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Abstract

In this paper we investigate the effect of higher personal income taxes on CEO and firm performance in publicly traded US firms. In response to higher taxes on compensation, CEOs are less likely to reach performance goals and spend more time working in boards outside of their firm. At the same time, firm performance drops before eventually recovering as investment projects with below average profitability are disregarded and due to adjustments in CEO compensation.

Keywords: Executive Compensation, Personal Income Taxation, Firm Performance

JEL classification: H24, M12

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1 Introduction

The input of CEOs is essential to their firms' performance (Bennedsen et al., 2020). This underscores the need to investigate whether income taxes affect the labor supply of CEOs, and thereby the performance of their firms.

When considering inventors taxes are found to significantly inhibit their patenting output (Akcigit et al., 2022). This suggests that CEOs' effort provision may also respond substantially to tax changes. As the input of managers is an important determinant of firm performance (Bertrand and Schoar, 2003) and with some superstar firms achieving disparate increases in market capitalization, even small differences in CEO talent justify large pay differences (Gabaix and Landier, 2008). This implies that even minor tax distortions to CEO effort may have an amplified economic impact due to the sheer scale of their firms. On the contrary, CEOs might exhibit a notable insensitivity to tax changes, consistent with research by Gruber and Saez (2002), which observed small real responses to taxes, even among individuals in the highest income brackets.

A fundamental hurdle in addressing this research question lies in the difficulty of measuring CEO effort on the necessary scale and over the required time frame to identify tax effects. To overcome this challenge, we employ a comprehensive approach drawing upon evidence from a variety of longitudinal data sources. First, we utilize data on performance goals linked to financial incentives as an indicator of CEO labor supply. Second, we gauge the deviation of CEO effort by examining CEOs' involvement in external boards. Lastly, we assess the CEOs' firm performance by investigating its return on assets.

To analyze the impact of increased taxes on our outcome variables, we make use of variation in the personal income tax rate across different US states spanning from 1992 to 2017. Our method of identification relies on comparing executive-firm pairs in states that underwent tax changes with those in states that did not experience such changes. This approach hinges on the assumption that, in the absence of tax reforms, treated and untreated executive-firm pairs would have followed a similar trajectory. To assess the validity of this assumption, we estimate the effect of tax changes on our outcome variables in an event study framework using an estimator that is robust to heterogeneous treatment effects. To ensure that our findings are not driven by spurious correlation between state-level economic trends, state taxes, and firm performance, we exclusively consider tax changes that have been classified

as exogenous by Giroud and Rauh (2019).[1] We furthermore incorporate various controls for the economic climate within each state.

Using the variation in tax rates across states yields the following results. First, there is a statistically significant and negative impact of taxes on CEOs' labor supply. Specifically, after a 1 percent rise in the state's marginal retention rate CEOs achieve an additional 0.8 out of 100 performance goals. Further, CEOs also increase their involvement in external boards in response to an increase in their personal tax rate. When the state-level marginal retention rate climbs by 1 percent, CEOs sit on 0.1 fewer committees.

The performance of the CEO's firm deteriorates as well. A one percent increase in the CEO's marginal retention rate results in a 0.1 percentage point decline in the firm's return on assets, when estimated as a static effect.

We also find a similar response of CEO labor supply and firm performance when estimating the impact of a tax change in a dynamic setting. Similar to our panel regressions, we find positive and statistically significant effects of tax reforms on engagement in outside boards as well as a negative and statistically significant effect on the number of performance goals an executive reaches. Prior to the reforms there is no evidence of a pretrend and the effect is persistent in the long run. We further find a negative and statistically significant effect on return on assets in the years immediately after the tax reform. Over a longer horizon, the return on assets reverts to its pre-reform level, aligning with expectations regarding firms' adjustment margins to cope with shocks such as tax rate changes.

We explore several mechanisms that may cause this recovery of return on assets. While there is no significant change in CEOs' total compensation, there is an effect on the composition of executive compensation: higher taxes increase the level of stock compensation CEOs receive, hence providing them with stronger incentives to maximize firm value. Further, we find that a tax change affects capital expenditure, with higher taxes depressing the amount of investment the firm undertakes. This effect is concentrated in the least profitable business segments, suggesting that CEOs no longer pursue investment projects which are barely profitable at the margin. This restrictive focus on more profitable projects thereby increases the average return of the firm's remaining project portfolio. The more restrictive approach to investment is also reflected in a lower level of total assets for firms with CEOs subject to a tax increase relative to firms without a tax change.

In a final step, we assess the robustness of our identification strategy. While we cannot

[1] Results are similar when considering all tax changes.

rule out that firm performance might also be affected by the labor supply response of other executives, we apply several robustness checks to ensure that the response is related to the labor supply response of the CEO. First, we exploit that personal income taxes on wages have only minor effects on the incentives of CEOs who hold a high amount of wealth in their companies as their main payoffs are in dividends or capital gains. Consequently, they should not respond as strongly to a change in the top personal income tax rate, which is applicable for compensation but not capital income. Comparing the effect of taxes on labor supply and firm performance for more and less affected CEOs also allows us to include state $\times$ year fixed effects addressing the concern that our effect is, e.g., driven by changes in state economic conditions. By employing this modified estimation strategy, we indeed find a stronger response of return on assets to a change in the top personal income tax rate for CEOs holding a low amount of wealth in their firms.

Second, we check whether the effect in return on assets is independent of the average wage level in the firm and the state taxes levied on other employees. To this end, we control for the progressivity of the state tax system by including the average tax rate of income earners at the median and the top one percent of the state income distribution. Controlling for the state income tax schedule does not change our main results. When exploiting heterogeneity in employee pay across firms, we do not find a stronger response in the performance of firms with a high level of average employee pay than in firms with a low level of average employee pay.

Third, we show that results are robust to using Tobin's Q as an alternative measure of firm performance.

The findings in this paper expand on several strands of literature. First, our analysis relates to the literature on the effects of taxes on high-income earners. Ales and Sleet (2016) derive the optimal income tax rate for CEOs accounting for the presence of spillover effects.[2] Due to the difficulty of measuring labor supply responses, the literature has so far focused on assessing the effect of higher taxes on observable measures such as the elasticity of taxable income.[3] Other studies investigate the effects of higher top-income tax rates on aggregate economic indicators such as GDP growth or employment. While Zidar (2019) finds no effects of higher taxes on GDP growth or employment, Mertens and Montiel Olea (2018) find that

[2]Scheuer and Werning (2017) derive the optimal tax rate for top-income earners in general.

[3]Saez et al. (2012) provide an overview.

cutting the top marginal personal income tax rate leads to higher employment and GDP.[4] In addition to these more aggregate-level studies, Akcigit et al. (2022) provide empirical evidence on how individual inventors adjust their economic activity in response to state income taxes. They find that higher rates inhibit patenting activity and reduce the quality of inventor's patents.

We contribute to the literature by examining labor supply responses of an important group of top income earners, namely executives of publicly listed companies. We add to studies examining the aggregate effects of higher top income taxes on economic variables by providing firm-level evidence on the effects of higher top income taxes on firm performance. Our findings are more in line with the findings of Mertens and Montiel Olea (2018), who find that aggregate economic variables respond to higher taxes on the top 1%.

Second, our findings also relate to the literature studying the effects of executives on their firms. This literature was pioneered by Bertrand and Schoar (2003) who show that executive fixed effects explain up to one-third of the variation in firm performance. In a more recent study, Bennedsen et al. (2020) use variation in the absence of executives from their companies due to hospitalization events. They find a significant effect of executive absence on firm profitability. Ben-Rephael et al. (2023) rely on minute-by-minute Bloomberg online status data and Bandiera et al. (2020) exploit CEO diary data to show that executive's effort provision has significant effects on firm value.[5] Malmendier and Tate (2009) evaluate the impact of CEOs winning awards on the performance of their firms and on the effort they provide. Our analysis builds upon the findings in this literature by showing that personal income tax policy affects executive behavior with spill-overs to their firms.

Third, our paper also relates to studies on the interaction between taxes and executive compensation. So far, there has been mixed evidence on the effect of taxes on executive compensation. Older studies assessing the effect of higher personal income taxes on executive compensation found no effect of taxes on compensation (Goolsbee, 2000; Frydman and Molloy, 2011). On the contrary, more recent evidence finds an effect of taxes on the composition and amount of executive compensation as well as the responsiveness of executive compensation to rents (Bennett et al., 2020; Gorry et al., 2017; Piketty et al., 2014). For a summary of the literature on the determinants of executive compensation, see Edmans

[4]Kindsgrab (2022) and Risch (2023) also study the incidence of higher top income taxes on earnings and find mixed results. While Kindsgrab (2022) finds no aggregate effects of higher taxes on wages, Risch (2023) finds that increasing income taxes for business owners reduces the wages of other workers at that firm.

[5]Biggerstaff et al. (2017) use playing golf as a measure of leisure and provide evidence that those CEOs who golf the most are associated with firms that have lower operating performance and firm values

et al. (2017). Corporate taxes also appear to affect the amount of compensation an executive receives (Ohrn, 2021).[6] However, our study goes beyond the analysis of the effect of taxes on income by directly studying how distorting marginal incentives affects the executive's labor supply response. Various papers study the effect of the incentive structure of CEO contracts on different measures of firm performance. Morck et al. (1988), Habib and Ljungqvist (2005) as well as Kim and Lu (2011) study the effect on firm value, Bergstresser and Philippon (2006) and Burns and Kedia (2006) study the effect on earnings management, with Armstrong and Vashishtha (2012) and Gormley et al. (2013) studying the effect on corporate risk taking. Lilienfeld-Toal and Ruenzi (2014) show that firms with a higher level of executive ownership outperform firms with a lower level of executive ownership.

Overall, we contribute to the literature by providing new evidence on how taxes affect the performance of an important subgroup of high-income earners. We are also able to show that these changes in individual performance have important economic effects in the form of lower firm performance. Additionally, our results also have implications for the discussion of the effect of executive pay on firm performance. The negative effect of higher taxes on firm performance suggests that (net) CEO pay is a factor in ensuring high firm performance.

The remainder of this paper is organized as follows. Section 2 incorporates taxes in theoretical models on CEO labor supply to derive empirically testable hypothesis. Section 3 describes the estimation strategy, while Section 4 presents the data. In Section 5 we outline and discuss the results of our estimation strategy. Section 6 presents the robustness checks and finally section 7 concludes.

2 Conceptual Framework

We provide a conceptual framework to rationalize how higher taxes should affect CEOs effort supply. To this end, we incorporate personal income taxes in standard models as summarized by Edmans et al. (2017) to demonstrate how state-level personal income taxation affects the optimal level of effort the executive exerts. The firm hires a CEO to run the firm. Firm value $V(a, S)$ increases in CEO effort a and firm size S and decreases in CEO pay $c(V)$,

[6] Studies on how higher taxes affect CEOs have not only been limited to study executive compensation. Armstrong et al. (2019) finds that higher taxes lead to higher corporate risk taking, while Goldman and Ozel (2022) show that CEOs are more likely to engage in insider trading following a change in the tax rate.

which may be conditioned on achieved firm value:

$$V(a) = S + b(S)a - c(V)$$

The function $b(S)$ measures the effect of CEO effort on firm value for a firm of size S. The CEO earns salary c, which increases his utility. On the other hand, providing effort a in order to manage the firm reduces his utility by $g(a)$. The higher the CEO's effort, the higher the reduction in his utility from providing effort. ($g(a)$ increases in a and is convex: $g'' > 0$.) The resulting utility function of the CEO is:

$$U(c, a) = c - g(a)$$

In addition, the CEO has the reservation utility ω. The CEO is only willing to work for the firm if his utility gain from doing so exceeds his reservation utility (participation constraint):

$$c - g(a) \geq \omega$$

The firm owner's objective is to maximize firm value under the participation constraint

$$max \quad V(a) - c(V(a))$$

$$s.t. \quad c - g(a) \geq \omega$$

For simplification we do not account for agency problems between executives and shareholders, but assume that the firm owner is able to direct the CEO to exert the desired effort level a. To realize a desired effort level a, firm owners then only have to pay a wage c high enough to fulfill the CEO's participation constraint. Accordingly, firm owners set the wage at the exact level that incentivizes the CEO to work at the desired effort level $a^\star$ and choose wage

$$c = \omega + g(a^\star).$$

The firm owners then maximize firm value taking this wage cost into account in order to choose the first best effort level $a^\star_{fb}$ of the CEO

$$\frac{\partial}{\partial a^\star}[S + b(S)a^\star - \omega - g(a^\star)] \stackrel{!}{=} 0$$

determining the first best CEO's effort level as

$$g`(a^{\star}_{fb}) = b(S)$$

Firm owners are willing to increase CEO pay in order to realize higher CEO effort as long as the additional wage cost $g^{'}(a_{fb})$ does not exceed the resulting additional contribution of CEO effort to firm value $b(S)$. This maximizes firm value. Introducing a wage tax at rate τ in this setting will affect the participation constraint resulting in

$$(1-\tau)c - g(a) \geq \omega$$

As long as firm owners do not adjust CEO pay to the new tax environment, the CEO will provide less effort than before (resulting in lower g(a)) in order to make the participation constraint binding again. *We thus expect reduced CEO effort, in the short run, following a wage tax rate increase and consequently a reduction in firm value or firm performance.* After some time, firm owners should react to the new tax environment and adjust CEO pay in order to maximize firm value taking taxes into account. As before, firm owners set the wage exactly at the level to get the CEO to work at the desired effort level $a^{\star}$. Taking taxes into account, this is costlier than before since now the participation constraint results in

$$(1-\tau)c = \omega + g(a^{\star})$$

and consequently the wage necessary to incentivize the CEO to work at the desired effort level $a^{\star}$ is

$$c = \frac{\omega + g(a^{\star})}{1-\tau}.$$

Firm owners maximize firm value taking this tax affected wage into account

$$\frac{\partial}{\partial a^{\star}}[s + b(S)a^{\star} - \frac{\omega + g(a^{\star})}{1-\tau}] \stackrel{!}{=} 0$$

in order to determine the first best CEO effort level under tax $a^{\star}_{fb\tau}$ as

$$g`(a^{\star}_{fb\tau}) = (1-\tau)b(S).$$

Since $g(a)$ is a convex function, $a^{\star}_{fb\tau}$ is smaller than $a^{\star}_{fb}$. The income tax on CEO pay

introduces a wedge between incentivizing the CEO via pay and the cost of doing so, as the CEO is interested in his net pay after tax, while the cost to the firm is the gross salary. It is now costlier for the firm to incentivize the CEO. Firm owners react by choosing a lower CEO effort level than before the reform. *We expect firm owners to adjust their incentive structure following the tax rate shock increasing CEO effort level. However, the resulting CEO effort level will be lower than the effort level before the tax rate increase.*

Assuming that the firm owner is able to direct the CEO to exert the desired effort level $a^\star$ is a simplification. Relaxing this assumption will result in an incentive compatibility constraint as discussed in Edmans et al. (2017). If firm owners cannot direct the CEO to exert the desired effort level, they need to incentivize the CEO using the pay structure. Typically, this is achieved by conditioning CEO pay on firm value. An unanticipated tax rate increase will then distort the participation constraint as well as the incentive compatibility constraint. Again, CEOs will react by providing less effort in the short run and firm owners will readjust the pay structure in the long run. Given the tax wedge between CEO incentives in net terms and firm costs in gross terms, in the long run the achieved CEO effort level should also be lower than before the tax rate increase.

3 Estimation Strategy

3.1 Difference-in-Difference Analysis

We start our analysis employing a difference in differences estimation strategy:

$$Y_{f,i,t} = \alpha + \beta \times ln(1 - MTR_{s,t}) + \gamma \times X_{f,i,t} + \delta_{i \times f} + \delta_t + \epsilon_{f,i,t} \tag{1}$$

The subscripts f, i, t and s indicate firm, CEO, year, and state respectively. Our outcome variables $Y_{f,i,t}$ are individual-level measures of the CEO's effort, namely the share of performance goals reached and the number of committees on external boards in which the CEO is involved. To capture spillover effects of changes in CEO labor supply on their firms, we also use firm performance measured by return on assets as a dependent variable. The coefficient β measures the change in the outcome variable induced by a one percent change in the net-of-tax rate. $MTR_{s,t}$ is the CEO's top marginal personal tax rate. We compare the labor supply and firm performance of treated CEO-firm pairs $i \times f$ with the labor supply of CEOs and firm performance of untreated CEO-firm pairs. We denote CEO-firm pairs

as treated if the personal income tax rate of the state s where the firm headquarters is located changes.[7] Using CEO-firm pairs as the main unit of analysis allows us to measure the intensive margin of response and abstract from any responses that could be caused by changes in the sorting of CEOs to firms. We consider specifications with and without control variables to test for robustness. $X_{f,i,t}$ denote control variables for firm size, past firm performance and state-economic trends. We include the first lag in the logarithm of assets as a control variable for firm size, the first lag of the deviation of industry return on assets, and the market-to-book ratio as controls for past economic performance. We include the state-level unemployment rate, GDP growth, an indicator for the party affiliation of the governor and the state corporate income tax rate to control for state-economic trends which might influence firm performance in particular. $\delta_{i\times f}$ is the CEO-firm pair fixed effect and δ_t is the year fixed effect. Since we use state-level variation in personal income tax rates, we cluster our standard errors at the state level.

3.2 Stacked Event Studies

To study the dynamics of the effect and to assess whether the assumption of parallel trends underlying our difference-in-difference analysis may hold, we employ an event study design. Estimating stacked event studies also allows us to verify that the results from (1) are not due to a bias that may emerge with two-way fixed effect estimation in the case of staggered events (e.g. Sun and Abraham, 2021; Baker et al., 2022).

Following Baker et al. (2022) and Agrawal and Tester (2023), we construct the stacked sample of treatment cohorts and the corresponding control groups as follows. A treatment cohort consists of all firms in states that exhibit a treatment in the same year. A treatment takes place when the maximum state tax rate changes by more than 0.5 percentage points. We only consider tax changes that were not preceded by another tax change within four years prior to the reform and not followed by a tax change of the opposite sign within four years after the reform. We compare the evolution of our outcome variables in each

[7] Using the state tax at the headquarters as the explaining variable implicitly assumes that the tax rate in the state of the headquarters is the relevant tax rate. We believe this assumption to hold even if a CEO does not live in the same state as their firms headquarters. State taxes in the US are usually levied in the state of employment if there are no reciprocity agreements between two states. If there are reciprocity agreements between two states the relevant tax rate is the highest between both states. Since the tax changes in our sample usually occur in states with relatively high tax rates such as California, CEOs are most likely treated by the change in the tax rate even if there is a reciprocity agreement in place. Even in instances in which the tax rate of the CEO would deviate from the headquarters state tax rate, this would attenuate our results.

treatment cohort to the evolution of the outcome variables in a clean control group. This group consists of all firms from states in which there was no tax change during the event window, that is four years before and after the event year of the treatment cohort. Each set of treatment and control group contains only observations within that event window.
We then stack these sets of treatment and control groups, indexing each set by j. Since non-treated control firms can enter the control group for several sets j the number of observations of our resulting regression sample may be larger than before. We estimate the following regression:

$$Y_{f,i,t,j} = \alpha + \sum_{l=-4,\dots,-2} \beta_l D^l_{s,t} + \sum_{l=0,\dots,4} \beta_l D^l_{s,t} + \gamma \times X_{f,i,t} + \delta_{i\times f\times j} + \delta_{t\times j} + \epsilon_{f,i,t,j} \qquad (2)$$

$Y_{f,i,t,j}$ represents the outcome of interest for executive i at time t, in firm f in the treatment and control pairing j. $D^l_{s,t}$ is an indicator that takes on the value 1 in year t if a tax increase happens in state s in year $t-l$. If the tax change that occurred is a tax decrease, $D^l_{s,t}$ takes on the value of -1. $D^l_{s,t}$ is always zero for the control group. To account for the stacking procedure we interact both fixed effects with j, an indicator for each pairing of treatment cohort and "clean" control group. The resulting coefficients β_l estimate any backward or forward-looking reactions to the tax change. We include the same control variables as in our panel regression. Our standard errors are clustered on the state $\times$ event level.

4 Data and Descriptive Statistics

4.1 Data

We combine tax data for the period 1992 - 2017 from NBER TaxSim with individual labor supply measures from BoardEX and ISS Incentive Lab, as well as data from Compustat to measure firm performance. Information on executives and their characteristics stem from ExecuComp.

State Tax Rates We obtain data on personal income tax rates from NBER TaxSIM. Our main variable of interest is the top marginal tax rate, which is computed as the marginal tax rate on an additional 1000 USD of income for a married individual filing jointly and

earning 1.5 million USD. Figure 1 shows the geographic distribution of tax increases and decreases above or below 0.5 percentage points in the period from 1992 to 2017. Although CEO compensation usually contains components such as options or stocks, all forms of managerial compensation are taxed at the personal income tax rate.[8] While salaries and bonuses are taxed at the point in time they are granted, stocks and options are taxed when they are exercised by the CEO.[9] Since labor income in the US is primarily taxed in the state of employment, we assume that the CEO pays her taxes in the headquarter state of the company that employs her. We also add data on the state-level corporate income tax rate which we use as a control variable from Giroud and Rauh (2019).

CEO and Firm Level Data Our primary data set is the combination of the ExecuComp and Compustat databases. ExecuComp contains information on all CEOs employed at S&P 1500 firms. Apart from compensation information, ExecuComp also contains detailed information on executives' tenure at a firm, their age and their gender. We also calculate executives' financial wealth based on the description in Coles et al. (2013). Compustat provides the financial statement information of CEOs' companies. See Table 1 for summary statistics. Since Compustat only contains information on the latest location of the headquarters, we match historical headquarter location data from SEC 10-k filings. We denote the headquarter state to be the state in which the company records its principal business activity.[10]

Board Seats and Performance Goal Data We complement our core data with data from ISS Incentive Lab. ISS Incentive Lab contains detailed information on compensation contracts of CEOs collected from a firm's proxy statements. Information on these contracts is available from 1998 onwards. These performance contracts specify which performance indicators the executive needs to reach in order to receive a payout. In our analysis, we focus on performance goals tied to accounting measures.[11] A performance goal counts as achieved

[8]One exception are incentive (ISO) stock options which are only subject to the capital gains tax rate. However, the maximum value of ISO stock options is limited to 100,000 USD every year. Given that the average CEO earns 4.8 million USD (see Table 1) this only constitutes a minor fraction of executive compensation. For a detailed overview of how the different components of executive compensation are taxed see Erickson et al. (2020).

[9]Compensation reported in ExecuComp also includes the monetary value of perquisite compensation such as travel expenses or other forms of non-monetary compensation which is also subject to the personal income tax rate.

[10]We drop all firms that experienced a headquarter change over the period of observation. Headquarter changes are frequently caused by mergers. We do not want to confound our effect with the effect of mergers on firm performance.

[11]The accounting measures traditionally employed are EPS (earnings per share), EBITDA, EBIT, Operating Income, FFO (funds from operations), Sales and Earnings.

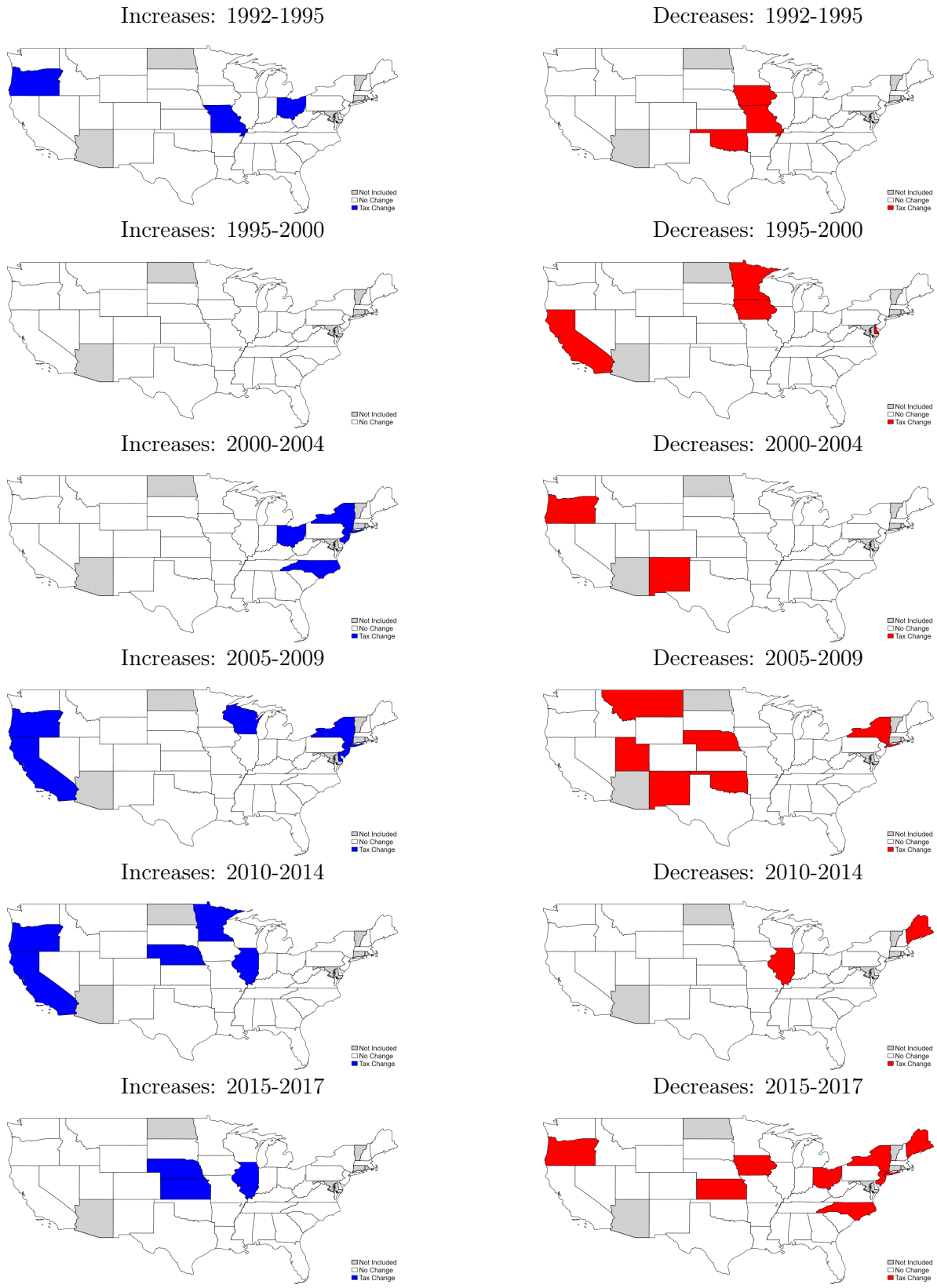
if the executive manages to hit or exceed the target value of the predefined goal. The average executive in our sample achieves 88 percent of her performance goals each year, while the median executive achieves all her performance goals (see Table 1 for summary statistics). Our data on engagement in outside board seats comes from the BoardEX database. BoardEX contains detailed information on executives employment histories. Further, BoardEX also collects information on the composition of the board of directors of every company. We use this information to determine whether an executive also serves as a director of a different company. A detailed overview of the construction of all control variables can be found in Table 13 in the Appendix.

Table 1: Descriptive Statistics

	Mean	Std.Dev.	25thPerc.	Median	75thPerc.	Obs
Firm Variables						
Return on Assets	8.28	10.01	3.58	8.05	13.25	34590
Tobin's Q	1.94	1.30	1.14	1.49	2.21	35026
Log of Assets	7.53	1.79	6.26	7.39	8.66	34590
Deviation Market to Book	-1.95	68.50	-1.70	-0.47	0.17	34590
R & D Indicator	0.42	0.49	0.00	0.00	1.00	34590
First lag of log Sale	7.06	1.68	5.96	6.97	8.12	34590
Other Variables						
Top Marginal Tax	5.82	3.81	3.02	6.07	8.09	34590
Total Compensation	4798.91	9086.26	1250.19	2679.09	5646.84	34787
Performance Goals	0.89	0.26	1.00	1.00	1.00	8691
Number of Committees	3.10	3.31	0.00	2.00	5.00	8181

Note: Table 1 presents the descriptive statistics. The sample includes firms which have not experienced a headquarter change during the period of observation and are situated in a state without an endogenous state tax change defined by Giroud and Rauh (2019). We show the descriptives of all outcome variables for the firms and executives for which all control variables are not missing. Total Compensation is the value of compensation awarded to the executive in the respective year scaled in 1,000 USD. The variable Return on Assets is the ratio of earnings before interest over assets, winsorized at the 99 % level and multiplied with 100. Tobin's Q is defined as the difference between market and book value over assets plus one, winsorized at the 99% level. The variable log of assets denotes the natural logarithm of firm assets. Book to market ratio is the book value per share over the end of year price of shares. The variable R&D indicator takes the value of one if a firm reports positive R&D expenditure. Log of sale is the natural logarithm of firm sales. The top marginal tax rate is the marginal tax rate on an additional 1,000 USD of income for a married individual filing jointly and earning 1.5 million USD from NBER TaxSim. Performance Goals is the fraction of pre-specified accounting goals the executive reaches. Number of outside board seats is the number of board seats the respective CEO holds in boards outside of her firm, number of committees is the number of committees the respective executive sits on the board. A detailed definition of variables can be found in the Appendix in Table 13.

Figure 1: Increases and Decreases in the Panel Regression



Note: Figure 1 shows the geographical distribution of tax increases and decreases above 0.5 percentage points over the sample period. The left side of the figure shows the states which experienced an increase in the respective year, the left side shows the states which experienced a decrease in the respective years. The states in grey are excluded from the estimation since they were classified as having an endogenous tax change according to Giroud and Rauh (2019)

5 Results

5.1 Panel Regression

We start our analysis by assessing whether individual measures of CEO labor supply change in the aftermath of a change in the tax rate by estimating equation (1) above. Table 2 presents baseline estimates of the effect of higher personal income tax rates on the fraction of performance goals that a CEO reaches. Specification (1) estimates the effect only controlling for executive-firm fixed effects and year fixed effects. Specifications (2)-(4) progressively add controls for firm size, past firm performance and state economic climate as described in section 3. Throughout all specifications the effect of the net-of-tax rate on performance

Table 2: Fraction of Goals reached

	(1)	(2)	(3)	(4)
ln(1-MTR)	0.779***	0.831***	0.893***	0.996***
	(0.276)	(0.285)	(0.265)	(0.207)
First lag of log Sale		0.022*	0.016	0.015
		(0.011)	(0.011)	(0.011)
R+D Indicator			0.000	-0.000
			(0.049)	(0.051)
Deviation ROA			0.166***	0.165***
			(0.047)	(0.047)
Deviation Market to Book			-0.000	-0.000
			(0.000)	(0.000)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls			✓	✓
State Controls				✓
Observations	8858	8852	8724	8691
R-squared	0.512	0.513	0.508	0.509

Note: Table 2 reports estimates from a regression following equation (1). The dependent variable is the fraction of performance goals reached. In column (1) we employ executive × firm fixed effects as well as year fixed effects. In columns (2) we add the first lag of the log of sales. In column (3) we further add an R+D indicator taking the value one if the firm reports positive R+D expenditures and 0 otherwise, the first lag of firm specific deviation from the industry median return on assets, the first lag of firm specific deviation from the industry median market-to-book ratio and governance controls from the Gomper's Index. In column (4) we include state-level control variables, namely the unemployment rate, state GDP, the state-level corporate income tax rate and an indicator which takes the value one if the governor of the state is democratic. For a more detailed definition of all variables, see Table 13. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

goals is positive and statistically significant. Using the specification without any controls as the baseline, the estimates in column (1) in Table 2 show that an increase in the retention rate by one percent significantly increases the fraction of performance goals reached by 0.008

(that is, 0.8 percentage points). Hence, if taxes are higher, CEOs reach fewer performance goals. Adding further controls that account for the economic climate in the state, as well as indicators for past firm performance and firm size, slightly increases the magnitude of the effect.

To provide further evidence on the labor supply of CEOs, we next assess the extent to which CEOs engage in alternative activities instead of running their firms. A well-observed outside activity of CEOs are board memberships at other firms. This measure for a reduction in the labor supply of CEOs is inspired by Malmendier and Tate (2009), who find that CEOs increasingly engage in outside boards after they win awards at the expense of the performance of their firms. Additionally, work by Hauser (2018) shows that engagement in outside boards reduces firm performance. We evaluate the effect of taxes on the intensity of CEOs' work in boards outside of their firm using the number of committees they are engaged in. Results are presented in Table 3. Again, controls are employed as in Table 2. The estimate in column (1) suggests that a one percent increase in the retention rate decreases the number of committees a CEO is engaged in by 0.109. Including further controls does not substantially change the magnitude and significance of the estimates.

In the next step, we assess whether the observed reduction in CEO labor supply is also reflected in firm performance. Bertrand and Schoar (2003) show that executive-firm fixed effects can explain up to one third of the variation in a firm's return on assets. They further show that the CEO has the strongest effect on return on assets relative to other executives. It has also been shown that return on assets responds to hospitalization of CEOs (Bennedsen et al., 2020) and is lower in firms in which the manager is an heir (Pérez-González, 2006). Hence, we believe that return on assets is the most suitable measure to capture the effect of changes in the CEO's behavior following the tax change. Table 4 presents the results of our difference in differences regression as specified in equation (1) with return on assets as the dependent variable. An increase in the marginal retention rate by one percent increases return on assets by 0.107 percentage points.[12] Employing the most extensive set of controls in column (4), we now find that a change in the retention rate by one percent increases return on assets by 0.121 percentage points. All results are statistically significant at the five percent level.

[12]Return on assets is measured in percentage points with an average value of 8.28.

Table 3: Number of Committees

	(1)	(2)	(3)	(4)
ln(1-MTR)	-10.942***	-12.252***	-12.118***	-13.166***
	(2.443)	(2.497)	(2.380)	(2.981)
First lag of log Sale		-0.116	-0.144	-0.117
		(0.156)	(0.144)	(0.139)
R+D Indicator			0.596	0.608
			(0.598)	(0.560)
Deviation ROA			0.099	0.097
			(0.218)	(0.221)
Deviation Market to Book			0.000	0.000
			(0.001)	(0.001)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls			✓	✓
State Controls				✓
Observations	8432	8355	8211	8181
R-squared	0.847	0.847	0.855	0.855

Note: Table 3 reports estimates from a regression following equation (1). The dependent variable is the number of committees on external boards that the CEO is involved in. In column (1) we employ executive × firm fixed effects as well as year fixed effects. In columns (2) we add the first lag of log of sales. In column (3) we further add a R+D indicator taking the value one if the firm reports positive R+D expenditures and 0 otherwise, the first lag of firm specific deviation from the industry median return on assets, the first lag of firm specific deviation from the industry median market-to-book ratio and governance controls from the Gomper's Index. In column (4) we include state-level control variables, namely the unemployment rate, state GDP, the state-level corporate income tax rate and an indicator which takes the value one if the governor of the state is democratic. For a more detailed definition of all variables, see Table 13. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Return on Assets

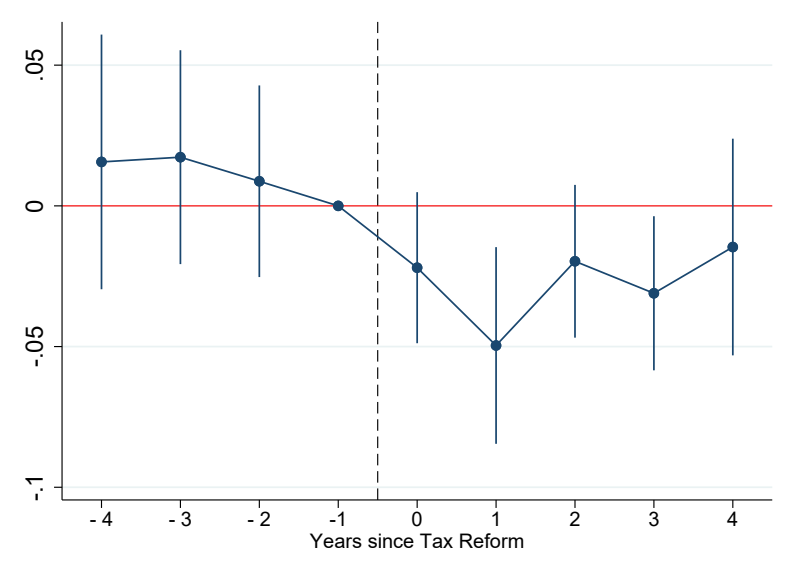
	(1)	(2)	(3)	(4)
ln(1-MTR)	10.685**	15.313***	14.687***	12.064**
	(4.814)	(4.751)	(4.107)	(4.709)
First lag of log Sale		1.419***	1.171***	1.171***
		(0.255)	(0.248)	(0.251)
R+D Indicator			-2.588***	-2.588***
			(0.840)	(0.829)
Deviation ROA			4.678**	4.680**
			(2.092)	(2.087)
Deviation Market to Book			-0.001*	-0.001*
			(0.001)	(0.001)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls			✓	✓
State Controls				✓
Observations	35854	35626	34682	34590
R-squared	0.707	0.709	0.716	0.716

Note: Table 4 reports estimates from a regression following equation (1). The dependent variable is return on assets (ratio of earnings before interest over assets, multiplied by 100). In column (1) we employ executive × firm fixed effects as well as year fixed effects. In columns (2) we add the first lag of log of sales. In column (3) we further add a R+D indicator taking the value one if the firm reports positive R+D expenditures and 0 otherwise, the first lag of firm specific deviation from the industry median return on assets, the first lag of firm specific deviation from the industry median market-to-book ratio and governance controls from the Gomper's Index. In column (4) we include state-level control variables, namely the unemployment rate, state GDP, the state-level corporate income tax rate and an indicator which takes the value one if the governor of the state is democratic. For a more detailed definition of all variables, see Table 13. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5.2 Stacked Event Studies

To verify that our results do not originate from some unobserved trend, we explore the dynamic effect of the top marginal tax rate on our variables of interest based on an event study estimated by stacked regressions as specified in equation (2). Figure 2 analyzes the dynamic effect of tax reforms on the number of performance goals that a CEO reaches. Consistent with our results from the panel regression, we find that an increase in the top marginal tax rate leads to a decrease in the number of performance goals reached. We find no evidence of a pre-trend prior to the reform. After a tax reform, the share of attained performance goals persistently drops with a briefly stronger effect one year after the reform.

Figure 2: Stacked Regression: Fraction of Performance Goals reached



Note: Figure 2 presents results from a stacked event study regression as specified in equation (2). The dependent variable is the fraction of performance goals the CEO reaches. The Figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 0.5 percentage points and -1 if the tax change is below -0.5 percentage points. The control variables are the same as in Table 2 column (4). Event time -1 is the year before the reform. The coefficient one year prior to the reform is normalized to zero. All Figures are made using the stacked event study design with clean controls. Standard errors are clustered at the state and event level, the vertical bars depict 95% confidence intervals.

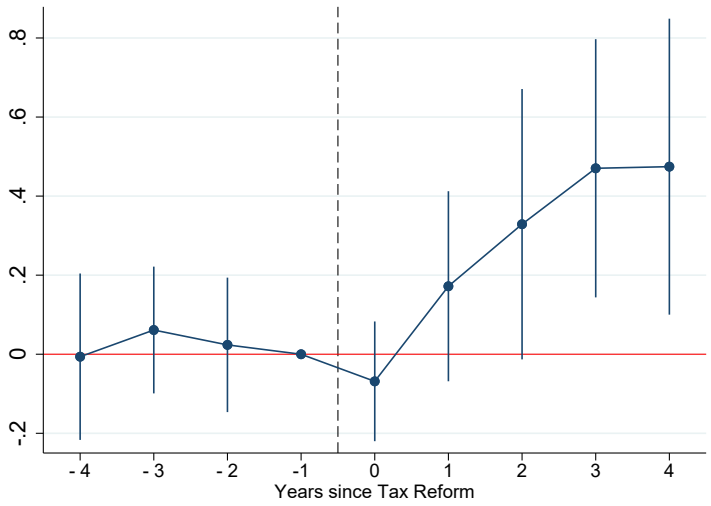
Figure 3 shows stacked event study results using the engagement in committees of a CEO in boards outside of her firm as the outcome variable. There is no evidence of a trend prior to the reform. After the reform, the number of committees in outside boards increases significantly, growing in size over a period of three years. This may reflect that networking takes time to have observable effects.

Figure 4 shows the stacked dynamic effects of changes in the top marginal tax rate on return on assets. Again, there does not appear to be a pre-trend. Following the reform, we observe

an immediate and statistically significant decrease in the return on assets which persists for two years before gradually recovering to the pre-reform level.

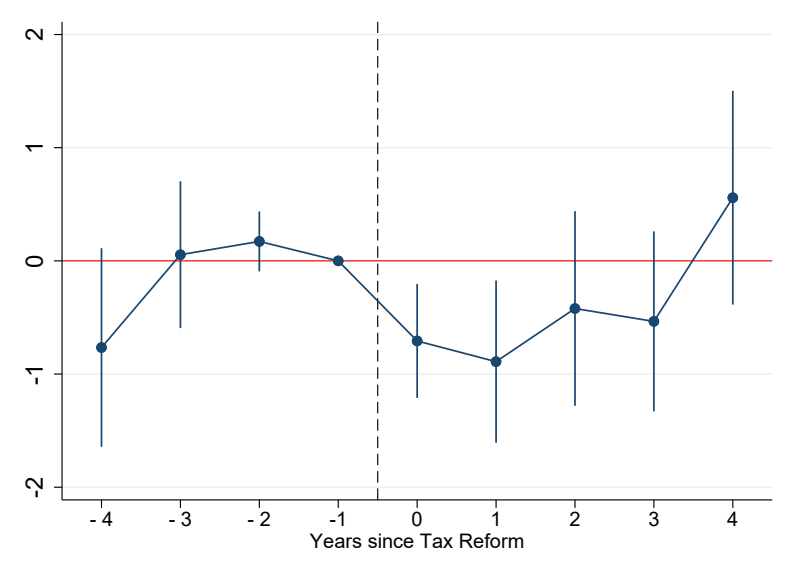
To account for potential asymmetries we estimate the effect of a change in the tax rate on our outcome variables only using tax increases (see Figure 9, Figure 10 and Figure 11 in the appendix). Although we have a large number of decreases in our setting, these decreases often occur in states in which large listed companies have little activity inhibiting us from estimating the effect of tax decreases as well.

Figure 3: Number of committees



Note: Figure 3 presents results from a stacked event study regression as specified in (2). The dependent variable is the number of committees on external boards the CEO is part of. The Figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 0.5 percentage points and -1 if the tax change is below -0.5 percentage points. The control variables are the same as in Table 3 column (4). Event time -1 is the year before the reform. The coefficient one year prior to the reform is normalized to zero. All Figures are made using the stacked event study design with clean controls. Standard errors are clustered at the state and event level, the vertical bars depict 95% confidence intervals.

Figure 4: Stacked Regression: Return on Assets



Note: Figure 4 presents results from a stacked event study regression as specified in equation (2). The dependent variable is return on assets. The Figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 0.5 percentage points and -1 if the tax change is below -0.5 percentage points. Control variables are the same as in Table 4 column (4).Event time -1 is the year before the reform. The coefficient one year prior to the reform is normalized to zero. All Figures are made using the stacked event study design with clean controls. Standard errors are clustered at the state and event level, the vertical bars depict 95% confidence intervals.

5.3 Firm-Level Adjustments

An increase in the personal income tax rate reduces the return on assets (Table 4). However, studying the dynamics of the effect shows that it is not persistent in the long run (Figure 4). We explore several reasons that can explain why the effect of the marginal top tax rate on CEO and firm performance may dissipate over time.

CEO compensation One explanation for why we do not find a sustained change in the return on assets might be that the CEOs' compensation structure is eventually adjusted. CEOs - following an increase in their personal income tax - may receive a compensating increase in their gross pay. In Table 5 we regress the log of gross CEO compensation granted on the marginal retention rate. We find no significant effect of taxes on compensation. If anything, the point estimates imply a negative effect of higher taxes on overall compensation. Hence, there is no evidence of CEOs receiving a compensatory increase in their gross pay.

Apart from adjusting the overall amount of compensation that executives receive, the firm can also adjust the composition of compensation to incentivize the executive more strongly following a change in the tax rate. Thus, we assess whether the composition of executive compensation changes after a tax reform. Such readjustments of incentives could explain why performance measures recover over time. Figure 5 shows the effect of the top marginal tax rate on the fair value of stock awards the CEO is granted. Following a change in the top marginal tax rate by more than 0.5 percentage points we find that the fair value of stock awards granted to the executive increases, although the increase is not statistically significant.

Firm Growth A second explanation for the recovery of return on assets could be slower firm growth due to the CEO exerting less effort and disregarding investment projects with borderline returns. Figure 6 shows that following a change in the top personal income tax rate there is indeed a cut in capital expenditure investment at the firm level, which is most pronounced one and two years after the reform. In line with this, we also find evidence that the negative effect on capital expenditure is particularly driven in particular by a cut in the marginally profitable investment projects. Using firm segment data, we differentiate between capital expenditure in the least and most profitable business segments of firms in Figure 7. We find that the decrease in capital expenditure primarily occurs in the least profitable segments while the development of capital expenditure does not appear to be

Table 5: Total Compensation Granted

	(1)	(2)	(3)	(4)
ln(1-MTR)	0.434	1.007	1.165	1.591*
	(0.638)	(0.774)	(0.724)	(0.796)
First lag of log Sale		0.212***	0.200***	0.201***
		(0.011)	(0.015)	(0.015)
R+D Indicator			0.227	0.226
			(0.154)	(0.154)
Deviation ROA			0.114***	0.113***
			(0.036)	(0.036)
Deviation Market to Book			0.000	0.000
			(0.000)	(0.000)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls			✓	✓
State Controls				✓
Observations	36267	35813	34884	34787
R-squared	0.752	0.756	0.757	0.757

Note: Table 5 reports estimates from a regression following equation (1). The dependent variable is the log of total compensation granted. In column (1) we employ executive × firm fixed effects as well as year fixed effects. In columns (2) we add the first lag of log of sales. In column (3) we further add a R+D indicator taking the value one if the firm reports positive R+D expenditures and 0 otherwise, the first lag of firm specific deviation from the industry median return on assets, the first lag of firm specific deviation from the industry median market-to-book ratio and governance controls from the Gomper's Index. In column (4) we include state-level control variables, namely the unemployment rate, state GDP, the state-level corporate income tax rate and an indicator which takes the value one if the governor of the state is democratic. For a more detailed definition of all variables see Table 13. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

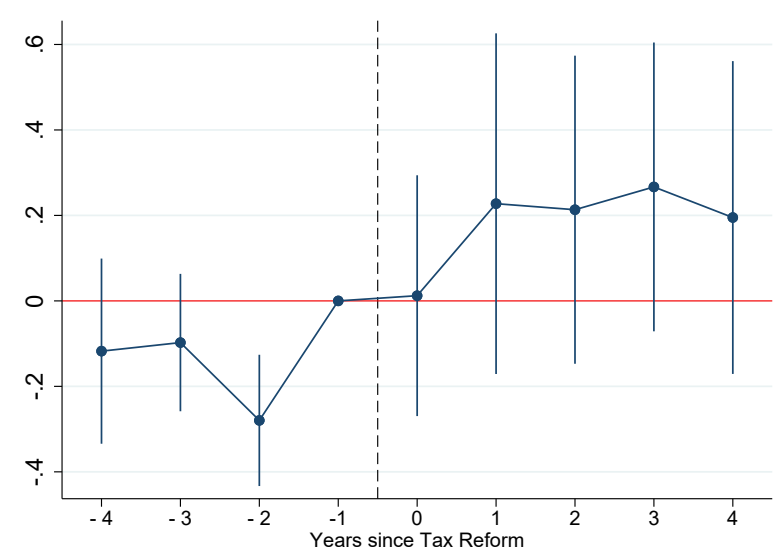
affected in the most profitable segments.

The evolution of total assets over time is another measure for firm growth. In line with the capital expenditure results, the logarithm of total assets decreases following an increase in the top marginal tax rate (Figure 8). The effects of slower growth accumulate over time such that total assets are eventually 4% smaller relative to the counterfactual without a change in tax.[13]

All in all, changes in the composition of executive compensation and slower firm-level growth can explain why the negative effect of the top marginal tax rate on the return on assets dissipates over time. CEOs become better incentivized through increased ownership in the firms they run, and firms grow at a slower pace focusing on the more profitable projects, thereby increasing the return on assets.

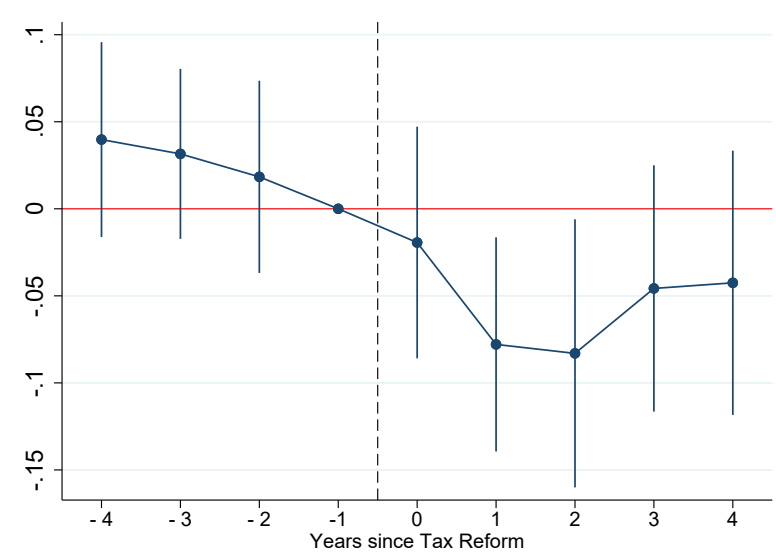
[13]We cannot verify if the reduction in assets is concentrated more strongly in the least profitable segments since the coverage of assets in Compustat segment data is poor.

Figure 5: Stacked Regression: Fair Value of Stock Awards



Note: Figure 5 presents results from a stacked event study regression as specified in equation (2). The dependent variable is the logarithm of the fair value of stock awards the CEO receives. The figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 0.5 percentage points and -1 if the tax change is below -0.5 percentage points. The control variables are the same as in Table 4 column (4). Event time -1 is the year before the reform. The coefficient one year prior to the reform is normalized to zero. All Figures are made using the stacked event study design with clean controls. Standard errors are clustered at the state and event level and the vertical bars depict 95% confidence intervals.

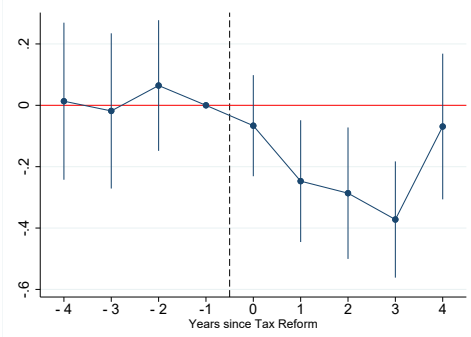
Figure 6: Stacked Regression: Capital Expenditure



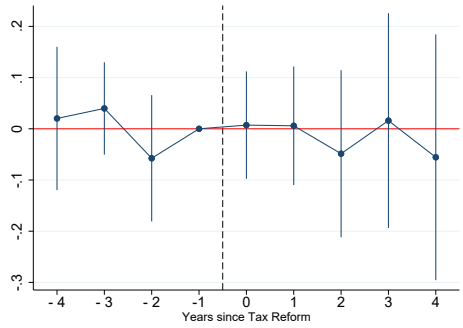
Note: Figure 6 presents results from a stacked event study regression as specified in equation (2). The dependent variable is the logarithm of capital expenditure. The figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 0.5 percentage points and -1 if the tax change is below -0.5 percentage points. The control variables are the same as in Table 4 column (4). Event time -1 is the year before the reform. The coefficient one year prior to the reform is normalized to zero. All Figures are made using the stacked event study design with clean controls. Standard errors are clustered at the state and event level and the vertical bars depict 95% confidence intervals.

Figure 7: Heterogeneities Capital Expenditure

(a) Capital Expenditure: Low Profitability Segments

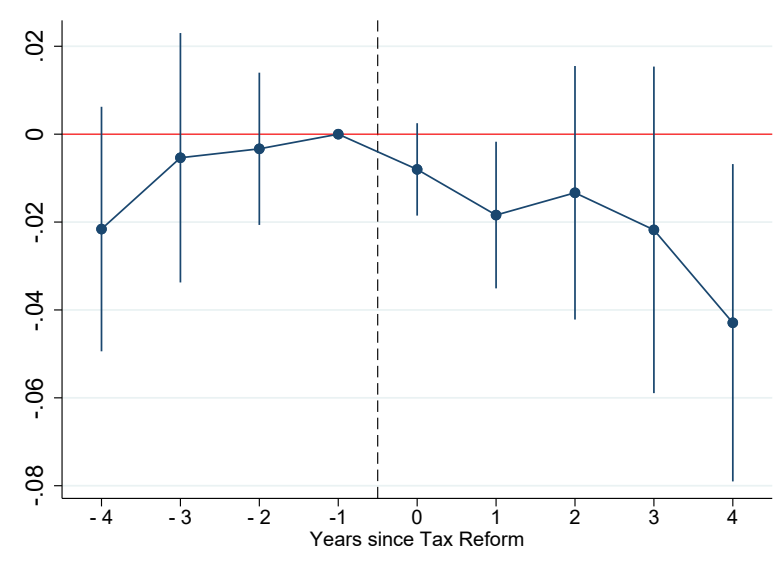


(b) Capital Expenditure: High Profitability Segments



Note: Figure 7 presents results from a stacked event study regression as specified in equation (2). The dependent variable is the logarithm of capital expenditure. Figure 7a shows the effect of tax increases and decreases in low profitable firm segments, all segments where the return on investment is below the median firm segment return on investment. Figure 7b shows the effect of tax increases and decreases in low profitable firm segments, all segments where the return on investment is above or equal to the firm segment median. The figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 0.5 percentage points and -1 if the tax change is below -0.5 percentage points. The control variables are the same as in Table 4 column (4). Event time -1 is the year before the reform. The coefficient one year prior to the reform is normalized to zero. All Figures are made using the stacked event study design with clean controls. Standard errors are clustered at the state and event level and the vertical bars depict 95% confidence intervals.

Figure 8: Stacked Regression: Log of Assets



Note: Figure 8 presents results from a stacked event study regression as specified in equation (2). The dependent variable is the logarithm of assets. The figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 0.5 percentage points and -1 if the tax change is below -0.5 percentage points. The control variables are the same as in Table 4 column (4). Event time -1 is the year before the reform. The coefficient one year prior to the reform is normalized to zero. All Figures are made using the stacked event study design with clean controls. Standard errors are clustered at the state and event level and the vertical bars depict 95% confidence intervals.

6 Robustness Checks

6.1 Individual Evidence

One concern about our identification strategy is that the change in firm performance might not be driven by changes in the CEO's labor supply, but by changes in the economic climate of the firm's headquarter state. To address this concern, we assess whether CEOs who should be more affected by a change in their personal income tax rate indeed react more strongly to tax changes as this within-state comparison also allows us to control for state by year specific effects. CEOs who own a substantial amount of wealth in their firms are incentivized less through their income from compensation compared to CEOs with a low amount of wealth in their firms. Hence, the former type of CEO should be less affected by a change in the marginal top tax rate compared to the latter. We construct a CEO-level measure of exposure to the personal income tax rate to exploit this heterogeneity. Using variation in the exposure of the CEO interacted with the tax rate allows us to employ state $\times$ year fixed effects, $\delta_{s\times t}$, absorbing any local economic shocks that might simultaneously affect tax rates and firm performance. We estimate the following regression equation:

$$Y_{f,i,s,t} = \beta \times ln(1 - MTR_{s,t}) \times D_{i,t} + \gamma \times X_{f,i,t} + \alpha_{i\times f} + \delta_{s\times t} + \epsilon_{f,i,s,t} \tag{3}$$

The dummy variable $D_{i,t}$ takes the value one if the CEO is in the bottom tercile of the distribution of CEO wealth invested in the firm in the respective state s and year t. The base effect of the top retention rate $ln(1 - MTR_{s,t})$ as well as all other controls without within-state variation are subsumed by the state-year fixed effect $\delta_{s\times t}$. The remaining control variables are the same as in Table 4 column (4). The coefficient β of the interaction variable $ln(1 - MTR_{s,t}) \times D_{i,t}$ represents the differential response of CEOs who we hypothesize to be more affected by the tax change. Table 6 shows the results comparing CEOs with low wealth to CEOs with high wealth in their firms. The coefficients in columns (1) and (2) show that an increase in the marginal retention rate has a positive albeit insignificant effect on the fraction of performance goals reached and a significantly negative effect on the number of committees the CEO engages in. An increase in the net-of-tax rate by one percent lowers the number of committees a low-wealth CEO engages in by 0.047 relative to a high-wealth CEO in the same state. Furthermore, the results in column (3) imply that an increase in the marginal retention rate by one percent significantly raises the return on assets by 0.141

percentage points for firms with a low-wealth CEO. These results confirm that the observed reactions are indeed due to the personal tax changes specifically related to the CEOs.

Table 6: Heterogeneous Response: Firm Wealth

	(1) Performance Goals	(2) Committees	(3) ROA
Low Wealth × ln(1-MTR)	0.135	-4.693*	14.109**
	(0.261)	(2.537)	(6.373)
Executive x Firm FE	✓	✓	✓
State x Year FE	✓	✓	✓
Size Controls	✓	✓	✓
ROA, RD controls	✓	✓	✓
Governance Controls	✓	✓	✓
Observations	4763	4769	19694
R-squared	0.598	0.889	0.779

Note: Table 6 presents the coefficients resulting from estimating equation (3). In column (1),the dependent variable is the fraction of performance goals reached. In column (2), it is the number of committees on external boards the CEO is engaged in. In column (3), it is the return on assets (ratio of earnings before interests over assets, multiplied by 100). The dummy Low Wealth indicates that the CEO is in the bottom tercile of the firm wealth distribution in her state and year t. All specifications include controls as in Table 4 column (4): first lag of the log of sales, an R+D indicator taking the value one if the firm reports positive R+D expenditures and 0 otherwise, the first lag of firm specific deviation from the industry median return on assets, the first lag of firm specific deviation from the industry median market-to-book ratio and governance controls from the Gomper's Index. We can not employ state-level controls, since they are now absorbed by the state × year fixed effects. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

6.2 Other employees

While we cannot rule out that the labor supply response of other employees or other executives may contribute to the observed decrease in return on assets, we aim to mitigate concerns that changes in firm performance are exclusively caused by changes in other employees labor supply. We propose two robustness checks to address this concern. First, we control for the progressivity of the state specific personal income tax system. We do so by adding the average state tax rate of the top one percent income earners as well as the average state tax rate of the median wage earner to our regressions. These tax rates capture tax incentives for employees earning less than the top one percent income earners.[14] Controlling for other changes in the tax rate schedule allows us to test whether it is indeed the marginal tax rate on the very top income earners which matters and not another more

[14]The average tax rate at a given income level is an average of all marginal tax rates which apply up to this income level.

generally applicable feature of the tax rate schedule. Table 7 reports the corresponding estimates. Adding the average tax rate faced by the median employee as well as the average tax rate faced by the top one percent income earner does not change the estimates of our baseline regression. We still find statistically significant effects of the marginal top tax rate on the fraction of performance goals reached, on the number of committees an executive is engaged in, and on return on assets.

Table 7: Outcome Variables: Controls for average tax rates

	(1) Performance Goals	(2) Committees	(3) ROA
ln(1-MTR)	1.008***	-12.892***	12.465**
	(0.207)	(2.953)	(4.738)
Avg. Top 1 Tax Rate	-0.000	0.001	-0.004
	(0.000)	(0.002)	(0.006)
Avg. Median Tax Rate	-0.000*	-0.005***	-0.006
	(0.000)	(0.001)	(0.006)
Executive x Firm FE	✓	✓	✓
Year FE	✓	✓	✓
Size Controls	✓	✓	✓
ROA, R+D controls	✓	✓	✓
Governance Controls	✓	✓	✓
State Controls	✓	✓	✓
Observations	8691	8181	34590
R-squared	0.509	0.856	0.716

Note: Table 7 reports estimates from a regression following equation (1). The dependent variable is the fraction of performance goals reached in (1), the number of committees on external boards the CEO is engaged in in (2) and return on assets (ratio of earnings before interests over assets, multiplied by 100) in column (3). We control for the average income tax rate of the top one percent earner and the median income earner. Otherwise we use controls as in Table 4 column (4): first lag of the log of sales, an R+D indicator taking the value one if the firm reports positive R+D expenditures and 0 otherwise, the first lag of firm specific deviation from the industry median return on assets, the first lag of firm specific deviation from the industry median market-to-book ratio and governance controls from the Gomper's Index, unemployment, GDP, corporate income tax rate and affiliation of the governor. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Furthermore, we check if the response to the change in the personal income tax rate differs between firms with many high paid employees in comparison to firms with many low paid employees. If the effect we recover is driven by high paid employees in general and not mainly by the CEO, we should see a stronger reaction for firms having many high paid employees. To this end we construct a firm level dummy of employee pay taking on the value one if the average level of employee pay in the firm is in the top tercile of the state-year specific distribution of employee pay. We estimate a regression similar to the one specified in expression (3) in section 6.1 and interact this dummy variable with the net-of-top-tax-rate.

Again, this allows us to include state × year fixed effects. Table 8 reports the estimates, which do not suggest a differential effect of the top marginal tax rate when comparing firms with high paid employees versus the rest.

Table 8: Outcome Variables: Interaction with Employee Pay

	(1) Performance Goals	(2) Committees	(3) ROA
High Pay × ln(1-MTR)	-2.560	-10.705	-14.750
	(2.969)	(12.158)	(24.325)
Executive x Firm FE	✓	✓	✓
State x Year FE	✓	✓	✓
Size Controls	✓	✓	✓
ROA, RD controls	✓	✓	✓
Governance Controls	✓	✓	✓
Observations	532	727	3134
R-squared	0.709	0.967	0.869

Note: Table 8 reports estimates from a regression following equation (3). The dependent variable is the fraction of performance goals reached in (1), the number of committees on external boards the CEO is engaged in in (2) and return on assets (ratio of earnings before interests over assets, multiplied by 100) in column (3). Instead of estimating the differential effect of having a high amount of wealth in the company, we now estimate the differential effect of the pay average employees receive in the firm. High Pay is a firm level dummy of employee pay taking on the value one if the average level of employee pay in the firm is in the top tercile of the state-year specific distribution of employee pay. Otherwise we use controls as in Table 4 column (4): first lag of the log of sales, an R+D indicator taking the value one if the firm reports positive R+D expenditures and 0 otherwise, the first lag of firm specific deviation from the industry median return on assets, the first lag of firm specific deviation from the industry median market-to-book ratio and governance controls from the Gomper's Index, unemployment, GDP, corporate income tax rate and affiliation of the governor. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

6.3 Other performance measures

To further investigate the robustness of our results we also consider the effect of changes in top personal income tax rates on Tobin's Q, which is an alternative measure of firm performance (e.g. Pérez-González, 2006). Table 9 reports the effect of a change in the net-of-tax rate on Tobin's Q. Results from estimating our baseline specification can be found in column (1). An increase in the net-of-tax rate by one percent increases Tobin's Q by 0.040. This effect is robust to including control variables for the state tax schedule as in Table 7 as shown in column (2). To check robustness against bias from differential trends we again exploit CEO heterogeneity as in expression (3) in Section 6.1 and include state × year fixed effects in column (3). Tobin's Q increases significantly more in firms in which the CEO only has a low amount of wealth invested in the firm following an increase in the marginal retention rate.

Table 9: Tobin's Q

	(1)	(2)	(3)
ln(1-MTR)	3.983***	3.959***	
	(1.009)	(0.981)	
Low Wealth × ln(1-MTR)			3.035***
			(0.865)
Executive x Firm FE	✓	✓	✓
State x Year FE			✓
Year FE	✓	✓	
Size Controls	✓	✓	✓
ROA, RD controls	✓	✓	✓
Governance Controls	✓	✓	✓
Tax Controls		✓	
Observations	35026	35026	19958
R-squared	0.749	0.749	0.812

Note: Table 9 reports estimates from a regression following equation (1) in column (1) and column (2) and following (equation 3) in column (3). The dependent variable is Tobin's Q. The dummy Low Wealth indicates that the CEO is in the bottom tercile of the firm wealth distribution in her state and year t. In all columns we employ controls as in Table 4 column (4): first lag of the log of sales, an R+D indicator taking the value one if the firm reports positive R+D expenditures and 0 otherwise, the first lag of firm specific deviation from the industry median return on assets, the first lag of firm specific deviation from the industry median market-to-book ratio and governance controls from the Gomper's Index, unemployment, GDP, corporate income tax rate and affiliation of the governor. In column (2) we add controls for the progressivity of the state tax system as in Table 7. In column (3) state-level controls, however, are absorbed by the state × year fixed effects. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

7 Conclusion

This paper analyzes the impact of higher personal income taxes on the performance of CEOs and of the firms they manage. Exploiting variation in state income tax rates, this paper shows that higher taxes lead to a reduction in CEO performance, measured by the fraction of performance goals they reach and the number of outside job opportunities they are engaged in. We find that higher taxes on CEO compensation also depress the firm's return on assets, although it eventually recovers. We find that this recovery in return on assets can be explained by the fact that CEO compensation is adjusted and firms remain smaller and more focused on particularly profitable projects. In our robustness checks, we find that effects are less pronounced for firms in which the CEO is particularly incentivized due to holding a large amount of wealth in the company. We do not find any differential effects according to the pay level in the company or the progressivity of the tax schedule. We also show that higher personal income taxes have a negative effect on Tobin's Q. Overall, our results suggest that higher personal income taxes distort the performance of CEOs and their firms.

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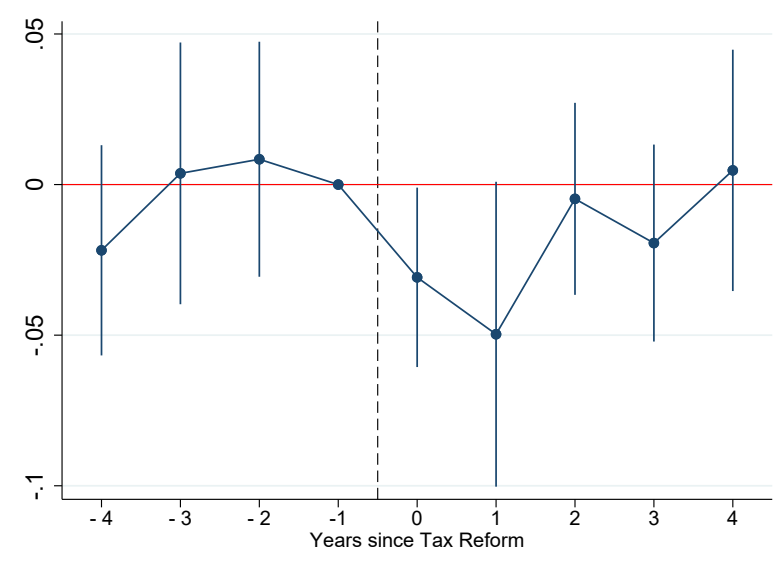
A Appendix (For Online Publication)

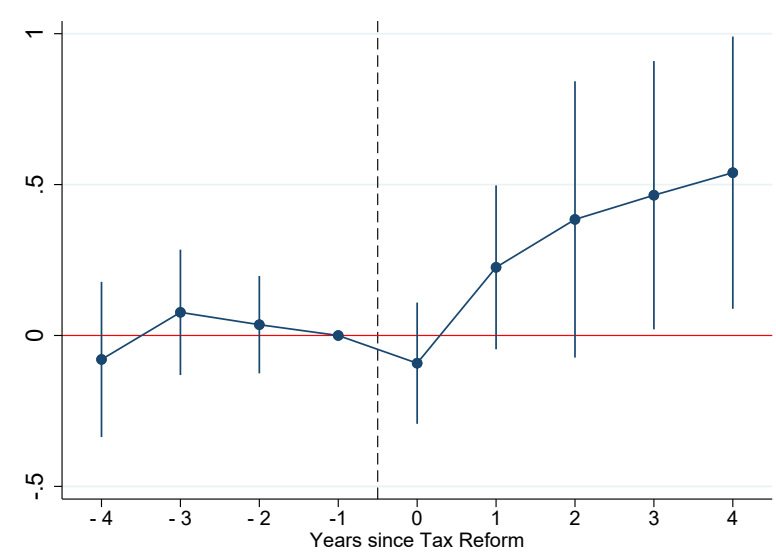
A.1 Stacked Regression: Only Increases

Figure 9: Stacked Regression: Fraction of Performance Goals reached (Only Increases)



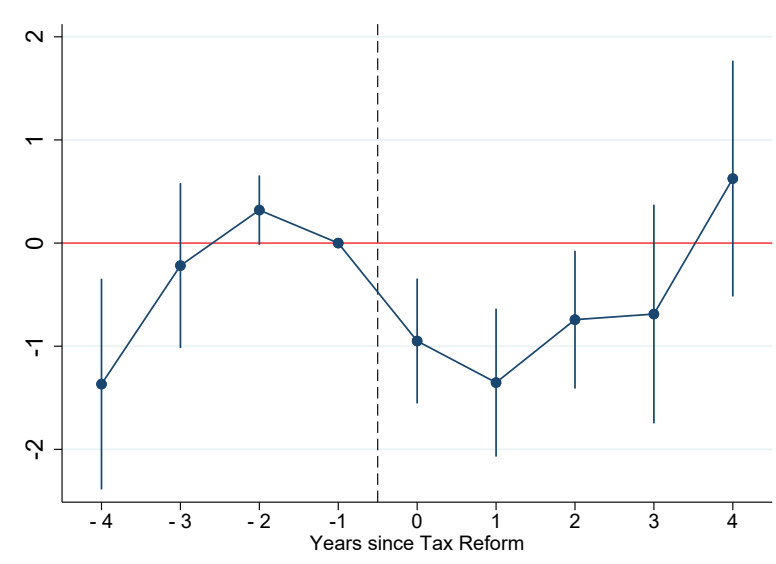
Note: Figure 9 presents results from a stacked event study regression as specified in equation (2) using only tax increases. The dependent variable is the fraction of performance goals reached. The figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 0.5 percentage points and -1 if the tax change is below -0.5 percentage points. The control variables are the same as in Table 4 column (4). Event time -1 is the year before the reform. The coefficient one year prior to the reform is normalized to zero. All Figures are made using the stacked event study design with clean controls. Standard errors are clustered at the state level and the vertical bars depict 95% confidence intervals.

Figure 10: Stacked Regression: Number of Committees (Only Increases)



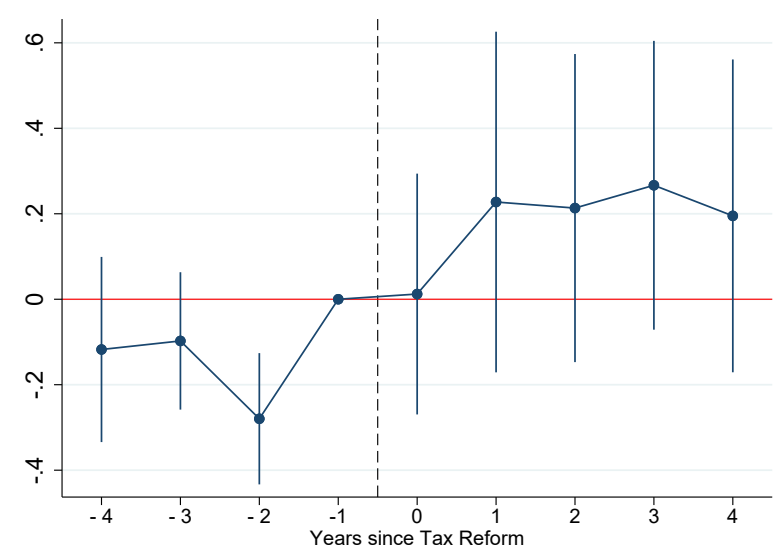
Note: Figure 10 presents results from a stacked event study regression as specified in equation (2) using only tax increases. The dependent variable is the number of committees the executive is engaged in. The figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 0.5 percentage points and -1 if the tax change is below -0.5 percentage points. The control variables are the same as in Table 4 column (4). Event time -1 is the year before the reform. The coefficient one year prior to the reform is normalized to zero. All Figures are made using the stacked event study design with clean controls. Standard errors are clustered at the state level and the vertical bars depict 95% confidence intervals.

Figure 11: Stacked Regression: Return on Assets (Only Increases)



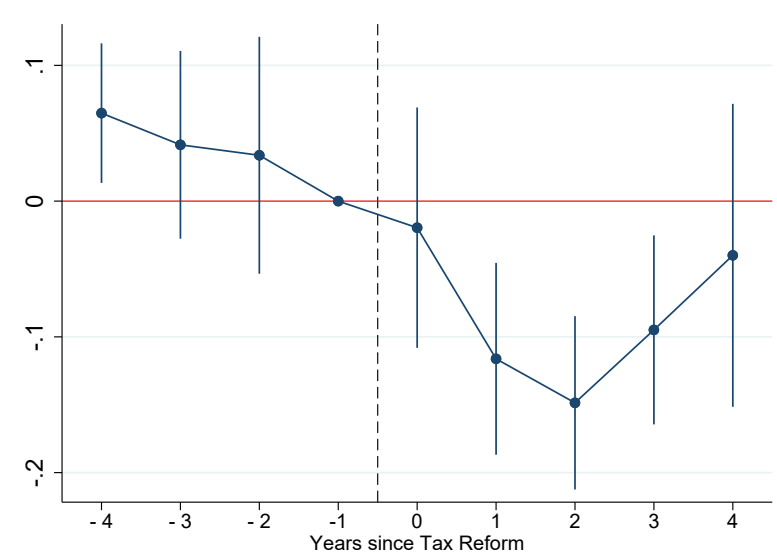
Note: Figure 11 presents results from a stacked event study regression as specified in equation (2) using only tax increases. The dependent variable is return on assets. The figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 0.5 percentage points and -1 if the tax change is below -0.5 percentage points. The control variables are the same as in Table 4 column (4). Event time -1 is the year before the reform. The coefficient one year prior to the reform is normalized to zero. All Figures are made using the stacked event study design with clean controls. Standard errors are clustered at the state level and the vertical bars depict 95% confidence intervals.

Figure 12: Stacked Regression: Fair Value of Stock Awards (Only Increases)



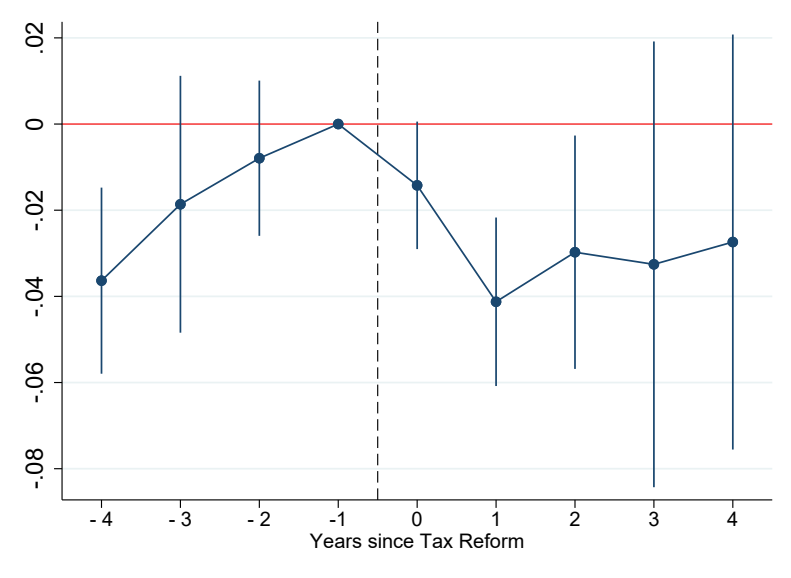
Note: Figure 12 presents results from a stacked event study regression as specified in equation (2) using only tax increases. The dependent variable is the logarithm of the fair value of stock awards the CEO receives. The Figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 0.5 percentage points and -1 if the tax change is below -0.5 percentage points. The control variables are the same as in Table 4 column (4). Event time -1 is the year before the reform. The coefficient one year prior to the reform is normalized to zero. All Figures are made using the stacked event study design with clean controls. Standard errors are clustered at the state and event level and the vertical bars depict 95% confidence intervals.

Figure 13: Stacked Regression: Capital Expenditure (Only Increases)



Note: Figure 13 presents results from a stacked event study regression as specified in equation (2) using only tax increases. The dependent variable is the logarithm of capital expenditure. The Figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 0.5 percentage points and -1 if the tax change is below -0.5 percentage points. The control variables are the same as in Table 4 column (4). Event time -1 is the year before the reform. The coefficient one year prior to the reform is normalized to zero. All Figures are made using the stacked event study design with clean controls. Standard errors are clustered at the state and event level and the vertical bars depict 95% confidence intervals.

Figure 14: Stacked Regression: Log of Assets (Only Increases)



Note: Figure 14 presents results from a stacked event study regression as specified in equation (2) using only tax increases. The dependent variable is the logarithm of assets. The Figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 0.5 percentage points and -1 if the tax change is below -0.5 percentage points. The control variables are the same as in Table 4 column (4). Event time -1 is the year before the reform. The coefficient one year prior to the reform is normalized to zero. All Figures are made using the stacked event study design with clean controls. Standard errors are clustered at the state and event level and the vertical bars depict 95% confidence intervals.

A.2 All Tax Changes

Table 10: Fraction of performance goals reached

	(1)	(2)	(3)	(4)
ln(1-MTR)	0.951***	1.003***	1.063***	1.250***
	(0.326)	(0.337)	(0.323)	(0.276)
First lag of log Sale		0.021**	0.015	0.014
		(0.010)	(0.010)	(0.010)
R+D Indicator			0.001	-0.002
			(0.046)	(0.048)
Deviation ROA			0.160***	0.158***
			(0.045)	(0.045)
Deviation Market to Book			-0.000	-0.000
			(0.000)	(0.000)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
State Controls			✓	✓
Governance Controls				✓
Observations	9411	9405	9276	9243
R-squared	0.514	0.515	0.511	0.511

Note: Table 10 reports estimates from a regression following equation (1). The dependent variable is the fraction of performance goals a CEO reaches. The sample now also includes states which experienced an endogenous increase in taxes according to Giroud and Rauh (2019). In column (1) we employ executive $\times$ firm fixed effects as well as year fixed effects. In columns (2) we add the first lag of log of sales. In column (3) we further add a R+D indicator taking the value one if the firm reports positive R+D expenditures and 0 otherwise, the first lag of firm specific deviation from the industry median return on assets, the first lag of firm specific deviation from the industry median market-to-book ratio and governance controls from the Gomper's Index. In column (4) we include state-level control variables, namely the unemployment rate, state GDP, the state-level corporate income tax rate and an indicator which takes the value one if the governor of the state is democratic. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 11: Number of Committees

	(1)	(2)	(3)	(4)
ln(1-MTR)	-9.738***	-10.839***	-10.742***	-11.596***
	(2.388)	(2.432)	(2.361)	(2.960)
First lag of log Sale		-0.090	-0.112	-0.094
		(0.141)	(0.131)	(0.127)
R+D Indicator			0.546	0.552
			(0.529)	(0.499)
Deviation ROA			0.241	0.240
			(0.282)	(0.285)
Deviation Market to Book			0.000	0.000
			(0.000)	(0.000)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
State Controls			✓	✓
Governance Controls				✓
Observations	8938	8860	8709	8679
R-squared	0.845	0.845	0.852	0.853

Note: Table 11 reports estimates from a regression following equation (1). The dependent variable is the fraction of performance goals a CEO reaches. The sample now also includes states which experienced an endogenous increase in taxes according to Giroud and Rauh (2019). In column (1) we employ executive $\times$ firm fixed effects as well as year fixed effects. In columns (2) we add the first lag of log of sales. In column (3) we further add a R+D indicator taking the value one if the firm reports positive R+D expenditures and 0 otherwise, the first lag of firm specific deviation from the industry median return on assets, the first lag of firm specific deviation from the industry median market-to-book ratio and governance controls from the Gomper's Index. In column (4) we include state-level control variables, namely the unemployment rate, state GDP, the state-level corporate income tax rate and an indicator which takes the value one if the governor of the state is democratic. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 12: Return on Assets

	(1)	(2)	(3)	(4)
ln(1-MTR)	9.437*	13.900***	13.412***	11.547***
	(5.003)	(4.920)	(4.035)	(4.004)
First lag of log Sale		1.533***	1.272***	1.274***
		(0.250)	(0.238)	(0.239)
R+D Indicator			-2.499***	-2.501***
			(0.809)	(0.798)
Deviation ROA			4.827**	4.830**
			(2.149)	(2.144)
Deviation Market to Book			-0.001*	-0.001*
			(0.001)	(0.001)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
State Controls			✓	✓
Governance Controls				✓
Observations	38095	37853	36854	36762
R-squared	0.710	0.712	0.719	0.719

Note: Table 12 reports estimates from a regression following equation (1). The dependent variable is return on assets (ratio of earnings before interests over assets, multiplied by 100). The sample now also includes states which experienced an endogenous increase in taxes according to Giroud and Rauh (2019). In column (1) we employ executive × firm fixed effects as well as year fixed effects. In columns (2) we add the first lag of log of sales. In column (3) we further add a R+D indicator taking the value one if the firm reports positive R+D expenditures and 0 otherwise, the first lag of firm specific deviation from the industry median return on assets, the first lag of firm specific deviation from the industry median market-to-book ratio and governance controls from the Gomper's Index. In column (4) we include state-level control variables, namely the unemployment rate, state GDP, the state-level corporate income tax rate and an indicator which takes the value one if the governor of the state is democratic. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 13: Variable Definition

Variable Name	Calculation	Source
Outcome Variables		
ROA	EBIT over Assets, where EBIT are earnings befor interest and taxes, winsorized at the 99th percent level	Compustat
Fraction of goals reached	Fraction of performance goals reached over the number of performance goals defined. Payments are tax relevant in the year in which they are paid out.	ISS Incentive Lab
Number of Committees	The number of committees in outside boards the respective executive sits on. The maximum value is set at 10.	BoardEX
Tobin's Q	Tobin's Q is defined as 1 + the difference between market value (common shares outstanding multiplied with the share price at fiscal year end) and common ordinary equity over assets. The variable is winsorized at the 99% level	Compustat
Granted Compensation	Compensation the executive is granted in the fiscal year. Consisting of salary, bonus, options and stock awards, non-equity incentive plans, pensions and other compensation items.	ExecuComp
Fair Value of Stock Awards	The estimated fair value of the amount of stock compensation the executive receives.	ExecuComp
Capital Expenditure	Capital expenditure the firm reported	ExecuComp
Assets	Assest the firm reported	ExecuComp
Firm-level Variables		
R+D indicator	Indicator for positive R+D expenses, if R+D expenses are missing, the indicator takes on the value of zero and an additional dummy denoting that the indicator is missing is included	Compustat
First lag of log sales	First lag of the log of sales	Compustat

Deviation ROA	First lag of the deviation of ROA from industry median. Industry is defined by the 2-level digit SIC code.	Compustat
Market-to-Book Ratio	Share price at the fiscal year end over book value per share	Compustat
High Pay	Indicator which takes on the value of one if the firm is in the top tercile of the state-level distribution of employee pay. Employee pay is calculated as the difference between labor related expenses and total executive compensation divided by the number of employees.	Compustat
Deviation Market-to-Book ratio	Deviation of market-to-book ratio from industry median. Industry is defined by the 2-digit level SIC code.	Compustat
Gomper's Governance Index	Categorical value for the level of corporate governance in a firm based on takeover laws ranging from 2 to 17. Higher values indicate a worse level of governance.	Gompers et al. (2003)
Gomper's Dummy	Indicator taking the value of one if the Gomper's Governance Index is below a value of 8. We interpolate missing values in a linear manner.	Gompers et al. (2003)
Individual CEO Variables		
Low Wealth	Variable which takes a value of one if the CEO is in the lower tercile of the state-level distribution of wealth CEOs hold in their firm. Firm wealth is the sum of shares owned excluding options times the share price at the end of the fiscal year, the estimated value of unexercised options and the estimated value of exercised options from Execucomp.	Data from ExecuComp, calculation based on Coles et al. (2013)

Tax Variables

Top Marginal Tax Rate	State level tax on wages for a married individual filing jointly with an income that exceeds 1.5 million USD	NBER TaxSim
Avg. Top 1 Tax Rate	Average tax rate paid by an individual whose income is at the top percentile of the state income distribution based on the state tax schedule.[a] We obtain data on the state income distribution from the statistics of income.	NBER TaxSim and Statistics of Income Tax Statistics
Avg. Median Tax Rate	Average tax rate paid by an individual whose income is at the 50th percentile of the state income distribution based on the state tax schedule. We obtain data on the state income distribution from the statistics of income.[b]	NBER TaxSim
Corporate Income Tax Rate	Corporate income tax rate at the state-level collected from Giroud and Rauh (2019) and state tax schedules	Giroud and Rauh (2019)
GDP	State GDP	Bureau of Economic Analysis
Unemployment Rate	State unemployment rate	Bureau of Labor Statistics
Governor Dummy	Dummy indicating the affiliation of the state governor, the variable takes on the value one if the governor is a democrat	Klarner (2013) data set on governors and hand-collected data

[a]Based on the tax schedule we calculate the amount of taxes paid by someone with an income at the top percentile of the income distribution and then divide this by the income received.

[b]Based on the tax schedule we calculate the amount of taxes paid by someone with an income at the median of the income distribution and then divide this by the income received.