbying firms increases. This is mainly due to a larger fraction of lobbying firms in the economy. All these predictions are confirmed in the data, with considerable success even at the quantitative level.

5.4.2 Resource Misallocation

The effective tax rate functions shown in Figure (4) suggest that a non-negligible distortion is created by the presence of lobbying activities on top of a distortion from the standard tax benefits, which are applied evenly across firms. Hsieh and Klenow (2009) point out that the more dispersed

is the marginal product of capital, the more severe is the resource misallocation in the economy. This is because capital can be reallocated across firms to achieve a higher level of output.

Table 11: Dispersion of Marginal Product of Capital

Measure	(1) Benchmark	(2) $\psi = 0, \underline{b} = 0$	(3) [†] $\psi = 0, \underline{b} = 0.075$	(4) ^{††} $\psi = 0, \underline{b} = 0.8$
Variance MPK	1.58	0.07	1.29	0.50
% Tax Expenditures	33%	0%	4%	33%

[†] The parameter value, \underline{b} , is kept at a benchmark value.

^{††} The parameter value, \underline{b} , is reassigned so that revenue losses from tax expenditure account for 33%.

Table (11) shows the dispersion of the marginal product of capital generated by the model with different sets of parameter values. The model with the benchmark parameter values is reported in the first column. The second column is the model without tax benefits. The last two columns are the models without lobbying benefits, one with the same base deduction as the benchmark and the other with the base deduction, which yields the benchmark’s fraction of tax expenditures. The benchmark parameters result in the most severe misallocation. Removing tax benefits washes out almost all of the misallocation except that created by entrants, driving down the variance of the marginal product of capital practically to zero.²³ Removing lobbying benefits yield intermediate results. Therefore, tax benefits, either base deductions or preferential tax treatment, endogenously generate a larger dispersion in the marginal product of capital, implying inefficiencies in the allocation of resources. When base deductions are high, there are a number of highly productive firms clustered around high levels of capital. Low-productivity firms choose to have low levels of capital because they can still enjoy very low effective tax rates. When base deductions are low, more firms, including productive firms, cluster around low levels of capital. As a result, the variance of the marginal product of capital is larger in the model with lower base deductions.

In summary, this section shows that the calibrated version of the model introduced in Section 4 successfully replicates the data features highlighted in Section 3. Moreover, the model suggests that the evolution of effective tax rates and lobbying activity in the U.S. economy between 1998-2011

²³Exit firms are replaced by entrants with capital holdings equal to the total capital of exit firms; only after a period are they able to adjust their holdings.

can be attributed to a relative increase in the availability of corporate tax benefits tied to capital usage. Finally, the calibrated model implies that corporate rent-seeking is responsible for at least 20% of capital misallocation in the U.S. economy.

6 Conclusion

In this paper, we document a wide heterogeneity in the effective corporate taxation paid by U.S. corporations. In particular, firms in the U.S. pay on average an effective tax rate that is more than ten percentage points lower than the statutory tax rate, with a great dispersion among them. This is mainly due to tax benefits granted by the government. These benefits are not exogenous for every firm. In fact, large, capital-intensive firms are able to lobby for tailored benefits that fit their profiles. Because most tax provisions are tied to capital holding, different firms face different marginal benefits depending on their capital accumulation. Therefore, corporate lobbying can be an endogenous mechanism driving capital misallocation in the economy.

The heterogeneous firm dynamic model presented in this paper formalizes this mechanism and provides a framework to quantify the role of capital-based tax benefits and firms' rent-seeking behavior in the economy. In the model, firms are granted tax benefits tied to their capital holdings, and lobbying firms are granted extra benefits depending on their lobbying expenditure. Because benefits available through lobbying are limited, only a small fraction of firms lobby in equilibrium. However, these firms are large and they can potentially hold most of the capital in the economy; therefore, the presence of capital-based tax benefits and lobbying behavior can potentially create important capital misallocation in the economy.

The calibrated model matches the targeted and non-targeted moments in the data. In particular, it is accurate when replicating the non-targeted moments, such as the first two moments of the marginal product of capital for a group of lobbying and non-lobbying firms. The two main quantitative results of the paper can be summarized as follow. First, the increase in the availability of tax benefits in the U.S. economy between 1998-99 and 2010-11 can explain most of the decrease

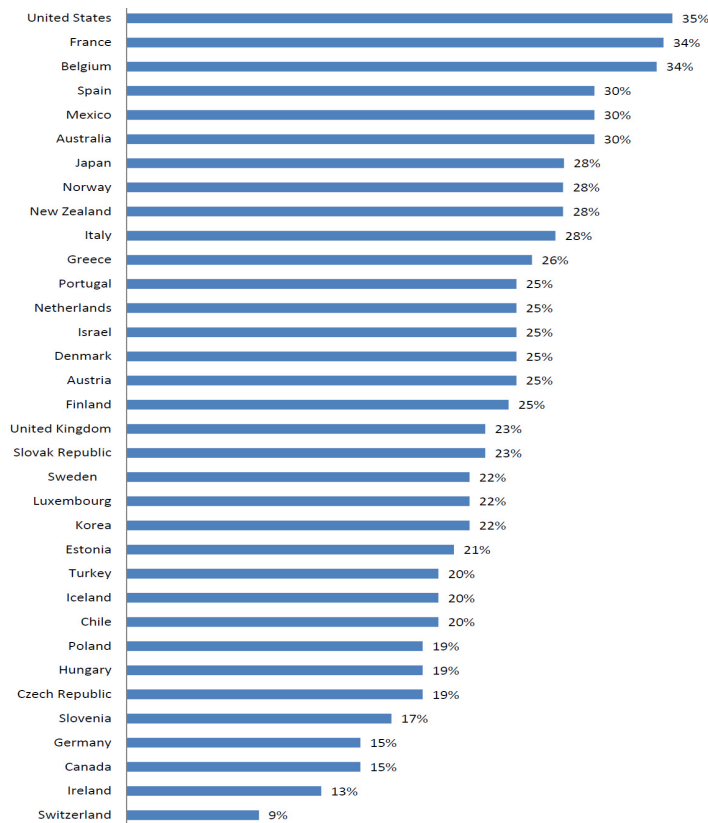
in the effective tax rate, and can also explain the increase in lobbying activity at both the intensive and extensive margins. Second, corporate lobbying accounts for more than 20% of the variance in the marginal product of capital in the U.S. economy, which measures the degree of misallocation.

This paper provides a new mechanism that can endogenously generate misallocation of resources in the economy. The main alternative channel in the literature to endogenize capital misallocation is the existence of credit-constrained firms that cannot achieve their optimal scale. Future research should contrast the two channels and quantify the contribution of each channel to the misallocation of capital. For this particular sample, the credit constraint channel does not seem to be particularly important. In fact, credit access has not been an issue for large and publicly-held firms in the U.S., even during the Great Recession. Nevertheless, in a developing economy where small firms are likely to be constrained, and weak institutions give wide access to rent-seeking behavior, the distinction of the two channels is fundamental for the efficient design of public policy.

APPENDIX

A Corporate Income Tax Rates in OECD Countries

Figure (6) shows that the current U.S. tax system taxes corporate income at a statutory rate of 35%, the highest rate among the Organization for Economic Co-operation and Development (OECD) nations. The Organization for Economic Cooperation and Development (OECD), however, face an average rate of 25%. Even corporations in high-tax European countries such as Belgium (34 %), France (34 %), and Sweden (22 %) face lower statutory rates than those in the United States.



Source: OECD Tax Database

Figure 6: Central Government Statutory (Flat or Top Marginal) Corporate Income Tax Rate by OECD Nation, 2013

B Ranking of Lobbying Issues Based on Expenditures

Table (12) lists the top ten lobbying issues by lobbying firms in the Compustat database, according to proportions of lobby expenditure for specific issues. Ranking is based on the matched data set before the sample selection. Because there can be multiple issues for a single bill, we discount each lobbying expenditure by dividing the total amount by the number of issues reported in each bill. During 1998-2011, taxation issues stay at the top for every single year except 2009, when the health care reform places health issues at the top.

Table 12: Top 10 Lobbying Issues Based on Aggregate Expenditures

1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
TAX	TAX	TAX	TAX	TAX	TAX	TAX	TAX	TAX	TAX	TAX	HCR	TAX	TAX
TRD	TRD	TRD	TRD	TRD	DEF	BUD	BUD	BUD	ENG	ENG	MMM	ENG	ENG
BUD	HCR	HCR	HCR	HCR	TRD	HCR	HCR	TRD	HCR	HCR	PHA	HCR	BUD
DEF	TEC	TEC	TEC	DEF	HCR	DEF	TRD	HCR	TRD	TRD	TAX	FIN	ENV
ENV	DEF	DEF	DEF	ENG	BUD	TRD	DEF	ENG	BUD	BUD	ENG	BUD	HCR
TEC	ENV	BUD	BUD	BUD	TEC	TEC	TEC	DEF	CPT	DEF	BUD	ENV	TRA
HCR	BUD	ENV	ENG	TEC	ENG	ENG	ENG	TEC	DEF	ENV	ENV	DEF	FIN
TRA	UTI	ENG	ENV	MMM	MMM	MMM	MMM	CPT	MMM	CPT	TRD	TRD	TRD
ENG	ENG	LBR	AVI	ENV	FIN	TOR	TRA	MMM	TEC	MMM	FIN	CPT	CPT
UTI	LBR	TRA	TRA	FIN	TOR	FIN	FIN	RET	FIN	TEC	CPT	MMM	SCI

¹ See Table (15) for an explanation of abbreviation.

C Data Source and Sample Selection

As explained in the main text, we link lobby data and data on firm characteristics from Compustat for the period of 1998–2011. We focus on lobby data on tax issues only and keep i) firm-year observations that have non-negative pre-tax income; ii) firms that are incorporated (or legally registered) in the U.S.; and iii) non-financial firms. Then, we further refine data by dropping extreme and missing values for variables considered in the regression. After selection, there are 28,710 firm-year observations, giving on average 2,050 firms each year. It is an unbalanced panel. Nominal variables are deflated by the GDP deflator so that they are in dollars in 1998.

Each company's effective tax rate is computed using data from Compustat as:

$$ETR = \frac{\text{Income Taxes Total} - \text{Deferred Taxes}}{\text{Pre Tax Income} - \text{Equity in Earnings} - \text{Special Items} + \text{Interest Expense}}. \quad (12)$$

Marginal product of capital is computed using data from Compustat as:

$$mpk = \frac{\text{SALE}}{\text{Property, Plant and Equipment} - \text{Total (Gross)}}.$$

D List of Variables

Table (13) provides details and sources of all variables used in the empirical analysis. Table (14) presents the variables used as regressors in this exercise and their Compustat codes.

Table 13: Variable Sources

	Code	Variable description	Source
ETR related variables			
	TXT	Income Taxes – Total	Compustat
	TXFO	Income Taxes – Foreign	Compustat
	TXDI	Income Taxes – Deferred	Compustat
	TXDFO	Deferred Taxes – Foreign	Compustat
	PI	Pretax Income	Compustat
	PIDOM	Pretax Income Domestic	Compustat
	PIFO	Pretax Income Foreign	Compustat
	ESUB	Equity in Earnings – Unconsolidated Subsidiaries	Compustat
	SPI	Special Items	Compustat
	XINT	Interest and Related Expense	Compustat
	TXPD	Income Taxes Paid	Compustat
Other variables			
	AT	Assets – Total	Compustat
	PPEGT	Property, Plant and Equipment – Total (Gross)	Compustat
	DLTT	Long – Term Debt – Total	Compustat
	INVT	Inventories – Total	Compustat
	XRD	Research and Development Expense	Compustat
	SALE	Sales/Turnover (Net)	Compustat
	LT	Liabilities – Total	Compustat
	FCA	Foreign Exchange Income (Loss)	Compustat
	EMP	Employees	Compustat
Deflator			
	GDPDEF	Gross Domestic Product: Implicit Price Deflator	FRED

Table 14: Variable Definitions

Variable name	Variable description	Calculation
def	GDP deflator	-
ETR_t	Effective tax rate at t	See equation (12)
if_lob_t	Indicator variable takes one when firm lobbies	-
lob_t	Lobby expenditure in million dollar (in 1998)	-
$loglob_t$	Natural logarithm of lob_t	$\log(lob_t + 1)$
cap_int	Deflated capital over workers ($ppegt/emp/def$)	$ppegt/emp/def$
inv_int	Deflated inventories over workers ($invt/emp/def$)	$invt/emp/def$
rnd_int	Deflated R&D over workers ($xrd/emp/def$)	$xrd/emp/def$
$size_at$	Log transformation of deflated total assets	$\log(at/def + 1)$
lev	Leverage (liabilities divided by total assets)	lt/at

E List of Lobbying Issues

Table 15: List of Lobbying Issues

Abbreviation	Full description	Abbreviation	Full description
ACC	Accounting	CSP	Consumer Issues/Safety/Protection
HOM	Homeland Security	RET	Retirement
ADV	Advertising	CON	Constitution
HOU	Housing	ROD	Roads/Highway
AER	Aerospace	CPT	Copyright/Patent/Trademark
IMM	Immigration	SCI	Science/Technology
AGR	Agriculture	DEF	Defense
IND	Indian/Native American Affairs	SMB	Small Business
ALC	Alcohol & Drug Abuse	DOC	District of Columbia
INS	Insurance	SPO	Sports/Athletics
ANI	Animals	DIS	Disaster Planning/Emergencies
INT	Intelligence and Surveillance	TAR	Miscellaneous Tariff Bills
APP	Apparel/Clothing Industry/Textiles	ECN	Economics/Economic Development
LBR	Labor Issues/Antitrust/Workplace	TAX	Taxation/Internal Revenue Code
ART	Arts/Entertainment	EDU	Education
LAW	Law Enforcement/Crime/Criminal Justice	TEC	Telecommunications
AUT	Automotive Industry	ENG	Energy/Nuclear
MAN	Manufacturing	TOB	Tobacco
AVI	Aviation/Aircraft/Airlines	ENV	Environmental/Superfund
MAR	Marine/Maritime/Boating/Fisheries	TOR	Torts
BAN	Banking	FAM	Family Issues/Abortion/Adoption
MIA	Media (Information/Publishing)	TRD	Trade (Domestic & Foreign)
BNK	Bankruptcy	FIR	Firearms/Guns/Ammunition
MED	Medical/Disease Research/Clinical Labs	TRA	Transportation
BEV	Beverage Industry	FIN	Financial Institutions/Investments/Securities
MMM	Medicare/Medicaid	TOU	Travel/Tourism
BUD	Budget/Appropriations	FOO	Food Industry (Safety, Labeling, etc.)
MON	Minting/Money/Gold Standard	TRU	Trucking/Shipping
CHM	Chemicals/Chemical Industry	FOR	Foreign Relations
NAT	Natural Resources	URB	Urban Development/Municipalities
CIV	Civil Rights/Civil Liberties	FUE	Fuel/Gas/Oil
PHA	Pharmacy	UNM	Unemployment
CAW	Clean Air & Water (Quality)	GAM	Gaming/Gambling/Casino
POS	Postal	UTI	Utilities
CDT	Commodities (Big Ticket)	GOV	Government Issues
RRR	Railroads	VET	Veterans
COM	Communications/Broadcasting/Radio/TV	HCR	Health Issues
RES	Real Estate/Land Use/Conservation	WAS	Waste (hazardous/solid/interstate/nuclear)
CPI	Computer Industry	WEL	Welfare
REL	Religion		

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