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// LAURA ARNEMANN, FLORIAN BUHLMANN,
MARTIN RUF, AND JOHANNES VOGET

The Effect of Taxes on CEO Performance

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The Effect of Taxes on CEO Performance*

Laura Arnemann†, Florian Buhlmann‡, Martin Ruf§, Johannes Voget¶

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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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†University of Mannheim; Centre for European Economic Research, Germany (e-mail: laura.arnemann@uni-mannheim.de),

‡University of Mannheim, Germany (e-mail: buhlmann_research@posteo.de),

§University of Tübingen, Germany (e-mail: martin.ruf@uni-tuebingen.de),

¶University of Mannheim, Germany (e-mail: voget@uni-mannheim.de),

1 Introduction

The input of CEOs is essential to their firms' performance (Bandiera 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-induced distortions to CEO effort can 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), who found small real responses to taxes, even among individuals in the highest income brackets.

A central challenge when 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 measure the reduction of CEO effort by examining CEOs' involvement in external boards. Lastly, we assess the CEOs' firm performance by investigating its return on assets. Further, expanding upon the research by Bertrand and Schoar (2003), we can analyze CEO treatment effects across all these dimensions. When a CEO's reaction to a tax rate increase is substantial and she misses many goals, it leads to a pronounced drop in firm performance. Similarly, if a CEO's treatment effect is substantial in terms of her involvement in committees after a tax rate increase, this exacerbates the firm's performance decline.

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 identification strategy relies on comparing executive-firm pairs in states that underwent tax changes with those in states that did not experience such changes. This strategy rests on

the assumption that, in the absence of tax changes, treated and untreated executive-firm pairs would have followed a similar trend. 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. Our sample comprises listed US firms such as Apple, Microsoft, and Amazon. These companies typically generate a significant portion of their sales outside their headquarters state. As a result, their firm performance is likely to be relatively independent of the economic climate within their headquarters state. However, to ensure that our findings are not influenced by spurious correlations, we exclusively consider tax changes classified as exogenous by Giroud and Rauh (2019).[1] We furthermore incorporate various controls for the economic climate within each state and check that results are also robust to excluding controls.

Based on this identification strategy we find the following results. 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 1 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 a change in the top marginal tax rate 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, return on assets reverts to its pre-reform level, aligning with expectations regarding firms' adjustment margins to cope with shocks such as tax rate

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

changes.

We explore several mechanisms that may cause this recovery of return on assets. 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.

We do not observe a significant change in CEOs' total compensation following a tax rate increase. At first glance, this is surprising. Given the resulting decline in firm performance, one might expect firms to compensate CEOs for their relatively small loss in net wage. However, 67% of directors admit that they are willing to sacrifice shareholder value to avoid controversy over CEO pay (Edmans et al., 2023). Additionally, De Angelis and Grinstein (2020) provide evidence that performance-based pay structures typically span a three-year period, suggesting that compensation adjustments might not occur immediately after the tax reform.

Nevertheless, there is a notable effect on the composition of executive compensation: higher taxes increase the level of stock compensation CEOs receive, thereby providing them with stronger incentives to maximize firm value over a longer horizon - consistent with the observed recovery of return on assets.

In the final step, we assess the robustness of our identification strategy. Although we cannot entirely rule out that firm performance may also be influenced by the labor supply responses of other executives, we perform several robustness checks to ensure that the response is indeed related to the CEO's labor supply.

Firstly, we leverage the fact that personal income taxes on wages have minimal effects on the incentives of CEOs who hold substantial wealth in their companies. Since their primary payoffs come from dividends or capital gains, they should not respond as strongly to changes in the top personal income tax rate. By comparing the effect of taxes on labor supply and firm performance between more and less affected CEOs, we can include state-by-year fixed effects to address concerns that our effect might be driven by changes in state economic conditions. Our modified estimation strategy reveals a stronger response of return on assets

to changes in the top personal income tax rate for CEOs with lower wealth in their firms. Secondly, we examine whether the effect on return on assets is independent of the average wage level within the firm and the state taxes imposed on other employees. 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 alter our main results. By exploring the heterogeneity in employee pay across firms, we do not observe a stronger response in the performance of firms with high average employee pay compared to those with low average employee pay. Thirdly, we demonstrate that our results are robust when 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 effect of higher taxes on GDP growth or employment, Mertens and Montiel Olea (2018) find that 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.

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

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

[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.

Our findings are 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 summarized by Edmans et al. (2017). 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. Edmans et al. (2023), using survey data, and Chaigneau et al. (2022), based on a model, emphasize CEOs' fairness concerns regarding their pay. Bai and Mkrtchyan (2023) analyze the relative performance of firms with inside and outside CEOs. Jenter and Lewellen (2021) revisit the relationship between firm performance and CEO turnover. Na (2020) examines the effect of CEOs' outside opportunities on the use of relative performance evaluation. Our analysis builds upon the findings in this literature by showing that personal income tax policy affects executive behavior with spillovers 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 et al. (2017). Corporate taxes also appear to affect the amount of compensation an exec-

[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.

utive 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) find 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:

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

The subscripts f, i and t indicate firm, CEO and year 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. $MTR_{i,t}$ 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 where the firm headquarter 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. $X_{f,i,t}$ denotes firm and state specific control variables. We include the 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 as firm specific

[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 headquarter. 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.

controls in some specifications. In some specifications we further include state-level control variables, namely the unemployment rate, state GDP and an indicator which takes the value one if the governor of the state is democratic. We also control for the state corporate income tax rate to account for simultaneous changes in tax policy. $\delta_{i\times f}$ 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. For a more detailed definition of all variables, see Table 17.

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 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:

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

$Y_{f,i,t,j}$ 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 Measuring CEO effort

To measure CEO effort we combine individual measures of CEO effort with broader measures of firm performance.

Performance Goals One measure of CEO effort we employ is the number of accounting-based performance goals CEOs achieve. Many CEOs receive equity or cash for reaching or surpassing a certain target with regards to operating income, sales or earnings per share. Performance goals are agreed upon by the shareholder meeting and are usually set for a period of several years. Figure 10 shows an excerpt of the performance goals set for the executives of Apple Inc. in 2016. Higher taxes discourage reaching such performance goals since the net cash-based incentive for reaching these goals is reduced. The rewards received upon reaching performance goals are non-negligible. In the case of Apple Inc. the CEO receives 100% of his salary upon reaching the threshold performance goal. While performance contracts of CEOs typically also feature awards based on relative performance with respect to their peers, we focus on accounting-based measures we observe on firm's

balance-sheets since the performance of competitors might also be affected by the tax rate change.

Activities in Boards 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.

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, the return on assets is the most suitable firm specific measure to capture the effect of changes in the CEO's behavior following the tax change.

4.2 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 at the state level. 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.[8] Although CEO compensation usually contains components such as options or stocks, all forms of managerial compensation are taxed at the personal income tax rate. Table 15

[8]Figure 8 and Figure 9 in the Appendix show the increases and decreases used in the stacked regression. Figure 9 shows that over the sample period considered we observe the majority of decreases in states with very little activity of publicly listed firms such as Montana or Kentucky. Hence, when analyzing asymmetries we only focus on analyzing the effects of tax increases.

shows how the different components of executive compensation are taxed. 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).[10]

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.[11]

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.[12] A performance goal counts as achieved if the executive manages to hit or exceed the target value of the predefined goal. The aver-

[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]Table 16 shows the states in which the personal income tax rate changed by more than 0.5 percentage points throughout the sample period and the point in time when the respective state experienced a change in the corporate income tax rate. It is important to note, that there were very few changes in the corporate income tax rate which occurred at the same time as a personal income tax change, in particular for the tax changes used in the stacked regression setting.

[11]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.

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

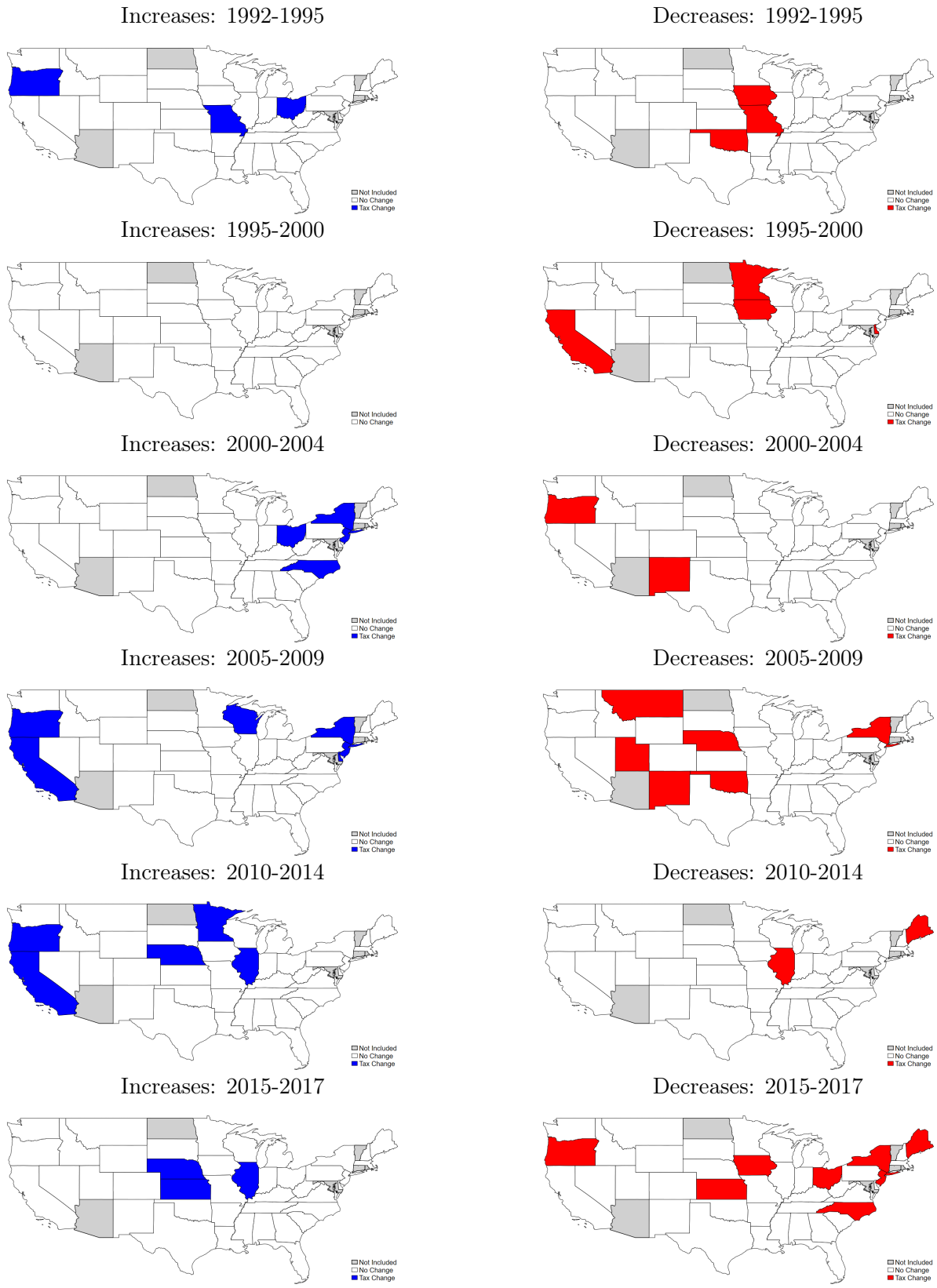
age executive in our sample achieves 88 percent of her performance goals each year, while the median executive achieves all her performance goals (see Table 1 for summary statistics). Our data on engagement in outside board seats comes from the BoardEX database. BoardEX contains detailed information 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 17 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	34589
First lag of log Sale	7.06	1.68	5.96	6.97	8.12	34589
R & D Indicator	0.42	0.49	0.00	0.00	1.00	34589
Deviation ROA	0.03	0.21	-0.00	0.03	0.08	34589
Deviation Market to Book	-1.95	68.50	-1.70	-0.47	0.17	34589
Other Variables						
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	8207
Top Marginal Tax	5.82	3.81	3.02	6.07	8.09	34589

Note: Table 1 presents the descriptive statistics for the panel regressions in section 5.1. 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). The variable Return on Assets is the ratio of earnings before interest over assets, winsorized at the 99 % level and multiplied with 100. Log of sale is the natural logarithm of firm sales. The variable R&D indicator takes the value of one if a firm reports positive R&D expenditure. The variable Deviation ROA is the deviation of firm specific ROA from the industry median. Industry is defined by the 2-level digit SIC code. Book to market ratio is the book value per share over the end of year price of shares. Performance Goals is the fraction of pre-specified accounting goals the executive reaches. The number of committees refers to the total committees on which the respective CEO serves if she is part of an outside board. 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. A detailed definition of variables can be found in the Appendix in Table 17.

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 years, the right 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 17. 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. 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, we employ similar controls 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. 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.[13] 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.

[13]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)	-10.423***	-11.672***	-11.596***	-12.296***
	(2.657)	(2.677)	(2.485)	(3.153)
First lag of log Sale		-0.103	-0.131	-0.104
		(0.154)	(0.141)	(0.138)
R+D Indicator			0.699	0.712
			(0.627)	(0.593)
Deviation ROA			0.128	0.125
			(0.226)	(0.229)
Deviation Market to Book			0.000	0.000
			(0.001)	(0.001)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls			✓	✓
State Controls				✓
Observations	8456	8381	8237	8207
R-squared	0.847	0.847	0.855	0.856

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 column (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 17. 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***	12.063**
	(4.814)	(4.751)	(4.107)	(4.710)
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	35853	35625	34681	34589
R-squared	0.707	0.709	0.716	0.716

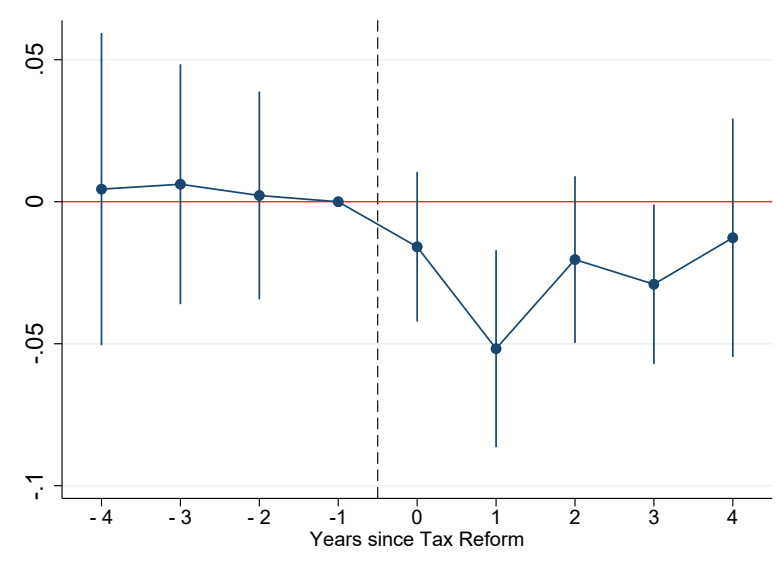
Note: Table 4 reports estimates from a regression following equation (1). The dependent variable is return on assets (ratio of earnings before interest over assets, multiplied by 100). In column (1) we employ executive × firm fixed effects as well as year fixed effects. In column (2) we add the first 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 17. 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). We do not include control variables in these stacked event study regressions as in column (1) of Table 2. However, we also estimate the stacked event study regressions with control variables as in column (4) of Table 2 as a robustness check. Results are similar to the estimates without control variables and presented in Section A.3.

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.

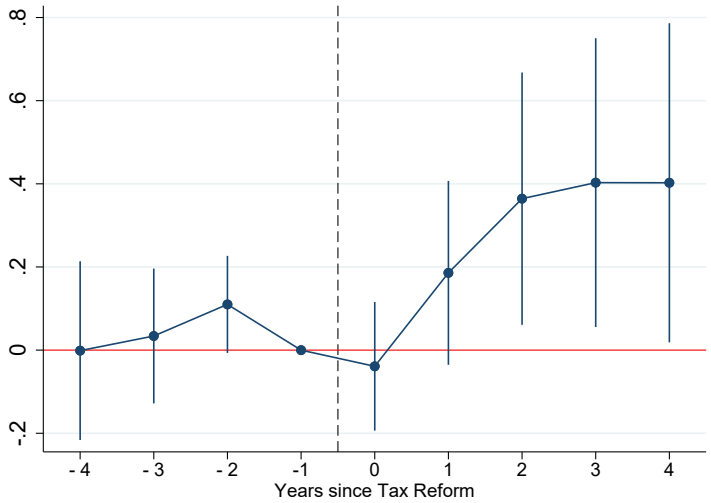
Figure 2: Stacked Regression: Fraction of Performance Goals reached



Note: Figure 2 presents results from a stacked event study regression as specified in equation (2). The regression is estimated without control variables. 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. 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 3: Number of committees

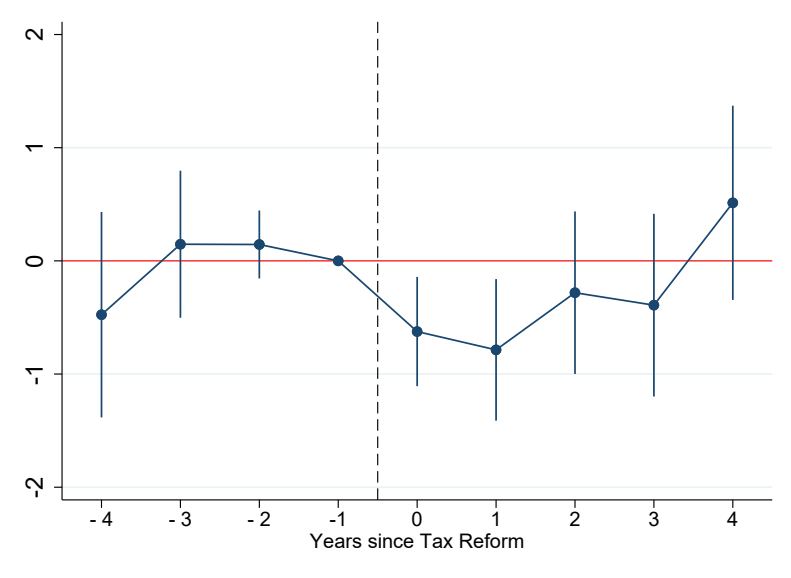


Note: Figure 3 presents results from a stacked event study regression as specified in equation (2). The regression is estimated without control variables. The dependent variable is the number of committees on external boards the CEO is part of. The Figure shows the year-specific coefficients on a dummy 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. 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 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 16, Figure 17 and Figure 18 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 4: Stacked Regression: Return on Assets



Note: Figure 4 presents results from a stacked event study regression as specified in equation (2). The regression is estimated without control variables. 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. 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 CEO Treatment Effects

To further assess whether the observed reduction in CEO labor supply causally impacts the drop in firm performance following an increase in CEO personal income taxation, we apply the methodology introduced by Bertrand and Schoar (2003). Their novel contribution lies in identifying the impact of different manager fixed effects on various firm performance indicators. They further show that different manager fixed effects are correlated to identify different management styles.

In the spirit of Bertrand and Schoar (2003) we recover CEO-specific treatment effects of a change in the personal income tax rate. Not all CEOs will react uniformly to changes in personal income taxation. While some CEOs may respond strongly to such tax changes, others may exhibit less pronounced reactions or none at all. To recover heterogeneous CEO-firm specific treatment fixed effects, we use the stacked regression sample as described in Section 3.2 to estimate the following regression:

$$Y_{f,i,t,j} = \alpha + \mu_{fi} \times Post_t \times Treat_i \times D_{fi} + \gamma \times X_{f,i,t} + \delta_{i \times f \times j} + \delta_{t \times j} + \epsilon_{f,i,t,j} \qquad (3)$$

$Y_{f,i,t,j}$ represents the outcome of interest in firm f for executive i at time t in the treatment and control pairing j. Our variable of interest is μ_{fi}, which is the CEO-firm specific treatment effect estimated separately for each CEO-firm combination D_{fi}. It is only estimated for CEOs and firms residing in a treated state ($Treat_i = 1$) in the periods after the treatment event ($Post_t = 1$). To account for the stacking procedure, we interact time fixed effects and CEO firm fixed effects with j - an indicator for each pairing of treatment cohort and "clean" control group as described above - as before and denote them with $\delta_{i \times f \times j}$ and $\delta_{t \times j}$. We include the same control variables $X_{f,i,t}$ in some specifications as before. Our standard errors are clustered on the state $\times$ event level.

The individual CEO-firm treatment effects μ_{fi} serve as indicators of the CEO's responsiveness to alterations in personal income taxation. Notably, CEOs with particularly low treatment effects regarding performance goal attainment tend to reduce their effort more significantly than their counterparts. Similarly, CEOs with exceptionally high treatment effects related to committee involvement exhibit a similar pattern.

We want to assess whether CEOs who show a strong treatment effect in the attainment of performance goals and the number of committees they are engaged in also show a strong treatment effect for firm performance. Our expectation is that firms led by CEOs who exhibit pronounced reactions in their effort (as indicated by the identified treatment fixed effects) will also experience a notable decline in firm performance. To explore this, we regress the CEO treatment effects associated with performance goal attainment $\mu_{fi}[(\text{Goals reached})]$ and committee participation $\mu_{fi}[(\text{Committees})]$ on the CEO treatment effects linked to their firm's performance $\mu_{fi}[(ROA)]$ in the following manner:

$$\mu_{fi}[(ROA)] = \alpha + \beta\mu_{fi}[(\text{Goals reached}) \text{ or } (\text{Committees})] + \epsilon_i \tag{4}$$

In line with our expectations, we observe a positive relationship between the CEO treatment effect with respect to the fraction of performance goals reached and the CEO treatment effect with respect to their firm's return on assets in Table 5 column (1). When a CEO's reaction to a tax rate increase is substantial and she misses many goals, it leads to a pronounced drop in firm performance. Similarly, if a CEO's treatment effect is large in terms of the number of committees she is involved in after a tax rate increase, the negative relation in column (2) indicates a more pronounced decline in the firm's performance. Overall, there exists a relationship between personal income taxation, CEO working effort, and firm performance.

Table 5: Correlation Treatment Effects

	(1)	(2)
Performance Goals FE	10.456**	
	(5.211)	
Committee FE		-0.547**
		(0.253)
Observations	211	180

Note: Table 5 reports estimates from a regression as specified by equation (4). The dependent variable is the executive-firm specific treatment effect for return on assets. The explaining variables are the executive-firm specific treatment effect for performance goals in column (1) and the executive-firm specific treatment effects for the number of committees in columnn (2). Such individual-specific treatment effects can only be identified for CEOs who experienced a tax change and were present in their firms before and after the tax reform. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5.4 Capital Investment

A core function of corporate headquarters is the efficient allocation of scarce resources within the firm (Giroud and Mueller, 2015; Shin and Stulz, 1998). CEOs play a pivotal role in capital allocation decisions, exercising significant discretion over investment choices. Prior research (Dittmar and Duchin, 2016; Duchin et al., 2021; Duchin and Sosyura, 2013; Giroud, 2013) indicates that various factors influence investment decisions, including the CEO's personal experiences, connections with division managers, and the geographical distance of divisions from headquarters.[14] One potential explanation for the observed recovery in return on assets is a reduction in firm growth, as CEOs may exert less effort and reduce investment in projects with marginal profitability. Figure 5 illustrates that following an increase in the top personal income tax rate, firms experience a reduction in capital expenditure, with the effect most pronounced in the first two years after the reform.

Consistent with this, our findings suggest that the decline in capital expenditure is primarily driven by a reduction in investments with lower expected profitability. To examine this in more detail, we leverage firm-segment data, following the approach of Shin and Stulz (1998), to distinguish between capital expenditure in the least and most profitable segments. Figure 6 demonstrates that the reduction in capital expenditure occurs predominantly in the least profitable segments, whereas investment in the most profitable segments remains relatively stable.

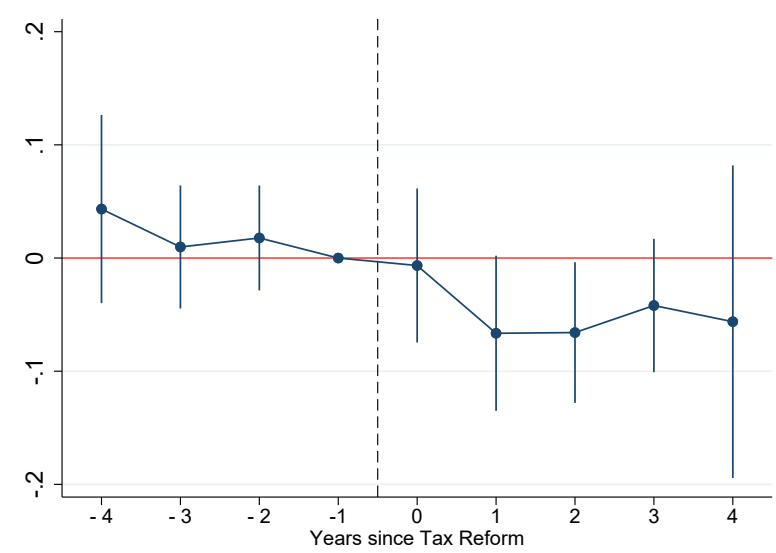
5.5 Compensation Response

CEO compensation Following an increase in taxes and corresponding decrease in firm performance, shareholders might be expected to adjust CEO compensation to realign incentives. One possible mechanism is an increase in gross pay to offset higher personal tax burdens.

In Table 6 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

[14] Interestingly, Dittmar and Duchin (2016) find that CFOs' employment experiences do not significantly impact investment decisions, reinforcing the CEO's central role in capital allocation.

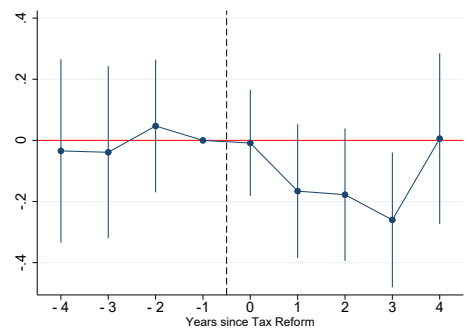
Figure 5: Stacked Regression: Capital Expenditure



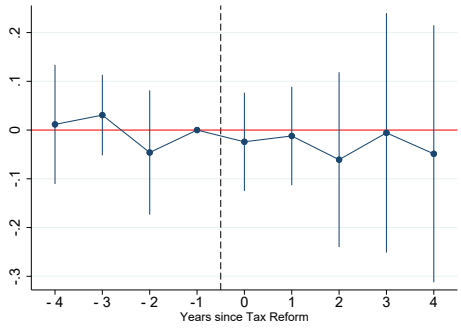
Note: Figure 5 presents results from a stacked event study regression as specified in equation (2). The regression is estimated without control variables, with the dependent variable being the logarithm of capital expenditure. The figure displays year-specific coefficients on a dummy variable equal to one for tax changes exceeding 0.5 percentage points and -1 for reductions below -0.5 percentage points. Event time -1 represents the year before the reform, and its coefficient is normalized to zero. The analysis employs the stacked event study design with clean controls. Standard errors are clustered at the state and event levels, with vertical bars depicting 95% confidence intervals.

Figure 6: Heterogeneity in Capital Expenditure

(a) Low Profitability Segments



(b) High Profitability Segments



Note: Figure 6 presents results from a stacked event study regression following equation (2). The regressions are estimated without control variables, with the dependent variable being the logarithm of capital expenditure. Figure 6a examines tax effects on segments with below-median return on investment, while Figure 6b focuses on segments with return on investment at or above the median. The figure displays year-specific coefficients on a dummy variable equal to one for tax changes exceeding 0.5 percentage points and -1 for reductions below -0.5 percentage points. Event time -1 represents the year before the reform, with its coefficient normalized to zero. Standard errors are clustered at the state and event levels, with vertical bars depicting 95 % confidence intervals.

no evidence of CEOs receiving a compensatory increase in their gross pay. Given the observed reduction in firm performance this finding is rather surprising. Shareholders would typically have an incentive to compensate CEOs to mitigate adverse performance effects. However, 67% of directors admit that they are willing to sacrifice shareholder value to avoid

controversy over CEO pay (Edmans et al., 2023). Additionally, De Angelis and Grinstein (2020) provide evidence that performance-based pay structures typically span a three-year period. Thus, compensation adjustments might not occur immediately after the tax reform. Thus, if the CEO achieves less performance goals, see Figure 2, compensation decreases. Moreover, recent evidence suggests that the board does not have complete discretion in setting executive pay; rather, it is influenced by investor expectations to determine the optimal level of CEO compensation (Edmans et al., 2017). Hence, while the board might want to increase CEO pay to incentivize the CEO properly, it might refrain from doing so out of fear of investor backlash.

Table 6: Total Compensation Granted

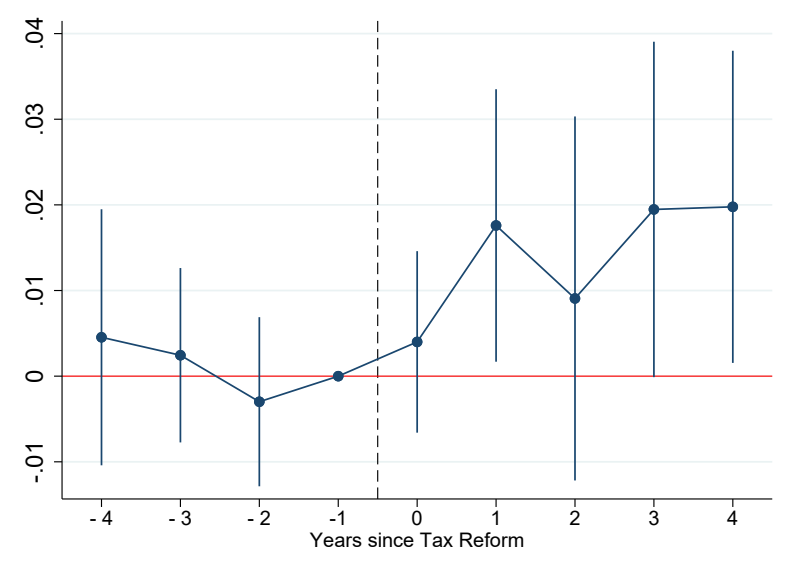
	(1)	(2)	(3)	(4)
ln(1-MTR)	0.434	1.007	1.165	1.590*
	(0.638)	(0.774)	(0.724)	(0.796)
First lag of log Sale		0.212***	0.200***	0.201***
		(0.011)	(0.015)	(0.015)
R+D Indicator			0.227	0.226
			(0.154)	(0.154)
Deviation ROA			0.114***	0.113***
			(0.036)	(0.036)
Deviation Market to Book			0.000	0.000
			(0.000)	(0.000)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls			✓	✓
State Controls				✓
Observations	36265	35812	34883	34786
R-squared	0.752	0.756	0.757	0.757

Note: Table 6 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 column (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 17. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Composition of Compensation Apart from adjusting the overall amount of compen-

sation 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. Figure 7 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 share of stock awards granted to the executive increases. This shift suggests that rather than raising total pay, firms restructure compensation packages to maintain performance incentives while managing costs associated with tax changes.

Figure 7: Stacked Regression: Fair Value of Stock awarded



Note: Figure 7 presents results from a stacked event study regression as specified in equation (2). The regression is estimated without control variables. 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. 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. Table 11 shows descriptive statistics for CEOs with a high level of wealth and CEOs with a low level of wealth. While firms with a high level of CEO wealth are larger and more profitable, the share of employees working for these firms in the headquarter state does not differ substantially from firms with a low wealth CEO. Anecdotal evidence also confirms that the requirement for stock holdings differ substantially between otherwise similar firms. For example in 2016, Apple's CEO Tim Cook was required to hold stock in Apple in the amount of 10 times his salary whereas Margaret C. Whitman CEO of HP was only required to hold stock in the amount of 7 times her salary in her company.[15] 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 × 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:

$$Y_{f,i,s,t} = \beta \times ln(1 - MTR_{s,t}) \times D_{i,t} + \gamma \times X_{f,i,t} + \alpha_{i\times f} + \delta_{s\times t} + \epsilon_{f,i,s,t} \quad (5)$$

[15]The information on stockownerhsip guidelines can be found in company's proxy statements. https://www.sec.gov/Archives/edgar/data/320193/000119312516422528/d79474ddef14a.htm https://www.sec.gov/Archives/edgar/data/1645590/000119312516460462/d73207ddef14a.htm

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 7 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.

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.[16] Controlling for other changes in the tax rate schedule allows us to test whether it is indeed

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

Table 7: Heterogeneous Response: Firm Wealth

	(1) Performance Goals	(2) Committees	(3) ROA
Low Wealth × ln(1-MTR)	0.135	-5.006*	14.109**
	(0.261)	(2.616)	(6.373)
Executive x Firm FE	✓	✓	✓
State x Year FE	✓	✓	✓
Size Controls	✓	✓	✓
ROA, RD controls	✓	✓	✓
Governance Controls	✓	✓	✓
Observations	4763	4779	19693
R-squared	0.598	0.890	0.779

Note: Table 7 presents the coefficients resulting from estimating equation (5). 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: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

the marginal tax rate on the very top income earners which matters and not another more generally applicable feature of the tax rate schedule. Table 8 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.

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 (5) in section 6.1 and interact this dummy variable with the net-of-top-tax-rate.

Table 8: Outcome Variables: Controls for average tax rates

	(1)	(2)	(3)
ln(1-MTR)	0.935**	-12.638***	10.516**
	(0.431)	(2.918)	(5.050)
Avg. Top 1 Tax Rate	-0.002	-0.012	-0.056***
	(0.015)	(0.023)	(0.017)
Avg. Median Tax Rate	0.001	-0.000	0.025***
	(0.015)	(0.008)	(0.008)
Executive x Firm FE	✓	✓	✓
Year FE	✓	✓	✓
Size Controls	✓	✓	✓
ROA, R+D controls	✓	✓	✓
Governance Controls	✓	✓	✓
State Controls	✓	✓	✓
Mean			
Observations	8691	8207	34589
R-squared	0.509	0.856	0.716

Note: Table 8 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: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Again, this allows us to include state $\times$ year fixed effects. Table 9 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 9: Outcome Variables: Interaction with Employee Pay

	(1) Performance Goals	(2) Committees	(3) ROA
High Pay × ln(1-MTR)	-2.560	-14.999	-14.750
	(2.969)	(14.101)	(24.325)
Executive x Firm FE	✓	✓	✓
State x Year FE	✓	✓	✓
Size Controls	✓	✓	✓
ROA, RD controls	✓	✓	✓
Governance Controls	✓	✓	✓
Observations	532	746	3134
R-squared	0.709	0.966	0.869

Note: Table 9 reports estimates from a regression following equation (5). 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 10 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 8 as shown in column (2). To check robustness against bias from differential trends we again exploit CEO heterogeneity as in expression (5) 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 10: Tobin's Q

	(1)	(2)	(3)
ln(1-MTR)	3.982***	3.865***	
	(1.009)	(0.970)	
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	✓	✓	✓
Observations	35025	35025	19957
R-squared	0.749	0.749	0.812

Note: Table 10 reports estimates from a regression following equation (1) in column (1) and column (2) and following equation (5) 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 8. 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, 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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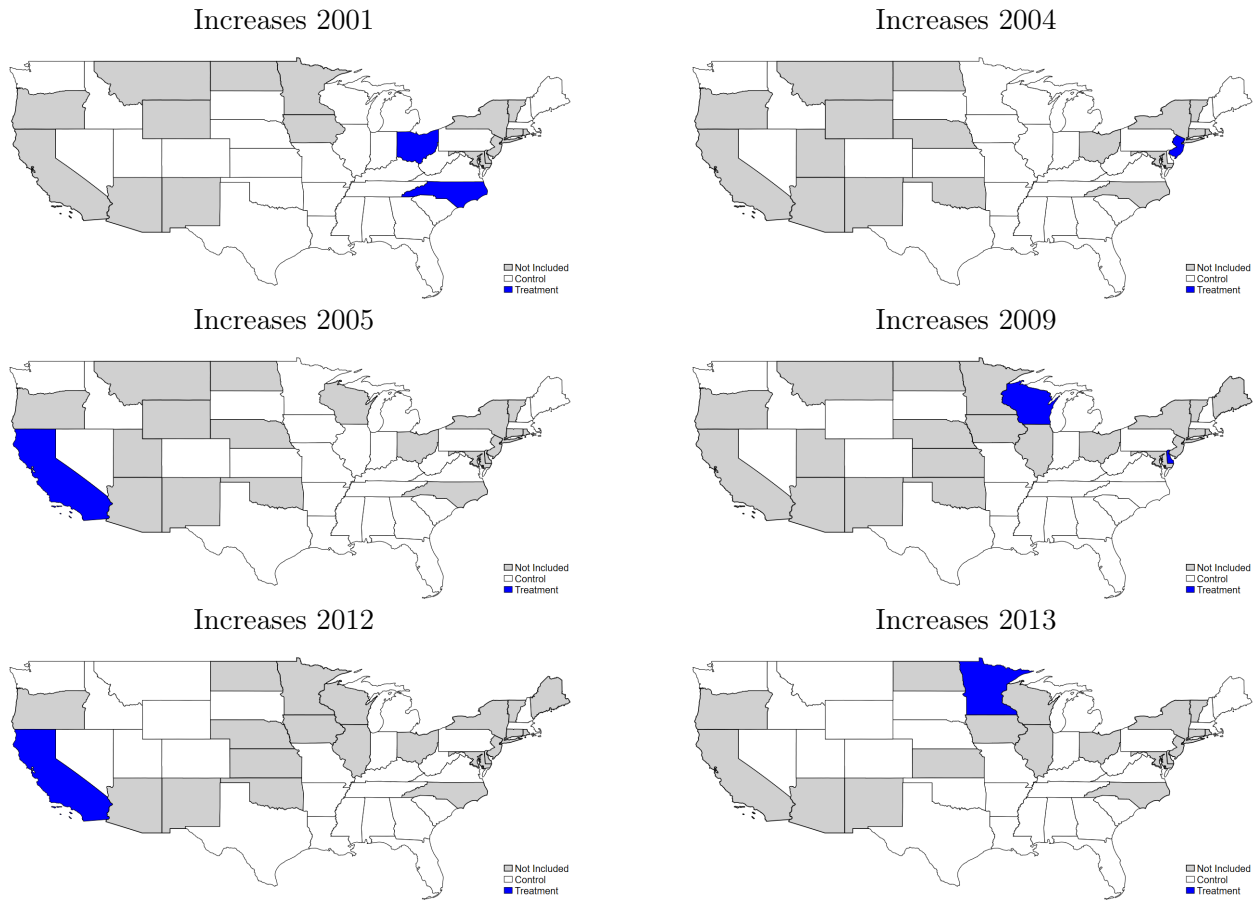
A Appendix (For Online Publication)

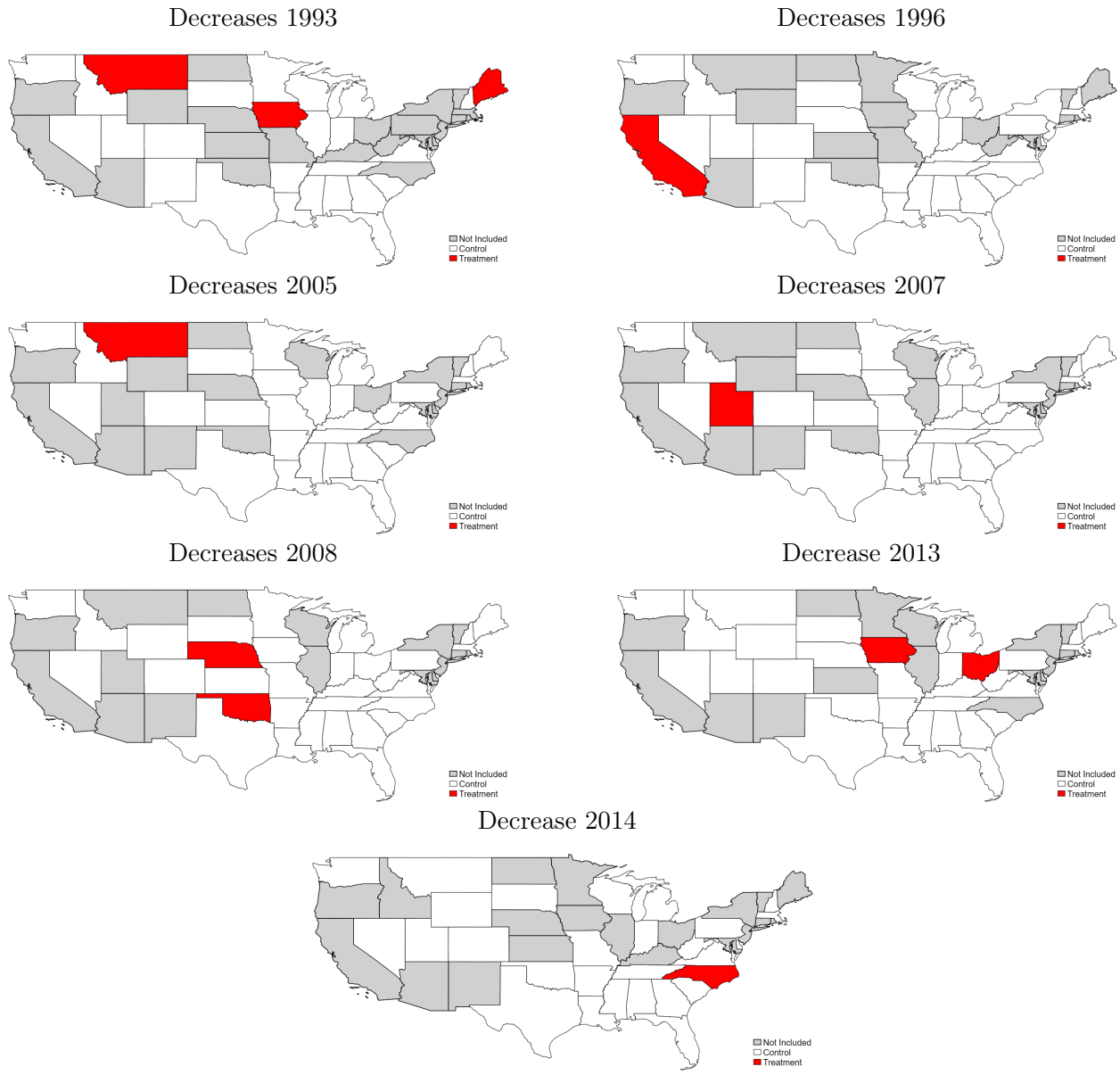
A.1 Tax Changes: Stacked Regression

Figure 8: Increases in the Stacked Regression



Note: Figure 8 shows tax increases used in the stacked regression. The states in blue are the states which experienced a tax increase larger than 0.5 percentage points. The states in grey are excluded from estimating the effects of this event because they either experienced an endogenous tax change in the sample period according to Giroud and Rauh (2019) or experienced a decrease or tax reversal following an increase in the state tax rate.

Figure 9: Decreases in the Stacked Regression



Note: Figure 9 shows tax decreases used in the stacked regression. The states in red are the states which experienced a tax decrease larger than 0.5 percentage points. The states in grey are excluded from estimating the effects of this event because they either experienced an endogenous tax change in the sample period according to Giroud and Rauh (2019) or experienced an increase or tax reversal following a decrease in the state tax rate.

A.2 Descriptives

Table 11: Descriptive Statistics: High Wealth vs. Low Wealth

	High Wealth			Low Wealth		
	Mean	Std.Dev.	Obs	Mean	Std.Dev.	Obs
Firm Variables						
Return on Assets	11.47	8.91	9904	5.15	10.84	9291
Tobin's Q	2.44	1.61	9901	1.54	0.89	9290
Deviation Market to Book	-2.48	27.97	9904	-1.33	67.38	9291
R & D Indicator	0.43	0.49	9904	0.42	0.49	9291
First lag of log Sale	7.76	1.70	9904	6.44	1.45	9291
Other Variables						
Top Marginal Tax	5.84	3.80	9904	5.83	3.79	9291
Total Compensation	7993.95	14405.74	9887	2303.27	2436.55	9275
Performance Goals	0.90	0.24	3519	0.87	0.28	1474
Number of Committees	3.31	3.25	3782	2.51	3.06	1031

Figure 10: Example Performance Goals

Annual Cash Incentive. The Compensation Committee approves, on an annual basis, a performance-based cash incentive opportunity for our executive officers based on the achievement of annual financial performance goals. For 2016, each of our named executive officers had a threshold annual cash incentive opportunity of 100% of base salary, a target annual cash incentive opportunity of 200% of base salary, and a maximum annual cash incentive opportunity of 400% of base salary.

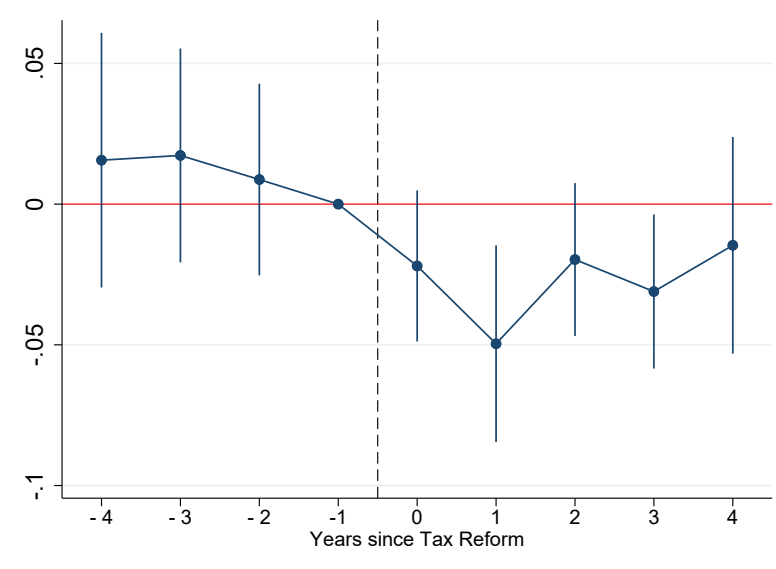
Net sales and operating income, as determined in accordance with generally accepted accounting principles, were chosen as the performance measures for the 2016 annual cash incentive opportunity because they reflect commonly recognized measures of overall company performance and are drivers of shareholder value creation. Payouts of the annual cash incentive are determined based on an equal weighting for the net sales and operating income measures. There is no payout for a particular performance measure unless the threshold performance goal is achieved with respect to that measure. Payouts are calculated based on the performance level achieved for each performance measure for 2016 and are linearly interpolated for achievement between the threshold, target, and maximum goals. The Compensation Committee may, in its discretion, reduce (but not increase) the actual payout of any individual's annual cash incentive based on Apple's performance and the Compensation Committee's subjective assessment of the named executive officer's overall performance.

The Compensation Committee established performance goals in the first quarter of 2016, taking into consideration Apple's 2015 financial results, macroeconomic factors, the payout opportunities based on attainment of performance goals at threshold, target, and maximum levels, and pay-for-performance alignment.

2016 Goals and Results

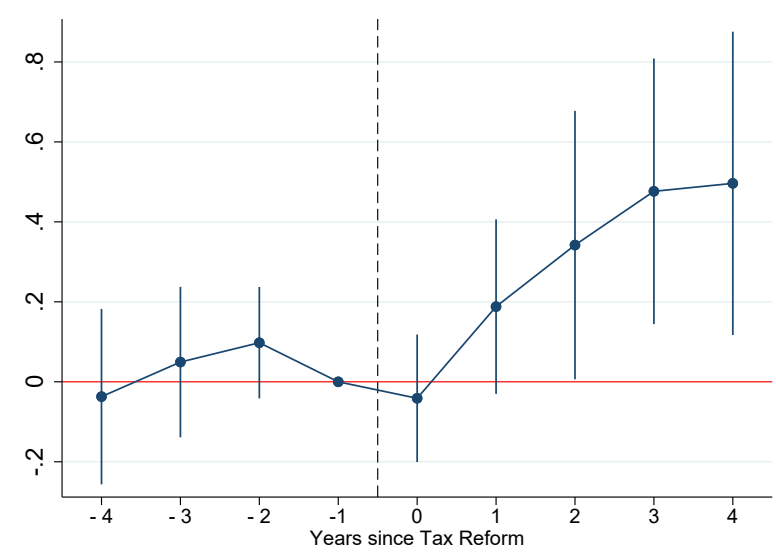
A.3 Stacked Regression: With Control Variables

Figure 11: Stacked Regression: Fraction of Performance Goals reached (Controls)



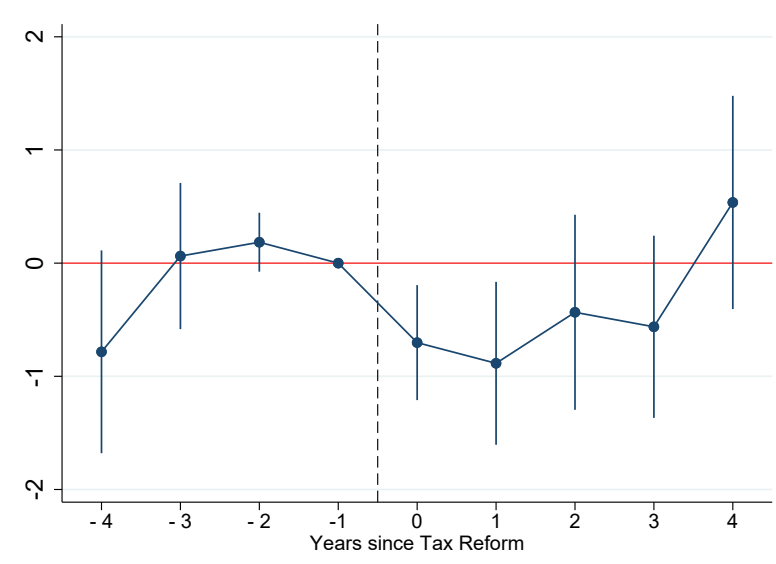
Note: Figure 11 presents results from a stacked event study regression as specified in equation (2) using only tax increases. The dependent variable is the fraction of performance goals reached. The figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 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 12: Stacked Regression: Number of Committees (Controls)



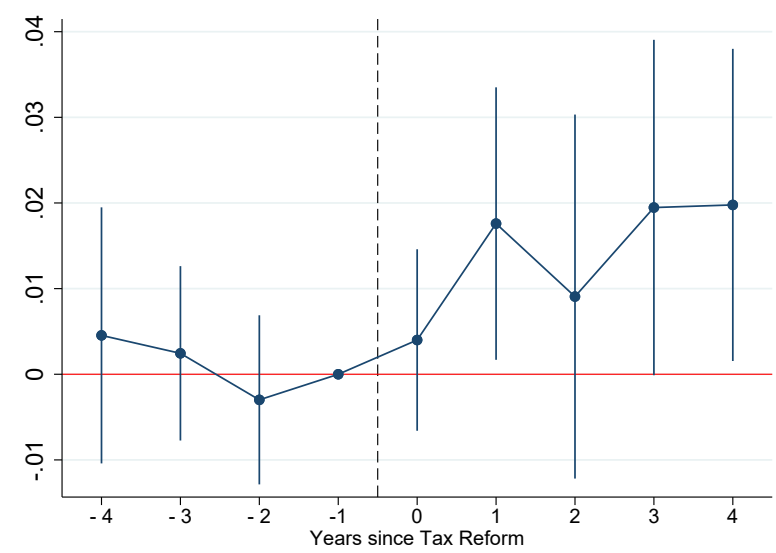
Note: Figure 12 presents results from a stacked event study regression as specified in equation (2) using only tax increases. The dependent variable is the number of committees the executive is engaged in. The figure shows the year-specific coefficients on a dummy which takes the value one if the tax 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 13: Stacked Regression: Return on Assets (Controls)



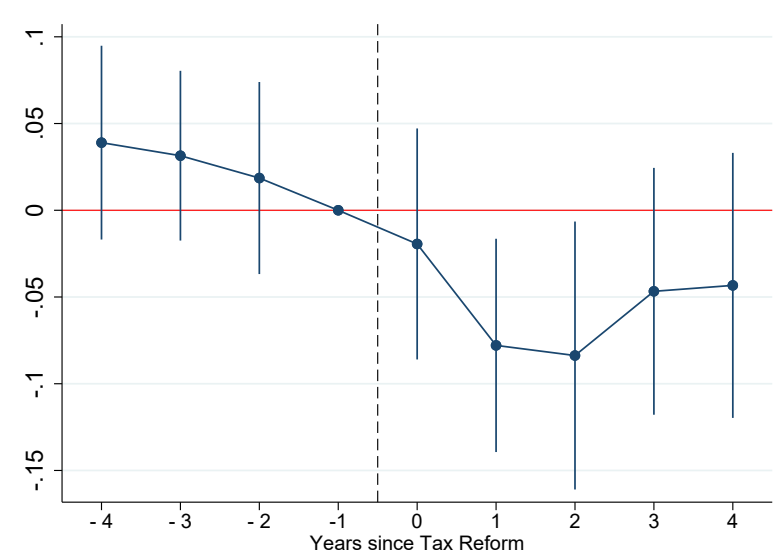
Note: Figure 13 presents results from a stacked event study regression as specified in equation (2) using only tax increases. The dependent variable is return on assets. The figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 0.5 percentage points 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 14: Stacked Regression: Share of Stock Compensation (Controls)



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 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.

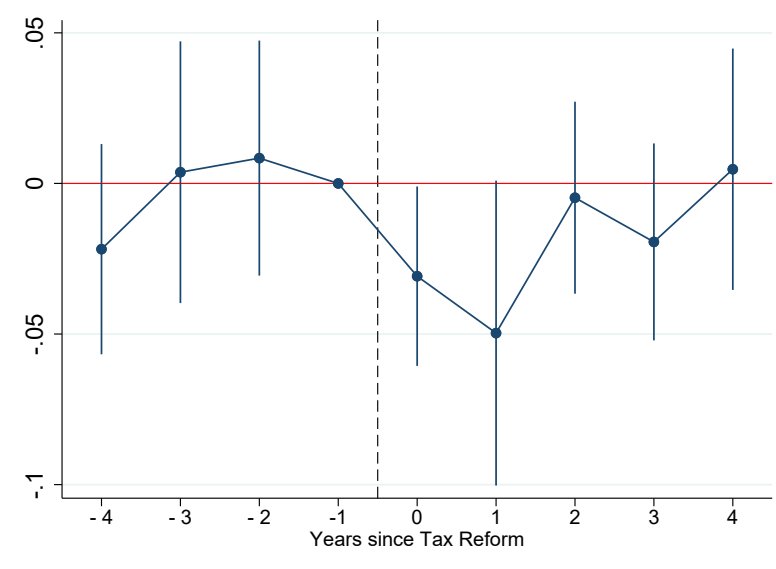
Figure 15: Stacked Regression: Capital Expenditure (Controls)



Note: Figure 15 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.

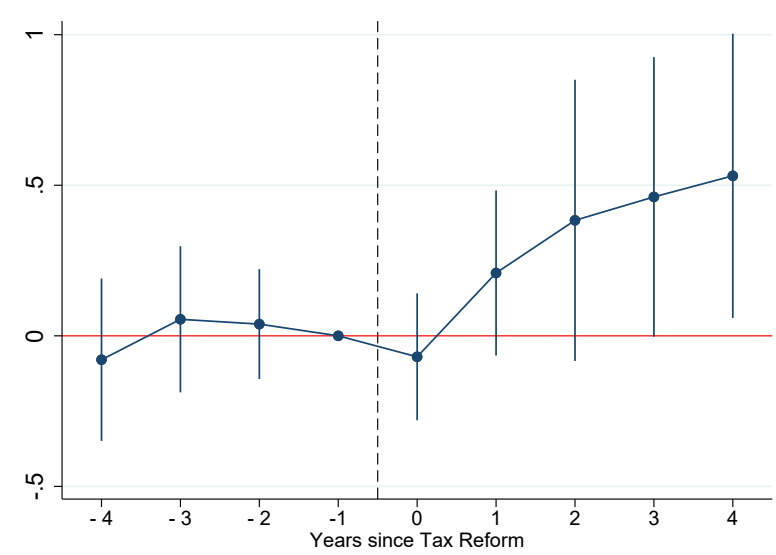
A.4 Stacked Regression: Only Increases

Figure 16: Stacked Regression: Fraction of Performance Goals reached (Only Increases)



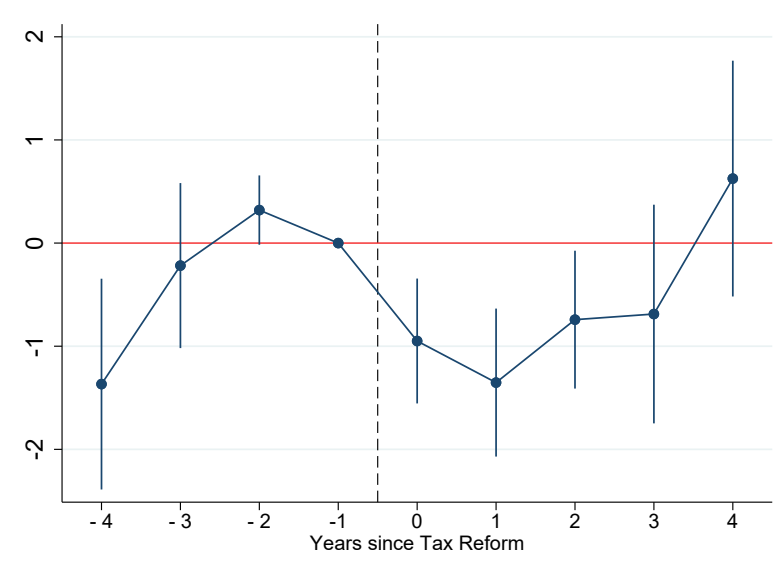
Note: Figure 16 presents results from a stacked event study regression as specified in equation (2) using only tax increases. The dependent variable is the fraction of performance goals reached. The figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 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 17: Stacked Regression: Number of Committees (Only Increases)



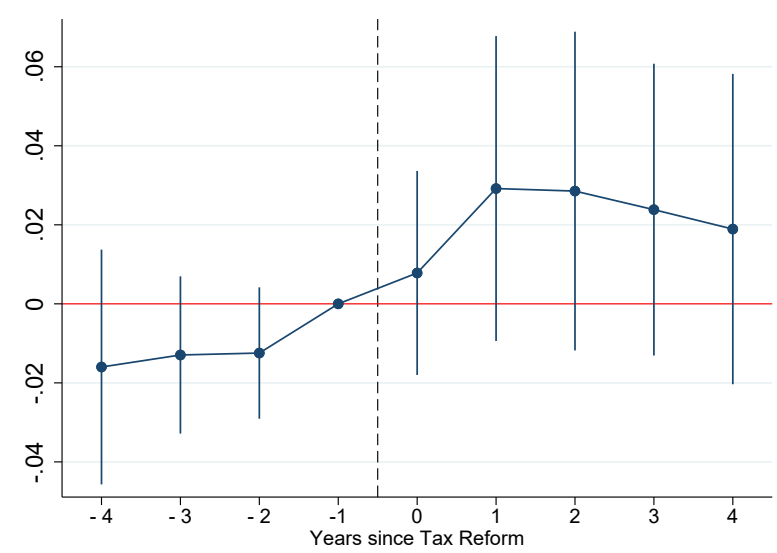
Note: Figure 17 presents results from a stacked event study regression as specified in equation (2) using only tax increases. The dependent variable is the number of committees the executive is engaged in. The figure shows the year-specific coefficients on a dummy which takes the value one if the tax 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 18: Stacked Regression: Return on Assets (Only Increases)



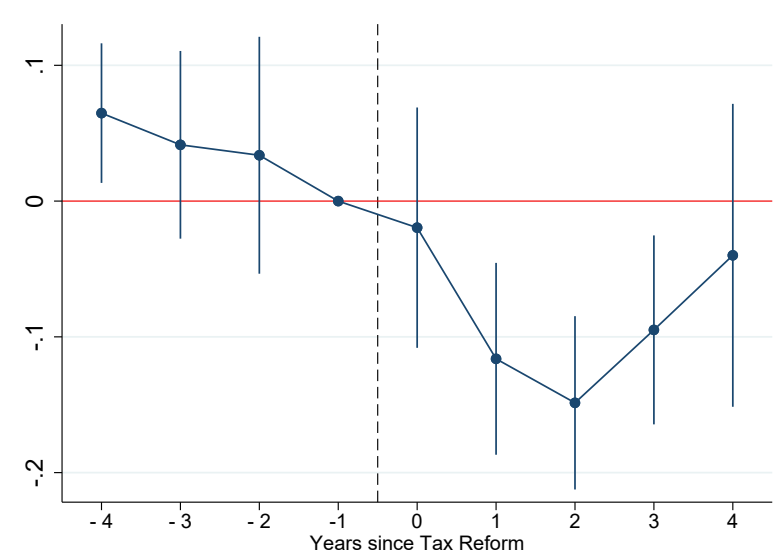
Note: Figure 18 presents results from a stacked event study regression as specified in equation (2) using only tax increases. The dependent variable is return on assets. The figure shows the year-specific coefficients on a dummy which takes the value one if the tax change exceeds 0.5 percentage points 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 19: Stacked Regression: Share of Stock Compensation (Only Increases)



Note: Figure 19 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 20: Stacked Regression: Capital Expenditure (Only Increases)



Note: Figure 20 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.

A.5 All Tax Changes

Table 12: 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 12 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 13: Number of Committees

	(1)	(2)	(3)	(4)
ln(1-MTR)	-9.096***	-10.167***	-10.114***	-10.748***
	(2.688)	(2.653)	(2.521)	(3.251)
First lag of log Sale		-0.079	-0.102	-0.085
		(0.140)	(0.129)	(0.126)
R+D Indicator			0.658	0.666
			(0.566)	(0.541)
Deviation ROA			0.271	0.268
			(0.290)	(0.292)
Deviation Market to Book			0.000	0.000
			(0.000)	(0.000)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
State Controls			✓	✓
Governance Controls				✓
Observations	8964	8887	8736	8706
R-squared	0.845	0.845	0.852	0.853

Note: Table 13 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 14: Return on Assets

	(1)	(2)	(3)	(4)
ln(1-MTR)	9.437*	13.901***	13.412***	11.546***
	(5.003)	(4.919)	(4.035)	(4.005)
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	38094	37852	36853	36761
R-squared	0.710	0.712	0.719	0.719

Note: Table 14 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 15: Taxation of CEO Compensation components

Compensation Component	**Tax Treatment for CEO**
Salary	Taxed as ordinary income in the year received
Bonus	Taxed as ordinary income in the year received
Stock Options (Non-Qualified)	Taxed at exercise as ordinary income on the spread between grant price and market value
Stock Options (Incentive)	Taxed at sale as capital gains if holding period met; otherwise taxed as ordinary income. Limited to 100,000 USD in a calendar year
Restricted Stock Awards	Taxed as ordinary income upon vesting unless an 83(b) election is made. An 83(b) election allows the CEO to pay income tax on the value of shares received at the grant date, gains in the price are taxed at the time of sale with the capital gains tax rate
Deferred Compensation	Taxed as ordinary income when received
Non-Equity Incentive Plan Compensation	Subject to the Personal Income Tax Rate once awarded

Note: Table 15 shows the different components of executive compensation which constitute granted compensation in ExecuComp.

Table 16: Tax Changes in Sample Period

State	Year	Other Changes	Included
Tax Increases			
California	2005	CIT decrease in 1997	Yes
California	2012	CIT decrease in 1997	Yes
Connecticut	2009	CIT increase in 1994 and 2013, CIT decrease in 1996, 1998, 1999 and 2000	No
Delaware	2009	No CIT change during sample period	Yes
Hawaii	2009	No CIT change in sample period	No
Hawaii	2011	No CIT change in sample period	No
Illinois	2009	CIT increases in 2011,2013 and 2018, CIT decrease in 2015	No
Maryland	2008	CIT increase in 2008	No
Minnesota	2013	No CIT change in sample period	Yes
Missouri	1994	CIT increase in 1992	No
North Carolina	2001	CIT decreases from 1997 to 2000 and from 2014 until 2017	Yes
North Dakota	1994	Reduction of the CIT in 2004, 2007, 2009, 2013, 2014 and 2016	No
New Jersey	2004	No CIT change during sample period	Yes
New Jersey	2009	No CIT change during sample period	No
New York	2009	Decreases in CIT in 1999, 2000, 2001, 2007 and 2016	No
Ohio	2001	A tax on gross receipts, the commercial activity tax (CAT), was instituted in 2005. It will be phased in through 2010 while the corporate franchise tax (Ohio's corporate net income tax) is phased out. From April 2008 through March 2009, the CAT rate is 0.208 %. Beginning April 1, 2009 the CAT rate is fully phased in and equals 0.26%. For tax year 2009 companies owe 20% of Corporate Franchise Tax liability. For Tax Year 2010 and thereafter the Corporate Franchise Tax is fully phased out	Yes

Oregon	2008	CIT increase in 2009 and decrease in 2011	No
Rhode Island	1993	CIT decrease in 2015[a]	No
Vermont	1993	CIT increase in 1997, CIT decrease in 2006 and 2007	No
Vermont	1994	CIT increase in 1997, CIT decrease in 2006 and 2007	No
Wisconsin	2009	No CIT change in sample period	Yes
Tax Decreases			
Arizona	1994	Decreases in 1994, 1998, 2000, 2001 and from 2014 until 2017	No
California	1996	CIT decrease in 1997	Yes
Delaware	1998	No CIT change in sample period	No
Hawaii	1999	No CIT change in sample period	No
Illinois	2015	CIT increases in 2011,2013 and 2018, CIT decrease in 2015	No
Iowa	1993	No CIT change in sample period	Yes
Iowa	2013	No CIT change in sample period	Yes
Kansas	2012	CIT increase in 1992 and 2003, CIT decrease in 2004	No
Maine	1993	No CIT change in sample period	Yes
Maryland	2012	CIT increase in 2008	No
Minnesota	1999	No CIT change in sample period	Yes
Missouri	1993	CIT increase in 1993	No
Montana	1993	No CIT change in sample period	Yes
Montana	2005	No CIT change in sample period	Yes
Nebraska	2008	No CIT change in sample period	Yes
New Jersey	2010	No CIT change during sample period	No

[a]Reduction of a 11% surcharge in tax liability in 1993.

New York	2009	CIT decrease in 1999, 2000, 2001, 2007 and 2016	No
North Carolina	2014	CIT decreases from 1997 to 2000 and from 2014 until 2017	Yes
Ohio	2013	A tax on gross receipts, the commercial activity tax (CAT), was instituted in 2005. It will be phased in through 2010 while the corporate franchise tax (Ohio's corporate net income tax) is phased out. From April 2008 through March 2009, the CAT rate is 0.208 %. Beginning April 1, 2009 the CAT rate is fully phased in and equals 0.26%. For tax year 2009 companies owe 20% of Corporate Franchise Tax liability. For Tax Year 2010 and thereafter the Corporate Franchise Tax is fully phased out	Yes
Oregon	2004	CIT increase in 2009, CIT decrease in 2011	No
Oklahoma	2008	No CIT change in sample period	Yes
Rhode Island	2007	CIT decrease in 2015[a]	No
Utah	2007	No CIT change in sample period	Yes
Vermont	1994	CIT increase in 1997, CIT decrease in 2006 and 2007	No

[a]Reduction of a 11% surcharge in tax liability in 1993.

Table 17: 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
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)
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)

State 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.

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ZEW – Leibniz-Zentrum für Europäische Wirtschaftsforschung GmbH Mannheim
ZEW – Leibniz Centre for European Economic Research

L 7,1 · 68161 Mannheim · Germany
Phone +49 621 1235-01
info@zew.de · zew.de