The effect of taxes on CEO performance*

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Abstract

A ten percentage point higher personal income taxation of CEOs results in a 1.7 percentage point lower firm performance, since CEOs reduce their effort as a response to their reduced net pay. There is a trade-off between the desire to tax CEOs more from an equity perspective and the resulting efficiency losses at the firm level. Our empirical results support the shareholder value view on CEO pay, since we show a causal effect of CEO pay on firm performance.

Keywords: Executive Compensation, Personal Income Taxation

JEL classification: H24, M12

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1 Introduction

CEO pay has increased drastically in recent years. In 2014 median CEO pay amounted to $ 12.7 million per year in the SP 500, which is six times higher than in 1980. Average CEO pay was 351 times higher than average worker pay in 2020 compared to a ratio of only 40 in 1980. CEOs have become much costlier to shareholders. The rapid increase in CEO pay also contributes significantly to the recent increase in income inequality (Piketty and Saez, 2003).

The conclusion seems to be that the marginal tax rate on top income earners should be higher: Diamond and Saez (2011) ask for a marginal federal income tax rate of up to 76 %. However, as pointed out by Ales and Sleet (2016), their arguments abstract from any positive impact of the efforts of these top income earners on the incomes of other agents or on tax revenues collected from other sources. Based on an assignment model (augmented with an intensive CEO effort margin) they show, that the taxation of CEO incomes affects the equilibrium pricing of CEO effective labor and, hence, spills over and affects firm profits. Based on their benchmark parameterization they conclude that a marginal income tax rate of only 15 % is optimal for top income earners - which is in sharp contrast to the 76 % optimal income tax rate proposed by Diamond and Saez (2011). We empirically investigate the causal effect of CEO pay on firm performance in order to check the validity of these views.

This empirical investigation is fundamental also from another point of view: According to the shareholder value view increasing CEO pay is justified, since CEO pay incentivizes mangers in the most efficient way in order to maximize shareholder value. The increasing importance of CEO ability for firm success over time explains increasing CEO pay. CEO pay matters for firm performance. On the contrary, according to the rent extraction view, increasing CEO pay is not justified. CEO themselves decide on their level of pay serving themselves being only limited by potentially weak corporate governance. CEO pay then should not matter for firm performance.

Empirically investigating the causal effect of CEO pay on firm performance will provide an understanding of the validity of the shareholder value view. However, if firms compete

with each other for managerial talent, CEO pay is the endogenous outcome of a process depending on several CEO and firm characteristics including firm performance. E.g., in order to optimally incentivize CEOs, optimal CEO contracts typically schedule an increase in CEO pay with increasing firm performance (Lemieux et al., 2009). This makes it impossible to interpret any observed correlation between executive pay and firm outcomes as a causal relationship (Edmans et al., 2017). We solve this dilemma in proposing a quasi-natural experiment in order to identify a causal relationship: The variation in income tax rates over time affects net CEO pay without being endogenously determined by CEO or firm characteristics.

We provide empirical evidence on how personal income taxation affects firm performance and why the observed effect is plausibly caused by CEOs. Our source of identification is the variation of personal income tax rates at the U.S. state level. Most U.S. states collect a state income tax in addition to the federal income tax currently levied at a top rate of 37 %. California has the highest additional top income tax rate of 13 % applied to those who earn more than $1 million. Many states have top income tax rates between 5% and 10%, some states do not levy an additional income tax at all. Even more important for our identification strategy many states changed their income tax rates over our sample period covering the years 1992 to 2018.

We show that operating firm performance declines by 1.7 percentage points if the state personal income tax rate increases by 10 percentage points. This observations is consistent with the assignment model of Ales and Sleet (2016) and the shareholder value view. Firms fix CEO pay in order to win the most productive CEO for the firm and to incentivize this CEO in an optimal way. Any unanticipated income tax change will violate the underlying optimality considerations. An income tax increase should result in CEOs reducing their effort due to their reduced net income or even leaving the firm. As a consequence operating firm performance declines.

This result is confirmed in an event study design. While we do not observe pre-trends, firm operating performance following a tax rate increase declines for 2 periods. Firms in the long run should then adapt to the new tax environment along many dimensions including the adjustment of CEO contracts. Consistent with this expectation, firm operating performance

starts to approach the pre-reform level in period 3 and the following periods.

We provide several empirical tests to show that decreased CEO effort is indeed the driver behind the observed decrease in operating firm performance. First, firms increasingly incentivize their CEOs not only based on stock options, but also using other performance goals (Bennett et al., 2017) such as earnings, sales or earnings before interest and tax (EBIT). Since the Securities and Exchange Commission (SEC) standardized the disclosure of such performance goals awards after 2006 and such performance goals are observable, we are able to investigate the effect of state level personal income taxation on the percentage of performance goals reached by CEOs. We find that following an increase in the state personal income tax rate by 10 percentage points, CEOs reach 12 out of 100 performance goals less. Second, if CEOs put less effort in managing their firms, they should put more effort in alternative activities such as assuming external board seats, writing books (Malmendier and Tate, 2009) or playing golf (Biggerstaff et al., 2017). Private activities such as writing books or playing golf are difficult to observe on a large scale. On the contrary, firms disclose their board members and external board membership is observable for many CEOs. We thus focus on board membership as a proxy for alternative CEO activities. We find CEOs to increase their activities at external boards following a personal tax rate increase. If their personal income tax rate increases by 10 percentage points, they take on 46% more committee memberships at external boards.

Third, if corporate governance is weak, CEOs should react more heavily to a tax caused reduction of their net earnings. Firms with weak corporate governance supervise CEOs actions to a lower extent, which increases the degrees of freedom of CEOs in such firms. We find that the reaction of operating firm performance to state level personal income taxation is especially strong for weakly governed firms.

Fourth, changes in state level personal income taxation could in principle affect all workers of a firm. To address this issue we control for the average tax rate faced by individuals at the median and the top one percentile of the state income distribution. While the average individual at the top percentile of the income distribution has an income of 500.000 USD, the average executive in our sample typically earns 4.8 million USD. Thus, executives should respond to a change in the marginal maximum state tax rate while standard workers should

react to changes in effective average tax rates.

Fifth, changes in state level personal income taxation - other than changes in individual CEO pay - should no be the endogenous outcome of a process depending on individual firm characteristics including firm performance. However, changes in state level personal income taxation could be affected by aggregated firm characteristics, e.g. in economic downturns. We employ exogenous tax rate changes as determined by Giroud and Rauh (2019) only in all our regressions to mitigate such endogeneity concerns.

Sixth, powerful CEOs could use their bargaining power to shift any additional personal tax load on their CEO pay fully to their employers (Bird, 2018). We investigate the variation in CEO pay following state level personal income tax changes. Consistent with the results of Bird (2018) we do not find evidence for CEOs shifting their personal tax load to their employers. In the short to medium run the CEO bears the incidence of increases in state level personal income taxes. This is a necessary condition for any change in CEO behavior in reaction to personal income tax changes as a quasi-natural experiment in order to identify a causal relationship between CEO pay and firm performance.

Our empirical results follow directly as a prediction form incorporating taxes in well established theoretical models on CEO pay. Assignment models such as Gabaix and Landier (2008) or Terviö (2008) discuss how CEO pay matters for the allocation of CEOs to firms. If taxes are incorporated into these models, large firms resident in high tax states may no longer be able to employ the most productive CEOs. Personal income taxation drives a wedge between gross CEO marginal productivity at the firm level and net income after taxes at the individual CEO level. The sorting of CEOs to firms is distorted resulting in decreasing firm performance following increases in personal income tax rates.

Another type of models (e. g. Gibbons and Murphy (1992) and Holmstrom (1999)) discuss how the level of pay should be determined in order to incentivize CEOs optimally. The principal uses pay and pay structure in order to realize the desired level of CEO effort resulting in an optimal CEO contract. Any unanticipated increase in personal income tax rates will violate the underlying first order conditions. CEO pay in net terms is lower than necessary for the desired CEO effort level. CEOs will decrease effort in order to rebalance the pay off of effort - net pay - and their cost of providing effort. As a consequence of

reduced CEO effort firm performance will decrease.

Our study is most closely related to other studies investigating the effect of CEO effort on firm performance. Malmendier and Tate (2009) evaluate the impact of CEOs achieving superstar status (reward winning CEOs) on the performance of their firms and on CEO effort provided proxied by the number of external board seats assumed. Ben-Rephael et al. (2021) use minute-by-minute Bloomberg online status data and Bandiera et al. (2020) use CEO diary data to study how the effort provision of top executives in corporations affects firm value. Bennedsen et al. (2020) use variation in firms' exposure to their CEOs resulting from hospitalization, and find CEO hospitalization to have a significant effect on profitability and investment. Biggerstaff et al. (2017) use golf play as a measure of leisure and provide evidence that those CEOs that golf the most are associated with firms that have lower operating performance and firm values. Armstrong et al. (2019) identify effects of CEO pay on corporate risk taking. Our contribution to this literature is to establish the link between net CEO pay, the following effect on CEO effort and the final effect on firm performance. Due to the endogeneity concerns mentioned above such a study has not been published before. We overcome these endogeneity concerns for the first time in using the variation in CEO personal income tax rates at the US state level as a quasi-natural experiment for the first time in this context. Our paper is the empirical implementation of the theoretical models developed by Ales and Sleet (2016) and Scheuer and Werning (2017). In line with their predictions we find personal income taxation to have an effect on CEO effort and firm performance.

Our study is also related to studies researching the effect of personal income taxation on the behavior of other top income earners. Akcigit et al. (2016) discuss the effect of personal income taxation on the international mobility of inventors, Kleven et al. (2013) on football superstars and Moretti and Wilson (2017) on star scientists. Saez et al. (2012) summarize the literature on income earners below the top.

Our study is further related to the broad literature on executive compensation as summarized by Edmans et al. (2017). E.g. 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) and Kim and Lu (2011) study the effect on firm value, Bergstresser

and Philippon (2006) and Burns and Kedia (2006) the effect on earnings management, Armstrong and Vashishtha (2012) and Gormley et al. (2013) the effect on corporate risk taking.

The paper is organized as follows. Section II incorporates taxes in theoretical models on CEO assignment to firms and on the optimal CEO contract to derive empirically testable hypothesis. Section III describes the data and the empirical approach. Section IV presents results. Section V concludes.

2 Model

2.1 Assignment of CEOs to firms

We use the sorting model presented by Gabaix and Landier (2008) and Terviö (2008) as summarized by Edmans et al. (2017) to demonstrate how state level personal income taxation affects the efficiency of the equilibrium assignment of workers to firms. For simplicity we consider a market consisting of two firms and two CEOs only. CEO talent increases firm value according to

$$V = S(n) + CS^{\gamma}(n)T(m) \tag{1}$$

2 potential firms and 2 CEOs are matched. Firm $n \in [1, 2]$ has baseline size $S(n)$ and CEO $m \in [1, 2]$ has talent $T(m)$. Low n denotes a larger firm and low m a more talented CEO. Each firm hires a CEO. $\underline{\omega}_n$ is the reservation wage of CEO n. In equilibrium the pay ω_n and the working place of each CEO should be determined such that firms have not incentive to employ a different CEO and CEOs have no incentive to work at a different firm or to not work at all. The wages

$$\omega_2 = \underline{\omega}_2 \tag{2}$$

$$\omega_1 = \underline{\omega}_2 + CS^{\gamma}(2)[T(1) - T(2)] \tag{3}$$

and the assignment of CEO 1 to firm 1 and CEO 2 to firm 2 define such an equilibrium. Each firm is better of employing the CEO and the CEOs receive a wage above or equal to

their reservation price[1]. Firm 2 is not interested in employing the more talented CEO 1, since the additional wage expenses in this case are at least equal to his additional productivity (which is $CS^{\gamma}(2)[T(1) - T(2)]$). Firm 1 is not interested in employing CEO 2 even at his reservation price, since the productivity loss would be as large as the wage savings. The equilibrium is efficient in the sense, that the more talented CEO works for the larger firm, where his talent pays more off in terms of firm value.

Now we introduce a personal income tax in the state of residency of the larger firm 1 only at rate τ. Depending on the level of the tax rate it could now happen that the gross wages

$$\omega_2 = \frac{\underline{\omega}_2}{1-\tau}$$

$$\omega_1 = (1-\tau)\left\{\frac{\underline{\omega}_2}{1-\tau} + CS^{\gamma}(1)[T(1) - T(2)]\right\}$$

and the assignment of CEO 1 to firm 2 and CEO 2 to firm 1 constitute an equilibrium. The larger firm 1 is able to offer the more talented CEO 1 a higher salary in gross terms. But firm 1 is not able to offer CEO 1 a higher salary in net terms than currently paid at firm 2 resident in the state without personal income taxation, since such a salary would be beyond CEO 1's relative contribution to the firm value of firm 1. CEO 1 is no longer interested in working for firm 1 because of the tax. If the tax rate is high enough firm 2 is not interested in hiring CEO 2 at his lower reservation wage, since the wage savings would be below the loss in productivity due to the CEO change $(1-\tau)CS^{\gamma}(1)[T(1) - T(2)] < CS^{\gamma}(1)[T(1) - T(2)]$. If the personal income tax rate is too high, it could even happen that the larger firm 1 is no longer able to offer the less talented CEO 2 his reservation wage in net terms and CEO 2 may drop out of the CEO market ($\frac{\underline{\omega}_2}{1-\tau} > CS^{\gamma}(1)T(2)$). For our empirical analysis we can draw two conclusions: *(1) Non harmonized state level personal income tax rates distort the efficient assignment of CEOs to firms. This should decrease firm value or firm productivity in states with relatively high personal income taxation. (2) Personal income taxation introduces a wedge between the contribution of CEO talent to firm value and the possible payoff to CEOs in net wage terms. High personal income taxation could thus drive CEOs out of the market, since firms are no longer able to offer their reservation wage in*

[1]In case of CEO 1 by assumption $\underline{\omega}_2 + CS^{\gamma}(2)[T(1) - T(2)] \geq \underline{\omega}_1$

net terms.

2.2 Setting incentives

The firm hires a CEO to run the firm. Firm value $V(a, S)$ is increasing in CEO effort a and firm size S and decreasing in CEO pay $c(V)$ possibly depending on realized firm value (Edmans et al., 2017):

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

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 his reduction in utility from providing effort ($g(a)$ is increasing in a and convex; $g'' > 0$). The resulting utility function of the CEO is:

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

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

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

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

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

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

In order to simplify the problem we assume the firm owner is able to direct the CEO to exert the desired effort level a. In order 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 exactly at the level to get the CEO work at the desired effort level

$a^\star$ and choose wage

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

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

$$S + b(S)a^\star - \omega - g(a^\star)$$

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 in the short run reduced CEO effort 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 choose a different CEO pay in order to maximize firm value taking taxes in to account. As before, firm owners set the wage exactly at the level to get the CEO work at the desired effort level $a^\star$. Taking taxes in to account this is costlier than before since now the participation constraint is

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

and consequently the wage necessary to get the CEO 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

$$s + b(S)a^\star - \frac{\omega + g(a^\star)}{1 - \tau}$$

in order to determine the first best CEO's effort level under tax $a_f b$ as

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

Since $g(a)$ is a convex function, $a^\star_{fb\tau} < a^\star_{fb}$. The income tax on CEO pay introduces a wedge between incentivizing the CEO via pay and the cost for doing so, since 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 in choosing a lower CEO effort level than pre-tax reform. *We expect firm owners in the long run to adjust their incentive structure following the tax rate shock again 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 simplifying assumption. 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 in (partly) paying the CEO dependent 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 with 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 be lower than before the tax rate increase also in this case.

3 Data and Estimation Strategy

3.1 Taxation of Executive Compensation

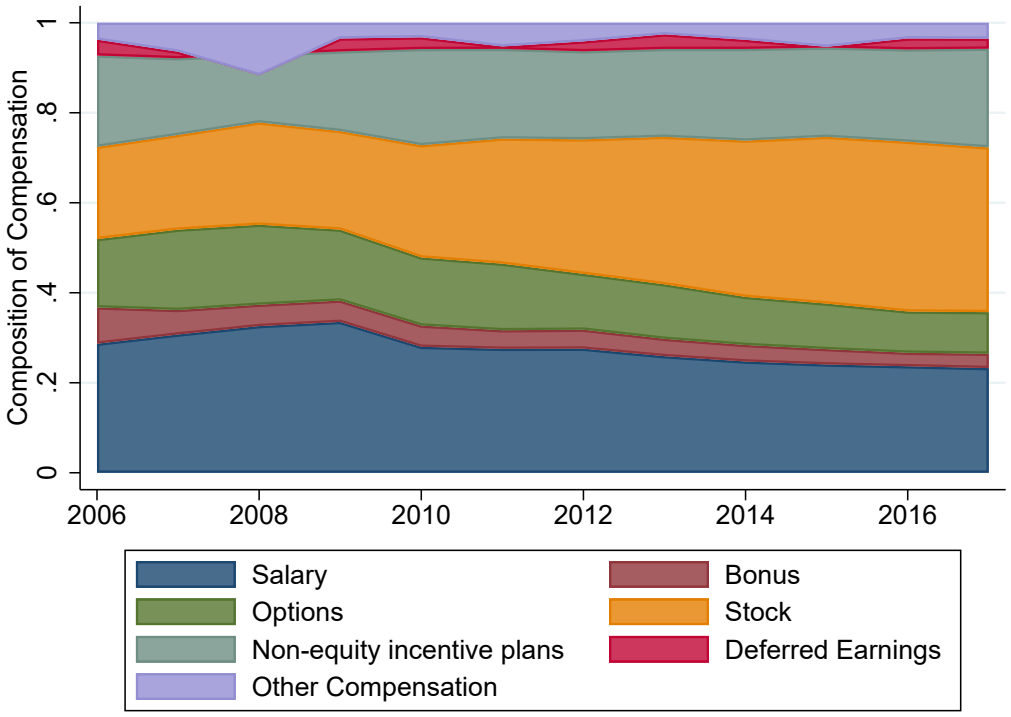
Some prominent executives such as Elon Musk, Mark Zuckerberg or Jeff Bezos have become renowned for not paying any personal income tax although earning high income according to the public opinion. Hence it seems worthwhile to discuss how executive compensation is affected by changes in the personal income tax rate. In contrast to regular wage earners, CEO pay has several components as shown in figure 1. The largest components are salary, options, stock and non-equity incentive plans. Salary amounts to 20 % of executive compensation and is usually subject to the personal income tax rate once it is granted to the CEO. Non-equity incentive plans are some form of performance-based pay which the executive receives upon reaching some predefined long-term performance goals. This part of executive compensation is also taxable upon payout. The largest component of CEO pay, which has become increasingly important over the years, is stock compensation. As part of their compensation package CEOs receive restricted stock grants, usually with a pre-specified vesting period. During this vesting period the CEO is required to hold on to the stock. Hence, stock compensation is subject to the personal income tax rate once this vesting period expires. Similar to stock compensation option compensation is not taxed at the personal income tax rate when the option is granted but when the CEO exercises it. The CEO can choose when she wants to exercise the option, once the vesting period has lapsed. All resulting personal income is taxed at the ordinary personal income tax rate.[2] A detailed overview of the way CEO compensation is taxed can found in ,Erickson et al. (2020) also provide an overview of the personal income tax treatment of the various components of CEO income.

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. This is not the case if the state has reciprocity agreements with the state of residence. The states with the largest number of observations in our sample typically do not have reciprocity

[2]The only exception are so called ISO stock options, which under some circumstances are taxed at the capital gains tax rate. However, the amount of ISO stock options is limited to 100,000 USD per year per employee. Given the high income of CEOs they are of minor importance and negligible.

agreements with other states.

Figure 1: Composition of Compensation



Notes: Figure 1 depicts the evolution of the composition of compensation from 2006 to 2012. Since the way in which stock and options were disclosed changed in 2006 we start our graph in the year 2006. The figure shows the evolution of the components based on which overall compensation awarded is calculated. The value of options and stocks is the fair value at grant date.

3.2 Data

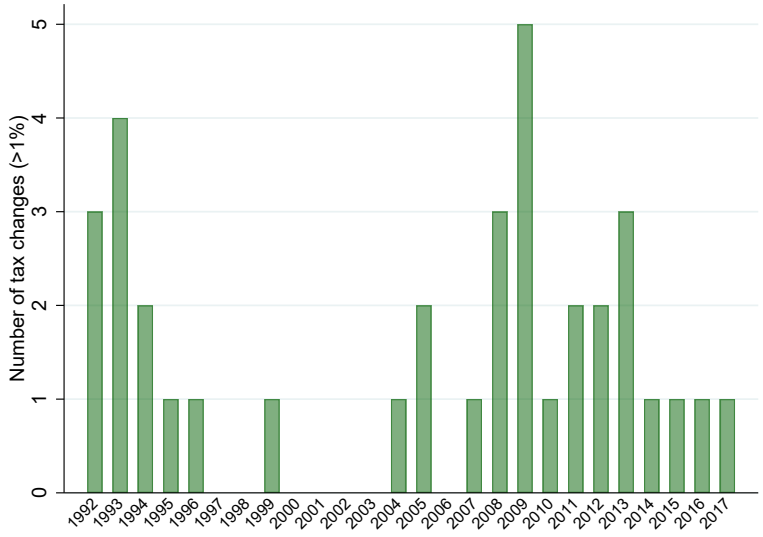
We combine tax data varying at the US state level from the NBER, data on CEO pay from Excecucomp and firm data from Compustat for our main empirical analysis. The resulting sample consists of 36.849 firm-year observations encompassing 3.088 firms and 6.407 executives covering the years 1992 - 2017. For additional tests we add data from ISS Incentive Lab on individual CEO performance goals, data on outside board seats from BoardEX and corporate governance indicators.

Tax Data We obtain data on personal income taxation from NBER TaxSIM. Our main variable of interest is the maximum state tax rate which is computed as the marginal tax rate due on an additional 1,000 USD personal income earned above 1.5 million USD at the

US state level.The taxpayer is assumed to be married and filing jointly.

Figure 2 counts the number of yearly marginal top income tax rate changes larger than one percentage point taking all US states into account. We count 36 changes over time during our sample period. We use the variation in the maximum state tax rate in figure 8 and figure 2 for identifying the economic effects of CEO personal income taxation on firm performance and CEO effort. Figure 7 shows the geographical distribution of marginal top income tax rates across the US. US states along the West and East coast have the highest marginal maximum state tax rates. Figure 8 shows the evolution of the maximum tax rate for the eight states where most firms are located.

Figure 2: Tax Changes over Time



Notes: Figure 2 presents the number of states which experienced a tax change exceeding the absolute value of one percentage point per year over the sample period.

We further restrict our analysis to tax changes which have been classified as exogenous by Giroud and Rauh (2019).[3]

Execucomp and Compustat Our primary data set is the universe of executives in Execucomp. Exceucomp contains information on the compensation of all executives employed at S&P 1500 firms. Apart from compensation information Execucomp also contains detailed

[3]We exclude all states from our sample which experienced a change in the personal income tax rate classified as endogenous over the sample period we consider. Thus we drop observations from Arizona, Connecticut, Hawaii, Maryland, North Dakota, Rhode Island and Vermont. As a robustness check we also run our regressions without dropping these observations.

information on an executive's tenure at the firm, age and gender. We drop all executives from our data set which have not been flagged as the CEO of the company in the respective year.We combine Execucomp with company's financial statements from Compustat. Our main firm outcome variable is winsorized at the 99% level. Since Compustat only contains information on the latest location of the headquarters we match in historical headquarter location data from SEC 10-k filings. We denote the headquarter state to be the state in which the company records it's principal business activity.[4] Table 1 shows descriptive statistics.

ISS Incentive Lab We complement our core data with data from ISS Incentive Lab. ISS Incentive Lab contains detailed information on compensation contracts of executives collected from firm's proxy statements. Information on these contracts is available from 1998 onwards.[5] These performance contracts specify which metrices the executive needs to reach in order to receive a payout of performance-based pay. In our analysis we focus on performance goals tied to accounting metrices.[6]We define a performance goal as reached if the executive manages to hit or exceed the target value of the pre-defined goal. Our main outcome variable is the fraction of performance goals reached (the number of performance goals reached over the number of performance goals defined for a given year). [7] Overall, we have information on the performance contracts of 1.090 firms and 2.106 executives. The average executive in our sample reaches 88 percent of her performance goals each year, while the median executive reaches all her performance goals (see Table 1).

Outside Board Seats Our data on outside board seats comes from the database BoardEX. BoardEX contains detailed information on executive's 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 to a different

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

[5]Due to more rigid disclosure requirements the sample increased substantially in 2006.

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

[7]We merge the data from ISS Incentive Lab to data on firm-level variables by Compustat using the SEC's central index key (CIK).

company. We match the information from BoardEX to Execucomp using the stock market ticker and the last name of an executive. We have information on the number of outside board seats and outside committees for a total of 1.378 executives and 846 firms.

Additional Variables We further add a number of different variables as control variables and for heterogeneity analyses. We construct measures of corporate governance previously used in the literature (e.g. by Chetty and Saez (2005) and Lilienfeld-Toal and Ruenzi (2014)) from the Gomper's governance index and Thomson Reuter's institutional (13-f) holdings database. We also add information on executive's financial wealth from Coles et al. (2013). Sample statistics can be found in Table 1. 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
Compensation						
Total Compensation	4762.69	8983.59	1219.92	2633.46	5612.73	36613
Firm Variables						
Return on Assets	8.09	10.20	3.41	7.91	13.13	36849
Log of Assets	7.51	1.81	6.24	7.37	8.64	36849
Book to Market Ratio	3.77	68.36	1.41	2.17	3.57	36205
R & D Indicator	0.76	0.43	1.00	1.00	1.00	20414
Log of Sale	7.12	1.68	6.03	7.04	8.18	36794
State Variables						
Maximum State Tax	5.82	3.83	3.02	6.07	8.09	36849
Performance Goals						
Fraction of Goals reached	0.88	0.26	1.00	1.00	1.00	9342
Board Seats						
Number of outside boards	2.19	1.82	1.00	2.00	3.00	8517
Number of Committees	3.09	3.52	0.00	2.00	5.00	8517

Note: Table 1 presents the descriptive statistics of the sample. The sample includes firms which have not experienced a headquarter change during the period of observation and are situated in a state without an exogenous state tax change defined by Giroud and Rauh (2019). We further restrict our sample to include only firms without missing values for return on assets. Total Compensation is the value of compensation awarded to the executive in the respective year. The variable ROA is the ratio of earnings before interest over assets, winsorized at the 99 % level and multiplied with 100.The variable log of assets denotes the natural logarithm of firm assets. Book to market ratio is the book value per share over the end of year price of shares. The variable R&D indicator takes the value of one if a firm reports positive R&D expenditure. Log of sale is the natural logarithm of firm sales. Maximum State Tax is the marginal tax rate on an additional 1000 USD of income for a married individual filing jointly and earning 1.5 million USD. Fraction of Goals reached is the fraction of pre-specified accounting goals the executive manages to reach. Number of outside board seats is the number of board seats the respective CEO sits on in other boards, number of committees are the number of committees the respective executive sits on the board. The definition of variables can be found in the Appendix in Table 17

3.3 Estimation Strategy

We use different empirical models to estimate the effect of a change in the maximum state tax rate on our three main outcome variables. We first determine whether a change in the maximum state tax rate impacts firm performance measured by return on assets. Return on assets is a firm performance measure which has been shown to be strongly associated with the behavior of the CEO [8]. We then assess whether the observed change in firm performance is accompanied by behavioral changes of the CEO. To this end we analyze the effect of taxes on reaching performance goals and the likelihood to participate in outside committees. In particular we use the likelihood to participate in outside committees to capture engaging in distractive activities. The more time the executive spends on outside committees the less time she can devote to managing her firms. Other studies have also shown a direct connection between different measures of CEO distractions and firm performance[9]. However, since tax changes are rather infrequent events we are limited to measures of distractive activities available for a larger number of CEOs.

Baseline Regression In our main analysis we exploit changes in the marginal top income tax rate $MTR_{s,t}$ at the level of state s at time t to identify the effect of taxes on CEO effort and then on firm performance. We measure firm performance by the return on assets $ROA_{f,t}$ of firm f at time t. We proxy CEO effort by measuring the fraction of performance goals the executive reaches and the number of outside committees she participates in. We control for year-fixed effects δ_t, and executive (indexed by i) $\times$ firm fixed effects $\delta_{i \times f}$. We also include additional firm- and executive-level control variables summarized as $X_{i,f,t}$ based on Pérez-González (2006). We control for firm size using the first lag of the logarithm of sales, past firm performance by including lagged values of the deviation from industry return on assets and market-to-book ratio. Additionally we also control for corporate governance using the Gomper's Index. A detailed description of the control variables included can be found in the Appendix. Since we exploit state-level variation our standard errors are clustered on

[8] See for example (Bertrand and Schoar, 2003), (Bennedsen et al., 2020)

[9] Biggerstaff et al. (2017) for example assess the effect of golfing on firm performance, Bandiera et al. (2020) analyze diary data from CEOs to assess the connection between different behavioral patterns and firm performance, Malmendier and Tate (2009) consider writing books.

state level. Our resulting baseline specification is:

$$Y_{f,t} = \alpha + \beta \times MTR_{s,t} + \gamma \times X_{i,f,t} + \delta_t + \delta_{i \times f} + \epsilon_{f,t}$$

We also present results for less rigid specifications including only firm or only executive fixed effects. In some specifications we use the ratio of performance goals reached by executives as the dependent variable.

Event Study Evidence To ensure that the effect of state taxes on our outcome variables of interest is not driven by different trends between high-tax and low-tax states we also estimate our model in a dynamic setting. The resulting regression equation is:

$$Y_{f,t} = \alpha + \sum_{l=-4,...4} \beta_t D_{s,t-l} + \gamma X_{i,f,t} + \delta_t + \delta_{i \times f} + \epsilon_{f,t}$$

We define an event as a change in the maximum state tax rate and include four leads and lags of the event. In our main specification an event $D_{s,t-l}$ is a dummy indicating that a tax change happened scaled by the magnitude of the tax change. As in our panel-estimation we include year-, state- and firm $\times$ executive fixed effects. Identification is achieved through changes in the tax rate for an executive-firm pair. The identification assumption underlying our estimation is the following: absent a change in the maximum state tax rate return on assets would have evolved in a similar way. The resulting coefficients β_t estimate any backward or forward-looking reactions to the tax change. For example the coefficient β_2 estimates the effect of a tax change from two periods before on return on assets at time t. We follow the literature and bin up end points to capture the effect of past and previous reforms.[10] The coefficient D_4 accounts for all changes happening four or more years ago, the coefficient D_{-4} for all changes happening four or more years in the future. To define the dummy D_{-4} we need information 4 years ahead. As a result the dummy D_{-4} is not defined and thus missing for the years 2018, 2017, 2016 and 2015. The respective years are not part of our regression sample in case of the event study. Since the "traditional" event study

[10]Following ((McCrary, 2007), (Fuest et al., 2018), (Schmidheiny and Siegloch, 2019))

style estimation only provides interpret-able estimates under the homogeneous treatment effect assumption we also present results using the newly developed estimator by Sun and Abraham (2021) as a robustness check.

4 Results

4.1 Baseline Results

We are interested in how CEO pay affects CEO effort and then eventually firm performance. Since CEO pay is endogenously determined by firm performance, our focus is on US state level personal income taxation ("Maximum State Tax Rate"). State level personal income taxation does affect net CEO pay, but is not endogenously determined by firm performance[11]. To absorb as much unobserved heterogeneity as possible, we employ executive-firm fixed effects and year fixed effects in all regressions. Consequently, identification is achieved by a change in the maximum state tax for a given CEO-firm pair.

Return on Assets Table 2 presents the results of our baseline regression as specified in equation 3.3. Our dependent variable is the firm and year specific return on assets observed for 3.088 firms over the years 1992-2017 resulting in 36.849 firm-year observations. The -0.119 coefficient in table 2 indicates, that a ten percentage point increase in the personal income tax rate results in a decrease of -1.19 in the return on assets. Given the 8.18 mean of return on assets, this is equivalent to a 1.5 % decrease. In column (2) we additionally control for firm size. The coefficient is now - 0.171. Our preferred specification is column (3), where we add further controls as in Pérez-González (2006). The resulting coefficient of - 0.167 is equivalent to a 2.1 % decrease in the return on assets following a ten percentage point increase in personal income taxation. In column (4) we include the Gomper's index to control for corporate governance[12], which changes the estimated coefficient only marginally.

[11] Aggregated firm performance could have an effect on state level personal income taxation as follows: If aggregated firm performance decreases in times of recession, governments my decrease tax rates to stimulate the economy. We mitigate this concern in using exogenous tax rate changes only following the classification of Giroud and Rauh (2019) in our regressions. We present regression results making use of all tax rate changes as a robustness check.

[12] Since the Gomper's index is only available every two years, we linearly interpolate values for years inbetween. For the remaining missing values we set the index to a value for missing observations and

Table 2: Return on Assets

	(1)	(2)	(3)	(4)
Maximum State Tax Rate	-0.119**	-0.171***	-0.167***	-0.165***
	(0.054)	(0.053)	(0.046)	(0.045)
First lag of log Sale		1.419***	1.085***	1.171***
		(0.255)	(0.247)	(0.248)
R+D Indicator			-2.648***	-2.587***
			(0.824)	(0.840)
Deviation ROA			4.780**	4.677**
			(2.110)	(2.092)
Deviation Market to Book			-0.001*	-0.001*
			(0.001)	(0.001)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls				✓
Mean	8.18	8.23	8.28	8.28
Observations	35854	35626	34682	34682
R-squared	0.707	0.709	0.715	0.716

Note: Table 2 presents the coefficients of the estimation of state level taxes. The outcome variable is the fraction of performance goals reached. In columns (2)-(4) control variables for firm size, firm performance and corporate governance are added. The first lag of log of sales controls for firm size, R+D indicator takes the value one if the firm report positive R+D expenditures and 0 if it does not. For firms for which R+D is missing the R+D indicator is set to zero and a dummy indicating that R+D is missing is included. By doing so we follow recommendations by Koh and Reeb (2015) and papers such as Bartram et al. (2012). We control for past firm performance by including the first lag of industry deviation from market-to-book ratio as well as the first lag of industry deviation from return on assets.In column 5 we include values for the Gomper's governance index and also include a separate variable as well as an indicator if the variable is missing. All specifications include executive × firm fixed effects as well as year fixed effects. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

To further validate that the change in state level personal income taxation is the driver behind the observed decrease in firm performance, we employ an event study design. Figure 3 presents results. We interact the change in state level personal income taxation with a dummy for the 9 periods surrounding the reform event. The interactions of these dummies and the tax rate change pre reform are indicated as[13] -4, -3, -2, -1 in figure 3. The coefficients estimated for -4, -3, -2, -1 do not show any significant effect on the return on assets and the point estimates are close to zero. We do not observe any pre-reform trends in the return on assets.

The interactions of these dummies and the tax rate change post reform are indicated as 0, 1, 2, 3, 4 in figure 3, where 0 is the year of reform.[14] In line with our expectations, we do see a

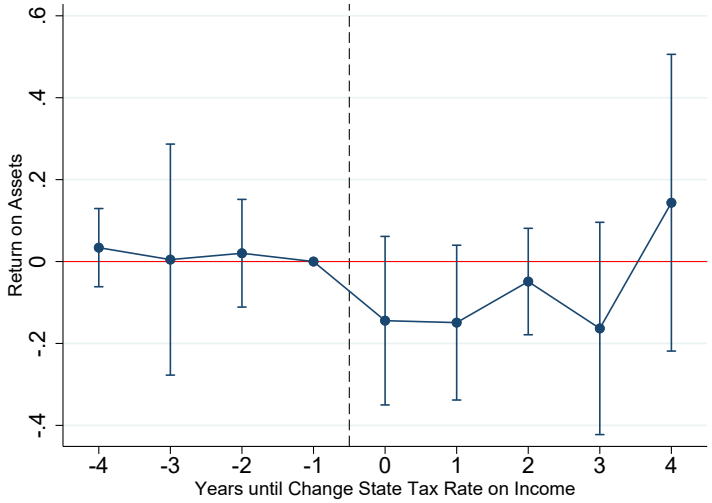
include a variable indicating that the index is missing for the respective observation.

[13]The coefficient estimated for -4 is based on all observation in period -4 and earlier (-5, -6, ...).

[14]Again the coefficient estimated for 4 is based on all observations in period 4 and later (5, 6, ...).

negative effect on the return on assets in periods 0 to 3. The effect is borderline significant at the five percent level for periods 0 and 1 immediately following the tax reform.

Figure 3: The effect of state taxes on return on assets



Notes: This figure presents event-study estimates. The dependent variable is return on assets, the independent variable is an indicator if the firm experienced a tax change scaled by the magnitude of the tax change.The regressions include executive × firm fixed effects as well as year effects. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

The point estimate for period 4 and later is almost zero and insignificant. This suggests that in the long run firms are able to adjust to changed CEO effort. Firms have a variety of channels to compensate the reduced CEO effort: (1) Firms can adjust the incentive structure of the CEO contract to the new tax environment as predicted by our model in section 2.2. (2) Firms can adjust their investment level to the increased input cost for CEO effort. (3) Firms can substitute CEO effort by other input factors.

Performance Goals Table 3 shows results of regressions using the percentage of performance goals reached by CEOs as a dependent variable instead of the return on assets. Controls are employed as in table 2. As part of an executive's compensation package firms frequently set performance goals tied to accounting metrices. Since firms disclose these performance goals and accounting figures are observable, we are able to compute the percentage amount of performance goals reached based on the data in ISS Incentive Lab. In our preferred specification in table 3 the coefficient on the state level personal income tax

rate ("Maximum State Tax Rate") is -0.011. Thus a one percentage point increase in the personal income tax rate results in a reduction in performance goals reached by -1.1 percentage points. Given the 88 % mean of performance goals reached this is equivalent to a 1.3 % reduction. CEOs react to personal income taxation and adjust their effort level accordingly. As a consequence, they reach less performance goals. Their reduced effort then also affect overall firm performance as shown in table 2.

Table 3: Fraction of Goals reached

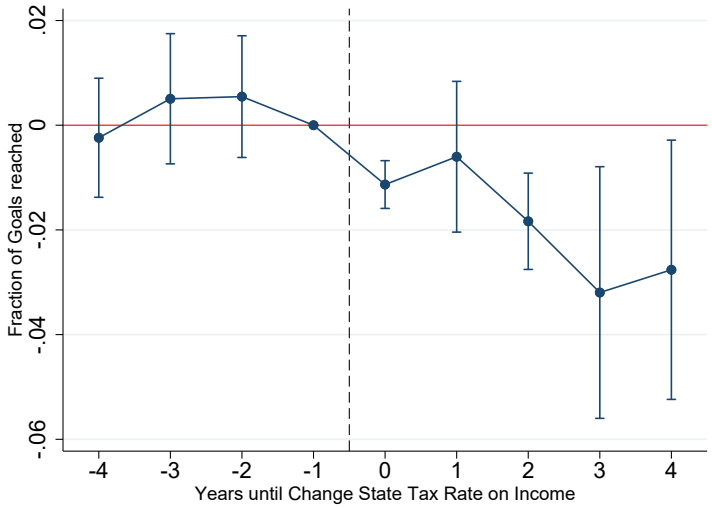
	(1)	(2)	(3)	(4)
Maximum State Tax Rate	-0.011**	-0.011**	-0.011**	-0.011**
	(0.005)	(0.005)	(0.004)	(0.004)
First lag of log Sale		-0.013	-0.020*	-0.020*
		(0.010)	(0.011)	(0.010)
R+D Indicator			0.015	0.015
			(0.042)	(0.042)
Deviation ROA			0.013	0.013
			(0.044)	(0.044)
Deviation Market to Book			-0.000	-0.000
			(0.000)	(0.000)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls				✓
Mean	0.88	0.88	0.88	0.88
Observations	8892	8877	8701	8701
R-squared	0.503	0.503	0.502	0.502

Note: Table 3 presents the coefficients of the estimation of state level taxes. The outcome variable are the number of committees an executive is sitting on. In columns (2)-(4) control variables for firm size, firm performance and corporate governance are added. The first lag of log of sales controls for firm size, R+D indicator takes the value one if the firm report positive R+D expenditures and 0 if it does not. For firms for which R+D is missing the R+D indicator is set to zero and a dummy indicating that R+D is missing is included. By doing so we follow recommendations by Koh and Reeb (2015) and papers such as Bartram et al. (2012). We control for past firm performance by including the first lag of industry deviation from market-to-book ratio as well as the first lag of industry deviation from return on assets.In column 5 we include values for the Gomper's governance index and also include a separate variable as well as an indicator if the variable is missing. All specifications include executive $\times$ firm fixed effects as well as year fixed effects.Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The results of the event-study are displayed in figure 4. We do not observe any significant effects prior to the reform: The coefficients for -4, -3, -2, -1 are all insignificant. We find significant negative coefficients for all periods following the reform apart from period 2.

Number of Committees Higher state level personal income taxation results in lower net pay, then in CEOs providing less effort to their firms and then finally in reduced firm

Figure 4: The effect of state taxes on fraction of performance goals reached



Notes: This figure presents event-study estimates. The dependent variable is return on assets, the independent variable is an indicator if the firm experienced a tax change scaled by the magnitude of the tax change. The regressions include executive × firm fixed effects as well as year effects. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

performance. Since CEOs spend less effort on managing their firms, on what else to they spend their effort instead? A few papers focus on this issue irrespective of personal income taxation: Bandiera et al. (2020) investigate CEO diary data, Biggerstaff et al. (2017) golf data and Malmendier and Tate (2009) book authorships. Other than these papers we need a large dataset spanning over the years 1992-2017, since tax rate changes are comparatively rare events. Thus, it is necessary to research a long time period to assure proper identification. Unfortunately, diary or golf data is not available for such long periods. We instead focus on the external board membership of CEOs, since this is readily available in BoardEx for our whole sample period. In the US CEOs frequently are members at the board of other firms. They may then there engage in specific activities organised in committees. Table 4 presents results making use of the number of external committees CEOs are engaged in as a dependent variable. Again, controls are employed as in 2. The coefficient of 0.122 in specification (3) indicates, that as a reaction to a one percentage point increase in the state level personal income tax rate CEOs engage in 0.122 committes at external boards more[15]. Given that CEOs on average are engaged in 3.10 external committees, this is equivalent to a

[15]If we focus on external board membership instead, we are not able to identify a significant coefficient.

4.4 % increase. Figure 5 provides event study results for the number of external committees CEOs are engaged in. We see no significant pre-trend, but significant positive coefficients post reform. The effect of the personal income tax rate on outside board membership is steadily increasing and positive in the long-term. It seems plausible that the effect of higher personal income taxes on outside activities in the form of membership in the committees of outside boards takes some time to materialize. Seats in outside boards need to become vacant and it needs to be clear that the respective executive has an interest in engaging more activities outside of her firm.

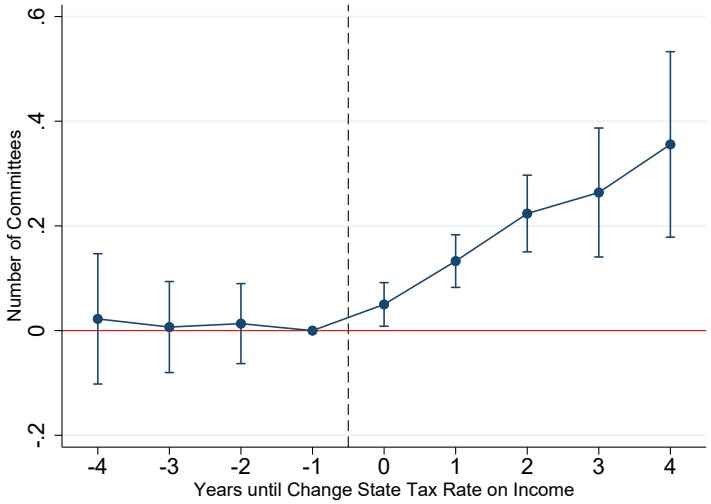
Table 4: Number of Committees

	(1)	(2)	(3)	(4)
Maximum State Tax Rate	0.122***	0.136***	0.135***	0.134***
	(0.028)	(0.028)	(0.027)	(0.027)
First lag of log Sale		-0.115	-0.161	-0.143
		(0.155)	(0.145)	(0.143)
R+D Indicator			0.590	0.595
			(0.605)	(0.597)
Deviation ROA			0.132	0.098
			(0.229)	(0.218)
Deviation Market to Book			0.000	0.000
			(0.001)	(0.001)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls				✓
Mean	3.10	3.10	3.10	3.10
Observations	8437	8360	8216	8216
R-squared	0.847	0.847	0.855	0.855

Note: Table 3 presents the coefficients of the estimation of state level taxes. The outcome variable is return on assets. In columns (2)-(4) control variables for firm size, firm performance and corporate governance are added. The first lag of log of sales controls for firm size, R+D indicator takes the value one if the firm report positive R+D expenditures and 0 if it does not. For firms for which R+D is missing the R+D indicator is set to zero and a dummy indicating that R+D is missing is included. By doing so we follow recommendations by Koh and Reeb (2015) and papers such as Bartram et al. (2012). We control for past firm performance by including the first lag of industry deviation from market-to-book ratio as well as the first lag of industry deviation from return on assets.In column 5 we include values for the Gomper's governance index and also include a separate variable as well as an indicator if the variable is missing. All specifications include executive $\times$ firm fixed effects as well as year fixed effects.Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Average Tax Rates In table 5 we add further tax rates as a control. It may well happen, that states change their personal income tax rate not only for CEOs with high income, but also for ordinary workers. Then our identified effect of the maximum state tax rate could

Figure 5: The effect of state taxes on outside committee seats



Notes: This figure presents event-study estimates. The dependent variable is return on assets, the independent variable is an indicator if the firm experienced a tax change scaled by the magnitude of the tax change. The regressions include executive × firm fixed effects as well as year effects. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

also be driven by the decreased effort of ordinary workers and not only by the decreased effort of CEOs. To differentiate between these two possible drivers behind the observed decrease in firm performance, we add the average tax rate for an individual at the median of the income distribution ("Avg. Median Tax Rate") as defined in section 3.2 in table 5 column (1) as a control. This is the tax rate which should matter for ordinary workers. On the contrary the maximum state tax rate applies only to income above 1.5 million USD and is the tax rate which should matter for CEOs. The result is reassuring: The coefficient on the maximum state tax rate is -0.172 and merely unchanged, while the coefficient on the average tax rate is -0.012 and significant, but 93 % lower in terms of value. The decreased effort of ordinary workers as a response to increased personal income taxation may also affect firm performance - but to a much lower extent than the effect attributable to CEOs. In table 5 column (3) we go up further in the income distriubtion and add the average tax rate for an individual at the top one percentile of the income distribution. This is the average tax rate which should be relevant for almost all workers of firms, including large parts of the top management. Results are similar to column (2). This also holds for column (4), where we add both average tax rates simultaneously. The significant effect on the maximum state

tax rate remains, but we loose significance for the average tax rates due to multicollinearity.

Table 5: Return on Assets

	(1)	(2)	(3)	(4)
Maximum State Tax Rate	-0.119**	-0.172***	-0.168***	-0.171***
	(0.054)	(0.046)	(0.045)	(0.046)
First lag of log Sale		1.225***	1.225***	1.225***
		(0.258)	(0.258)	(0.258)
R+D Indicator		-2.558***	-2.556***	-2.557***
		(0.808)	(0.808)	(0.808)
Deviation ROA		4.854**	4.854**	4.854**
		(2.177)	(2.178)	(2.177)
Deviation Market to Book		-0.001*	-0.001*	-0.001*
		(0.001)	(0.001)	(0.001)
Avg. Median Tax Rate		-0.012***		-0.008
		(0.003)		(0.007)
Avg. Top 1 Tax Rate			-0.010**	-0.004
			(0.004)	(0.006)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls		✓	✓	✓
Mean	8.18	8.26	8.26	8.26
Observations	35854	36026	36026	36026
R-squared	0.707	0.713	0.713	0.713

Note: Table 5 presents the coefficients of the estimation of state level taxes. The outcome variable is the fraction of performance goals reached. The sample now also includes states which experienced an endogenous increase in taxes. In columns (2)-(4) control variables for firm size, firm performance and corporate governance are added. The first lag of log of sales controls for firm size, R+D indicator takes the value one if the firm report positive R+D expenditures and 0 if it does not. For firms for which R+D is missing the R+D indicator is set to zero and a dummy indicating that R+D is missing is included. By doing so we follow recommendations by Koh and Reeb (2015) and papers such as Bartram et al. (2012). We control for past firm performance by including the first lag of industry deviation from market-to-book ratio as well as the first lag of industry deviation from return on assets.In column 5 we include values for the Gomper's governance index and also include a separate variable as well as an indicator if the variable is missing. All specifications include executive × firm fixed effects as well as year fixed effects. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Incidence Personal income taxes reduce CEO net pay and consequently lead to a decrease in firm performance. We confirm that the incidence of the tax change is borne by the executive in Table 6. Table 6 shows that there is no effect of the maximum state tax rate on the logarithm of granted compensation. In our preferred specification in column (3) an increase in the maximum state tax rate by one percentage point reduces granted compensation by 1.4 percent. The point estimates are negative and insignificant in columns (1), (2) and (4). The estimate is statistically significant at the 10 percent level in column

(3). Figure 6 shows the effect of taxes on granted compensation in the dynamic setting. A change in the maximum state tax rate has a negative effect on compensation granted up to 3 years after it's adoption. Figure 6 and table 6 suggest that in the short-run there are no adjustments in executive pay following a change in the maximum state tax rate.However, despite still being negative the long-term coefficient in period 4 is insignificant. Hence, we cannot reject that in the long-run firms adjust the compensation package of the CEO following a tax change.

Table 6: Log of total compensation granted

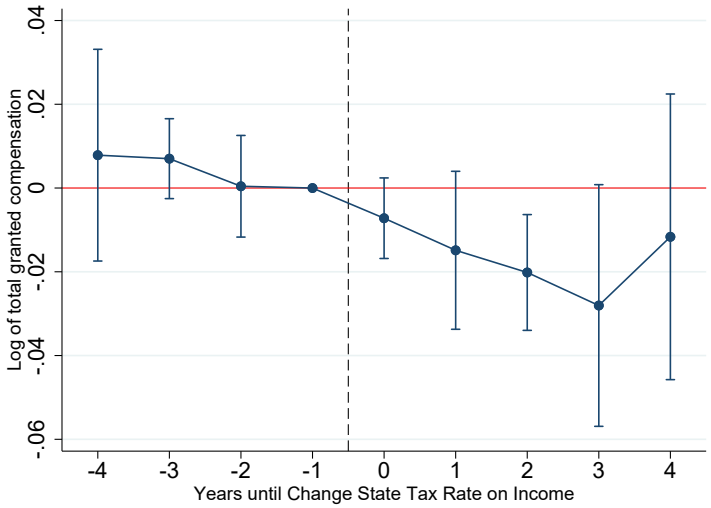
	(1)	(2)	(3)	(4)
Maximum State Tax Rate	-0.005	-0.012	-0.014*	-0.013
	(0.007)	(0.009)	(0.008)	(0.008)
First lag of log Sale		0.212***	0.197***	0.200***
		(0.011)	(0.014)	(0.015)
R+D Indicator			0.223	0.227
			(0.154)	(0.154)
Deviation ROA			0.119***	0.114***
			(0.037)	(0.036)
Deviation Market to Book			0.000	0.000
			(0.000)	(0.000)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls				✓
Mean	7.85	7.86	7.87	7.87
Observations	36267	35813	34884	34884
R-squared	0.752	0.756	0.757	0.757

Note: Table 6 presents the coefficients of the estimation of state level taxes. The outcome variable is the fraction of performance goals reached. In columns (2)-(4) control variables for firm size, firm performance and corporate governance are added. The first lag of log of sales controls for firm size, R+D indicator takes the value one if the firm report positive R+D expenditures and 0 if it does not. For firms for which R+D is missing the R+D indicator is set to zero and a dummy indicating that R+D is missing is included. By doing so we follow recommendations by Koh and Reeb (2015) and papers such as Bartram et al. (2012). We control for past firm performance by including the first lag of industry deviation from market-to-book ratio as well as the first lag of industry deviation from return on assets.In column 5 we include values for the Gomper's governance index and also include a separate variable as well as an indicator if the variable is missing. All specifications include executive × firm fixed effects as well as year fixed effects. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.2 Heterogeneous Effects

Some executives should respond stronger to changes in state taxes than other executives. To corroborate the validity of our findings we assess if CEOs in firms with a high level of corporate governance or with low levels of managerial wealth and high firm discretion show

Figure 6: The effect of state taxes on compensation granted



Notes: This figure presents event-study estimates. The dependent variable is return on assets, the independent variable is an indicator if the firm experienced a tax change scaled by the magnitude of the tax change. The regressions include executive × firm fixed effects as well as year effects. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

a stronger response to a change in state level taxes.

Corporate Governance Table 8 explores, whether corporate governance matters for the transmission of the CEO tax effect. It has been shown that stronger corporate governance has a disciplining effect on the executive.[16] Consequently, in firms with low corporate governance changes in managerial behavior should matter more for firm performance than in well-governed firms. This implies that the increase in personal income taxation should matter less for CEO effort and consequently firm performance for firms with good corporate governance. In table 8 we interact indicators for good corporate governance with the maximum state tax rate. We consider two indicators for good corporate governance: the Gomper's governance index (see section 3.2 for a description) and institutional ownership.[17] We consider all firms with a Gomper's governance index below eight as firms with good governance. We interact the resulting dummy with the maximum state tax rate in table

[16]For example Bertrand and Mullainathan (2003) show that firm productivity is lower in settings with low corporate governance.

[17]We follow Chetty and Saez (2005) who find that agency problems are more severe in firms with low institutional ownership and Lilienfeld-Toal and Ruenzi (2014) who find more pronounced effects of managerial behavior in firms with a high Gomper's Index and low institutional ownership.

8 in column (1) and (2) and add the Gomper's governance index as a control as described in footnote 12. Column (1) in terms of specification is otherwise equal to column (1) of table 2, column (2) is otherwise equal to column (4) of table 2. We find that firms with good corporate governance experience a lower effect of CEO personal income taxation on firm performance. However, the interaction between the Gomper's based indicator for good governance and the state tax is not significant.

Table 7: Return on Assets

	(1)	(2)	(3)	(4)
Maximum State Tax Rate	-0.318***	-0.369***	-0.195**	-0.238***
	(0.080)	(0.059)	(0.074)	(0.056)
Good Gov. × Maximum State Tax Rate	0.112	0.095		
	(0.122)	(0.117)		
Large Ownersh. × Maximum State Tax Rate			0.087*	0.083*
			(0.050)	(0.047)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
State FE	✓	✓	✓	✓
Size Controls		✓		✓
ROA, RD controls		✓		✓
Governance Controls	✓	✓	✓	✓
Mean	8.18	8.28	8.18	8.28
Observations	35854	34682	35854	34682
R-squared	0.708	0.716	0.708	0.715

Note: Table 8 presents the coefficients of the estimation of state level taxes. The outcome variable is return on assets. The dummy variable for good governance (Good Gov.) takes on the value one if the Gomper's Governance Index is smaller than 8. A firm is defined as having a large share of institutional ownership if institutional ownership (Large Ownersh.) exceeds 50 percent. In columns (1) and (3) we only include the respective control variables for corporate governance in the equation (the Gomper's Index in column (1) and the Thomson Reuter's Indicator for good governance in column (4). In columns (2) and (4) we add as controls for past firm performance the lagged value of deviation from industry Market-to-Book ratio as well as lagged value of the deviation from industry return on assets. We also add the lag of the log of sales as a control for firms size and an indicator for R+D. The R+D indicator takes the value one if the firm report positive R+D expenditures and 0 if it does not. For firms for which R+D is missing the R+D indicator is set to zero and a dummy indicating that R+D is missing is included. By doing so we follow recommendations by Koh and Reeb (2015) and papers such as Bartram et al. (2012). All specifications include executive × firm fixed effects as well as year fixed effects.Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

As an additional measure of corporate governance we use institutional ownership. We assume good governance for firms in which institutional ownership exceeds 50 percent. In column (3) and (4) we interact the resulting dummy for good corporate governance based on institutional ownership with the maximum state tax rate. Again the effect of CEO personal income taxation on firm performance is weaker for firms with good corporate governance.

The interaction effect now is significant at the 10-percent level in both specifications. The fact that the effect of state taxes on firm performance is more concentrated in firms with low levels of corporate governance corroborates that the decrease in return on assets is driven by effort adjustments of the CEO.

Firm Related Wealth and Managerial Discretion We further assess whether the magnitude of response to the state tax varies with the amount of firm related wealth and managerial discretion of the CEO. Many CEOs hold a substantial fraction of their wealth in company stock. Regardless of their compensation these CEOs still have a very strong incentive to exert effort, since their portfolio will benefit from improved firm performance. Hence, we expect that taxes have a smaller effect on the effort wealthy CEOs provide. Data on firm related wealth is obtained by Coles et al. (2013). We compare the effect of an increase in the maximum state tax rate for CEOs with wealth in their firms below the 25th percentile of the CEO wealth distribution to CEOs with wealth above the 75th percentile. As expected, the effect of state taxes on return on assets is significantly smaller for CEOs with a high level of firm wealth.

Apart from wealth, the influence a CEO has over her company might also be an important determinant of the magnitude of response. To this end we interact a proxy for managerial discretion with the state level tax. As Lilienfeld-Toal and Ruenzi (2014) we proxy managerial discretion by the level of product market competition, since in highly concentrated markets CEOs are assumed to have a higher level of power. We use the Herfindahl-Hirschman Index as a measure of product market competition. Higher values of the Herfindahl-Hirschman Index imply a higher concentration of market power. As anticipated, we find a stronger reaction of return on assets to taxes among firms in concentrated industries. However, the effect is not significant. The fact that the effect of state taxes on firm performance varies with the level of firm wealth and discretion of the executive strongly suggests that indeed the response to state taxes is caused by changes in the behavior of the executive.

Table 8: Return on Assets

	(1)	(2)	(3)	(4)
Main Effect:				
Maximum State Tax Rate	-0.238	-0.262*	-0.029	-0.074
	(0.163)	(0.155)	(0.044)	(0.051)
High Wealth × Maximum State Tax Rate	0.272*	0.264**		
	(0.143)	(0.121)		
High Discretion × Maximum State Tax Rate			-0.131	-0.119
			(0.081)	(0.088)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
State FE	✓	✓	✓	✓
Size Controls		✓		✓
ROA, RD controls		✓		✓
Governance Controls	✓	✓	✓	✓
Mean	8.18	8.24	8.10	8.22
Observations	17551	17367	43182	41752
R-squared	0.778	0.784	0.716	0.721

Note: Table 8 presents the coefficients of the estimation of state level taxes. The outcome variable is return on assets. The dummy variable for High Wealth takes on the value one if the executive is in the top quarter of the executive firm wealth distribution. In columns (2) and (4) we add as controls for past firm performance the lagged value of deviation from industry Market-to-Book ratio as well as lagged value of the deviation from industry return on assets. We also add the lag of the log of sales as a control for firms size and an indicator for R+D. The R+D indicator takes the value one if the firm report positive R+D expenditures and 0 if it does not. For firms for which R+D is missing the R+D indicator is set to zero and a dummy indicating that R+D is missing is included. By doing so we follow recommendations by Koh and Reeb (2015) and papers such as Bartram et al. (2012). All specifications include executive × firm fixed effects as well as year fixed effects.Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.3 Asymmetries

Asymmetries. Executives might respond to changes in the personal income tax rate in an asymmetric manner. It seems plausible that following a tax increase executives will demand higher compensation in the long-run to be compensated for their increased tax burden. On the contrary it is very unlikely that the executive will demand any changes to her compensation bundle following a tax decrease. In the following we briefly discuss the effects of tax increases and tax decreases on our outcome variables of interest. We define all tax changes above one percentage point as a large tax in- or decrease. For the analysis of the effects of tax increases we exclude all states which experienced a tax decrease in the nine periods surrounding the tax increase. We proceed in a similar manner for the analysis of tax decreases.

As expected we find similar effects for tax increases as for all tax changes. The effect on return on assets is negative for all periods following the reform as displayed in figure 9. The coefficients for the periods immediately following the tax increase and three periods after the tax increase are now even statistically significant. Again, the long-term effect is zero. The event study for the effect of tax increases on the fraction of performance goals reached also resembles the effect of all tax changes on the fraction of performance goals reached (figure 11). However, some differences emerge as well. Most notably, the long-term effect of tax increases on performance goals reached is zero and statistically insignificant. In addition it appears that there are some form of anticipation effects, since the effect in the period prior to the reform is already smaller than in years 2 to 4 before the reform. Figure 13 shows the effect of tax increases on the number of outside committees the executive engages in. It appears that following a tax increase the executive works in more outside committees. Again, this effect vanishes in the long-run. Due to the fact that pre-trends are not flat prior to the reforms we cannot make any causal statement about the effect of tax increases on the number of committees an executive sits on.

We now turn to assess the effects of tax decreases on our outcome variables of interest. Interestingly, executives also show a strong response to tax decreases. Figure 10 shows that return on assets increases substantially following a tax decrease. The coefficient in period

-1 suggests that there are significant anticipation effects, since the coefficients -4 to -2 are negative and statistically significant. Following the tax decrease, there is a positive effect on return on assets. This effect is not sustained in the long-run and the effect of a tax decrease on return on assets becomes zero and insignificant in the long-run. Tax decreases have a similar effect on the fraction of performance goals reached as on return on assets (figure 12). The coefficient in period -1 suggests that there is a strong anticipation effect. There is a positive and significant increase in the fraction of performance goals an executive reaches in the periods 0 and 1 following the tax decreases. Again, this effect is not sustained in the long-run and zero and insignificant two periods after the tax decrease. When assessing the effect of tax decreases on the number of external committees an executive engages in in figure 14 we see that tax decreases reduce the number of committees that an executive participates in. As for the effect of all tax changes, the impact of the tax decrease becomes larger over time.

5 Firm Adjustments

We consider several channels which explain why we do not find a long-term effect of higher state taxes on firm performance. First, firms may adjust the executive's compensation contract upon observing the drop in executive performance and provide her with different incentives. Second, we assess if firms adopt coping mechanisms to cushion the reduced effort provided by the executive. Third, after experiencing a tax change and a drop in compensation executives might be more inclined to leave the firm causing short-term perturbations in the firm production process.

Executive Compensation As hypothesized in section 4.1 upon observing the drop in firm performance boards should react by adjusting executive's compensation contracts to the change in the tax environment. One potential route for achieving this is by increasing the level of managerial ownership in the firm. Lilienfeld-Toal and Ruenzi (2014) have shown that firms with a higher level of CEO ownership continuously outperform firms with a low level of executive ownership. Hence, instead of incentivizing the executive through cash compensation the firm can increase the stake the executive holds in the company by increasing her ownership position. Figure 15 shows the effect of an increase in the maximum state tax on the percentage of shares the executive holds in her company. Four periods prior to the reform there is little evidence of a pre-trend. One period after the reform managerial ownership in the firm increases. The observed effects are borderline significant and the long-term effect is positive. The increase in managerial ownership can be attributed to an increase in amount of stock awards received as displayed in figure 16. Following an increase in the maximum state tax rate by more than one percentage point the amount of stock awards the executive receives increases until one period after the tax reform and remains positive in the long-term as well. Since managers own a larger share in the company they run, they should increase the effort they provide to the company again explaining the long-term zero effect on firm performance.

Other firm outcomes Higher state taxes might effect firm dynamics in other ways which

could explain the observed recovery in return on assets. Due to a reduction in executive effort firms might grow at a lower rate than before and become smaller. Given a reduced level of effort provision the effect on return on assets might evaporate since in a smaller firm the CEO still needs lower effort to achieve the same returns as before. To this end we assess the effect of the maximum state tax rate on capital expenditure, the logarithm of assets and the number of employees. Figure 17 shows that a change in the state tax rate has a negative effect on the amount of investment a firm undertakes. A one percentage point decrease in the state tax rate leads to a 2 percent decrease in capital expenditure. This effect persists up to four periods after the tax change but becomes insignificant. Following a tax change firms shrink in terms of assets and number of employees as well. We find a significant decrease in assets in the first, third and fourth period after the tax change as shown in figure 18. An increase in the maximum state tax by one percentage point leads to a long-run decrease in assets of one percent. Simultaneously, after the reform firms affected by the tax increase continuously reduce the number of people they employ. Figure 20 shows a continuous drop in the number of employees following a tax change. Four periods following a one percentage point decrease in the maximum state tax rate the number of employees has decreased by 500. Overall, these results suggest that firms do become smaller following an increase in the maximum state tax rate. This should make it easier for the executive to reach similar returns as before despite exerting a lower level of effort.

Mobility Higher taxes might make it more attractive for the CEO to leave the company and pursue outside activities or relocate to another state.[18] An increase in executive turnover following a tax change might lead to disruptions in the firm production process causing a decrease in return on assets. Hence, we assess if executives become more likely to leave the firm following a tax change. Figure 8.4.3 shows that the maximum state tax rate does not affect the likelihood that the CEO leaves the company. Hence, perturbations in the firm production process following a change in executive leadership do not explain the short-term decrease in return on assets.

[18]It is important to note that we include executive-firm fixed effects in our baseline regression. Thus, any changes in the quality of the executive following a change in leadership are controlled for.

6 Robustness

In the following we conduct some robustness checks to confirm the validity of our results.

All Tax Changes As a first robustness check we extend our sample to include all tax changes and not only those qualified as exogenous by Giroud and Rauh (2019). We do so for all our baseline results: in table 10 concerning the dependent variable return on assets, in table 11 concerning the dependent variable fraction of performance goals reached, in table 12 concerning the dependent variable external committees and in table 13 concerning the dependent variable return on assets with additional average tax rates added as controls. Overall, the point estimate for our variable of interest maximum state tax rate changes slightly, but our conclusions in all cases still hold. E.g. in table 10 column (1) the effect of state taxes on the return on assets becomes smaller and less significant compared to table 2 column (1). When allowing for endogenous tax changes an increase in the state specific personal income tax rate by one percentage point decreases the return on assets by 0.104 percentage points only compared to 0.119 percentage points before. When we add further controls in table 10 column (2) to (4) the point estimate is again smaller, but still significant at the one percent level as before. The effect of a one percentage point increase in the maximum state tax leads to a reduction in the return on assets by 0.15 percentage points compared to 0.17 percentage points before. Similarly, we find slightly smaller effects on the number of outside committees the executive engages in (table 12) and similar effects on the fraction of performance goals reached (table 11). The estimated effect on the fraction of performance goals remains at 1.1 percentage points an statistically significant at the one percent level. The effect of state taxes on the number of outside committees an executive takes part in also remains significant at the one percent level and only diminishes slightly. Overall, the results imply that discarding endogenous tax changes does not changes the results of our analysis.

Heterogeneous Treatment Effects Recent studies for example by Sun and Abraham (2021), De Chaisemartin and d'Haultfoeuille (2020) have brought forward difficulties when

estimating two-way-fixed effect models with staggered treatment. In the presence of heterogeneous treatment effects the derived estimates do not yield the average treatment effect and are difficult to interpret. To address this issue we apply the estimator developed by Sun and Abraham (2021). We restrict our sample to the period after 2005 and exclude all states with more than one tax in- or decrease during this period. Applying this robust estimator yields similar results as our baseline event study suggesting that contamination by heterogeneous treatment effects is not driving our results.

7 Conclusion

The taxation of top income earners in particular executives has been a contentious topic over the last years. One very prevalent argument against higher taxes are the strong effects top income earners, in particular executives have on the firms they run. We assess the distortionary effects of higher taxes on executives. Using exogenous variation in state level taxes we find that an increase in the state tax leads to a reduction in firm performance, a decrease in the likelihood to reach performance goals and encourages the executive to take up outside engagements in the form of sitting on outside committees. These effects are stronger in firms in which the CEO has more discretion and which are badly governed. Further, CEOs with a high share of firm wealth do not respond as strongly to state taxes as CEOs with a low share of firm wealth. While the effect on the fraction of performance goals reached as well as the likelihood to engage in outside committees is negative in long-run, the effect of state taxes on return on assets vanishes. We find that following a tax change the compensation of the executive is adjusted and firms become smaller. In smaller firms CEOs should achieve similar returns with a reduced level of effort. Our findings show that there is no asymmetry in how executives respond to tax increases or tax decreases. Overall, our results suggest that the redistributional consequences of higher taxes need to be weighed against labor supply distortions which can have substantial spillover effects in particular among top income earners. Future research should focus on who is most affected by these spillover effects.

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8 Appendix

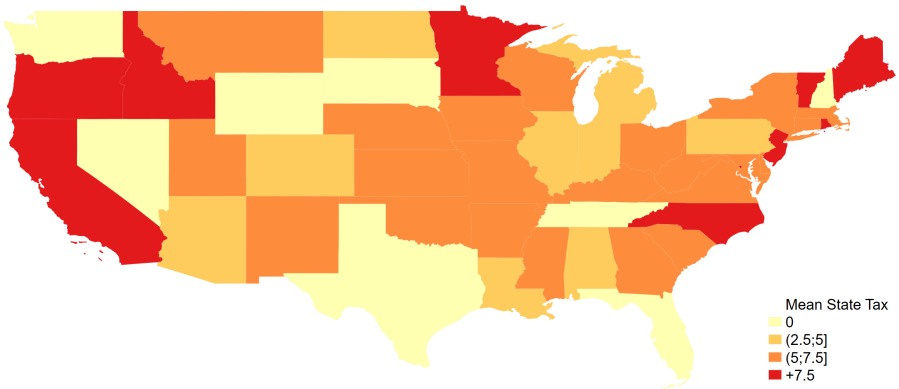
8.1 Descriptives

Table 9: Taxation of CEO compensation components

Category	Relevant Tax Rate
Salary	Subject to the Personal Income Tax Rate once awarded
Bonus	Subject to the Personal Income Tax Rate once awarded
Option Awards	Subject to the Personal Income Tax Rate when exercised, not taxable once when awarded [a]
Stock Awards	Similar to Stock Options subject to the Personal Income Tax Rate once they vested
Non-Equity Incentive Plan Compensation	Subject to the Personal Income Tax Rate once awarded
Deferred Compensation	Subject to the Personal Income Tax once granted

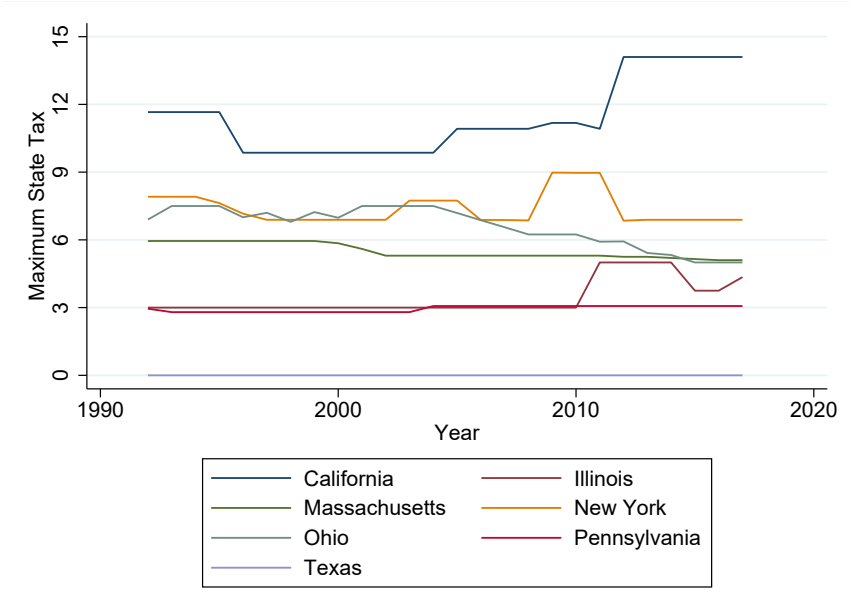
[a] One exception are incentive stock options which are taxed at the capital gains rate. However, incentive stock options are only deductible from the corporate tax bills of the employee up to 100.000 USD.

Figure 7: Mean Level of Taxes



Notes: Figure 7 presents the mean of the maximum state tax for each state in the U.S. over our sample period.

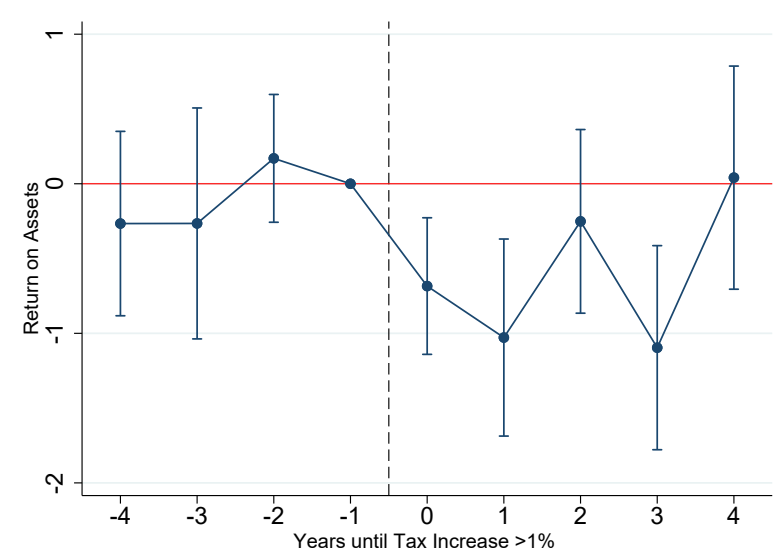
Figure 8: Evolution of taxes in largest states



Notes: Figure 8 presents the evolution of the maximum state tax rates for the states where most firms are located in our sample from 1992 to 2017.

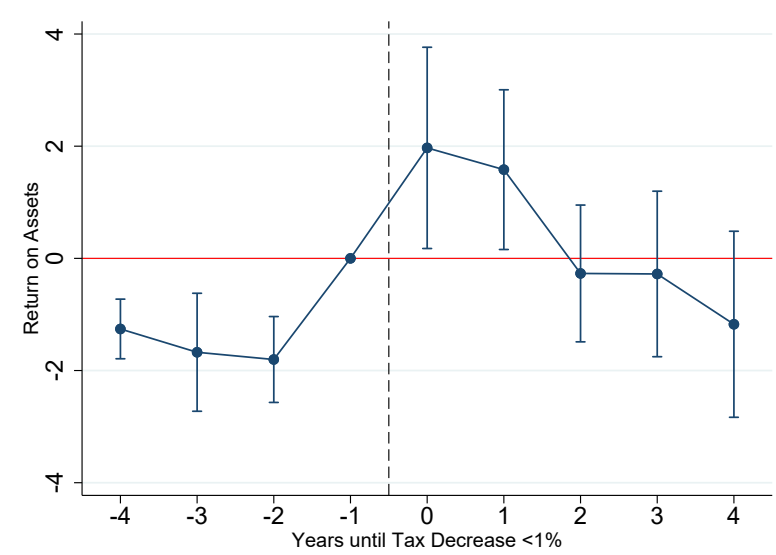
8.2 Asymmetries

Figure 9: The effect of tax increases on return on assets



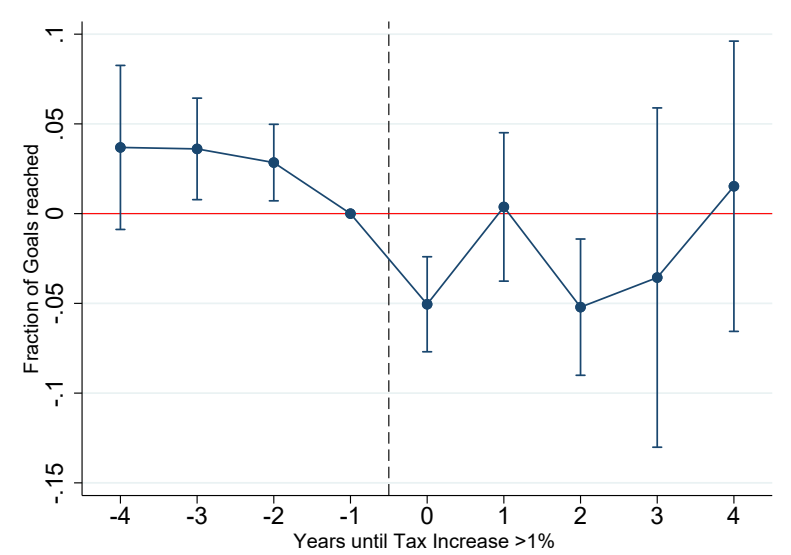
Notes: This figure presents event-study estimates. The dependent variable is return on assets, the independent variable is an indicator which takes the value of one if the firm experienced a tax increase. The regressions include executive × firm fixed effects as well as year effects. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

Figure 10: The effect of tax decreases on return on assets



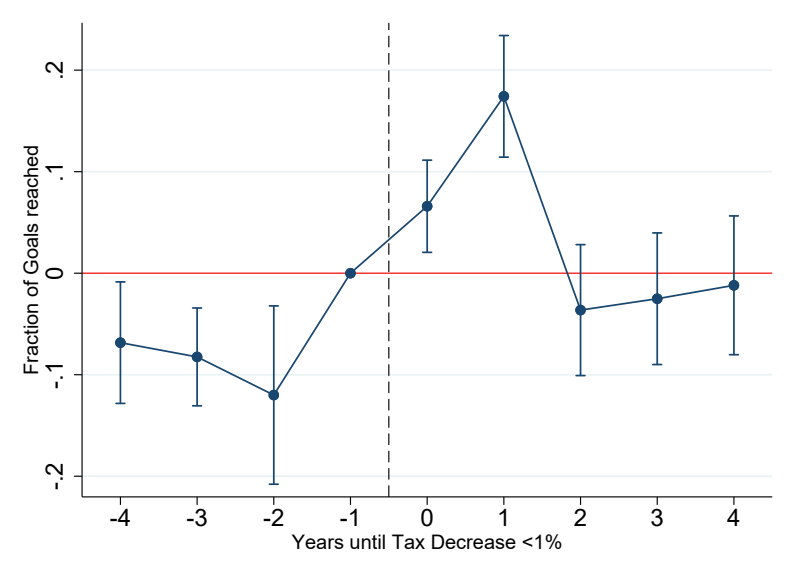
Notes: This figure presents event-study estimates. The dependent variable is return on assets, the independent variable is an indicator which takes the value of one if the firm experienced a tax decrease The regressions include executive × firm fixed effects as well as year effects. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

Figure 11: The effect of tax increases on the fraction of performance goals reached



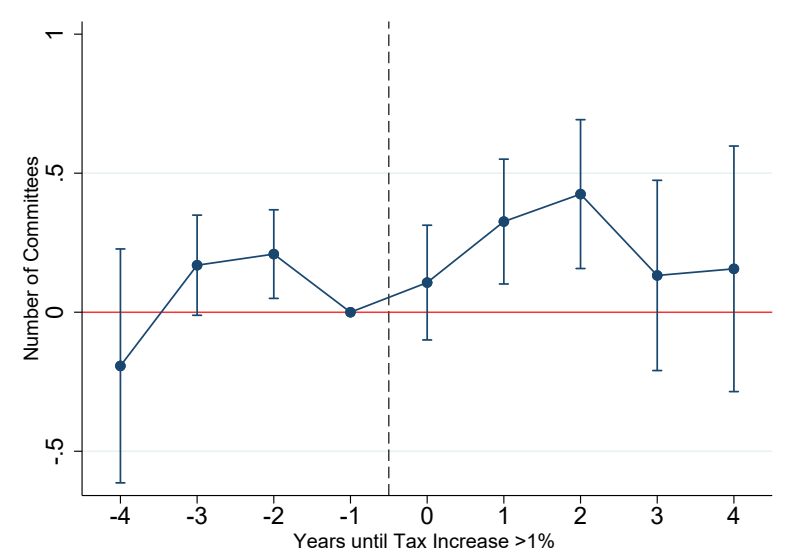
Notes: This figure presents event-study estimates. The dependent variable is the fraction of performance goals reached, the independent variable is an indicator which takes the value of one if the firm experienced a tax increase. The regressions include executive × firm fixed effects as well as year effects. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

Figure 12: The effect of tax decreases on the fraction of performance goals reached



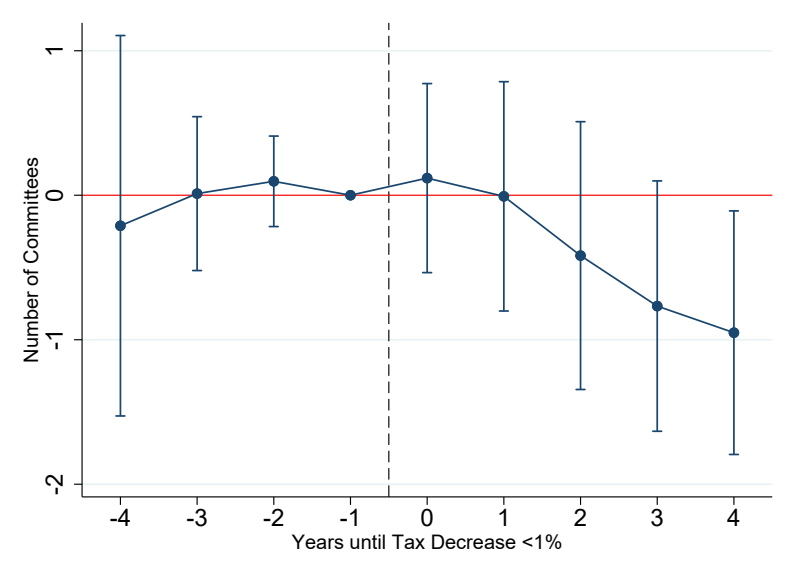
Notes: This figure presents event-study estimates. The dependent variable is the fraction of performance goals reached, the independent variable is an indicator which takes the value of one if the firm experienced a tax decrease. The regressions include executive × firm fixed effects as well as year effects. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

Figure 13: The effect of tax increases on the number of committees



Notes: This figure presents event-study estimates. The dependent variable is the number of outside committee seats the executive holds, the independent variable is an indicator which takes the value of one if the firm experienced a tax increase. The regressions include executive $\times$ firm fixed effects as well as year effects. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

Figure 14: The effect of tax decreases on the number of committees



Notes: This figure presents event-study estimates. The dependent variable is the number of outside committee seats the executive holds, the independent variable is an indicator which takes the value of one if the firm experienced a tax decrease. The regressions include executive $\times$ firm fixed effects as well as year effects. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

8.3 All Tax Changes

Table 10: Return on Assets

	(1)	(2)	(3)	(4)
Maximum State Tax Rate	-0.104*	-0.153***	-0.152***	-0.148***
	(0.056)	(0.055)	(0.046)	(0.045)
First lag of log Sale		1.532***	1.192***	1.272***
		(0.250)	(0.239)	(0.238)
R+D Indicator			-2.551***	-2.499***
			(0.796)	(0.809)
Deviation ROA			4.919**	4.827**
			(2.161)	(2.149)
Deviation Market to Book			-0.001*	-0.001*
			(0.001)	(0.001)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls				✓
Mean	8.24	8.29	8.34	8.34
Observations	38095	37853	36854	36854
R-squared	0.710	0.712	0.718	0.719

Note: Table 10 presents the coefficients of the estimation of state level taxes. The outcome variable is the fraction of performance goals reached. The sample now also includes states which experienced an endogenous increase in taxes. In columns (2)-(4) control variables for firm size, firm performance and corporate governance are added. The first lag of log of sales controls for firm size, R+D indicator takes the value one if the firm report positive R+D expenditures and 0 if it does not. For firms for which R+D is missing the R+D indicator is set to zero and a dummy indicating that R+D is missing is included. By doing so we follow recommendations by Koh and Reeb (2015) and papers such as Bartram et al. (2012). We control for past firm performance by including the first lag of industry deviation from market-to-book ratio as well as the first lag of industry deviation from return on assets.In column 5 we include values for the Gomper's governance index and also include a separate variable as well as an indicator if the variable is missing. All specifications include executive $\times$ firm fixed effects as well as year fixed effects. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 11: Fraction of Performance Goals reached

	(1)	(2)	(3)	(4)
Maximum State Tax Rate	-0.012***	-0.011**	-0.011***	-0.011***
	(0.004)	(0.004)	(0.004)	(0.004)
First lag of log Sale		-0.016*	-0.022**	-0.022**
		(0.009)	(0.010)	(0.010)
R+D Indicator			0.020	0.020
			(0.041)	(0.041)
Deviation ROA			0.006	0.006
			(0.042)	(0.042)
Deviation Market to Book			-0.000	-0.000
			(0.000)	(0.000)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls				✓
Mean	0.88	0.88	0.88	0.88
Observations	9451	9434	9256	9256
R-squared	0.508	0.508	0.507	0.507

Note: Table 11 presents the coefficients of the estimation of state level taxes. The outcome variable is the fraction of performance goals reached. The sample now also includes states which experienced an endogenous increase in taxes. In columns (2)-(4) control variables for firm size, firm performance and corporate governance are added. The first lag of log of sales controls for firm size, R+D indicator takes the value one if the firm report positive R+D expenditures and 0 if it does not. For firms for which R+D is missing the R+D indicator is set to zero and a dummy indicating that R+D is missing is included. By doing so we follow recommendations by Koh and Reeb (2015) and papers such as Bartram et al. (2012). We control for past firm performance by including the first lag of industry deviation from market-to-book ratio as well as the first lag of industry deviation from return on assets.In column 5 we include values for the Gomper's governance index and also include a separate variable as well as an indicator if the variable is missing. All specifications include executive $\times$ firm fixed effects as well as year fixed effects. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 12: Number of Committees

	(1)	(2)	(3)	(4)
Maximum State Tax Rate	0.108***	0.120***	0.118***	0.118***
	(0.027)	(0.028)	(0.027)	(0.027)
First lag of log Sale		-0.089	-0.132	-0.111
		(0.141)	(0.131)	(0.131)
R+D Indicator			0.530	0.546
			(0.533)	(0.529)
Deviation ROA			0.277	0.240
			(0.288)	(0.282)
Deviation Market to Book			0.000	0.000
			(0.000)	(0.000)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls				✓
Mean	3.09	3.10	3.10	3.10
Observations	8944	8865	8714	8714
R-squared	0.845	0.845	0.852	0.852

Note: Table 12 presents the coefficients of the estimation of state level taxes. The outcome variable is the fraction of performance goals reached. The sample now also includes states which experienced an endogenous increase in taxes. In columns (2)-(4) control variables for firm size, firm performance and corporate governance are added. The first lag of log of sales controls for firm size, R+D indicator takes the value one if the firm report positive R+D expenditures and 0 if it does not. For firms for which R+D is missing the R+D indicator is set to zero and a dummy indicating that R+D is missing is included. By doing so we follow recommendations by Koh and Reeb (2015) and papers such as Bartram et al. (2012). We control for past firm performance by including the first lag of industry deviation from market-to-book ratio as well as the first lag of industry deviation from return on assets.In column 5 we include values for the Gomper's governance index and also include a separate variable as well as an indicator if the variable is missing. All specifications include executive × firm fixed effects as well as year fixed effects. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 13: Fraction of Goals reached

	(1)	(2)	(3)	(4)
Maximum State Tax Rate	-0.011**	-0.011***	-0.011***	-0.011***
	(0.005)	(0.004)	(0.004)	(0.004)
First lag of log Sale		-0.018	-0.018	-0.018
		(0.012)	(0.012)	(0.012)
R+D Indicator		0.011	0.011	0.011
		(0.041)	(0.041)	(0.041)
Deviation ROA		0.029	0.029	0.029
		(0.037)	(0.037)	(0.037)
Deviation Market to Book		-0.000	-0.000	-0.000
		(0.000)	(0.000)	(0.000)
Avg. Median Tax Rate		0.001**		0.001**
		(0.000)		(0.000)
Avg. Top 1 Tax Rate			0.000*	0.000
			(0.000)	(0.000)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls		✓	✓	✓
Mean	0.88	0.88	0.88	0.88
Observations	8892	9293	9293	9293
R-squared	0.503	0.494	0.494	0.494

Note: Table **??** presents the coefficients of the estimation of state level taxes. The outcome variable is the fraction of performance goals reached. The sample now also includes states which experienced an endogenous increase in taxes. In columns (2)-(4) control variables for firm size, firm performance and corporate governance are added. The first lag of log of sales controls for firm size, R+D indicator takes the value one if the firm report positive R+D expenditures and 0 if it does not. For firms for which R+D is missing the R+D indicator is set to zero and a dummy indicating that R+D is missing is included. By doing so we follow recommendations by Koh and Reeb (2015) and papers such as Bartram et al. (2012). We control for past firm performance by including the first lag of industry deviation from market-to-book ratio as well as the first lag of industry deviation from return on assets.In column 5 we include values for the Gomper's governance index and also include a separate variable as well as an indicator if the variable is missing. All specifications include executive × firm fixed effects as well as year fixed effects. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 14: Number of Committees

	(1)	(2)	(3)	(4)
Maximum State Tax Rate	0.122***	0.132***	0.133***	0.131***
	(0.028)	(0.028)	(0.028)	(0.028)
First lag of log Sale		-0.139	-0.140	-0.139
		(0.143)	(0.143)	(0.143)
R+D Indicator		0.566	0.568	0.565
		(0.605)	(0.606)	(0.605)
Deviation ROA		0.043	0.045	0.043
		(0.214)	(0.215)	(0.215)
Deviation Market to Book		0.000	0.000	0.000
		(0.001)	(0.001)	(0.001)
Avg. Median Tax Rate		-0.003***		-0.005***
		(0.001)		(0.002)
Avg. Top 1 Tax Rate			-0.002	0.002
			(0.002)	(0.002)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls		✓	✓	✓
Mean	3.10	3.07	3.07	3.07
Observations	8437	8477	8477	8477
R-squared	0.847	0.854	0.854	0.854

Note: Table 14 presents the coefficients of the estimation of state level taxes. The outcome variable is the fraction of performance goals reached. The sample now also includes states which experienced an endogenous increase in taxes. In columns (2)-(4) control variables for firm size, firm performance and corporate governance are added. The first lag of log of sales controls for firm size, R+D indicator takes the value one if the firm report positive R+D expenditures and 0 if it does not. For firms for which R+D is missing the R+D indicator is set to zero and a dummy indicating that R+D is missing is included. By doing so we follow recommendations by Koh and Reeb (2015) and papers such as Bartram et al. (2012). We control for past firm performance by including the first lag of industry deviation from market-to-book ratio as well as the first lag of industry deviation from return on assets.In column 5 we include values for the Gomper's governance index and also include a separate variable as well as an indicator if the variable is missing. All specifications include executive $\times$ firm fixed effects as well as year fixed effects. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

8.4 Firm adjustments

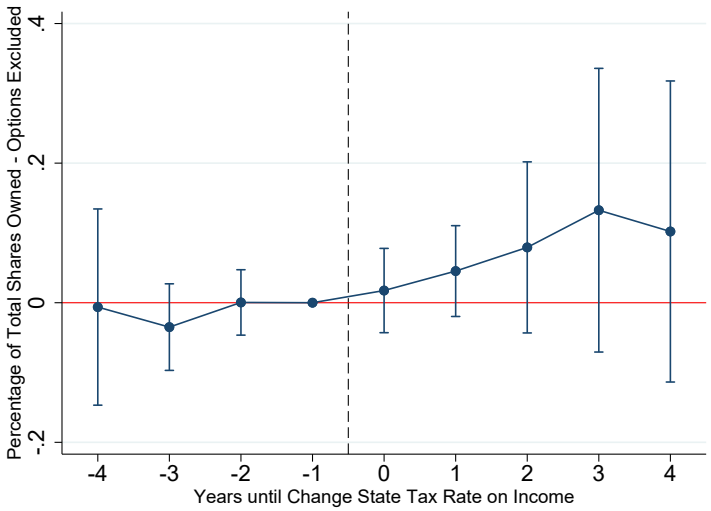
8.4.1 Executive Compensation

Table 15: Percent of Shares owned

	(1)	(2)	(3)	(4)
Maximum State Tax Rate (Lag 1)	0.023	0.045	0.055	0.055
	(0.041)	(0.045)	(0.045)	(0.045)
First lag of log Sale		-0.699***	-0.699***	-0.672***
		(0.116)	(0.126)	(0.125)
R+D Indicator			-1.604**	-1.586**
			(0.773)	(0.765)
Deviation ROA			0.287***	0.263**
			(0.106)	(0.100)
Deviation Market to Book			-0.000	-0.000
			(0.000)	(0.000)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls				✓
Mean	3.23	3.23	3.22	3.22
Observations	25840	25731	25249	25249
R-squared	0.901	0.903	0.904	0.905

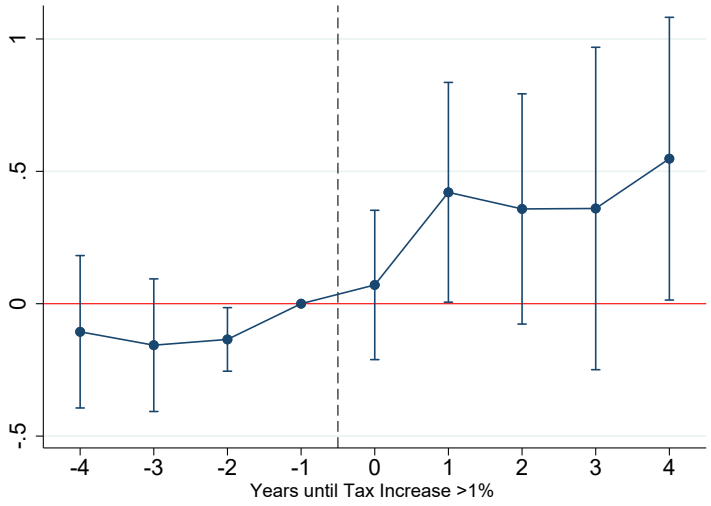
Note: Table 15 presents the coefficients of the estimation of state level taxes. The outcome variable is the percent of shares owned by the executive. In columns (2)-(4) control variables for firm size, firm performance and corporate governance are added. The first lag of log of sales controls for firm size, R+D indicator takes the value one if the firm report positive R+D expenditures and 0 if it does not. For firms for which R+D is missing the R+D indicator is set to zero and a dummy indicating that R+D is missing is included. By doing so we follow recommendations by Koh and Reeb (2015) and papers such as Bartram et al. (2012). We control for past firm performance by including the first lag of industry deviation from market-to-book ratio as well as the first lag of industry deviation from return on assets.In column 5 we include values for the Gomper's governance index and also include a separate variable as well as an indicator if the variable is missing. All specifications include executive × firm fixed effects as well as year fixed effects. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 15: The effect of state taxes on the percentage of shares held



Notes: This figure presents event-study estimates. The dependent variable is the percentage of shares held by the executive, the independent variable is an indicator if the firm experienced a tax change scaled by the magnitude of the tax change. The regressions include executive × firm fixed effects as well as year effects. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

Figure 16: The effect of state taxes on the logarithm of the fair value of stock awards



Notes: This figure presents event-study estimates. The dependent variable is the logarithm of the fair value of stock awards the executive has been granted in the fiscal year, the independent variable is an indicator if the firm experienced a tax change scaled by the magnitude of the tax change. The regressions include executive × firm fixed effects as well as year effects. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

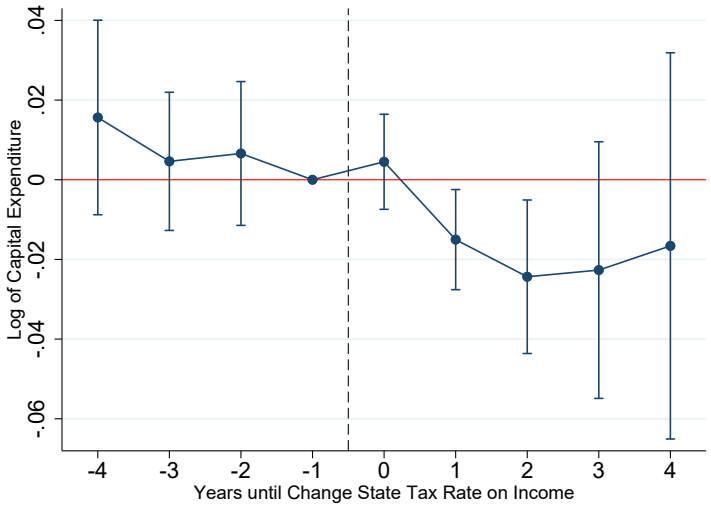
Table 16: Logarithm of Fair Value of Stock Awards

	(1)	(2)	(3)	(4)
Maximum State Tax Rate	0.137***	0.110**	0.114**	0.115**
	(0.045)	(0.050)	(0.045)	(0.045)
First lag of log Sale		0.579***	0.449***	0.450***
		(0.111)	(0.109)	(0.109)
R+D Indicator			-0.474*	-0.475*
			(0.262)	(0.261)
Deviation ROA			0.210*	0.209*
			(0.115)	(0.115)
Deviation Market to Book			-0.001	-0.001
			(0.000)	(0.000)
Executive x Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Governance Controls				✓
Mean	4.96	5.03	5.12	5.12
Observations	20288	19902	19160	19160
R-squared	0.630	0.634	0.638	0.638

Note: Table 16 presents the coefficients of the estimation of state level taxes. The outcome variable is the logarithm of the fair value of stock awards the executive has been granted in the fiscal year. In columns (2)-(4) control variables for firm size, firm performance and corporate governance are added. The first lag of log of sales controls for firm size, R+D indicator takes the value one if the firm report positive R+D expenditures and 0 if it does not. For firms for which R+D is missing the R+D indicator is set to zero and a dummy indicating that R+D is missing is included. By doing so we follow recommendations by Koh and Reeb (2015) and papers such as Bartram et al. (2012). We control for past firm performance by including the first lag of industry deviation from market-to-book ratio as well as the first lag of industry deviation from return on assets.In column 5 we include values for the Gomper's governance index and also include a separate variable as well as an indicator if the variable is missing. All specifications include executive $\times$ firm fixed effects as well as year fixed effects. Standard errors are clustered at state level. Significance Levels are: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

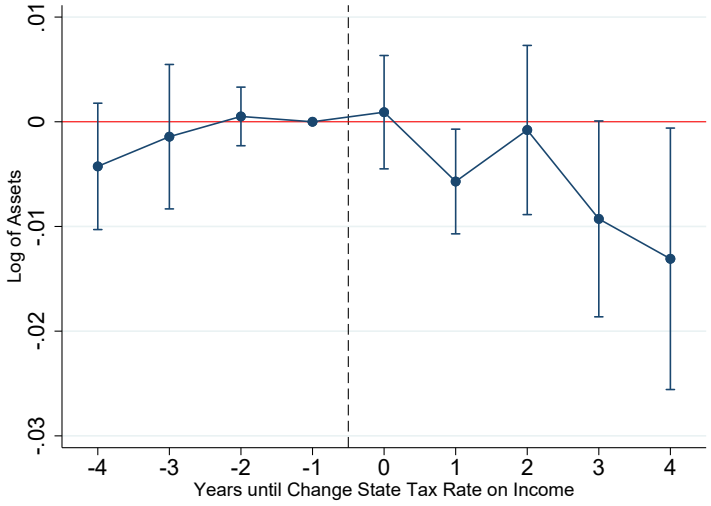
8.4.2 The effect on firm-level outcomes

Figure 17: The effect of state taxes on the logarithm of capital expenditures



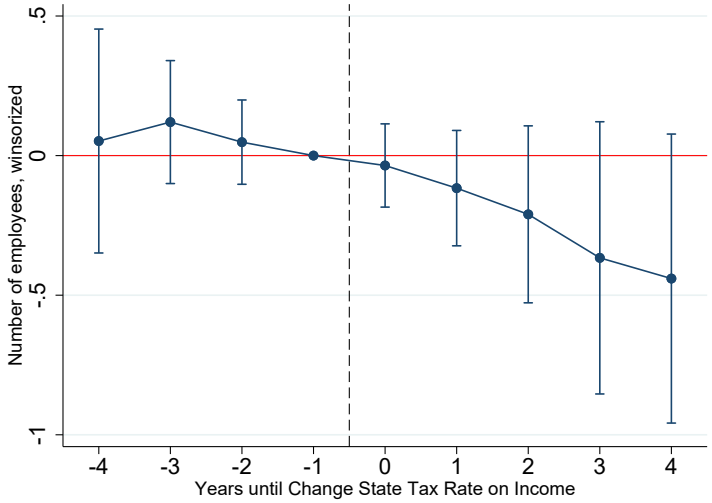
Notes: This figure presents event-study estimates. The dependent variable is the logarithm of capital expenditure, the independent variable is an indicator if the firm experienced a tax change scaled by the magnitude of the tax change. The regressions include executive × firm fixed effects as well as year effects. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

Figure 18: The effect of state taxes on the logarithm of assets



Notes: This figure presents Dynamic Difference-in-Differences estimates. The dependent variable is return on assets, the independent variable is an indicator if the firm experienced a tax increase larger than one percentage point. The regressions include executive × firm fixed effects, a state-specific linear trend as well as year effects. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

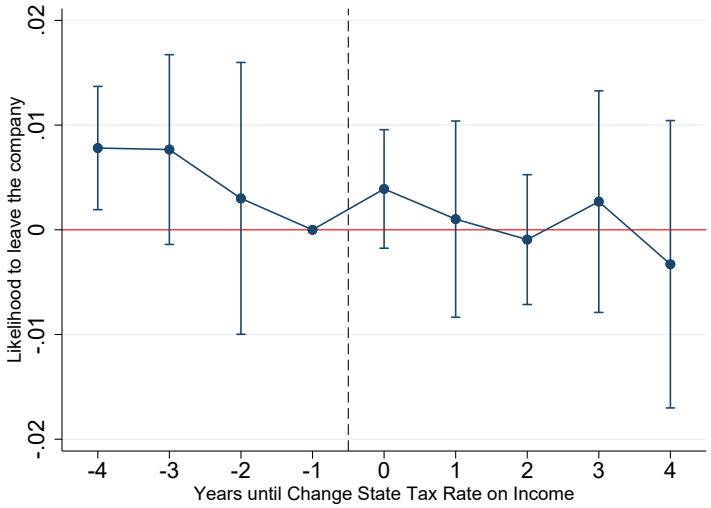
Figure 19: The effect of state taxes on the number of employees



Notes: This figure presents event-study estimates. The dependent variable is the number of employees winsorized at the on percent level, the independent variable is an indicator if the firm experienced a tax change scaled by the magnitude of the tax change. The regressions include executive × firm fixed effects as well as year effects. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

8.4.3 The effect on mobility

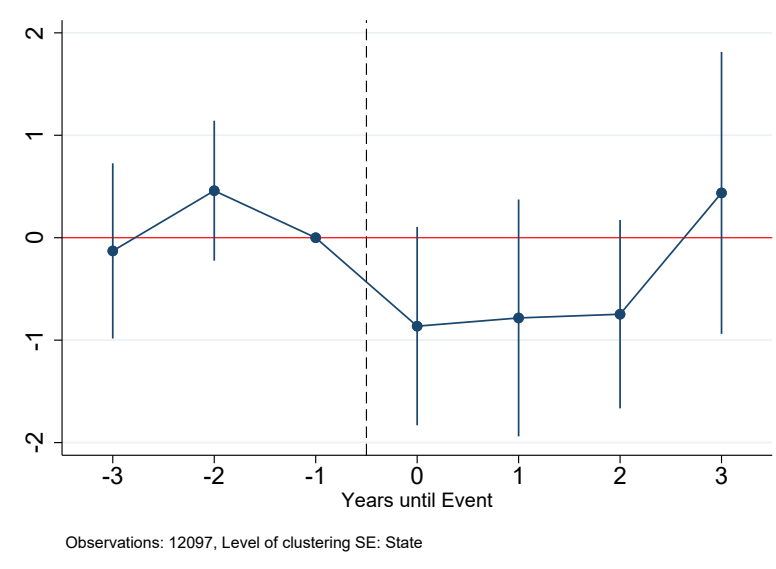
Figure 20: The effect of state taxes on executive turnover



Notes: This figure presents event-study estimates. The dependent variable is an indicator equal to one if there was a change in the CEO, the independent variable is an indicator if the firm experienced a tax change scaled by the magnitude of the tax change. The regressions include executive $\times$ firm fixed effects as well as year effects. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

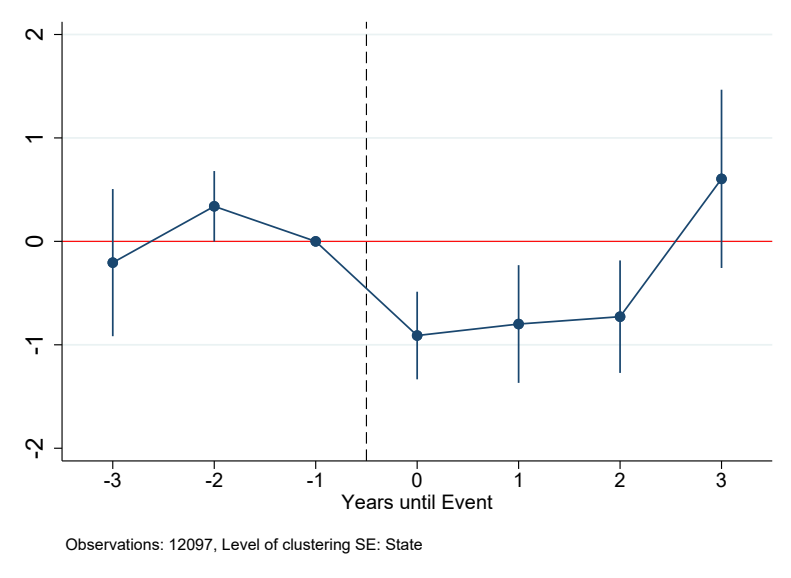
8.5 Heterogeneous Treatment Effects

Figure 21: Baseline Event Study



Notes: This figure presents Dynamic Difference-in-Differences estimates. The dependent variable is return on assets, the independent variable is an indicator if the firm experienced a tax increase larger than one percentage point.The regressions include executive × firm fixed effects as well as year effects. The sample spans the period 2005 to 2018. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

Figure 22: Sun and Abraham Event Study



Notes: This figure presents Dynamic Difference-in-Differences estimates adjusted for contamination by heterogeneous treatment effects. The dependent variable is return on assets, the independent variable is an indicator if the firm experienced a tax increase larger than one percentage point. The point estimates represent the sum of cohort average treatment effects weighted by their sample proportion. The regressions include executive $\times$ firm fixed effects as well as year effects. The sample spans the period 2005 to 2018. Vertical bands represent 95% confidence intervals. Endpoints are binned up to capture following and prior tax changes. Standard errors are clustered at state level.

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 number of performance goals reached over the number of performance goals defined. We define a performance goal as reached if the value of the accounting metric exceeds or meets the value of the target metric.	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
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	Price at the fiscal year end over book value per share	Compustat
Deviation Market to Book	First lag of the 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. Higher values indicate a worse level of governance	Gompers et al. (2003)
Gomper's Dummy	Indicator taking the value of one if the Gomper's Governance Index is below a value of 8	Gompers et al. (2003)
Institutional Ownership Dummy	Dummy which takes on the value of one if Institutional Ownership exceeds 50 percent	Thomson Reuters 13-f holdings

Tax Variables

Maximum State Tax	State level tax on wages for a married individual filing jointly with an income that exceeds 1.5 million USD	NBER Taxsim
Avg. Top1 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]	NBER Taxsim
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. [b]	NBER Taxsim

[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.