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December 2025

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Abstract

We quantify the effects of personal income taxes on executive compensation in the US. Addressing other determinants of compensation and endogeneity concerns, CEOs receive an abnormal increase in pay of 6.4% to 7.4% following large state personal income tax increases, relative to pay growth of CEOs who do not experience such tax shocks. Various estimates indicate that pay increases within two years by an amount that more than fully compensates the CEO for the increased tax liability. The increase in pay is larger when: there are more employment options in the industry; the CEO is less tied personally to the company; the CEO-firm match is more valuable; and governance is doubtful (high E-index, low board independence). In stark contrast, CEOs and other NEOs do not experience a cut or slower growth in pay following a tax cut. The measured size of and asymmetry in the response to state tax shocks quantify the extent to which both supply considerations, arising in part from outside employment options, and agency concerns and rent extraction affect CEO pay.

Keywords: Executive compensation, Personal income tax

JEL Classifications: H24, H71, J33, M12

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We quantify the effects of personal income taxes on executive compensation in the US. Addressing other determinants of compensation and endogeneity concerns, CEOs receive an abnormal increase in pay of 6.4% to 7.4% following large state personal income tax increases, relative to pay growth of CEOs who do not experience such tax shocks. Various estimates indicate that pay increases within two years by an amount that more than fully compensates the CEO for the increased tax liability. The increase in pay is larger when: there are more employment options in the industry; the CEO is less tied personally to the company; the CEO-firm match is more valuable; and governance is doubtful (high E-index, low board independence). In stark contrast, CEOs and other NEOs do not experience a cut or slower growth in pay following a tax cut. The measured size of and asymmetry in the response to state tax shocks quantify the extent to which both supply considerations, arising in part from outside employment options, and agency concerns and rent extraction affect CEO pay.

Keywords: Executive compensation; personal income tax; elasticity of CEO supply curve; governance; agency concerns. *JEL codes*: G3, H24, H71, J33, M12.

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How Executive Compensation Changes In Response to Personal Income Tax Shocks (Who Pays the CEO's Income Taxes?)

1. Introduction

The level and structure of executive pay are complex, controversial concerns. Persistent interest among investors, regulators, politicians, and executives has spawned a substantial scholarly literature as well as a considerable compensation consulting industry. Both address the determinants and consequences, economic and otherwise, of the level and incentive properties of executive pay.

Edmans, Gabaix, and Jenter (2017), in their survey of the theories and empirical evidence on managerial compensation, note that the various empirical designs arise from at least three, non-mutually-exclusive perspectives: shareholder value maximization; rent extraction by executives; and institutional forces. The focus in the literature has been on the first two perspectives.

> Most recent analyses of executive compensation have focused on efficient-contracting or managerial-power rationales for pay, while ignoring or downplaying the causes and consequences of disclosure requirements, **tax policies**, accounting rules, legislation, and the general political climate. (Murphy, 2013; emphasis added)

We emphasize this third approach, in large part as an empirical means to examine the other two.

Several prior studies that have examined income taxes and executive compensation report negligible effects of US *federal* income tax policy on managerial pay (Goolsbee, 2000a; Hall and Liebman, 2000; Rose and Wolfram, 2002). Frydman and Molloy (FM, 2011, p. 1434) conclude that "(I)n summary, we have found little evidence that changes in tax rates are related to changes in executive pay…". Given the finding that federal income tax shocks have negligible effects, a plausible initial view is that there would be no change in executive pay in response to a change in personal state income tax. We argue instead that state tax rate changes are fundamentally different.

Federal tax shocks apply uniformly across all states to all U.S. executives. The employment options that would avoid a federal personal income tax increase would require relocation to a foreign country with a lower national personal income tax rate. In contrast, for US state personal income tax shocks the threat of relocating to a US state with a lower personal income tax rate is likely to be more credible. Differences across states in rates can be substantial. For example, in 2018 California's top marginal rate was 13.3 percent, as compared to no state personal income tax in Texas, Florida, and several other states. Furthermore, it appears that top executives are attuned to such differences in state tax rates and will threaten to relocate or actually will relocate.[1]

We reject the null hypothesis of no state income tax effect on CEO pay. Our empirical analysis indicates that the response of CEO compensation to state personal income tax increases is economically and statistically significant. The size of the pay increase depends on supply and demand considerations, such as outside employment opportunities for CEOs, as well as agency concerns and rent extraction. The effect is asymmetric. Tax increases lead to compensation increases, while tax decreases have no effect on pay for CEOs and other named executive officers.

To frame our analysis, suppose that top executives and firms are assortatively matched based on attributes of each that are reciprocally-synergistic, costly-to-transfer, and differentiated (Rosen 1981; Tervio 2008; Pan 2017). Then there are several reasons why a change in personal income tax rate would affect executive pay. First, higher income taxes can directly reduce executives' after-tax income, thereby shifting the supply curve for executive input inward, which implies

[1] We thank Carola Frydman and Wayne Guay for bringing locational concerns to our attention. Also see https://www.bizjournals.com/sanfrancisco/news/2020/11/17/california-exodus-roared-on-even-before-covid-hit.html and https://www.wsj.com/tech/elon-musk-to-discuss-teslas-banner-year-despite-pandemic-silicon-valleys-future-11607449988. Moreover, top athletes in team sports have limited locational flexibility but are acutely aware of how income tax rates vary across jurisdictions. For example, see reporting on NHL hockey players (https://www.wsj.com/sports/hockey/stanley-cup-low-tax-states-florida-panthers-7d15ecff?mod=hp_featst_pos4).

upward pressure on CEO pay, especially if the demand curve for CEO input is inelastic. The version of the supply curve we have in mind includes both the intensive and extensive margins, though we think of the intensive margin as largely irrelevant. CEOs have significant span of control and demands on their time and rise to the apex of the organization because they supply maximal feasible managerial input. The participation decision, in contrast, is likely to matter. By this we do not mean whether the CEO decides to leave the labor market. Rather, as intimated above, the location and shape of the supply curve will depend on the external opportunities, *if any*, the CEO has for CEO positions at employers offering higher pay or in alternative low-tax domiciles, and on the frictions, benefits, and costs to the CEO of switching.[2]

Second, in the matching model some will prefer to understand the determination of pay in the transaction cost economics (TCE) framework. Again, think of firm and executive "endowments" matched based on the potential reciprocal synergies arising from the characteristics and capabilities of the firm and manager. This bilateral dependency can create a one- or two-sided holdup problem. Therein specific firm assets and a particular manager's specific human capital cannot generate surplus without the other, so that an asymmetry in bargaining power can be ascribed to the firm or manager (Hart and Moore, 1990).[3]

Third and in addition, governance considerations likely affect the ability of the matched CEO to extricate additional pay. Perhaps the firm is not disposed to implement appropriate governance that would hold the CEO's feet to the fire, or the costs of discovering and achieving an optimal

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[2] More generally, migration associated with tax differentials or changes in tax differentials does occur. Estimates of lost (gained) tax revenue over the last decade (2011-2021) due to interstate migration away from high-tax or to low-tax states include the following: New York lost $111 billion in AGI; California lost $102 billion; Illinois lost $63 billion; Florida gained $196 billion; and Texas gained $54 billion. See https://www.ntu.org/foundation/detail/florida-continues-to-attract-new-residents-new-york-california-and-illinois-lose-the-most-population.

[3] In a different but related approach, Barry (2025) estimates a structural model of the managerial labor market with general and firm-specific human capital accumulation, bargaining power, and imperfect competition.

governance structure are prohibitive.[4] Even if governance mechanisms are optimally configured, the presence of informational or other frictions implies second-best solutions (Holmstrom, 1979), resulting in a "residual loss" (Jensen and Meckling, 1976). In this setting, governance permitting, executives potentially can exercise influence or power to increase their pay over and above what would arise from the conventionally understood intersection of supply and demand.

Over the 1992 – 2022 period there were 371 changes in the top marginal US state personal income tax rates, of which 116 were increases and 255 were decreases. Following Heider and Ljungqvist (HL, 2015), we focus primarily, though not exclusively, on the 46 "large" state tax rate shocks, meaning rate changes at least as large as one percentage point, including 27 tax increases and 19 tax cuts, in our sample (Fig. 1). This approach is consistent with the possibility that large tax changes are more salient than small ones and that the costs associated with adjusting compensation in response to very small income tax rate changes are large relative to the benefits.

We apply two empirical approaches to the question of the effect of state personal income tax changes on pay. First, we apply a difference-in-differences (DiD) approach to state personal income tax shocks. Second, following the prior literature on federal income tax changes (e.g., Frydman and Malloy, 2011), we estimate the elasticity of CEO pay in the net-of-tax rate.

In our DiD specifications, we use state-level personal income tax changes as plausibly exogenous shocks to tax rates. Compared with federal tax changes, state-level changes in personal income taxes are more frequent and do not affect all states at the same time. The staggered nature of state-level personal tax shocks potentially provides valid control firms as a set of counterfactuals for how executive compensation would have evolved without the tax changes. The treated group

[4] Either way, the board of directors could be co-opted (Coles, Daniel, and Naveen, 2014) or insufficiently independent (Weisbach, 1988) or the sensitivity of CEO pay to firm performance could be suboptimal (Coles et al, 2012).

includes CEOs of firms headquartered in states experiencing increases or decreases in top personal income tax rates. The control group includes the remaining CEOs in the sample. Because states can and do experience repeated tax shocks, we define our treatment variable to indicate the appearance of each tax shock, while using the first difference of control variables on the right-hand side (per Heider and Ljunqvist, 2015).

Our DiD estimates show that CEOs receive economically and statistically higher pay two years after a large (≥1%) increase in personal income tax rates. CEOs receive an extra increase in pay of 6.4 up to 7.4% following large tax increases, relative to CEOs who do not experience such tax shocks, controlling for other determinants of compensation. The 6.4 - 7.4% pay increase is larger than the 3.46% increase in pay that on average would make the CEO whole after a 1.95% mean state tax increase. On average, the CEO is more than fully compensated for a state personal income tax increase. Furthermore, the effect is asymmetric. In contrast to tax increases, the effect of a state income tax cut is statistically and economically insignificant. Thus, regardless of the direction of the change in tax rate, on average the CEO is never a loser.

The DiD results survive various hurdles for credible identification. First, we estimate stacked DiD (Cengiz et.al., 2019; Baker, Larcker, and Wang, 2022). Despite the smaller sample size, our estimates and conclusions are robust. Second, we investigate whether state tax changes arise from prior rapid growth in executive pay. They do not. Third, we further remove political considerations by performing our tests using only exogenous tax shocks, as determined using a narrative approach (Romer and Romer, 2010; Giroud and Rauh, 2019). Our findings are the same.

Fourth, a concern is that both state tax changes and executive pay changes can be affected by local economic conditions. Exploiting the fact that local economic conditions tend to be more similar in bordering states, we use a control group including only CEOs of firms headquartered in

bordering states that do not experience any tax shock. This neighboring control group establishes the counterfactual response of CEO compensation to the unobserved local factors excluding the effects of tax changes. The effect of state tax changes on CEO pay in our full sample is robust to the bordering-state setting. Fifth, the treated and control groups appear to exhibit parallel trends in CEO pay changes before both positive and negative shocks to tax rates. Finally, we assess and then discard the possibility that our results on tax increases are attenuated towards zero by CEOs who avoid a state tax increase by a preemptive original choice of domicile.

We provide several triangulating results that address each of agency costs and the managerial supply curve. First, the pay increase is larger when the CEO has more outside options (more CEO slots in the industry) and is more disposed to exercise the outside option (non-founder). Second, the pay increase is somewhat larger when the firm has higher cash flow and high market-to-book ratio (MTB), the latter result suggesting that the CEO has more bargaining power than the firm in the holdup problem. Third, the size of the pay response to a large state income tax change depends on governance. The CEO pay increase is larger when the board is less independent and when the entrenchment index (E-Index per Bebchuck et al., 2009) is high. Fourth, a named executive officer (NEO) who is not CEO is likely to have a lower ability than the CEO to extract rents in a given governance setup. Accordingly, we find that they receive a much smaller pay increase of about 2.5%, about one-third of that of the CEO, in response to a large increase in personal income tax rate. Like CEO pay, non-CEO NEO pay does not decline in response to a tax decrease.

Finally, directly analogous to our DiD analysis of US state income tax changes, we collect *international* data on staggered national income tax shocks across 20 additional countries. We find that CEO pay increases significantly the second year following a national personal income tax increase. Our interpretation is that mobility frictions are not sufficient to fully undermine the

credibility of the cross-border outside option to relocate to another country. Like state personal income tax decreases in the US, we find that national income tax decreases do not lead to a decline in CEO pay relative to benchmark.

For a second empirical lens, we follow the approach in FM (2011) to regress the natural logarithm of the ratio of post-tax to pre-tax managerial pay, $y_{m,t}/y_{m,t-k}$, on the logarithm of the inverse of the ratio of post-tax-change (year *t*) *net-of-tax rate* (*NOT*) to the pre-tax-change (year *t-k*) net-of-tax rate, specifically $(NOT_{m,t-k}/NOT_{m,t}) = (1-\tau^{F}_{m,t-k}-\tau^{St}_{m,t-k})/(1-\tau^{F}_{m,t}-\tau^{St}_{m,t})$ The superscript denotes the federal (*F*) or state (*St*) personal income tax rate, *m* indexes the manager, and *t* and *t-k* index time. Controlling for other factors that would affect the rate of change in executive pay, an estimate of the coefficient on the log of the NOT equal to 1.0 would indicate that the proportional change in executive pay exactly offsets the tax increase, making the executive whole after-tax and fully shifting the incidence of the tax increase to the firm. Based on our estimate from the full sample of all state tax shocks, when the NOT changes by 1% due to a state personal income tax shock, CEO pay changes by 0.730% to 0.906%. These estimates imply that CEO pay increases within two years by an amount three-quarters or more of the way to fully compensating the CEO for the increased tax liability. Consistent with such incidence of the state personal income tax shock, the estimates of the elasticity of CEO pay in the net-of-tax rate indicate that the supply curve for CEO services is at least 2.70 times and perhaps as much as 9.64 times as elastic as the CEO demand curve.

Our analysis of the effects of state personal income tax changes on executive compensation contributes to several intersecting segments of the literature. We use changes in state personal income tax rates to advance the literatures on: the determinants of the level and rate of change of managerial compensation; supply and demand and the extensive margin for executives in the

managerial labor market; corporate governance and rent extraction; and the incidence of personal income taxes. We build on prior studies that estimate the effects of taxes on executive pay, including Bird (2018) and Perry and Zenner (2001), who examine changes in the tax treatment of pay components, Frydman and Molloy (2011), who study federal tax reforms, and Goldman, Henley, and Lewellen (2024), who address convexity in the personal income tax schedule.

2. Empirical Design

We use two approaches to examine the changes, if any, in CEO pay in response to changes in personal income tax rates. We estimate: (1) a DiD model for repeated treatments, which we describe just here; and (2) an elasticity (in the net-of-tax rate) model, which we describe and deploy in Section 5.

In a DiD analysis based on a single event, the treatment indicator (i.e., Treat x Post) typically is set to one in years after the event (as illustrated in the upper panel of Figure A1, Appendix 2). In our analysis, however, there are multiple shocks to tax rates through time and there can be repeated shocks in one state. For example, one tax increase may be followed by another tax increase or decrease in the same state in the future. In this case, a single treatment indicator equal to one after the first shock would fail to capture the subsequent shocks (lower panel of Figure A1).

One way to accommodate repeated events is to set the treatment variable as a count variable, or equivalently, use the first differences of all variables, including the treatment variable, in the DiD analysis (Heider and Ljungqvist, 2015). Accordingly, we define a dummy variable, *Tax Increase* (*Decrease*), which equals one if a large tax increase (decrease) occurs in the headquartered state in a year, and zero otherwise, where a large tax change refers to a change of at

least one percentage point. This is equivalent to the first difference of a count variable and captures all large tax shocks in a state (lower panel of Figure A1). We estimate:

$$\begin{aligned}\Delta Ln(y_{m,t}) = \beta_0 \; &+ \beta_{-2}^{Incr} \cdot Tax\ Increase_{m,t-2} + \beta_{-1}^{Incr} \cdot Tax\ Increase_{m,t-1} \\ &+ \beta_{-2}^{Decr} \cdot Tax\ Decrease_{m,t-2} + \beta_{-1}^{Decr} \cdot Tax\ Decrease_{m,t-1} \\ &+ \Delta X_{m,f,t}\Gamma \; + \mu_{m,f} + \vartheta_{ind,t} + \varepsilon_{m,t},\end{aligned} \tag{1}$$

where *y* is CEO compensation, the superscript *Incr* (*Decr*) indicates a coefficient for tax increase (decrease), the subscript -2 (-1) indicates a coefficient for a tax shock two years (one year) ago, *m* is the CEO index, *t* is the time index, *f* is the firm index, *ind* is the industry index, and *y* is CEO compensation. $X_{m,f,t}$ is the vector of control variables (including characteristics of the firm that employs the CEO), Δ is the first difference operator (within CEO-firm), Γ is the coefficient vector for the control variables, $\mu_{m,f}$ is the CEO-firm fixed effect, $\vartheta_{ind,t}$ is the industry-year fixed effect, and $\varepsilon_{m,t}$ is the error term. The control variables in *X* can be scaled, transformed using the natural logarithm function, or not transformed at all. We include the obvious control variables from prior literature. Here and throughout $\Delta X_{m,f,t}\Gamma \; + \mu_{m,f} + \vartheta_{ind,t}$ is meant to capture determinants, other than tax rate changes, of the change in CEO pay.

The β coefficients show the treatment effects in the DiD analysis. For example, a significantly positive β_{-2}^{Incr} would indicate that CEO compensation increases two years following an increase in the state personal income tax rate. We consider changes in CEO compensation both one and two years after shocks to top state personal income tax rates because benchmarking and pay-formation processes used by many listed US firms generally include lags in data and response. For a state personal income tax shock in year *t*, any new compensation contract that responds to the shock will be effective no earlier than year *t+1* or perhaps more likely one more year later, in year

t+2. Accordingly, we expect a lag of at least one year and more likely two years for a response in CEO pay, if any, to a change in the personal income tax rate.[5, 6]

3. Sample Construction

For the US sample, we obtain data on personal income tax rates from the official website of the Tax Policy Center (https://www.taxpolicycenter.org). CEOs generally have high income, so for any state we use the change in the top personal marginal income tax rate. Over the period 1992 – 2022 there were 1,581 (= 51 x 31) state-years (including Washington, DC) and 371 changes in the top state personal income tax rate (Table 1). Of these, 116 (255) were increases (decreases), while 46 (325) were large (small) changes of at least (less than) one percentage point. Following Heider and Ljungqvist (2015), we focus primarily, though not exclusively, on the 46 large tax rate shocks, meaning rate changes at least as large as one percentage point, including 27 tax increases across 18 states and 19 tax cuts across 17 states in our sample (Figure 1). Treated firms are those headquartered in states experiencing large tax shocks. In our baseline setting, control firms are those headquartered in states without contemporaneous large state income tax shocks.

Appendix 1 displays variable definitions. We obtain compensation data from Execucomp and corporate accounting data from Compustat. We extract information on the location of firms'

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[5] The human resources director and board compensation committee, often in collaboration with a compensation consultant, set pay based on lagged pay data for size- and industry-based comparison firms and with a lag in pay determination based on those data (Murphy, 1999). The compensation consultant will collect compensation data on the various positions (CEO, CFO, SVP, Chief Legal Officer, Division Head, SVP, etc.) from those comparable companies and, as the benchmark, pick the median, mean or appropriate percentile, based on where the board determines the executive resides in effectiveness and performance relative to peer executives. To formulate contemporaneous benchmarks for setting pay, many firms apply an annual inflation factor, such as the 5% often suggested by compensation consultants, to the lagged benchmark data for overall pay and the components of pay.

[6] To elaborate further on timing, US personal income taxes in year *t* usually need to be paid no later than October in year *t+1*, when any liquidity issue arises from the need to pay more income tax. The need for liquidity can motivate CEO option exercises and equity sales, which in turn can motivate the compensation committee of the board of directors to recalibrate the CEO's compensation contract, which would come into effect the following year.

executive offices directly from SEC 10K filings. To identify the relevant state for personal income tax rates, we use the "Mail Address" in 10K filings, which is the HQ address or the "Address of principal executive offices" for the firm.

Our sample reflects the merged intersection of the Execucomp and Compustat datasets. We only include CEOs who have worked in their current positions more than two years, so that their compensation in the current firms can be affected by the tax changes in the past couple of years and that CEO moves across firms do not contaminate the compensation data. Starting from 47,083 CEO-firm-year observations, we drop 12,745 because the CEO has less than 2 years of tenure, 5,765 by eliminating firms that change state of domicile, 425 when the firm has less than $50 million in market equity, and 5,857 from banks and utilities. Accordingly, over 1992–2022, the final sample includes 22,291 CEO-firm-year observations. About 2.6% and 1.3% (5.1% and 13.5%) of CEO-year observations reflect a large (small) increase or decrease, resp., in the CEO's top personal income tax rate.

We use the method described in Coles, Daniel, and Naveen (2013) to measure compensation. We deploy their code to calculate the value and incentive properties of cash, equity, and option awards to executives and the value and incentive properties of the accumulation of those awards (net of dispositions) as they comprise the executive's portfolio (we thank the authors: https://astro.temple.edu/~lnaveen/documents/deltavega_2013.sas). Panel B of Table 1 reports summary statistics. The average CEO in the US sample earns US$5.88M per year. In our empirical analysis, we control for firm size (book value of assets), market-to-book assets, and CEO-firm

performance (ROA), as well as CEO-firm fixed effects and industry-year fixed effects. Firm-year averages are $6.489B for book assets, 2.189 for market-to-book assets, and 4.7% for ROA. [7]

We also collect data for CEOs and their firms for national personal income tax rate changes in 20 other countries. Federal and national tax changes are less frequent but larger than US state personal income tax shocks (Table 1, Panel A). About 8.0% and 7.7% of CEO-year observations reflect a large increase or decrease, respectively, in the top personal national income tax rate faced by the CEO. CEO compensation data are from Incentive Lab Europe, which covers countries and regions including Great Britain, France, Switzerland, the Netherlands, Hong Kong, and Singapore. Panel C reports the summary statistics for the international sample including US and non-US firms.

4. DiD Analysis: The CEO Pay Response to Personal Income Tax Rate Changes

The primary treatment group is CEOs at firms in states with a personal state income tax shock greater than or equal to 1%, up or down. The "base" control sample is CEOs at firms in states that did not have a *large* personal state income tax shock. Because small changes in personal income tax rates are less likely to trigger pay negotiations between CEOs and their firms, we expect CEO compensation in these states to remain relatively unaffected, making them suitable candidates for the control group. A potential concern, however, is that this control sample is not perfectly clean. Accordingly, following de Chaisemartin and D'Haultfoeuille (2020), as a robustness test we clean the base control sample further by eliminating CEOs of firms in states that had any small personal state income tax increase during the sample period. This removes 6,728 CEO-firm-year

[7] An extensive literature in accounting and corporate finance establishes that these variables are related to the level and structure of executive pay. For examples, see: Smith and Watts (1992); Bizjak et al. (1993); Core et al. (1999); Murphy (1999); Coles et al. (2006); and Frydman and Malloy (2011).

observations from the base control sample to yield a smaller (15,563) "spotless" control sample. The dependent variable is Δln(TDC1).

4.1. Large State Personal Income Tax Increases

Table 2 presents the results for the indicators for large tax shocks. Column 1 (2) shows the estimates of the effect on CEO compensation of tax increases (decreases) one year and two years prior. Column 3 includes indicator variables for both tax increases and decreases. The results show that CEO compensation significantly increases two years after a large tax increase. Controlling for other determinants of pay changes, column 1 (3) shows that CEO compensation increases by 6.4% (6.6%) two years after a state personal income tax increase, relative to normal pay growth based on firm performance, size, MTB, and factors captured by CEO-firm and industry-year fixed effects. We observe no significant changes in compensation in the adjacent lagged year of a tax increase. It takes two years for CEO pay to adjust following a tax increase.

These estimates for large state personal income tax shocks are based on the control sample that includes small state income tax shocks. To assess robustness, we also use the smaller spotless control sample. Model 4 (6) of Table 2 indicates that CEO compensation increases by 7.2% (7.4%) two years after a state personal income tax increase. These coefficients are somewhat larger, with lower *p*-values, than those in models 1 and 3, even though using the spotless control sample reduces the number of CEO-firm observations.[8]

[8] Using an intermediate control sample, which excludes state personal income tax shocks that occur within the three-year window starting with any large state tax shock, yields statistically significant estimates on the two lagged indicators of 6.6% and 6.7%. These figures, as well as the other parameter estimates, are similar in economic and statistical terms to those reported in Table 2. Moreover, for all results reported below, the estimates using the intermediate control sample are similar to those using the base and spotless control sample.

4.2. Large State Income Tax Decreases

In stark contrast, there is no decrease in compensation following a tax decrease. As columns 2 and 3 of Table 2 report, the estimated coefficients on the lagged and twice-lagged tax decrease indicator variables are close to zero and insignificantly different from zero.

Using the spotless control sample does not alter the finding of asymmetry. In models 5 and 6 the estimated coefficients on the lagged and twice-lagged tax decrease indicator variables continue to be economically and statistically insignificantly different from zero.[9]

4.3. Robustness Tests: Further Evidence

4.3.1. Parallel Trends

We compare CEO pay changes [Δln(TDC1)] in the treated group and the control group in years around a shock to a state top personal income tax rate. Panel A (B) of Figure 2 plots the yearly differences for large tax increases (decreases). The dots represent the average yearly differences in CEO pay changes [Δln(TDC1)] between treated and control groups. The upper and lower bounds show the 90% confidence intervals. Consistent with the parallel trends assumption, in years before the event year (year *t*), i.e. year *t-2* and year *t-1*, the differences between treated and control groups are not statistically different from zero. Consistent with the results in Table 2, CEO compensation increases (is unchanged) after a large state personal income tax increase (decrease).

4.3.2. Changes in CEO Pay Do Not Precipitate State Income Tax Rate Changes

To alleviate the potential reverse causality concern that high growth in executive pay could trigger regulatory intervention in the form of a higher marginal tax rate for high earners, we regress

[9] For state income tax decreases, note that a reduction in nominal pay would not necessarily be required, all else equal, to equate after-tax CEO pay before and after a tax reduction. The specifications in Table 2 control for normal growth in pay associated with firm performance, size, and asset composition. While frictions in the pay-setting process for adjustment of *nominal* pay downward may be larger than for escalating pay, such is an unlikely explanation for the lack of a downward abnormal response in pay to tax rate decreases when benchmark pay grows for other reasons.

the indicator *Tax Increase* (*Decrease*) on CEO pay growth in a state one and two years prior, controlling for state characteristics, including state debt, state GDP, tax revenues, cash savings, population, government indicator (democratic governor = 1, otherwise = 0), and unemployment rate. The test sample is at the state-year level, so we include state fixed effects and year fixed effects. CEO pay growth is the average change in firm-level CEO pay within a state-year. We have the relevant data for 1997-2021. Table A1 (tables labeled "A#" are located in Appendix 2) reports the results. The coefficients on CEO pay growth in the previous two years are not statistically different from zero for both tax increases and decreases. State-level personal income tax changes do not appear to be associated with prior CEO pay growth in the specific state.

4.3.3. Exogenous Tax Shocks Identified by a Narrative Approach

To address political economy considerations as an omitted variable, Romer and Romer (2010) apply a narrative approach to classify tax changes larger than 1% into four categories based on the motivation of the tax changes. The categories are: (i) offsetting a change in government spending; (ii) offsetting some factor other than spending likely to affect output in the near future; (iii) dealing with an inherited budget deficit; and (iv) achieving some long-run goal, such as higher normal growth, increased fairness, or a smaller role for government. They define the last two categories as exogenous tax shocks. Likewise, to form the treated group we include only the 38 (of 46 total) large tax shocks defined by the narrative approach as exogenous.[10]

[10] Giroud and Rauh (2019) use the same approach and study the effects of state taxation on the reallocation of business activity. We thank Giroud and Rauh for making their classification of tax shocks publicly available. Their latest tax increases were in 2011. For the tax changes (greater than 1%) after 2011 in our sample, we manually collect the information and apply the narrative approach proposed by Romer and Romer (2010). The sample period for this test is 1992-2021.

Table A2 reports results similar to those in Table 2. Using the base (spotless) control sample, CEO pay increases by 6.8% to 6.9% (8.1% to 8.3%) two years following a large increase in personal income tax rates. In contrast, there is no significant effect on pay for large tax decreases.

4.3.4. Neighboring Control States Without Tax Shocks

Local economic conditions likely affect both executive compensation and local tax policies. Such effects are not necessarily removed in tests in which treated and control firms can be in different states far away from each other. Thus, we restrict control firms to those located in bordering states. Such states are more likely than distant states to share similar local economic conditions. For a treated state with a large tax shock, we include as control states only bordering states that do not experience a contemporaneous large shock to the personal income tax rates (Figure A3, Appendix 2). Table A3 reports the results. The effects of tax increases on CEO pay remain positive and statistically significant [models 1 and 3 (4 and 6) for the base (spotless) control sample], while the effects of tax decreases remain insignificant [models 2 and 3 (5 and 6)].

4.3.5. Distance to the Nearest Other State

Supposing that a CEO should be proximate to corporate HQ for peak performance (Duchin and Sosyura, 2021), we interact the tax shock with the distance to the nearest state line. If that distance is large, it is less likely that the CEO is domiciled elsewhere and thereby insulated from the state tax shock. The estimated coefficient on the interaction term should be positive if a sizable number of CEOs in the sample are domiciled elsewhere and thereby avoid the state tax shock. Table A4 (Appendix 2) reports that the interaction coefficient estimate is essentially zero. CEO preemptive location and reactive relocation are unlikely to contaminate our main findings.

4.3.6. Placebo Test

To perform a placebo test, we randomly assign large tax increases and decreases to CEO-years, setting the mean of the increases and decreases equal to the actual sample mean at the CEO-year level. Table A5 reports the results. The estimates on the state personal income tax shock variables are insignificant.

4.3.7. Stacked DiD

We also estimate the effects of changes in personal US state income tax rates on CEO compensation using a stacked DiD approach (e.g., Cengiz et.al., 2019). This setup addresses the possibility of heterogeneity in treatment effects. We construct a [-2, +2] stack window for each large tax increase or decrease (at least 1%). States with any other large changes (increases or decreases) at any point within a stack window are excluded. This stacked DiD setting excludes any state experiencing more than one large tax shock within a five-year window. As a result, the sample includes only 12 large tax increases and 14 large tax decreases, compared with 27 increases and 19 decreases in the full sample. CEOs of firms headquartered in states with large changes are in the treatment group. The remaining CEOs are in the control group. For each stack, *Tax Increase* (*Tax Decrease*) is a dummy variable that equals one if a CEO's state personal income tax rate increases (decreases) by at least one percentage point at the central year of the stack, and zero otherwise. *Post1* (*Post2*) is an indicator variable for the first (second) year following a large tax shock. We estimate the model for tax increases and decreases separately.

Table 3 reports stacked DiD estimates that, despite the smaller sample size arising from the construction of clean stacks, are similar to the DiD estimates in Table 2.[11] The coefficient on the

[11] Figure A2 (Appendix 2) provides supportive evidence for the parallel trends assumption of the stacked DiD analysis.

lagged tax indicator for increases is 0.073 ($p < 0.001$) while the estimate on the lagged-tax-decrease indicator is close to zero. Moreover, the results are similar to those in Tables 2 and 3 when applying the stacked DiD procedure to the samples restricted using the narrative approach to tax shocks and the neighboring states approach for control firms (Tables A6 and A7 in Appendix 2).

5. The Elasticity of CEO Compensation in the Net-of-Tax Rate

To better assess the size of the pay response, we estimate the elasticity of CEO pay in the net-of-tax rate. Our design follows that of Frydman and Malloy (2011) and their antecedents. First, we use the net-of-tax rate to frame the DiD results that are reported in Table 2. Second, we directly estimate the elasticity of the CEO pay response in the net-of-tax rate both without and with adjusting for the state and local tax deduction. Finally, in following FM (2011) we re-estimate the effect of US federal personal income tax shocks on CEO pay using our data. The federal estimates provide a benchmark for comparison of the elasticity results for state personal income tax changes.

5.1. How Large is the DiD CEO Pay Response?

Let $y_{m,t}$ be nominal period *t* compensation of CEO *m* and let $\tau_{m,t}^{F}$ and $\tau_{m,t}^{St}$ be the federal and state tax rates applicable to CEO *m* in period *t*. For simplicity, assume linear state and federal tax schedules and, for the time being, set aside any deductibility of state and local taxes. Then after-tax, period-*t* pay of the CEO of the firm is $y_{m,t} \cdot (1 - \tau_{m,t}^{F} - \tau_{m,t}^{St}) = y_{m,t} \cdot NOT_{m,t}$, where $NOT_{m,t} \equiv (1 - \tau_{m,t}^{F} - \tau_{m,t}^{St})$ is the "net-of-tax" rate which, when applied to taxable income, determines after-tax income. Assuming for now that we have controlled for or removed pay change based on other factors, such as firm performance or size, let $\hat{y}_{m,t}$ denote the nominal pay of the CEO in period *t* that makes the CEO whole after-tax, versus period *t-k* income $y_{m,t-k}$,

holding all else constant: $\hat{y}_{m,t} \cdot (1 - \tau^{F}_{m,t} - \tau^{St}_{m,t}) = y_{m,t-k} \cdot (1 - \tau^{F}_{m,t-k} - \tau^{St}_{m,t-k})$, or identically $\hat{y}_{m,t}/y_{m,t-k} \equiv (NOT_{m,t-k}/NOT_{m,t})$.

For the average state income tax increase of 1.95%, assuming the average state income tax rate of 5.3% and a federal tax rate of 36.4%, that abnormal growth rate is given by (1 – 0.3640 – 0.0530)/(1 – 0.3640 – 0.0530 – 0.0195) = 1.0346, or an increase of 3.46%. The DiD tax-shock-related CEO pay response of either 6.2-6.4% or 7.2-7.4% is substantially larger. It appears that the average CEO is more than fully compensated for the state income tax increase.

Relative to normal growth in pay, the pay decline that would make the CEO whole, based on average federal and state rates of 36.4% and 5.3% and the average large state personal income tax rate decrease of 1.60%, is indicated by (1- 0.364 – 0.0530)/(1 – 0.364 – 0.0530 + 0.0160) = 0.9733. This implies a decrease of 2.67% in CEO pay relative to the benchmark based on firm size and performance. The DiD estimates show no such decrease in the data.

5.2. Estimates of the Elasticity of CEO Compensation in Personal State Income Taxes

To assess further the magnitude of the responsiveness of CEO pay to personal state income taxes, we estimate the elasticity of CEO compensation with respect to the factor that captures what is left after income taxes, the net-of-tax rate. We consider both federal level and state level changes in personal income tax rates and address large tax shocks alone and large and small tax shocks together.[12]

Let $g_{m,t}$ be the equilibrium growth rate in CEO pay, over period *t-k* to period *t*, based on CEO-firm performance, size, asset tangibility, etc. Again let $\hat{y}_{m,t}$ denote the nominal pay of the CEO

[12] Local income taxes are low (between 1% to 3%, with a few exceptions, https://taxfoundation.org/local-income-taxes-city-and-county-level-income-and-wage-taxes-continue-wane/), so we approximate the personal income tax rate as the sum of federal and state income tax rates and ignore local income tax.

in period t that makes the CEO whole after-tax, holding all else constant: $\hat{y}_{m,t} \cdot (1 - \tau^{F}_{m,t} - \tau^{St}_{m,t}) = (1 + g_{m,t}) \cdot y_{m,t-k} \cdot (1 - \tau^{F}_{m,t-k} - \tau^{St}_{m,t-k})$, or identically, $\hat{y}_{m,t} \equiv (1 + g_{m,t}) \cdot (NOT_{m,t-k}/NOT_{m,t}) y_{m,t-k}$. Dividing both sides by prior pre-tax pay, and allowing that tax rate changes can affect pay potentially with a lag, suggests the following specification to estimate the effect on actual period-t CEO pay, $y_{m,t}$, of a change in the personal income tax rate:

$$Ln\left(\frac{y_{m,t}}{y_{m,t-1}}\right) = \Pi^{q}_{0} + \Pi^{q}_{-2} Ln\left(\frac{NOT_{m,t-3}}{NOT_{m,t-2}}\right) + \Pi^{q}_{-1} Ln\left(\frac{NOT_{m,t-2}}{NOT_{m,t-1}}\right) + \Delta X^{q}_{m,f,t} \cdot \Gamma^{q} + \mu^{q}_{m,f} + \vartheta^{q}_{ind,t} + \varepsilon^{q}_{m,t}, \tag{2}$$

where the indices are defined as before, superscript q = *St* (*F*) signifies the data and parameter estimate are based on state (federal) personal income tax shocks, and $\Delta X^{q}_{m,f,t} \cdot \Gamma^{q} + \mu^{q}_{m,f} + \vartheta^{q}_{ind,t}$ is meant to capture determinants, other than tax rate changes, of the change in CEO pay. For state tax changes we expect the estimate of Π^{St}_{-2} to be positive because an increase (decrease) in the state personal income tax rate implies an increase (decrease) in the inverse *NOT* ratio, $NOT_{m,t-3}/NOT_{m,t-2}$. If compensation responds sooner, Π^{St}_{-1} could be positive. Note that the effect of a state tax rate change on the inverse net-of-tax ratio depends on the level of the federal tax rate.[13]

Table 4 displays the results. Columns 1 and 2 consider large ($\Delta\tau^{St} \geq 0.01$ or $\Delta\tau^{St} \leq -0.01$) salient tax rate changes. We remove small state tax shocks by setting the maximum state tax rate (and NOT) in the adjacent following year to be equal to the earlier of the two years. That is, for columns 1 and 2, which are focused on large shocks, we set $NOT_{m,t-k}/NOT_{m,t-(k-1)} = 1$ for all

[13] Obviously, the estimate of Π^{St}_{-k} is opposite in sign if we perform the regression analysis based on $NOT_{m,t-k}/NOT_{m,t-k-1}$ rather than the inverse after-tax ratio used in Equation (2).

observations for which the tax rate change was less than one percentage point. This immunizes the analysis of large state tax shocks from contamination by small state tax rate changes.

The estimates on the lagged response coefficients are $\Pi_{-2}^{St} = 0.906$ and 0.730. That is, columns 1 and 2 indicate that a 1% decrease in the net-of-tax rate due to a state personal income tax rate increase is associated with a 0.906% ($t = 2.30$) or 0.730% ($t = 2.01$) increase in total compensation two years later, respectively. Moreover, the sum of the coefficients on the lagged once and twice NOT ratios are 0.947 (column 1) and 0.826 (column 2). An estimate of 1 would be consistent with an increase in pay that makes the CEO exactly whole in terms of after-tax pay. Both estimates indicate that the CEO is substantially compensated two years later for a change in state personal income tax rate.

Column 3 includes both large and small state tax changes. It is possible that all tax rate changes, large or small, matter for CEO pay. The estimated coefficients on the inverse net-of-tax rate, however, are both statistically insignificant: $\Pi_{-2}^{St} = 0.405$ ($t = 1.20$) and $\Pi_{-1}^{St} = 0.315$ ($t = 0.75$). The sum of the two estimates is $\Pi_{-2}^{St} + \Pi_{-1}^{St} = 0.720$, which is sizable but insignificant.

To illustrate the economic significance of the parameter estimates, suppose the state personal income tax rate goes up by 0.0195 from period $t-3$ to $t-2$. Assume that prior to the tax increase that the federal and state rates are the CEO-year averages in the sample, 36.4% and 5.3%, respectively, so the federal and state rates sum to 0.417 at $t-3$ and 0.437 at $t-2$. Then $Ln(NOT_{m,t-3}/NOT_{m,t-2}) = Ln(1.0346)$ becomes 0.0340 rather than 0 (had there been no tax rate change) after the state tax increase. Using the elasticity estimates from columns 1 and 2 of Table 4 implies a 3.13% ($e^{(0.0340\,x\,0.906)} - 1$) and 2.51% ($e^{(0.0340\,x\,0.730)} - 1$) proportional abnormal (due to the tax shock) increase in CEO pay. Compared to a coefficient estimate of 1, which would be consistent with an increase in pay that makes the CEO exactly whole in terms of after-tax pay

(3.46%), the estimates indicate that the CEO is substantially compensated two years later for a change in state personal income tax rate.

The analysis above does not account for the state and local tax deduction (SALT). The SALT deduction, which has allowed itemizing taxpayers to deduct certain state and local taxes from their federal adjusted gross income, predates the establishment of the permanent federal income tax as instituted by the Revenue Act of 1913. Thus, the SALT deduction likely was utilized by CEOs and other top executives until the Tax Cuts and Jobs Act of 2017, which capped the deduction for itemizers at $10,000 (filing jointly) for years 2018-2025.

To adjust for the deductibility of state personal income taxes at the federal level, the net-of-tax for years 1992-2017 becomes $NOT_{m,t} \equiv (1 - \tau^{F}_{m,t}(1 - \tau^{St}_{m,t}) - \tau^{St}_{m,t})$, versus $NOT_{m,t} \equiv (1 - \tau^{F}_{m,t} - \tau^{St}_{m,t})$ for sample years 2018-2022. Based on this adjustment, we estimate Equation (2) for large state personal income tax shocks. Again, we set $NOT_{m,t-k}/NOT_{m,t-(k-1)} = 1$ for all observations for which the tax rate change was less than one percentage point. Table 5 reports the estimates on the lagged response coefficients as Π^{St}_{-2} = 1.159 and 0.835. These figures indicate a slightly larger response to changes in the net-of-tax rate arising from state personal income tax shocks than is given by the coefficient estimates in Table 4.

5.3. Supply and Demand Elasticities for CEO input.

We consider whether there is a combination of standard supply and demand effects that accommodate the elasticity estimates reported in Section 5.2. Setting aside the SALT deduction, denote equilibrium executive compensation as y, the sum of the federal and state tax rates as $\tau = \tau_f + \tau_s$, and CEO pay after income tax as $y \cdot (1 - \tau) = y \cdot NOT$. Denote the demand function of the firm for executive "labor" or input as $D(y)$ and the executive's supply function as $S(y \cdot NOT)$.

In partial equilibrium in the executive labor market, $D(y) = S\big(y \cdot (1-\tau)\big) = S(y \cdot NOT)$ determines the equilibrium level of compensation for a given net-of-tax rate.

Suppose that there is a shock to the net-of-tax rate. The shock could be an increase (a reduction) in federal or state tax rate, in which case NOT would fall (rise). To assess the effect of the tax shock on equilibrium pay, totally differentiate the expression equating demand and supply in y and NOT to get $D'(y) \cdot dy = S'(y \cdot NOT)[y \cdot dNOT + NOT \cdot dy]$. Rearranging gives $\varepsilon_{y,NOT}^{St} = -\varepsilon_S/(\varepsilon_S - \varepsilon_D)$, where $\varepsilon_{y,NOT}^{St} \equiv (NOT/y) \cdot (dy/dNOT)$ and the supply and demand elasticities in the CEO labor market are $\varepsilon_S \equiv y \cdot NOT \cdot S'(y \cdot NOT)/\, S(y \cdot NOT)$ and $\varepsilon_D \equiv y \cdot D'(y)/\, D(y)$. For $\varepsilon_S \in [0, \infty)$ and $\varepsilon_D \in (-\infty, 0]$, $-\varepsilon_{y,NOT}^{St} = \varepsilon_S/(\varepsilon_S - \varepsilon_D) \in [0, 1]$.

Note that the estimated coefficient from Equation (2) is the negative of the elasticity of executive pay in the inverse net-of-tax rate, $\Pi_{-k}^{St} = -\varepsilon_{y,NOT}^{St} \equiv -(NOT_{t-k}/y_t)(dy_t/dNOT_{t-k})$. Both of the estimates of $-\varepsilon_{y,NOT}^{St}$ (for k = 2) from Table 4, 0.906 from column 1 and 0.730 from column 2, fall inside the $[0, 1]$ interval. The estimated value of $-\varepsilon_{y,NOT}^{St}$ = 0.906 indicates that the supply curve for CEO input is almost ten times as elastic as the supply curve ($\varepsilon_S^{St} = -9.6383\ \varepsilon_D^{St}$). Using $\varepsilon_{y,NOT}^{St} = -0.730$ gives $\varepsilon_S^{St} = -2.7037\ \varepsilon_D^{St}$. Restated, the elasticity of demand is about one-tenth (three-eighths) as elastic as the supply curve, with $\varepsilon_D^{St} = -0.1038\ \varepsilon_S^{St}$ ($\varepsilon_D^{St} = -0.3699\ \varepsilon_S^{St}$).[14]

Having located the assortative match between the firm and CEO by means of the firm-CEO fixed effect, for both estimates based on large tax shocks the demand curve for CEO input appears to be highly inelastic relative to the supply curve. The relatively elastic supply curve is consistent

[14] Based on the elasticity estimates of CEO pay in the SALT-corrected inverse net-of-tax rate (Table 5, column 2), Π_{-2}^{St} = 0.835, indicates $\varepsilon_D^{St} = -0.1976\ \varepsilon_S^{St}$ (and $\varepsilon_S^{St} = -5.0606\ \varepsilon_D^{St}$). While Π_{-2}^{St} = 1.159 (Table 5, column 1) lies outside of the unit interval, the estimate is not statistically different from 1 (the demand curve is fully inelastic).

with the high responsiveness of CEO pay to state personal income tax shocks. If human capital is relatively mobile or deployable relative to the assets of the firm, the supply curve would be relatively more elastic than the demand curve. [15]

5.4. The Elasticity of CEO Compensation in the Net-of-Tax Rate: US Federal Tax Shocks

As a benchmark for comparison, we estimate the elasticity of CEO pay in the net-of-tax rate based on shocks to the US federal personal income tax rate. Frydman and Malloy (2011), using a sample of top executives in 50 large firms from 1946 to 2005, find very little response in the compensation of top executives, including some non-CEOs, to changes in federal tax rates on labor income. Other previous studies, relying in like manner on identification by time series variation within firms, report that changes in federal income tax rates have negligible effects on CEO compensation (Goolsbee, 2000; Hall and Liebman, 2000; Rose and Wolfram, 2002).

There are 6 large ($\Delta\tau^F \geq 0.01$) changes in the top US federal personal income tax rate in our sample period, ranging from -3.6% to 8.6%. We exclude state tax changes from the inverse NOT calculations. Those state shocks, while generally much smaller than federal income tax shocks, allow some noise to remain in the analysis of federal tax shocks.[16] Our reading of the prior literature is that those studies calculated the NOT based only on the federal tax rate. We include the standard control variables and CEO-firm and industry-year fixed effects. Federal tax changes apply to all CEOs in a year and potentially would mostly be washed away by time fixed effects.

Table 6 reports elasticity estimates that are consistent with the prior literature. In all four specifications the estimates on the inverse NOT ratio lagged once are small and statistically

[15] Based on CEO-to-CEO transitions across firms (Execucomp data), when a CEO moves to the next CEO position, in 74% of cases the CEO moves to a different state. Geographical continuity is unlikely to be a hard and fast job search requirement for many CEOs.

[16] The results are similar if we do not exclude changes in the state personal income tax rate in the NOT.

insignificant. Frydman and Malloy (2011) in every specification confidently reject an elasticity of taxable compensation with respect to the net-of-tax rate greater than +0.200. Thus, our results are consistent with Frydman and Malloy (2011) and, for example, with the negligible effect of tax rates found by Goolsbee (1999) for tax reforms prior to 1986.

The federal income tax applies to US CEOs regardless of location. The elasticity estimates for federal tax shocks should be negligible if outside options in other US states (or other countries) for US CEOs are unavailable or costly to obtain. Comparison of the state and federal elasticities suggests that outside options on the extensive margin are one important source of the significant pay response by firms to state personal income tax shocks.

6. Supply and Demand Versus Governance, Agency Costs, and Rent Extraction

The large, estimated response in CEO pay to a state income tax increase is consistent with low locational frictions and a credible threat by the CEO of moving to another job in a low-tax state. It also can be the case that the CEO has a hold-up advantage, arising from asset specificity, over the firm. For example, suppose the CEO's human capital is relatively valuable to the enterprise and hard to duplicate and the firm's capital is relatively duplicatable. For high upward responsiveness of CEO pay and downward rigidity in tax shocks, CEO power and entrenchment also arise as possible explanations. It is likely that some firms are ineffective at devising good governance or choose not to do so. Even if governance is optimally configured, the governance mechanisms in place can be insufficient to fully prevent second-best residual losses.

In this section we provide evidence on (i) CEO-firm negotiation (in the context of supply and demand) versus (ii) residual loss from CEO power and rent extraction as potential explanations.

6.1. At the Intersection of Supply and Demand (at the Nexus of the Assortative Match)

In terms of the threat to leave for another position in a low-tax domicile, CEOs can seek CEO positions (or take a demotion to CFO) in low-income-tax-rate states. Such locational considerations at the extensive margin determine the elasticity of the CEO's response, as a supplier of managerial input to the employer, to a state personal income tax shock. For example, if there are many firms in the industry, giving CEOs more outside options for higher pay, especially when a significant number of those firms are located in states that did not increase the personal income tax rate, the threat of relocation will confer on the CEO more negotiating power and the supply of managerial input will be more elastic. On the other hand, if the CEO is the founder of the firm and is attached to the firm for personal reasons, such as inappropriate treatment of sunk costs or escalated commitment to the firm, then the threat of relocating is relatively empty. Table 7 reports that both of these hypotheses are supported in the data.

Per model 1, the coefficient estimate (0.146, $p < 0.001$) on the interaction of the dummy variables for whether the CEO is **not** a founder of the firm and the lagged state tax increase is positive and significant. Likewise, in model 2 the estimate on the interaction of indicator variables for whether the number of firms in the industry exceeds the median in that year and for the positive lagged state tax shock is positive and significant (0.089, $p = 0.012$). Both results suggest that the availability of outside employment options and the willingness to pursue those outside options are associated with a larger increase in pay in response to a state personal income tax increase.

Turning to the employer, if the firm generates high cash flow and is relatively unconstrained financially, the firm can be more willing to deploy funds for retention. Moreover, the CEO may argue that employees should share with shareholders and other employees in the larger pie.[17]

We interact the state income tax shock indicator with a dummy based on whether the firm is above or below the industry-level median profit margin [(Sales – COGS)/Sales] (two-digit SIC). Controlling for the change in firm performance, in model 3 (Table 7) the estimate on the interaction term of the dummy for the lagged state tax increase and the dummy for profit margin above the yearly median is positive and significant only at the 10% level (0.070, $p = 0.091$).

If a firm's market-to-book ratio exceeds 1.0, the executive team appears to be managing the assets at a premium above book value. The unique, firm-specific skills and experience and potentially rare general human capital of the CEO are examples of intangible assets that contribute to market value. In a firm with a high MTB ratio, the value of the incumbent is likely to be high relative to the next-best CEO match, in which case the firm will be more likely to respond to a tax shock with additional compensation. The parameter estimate on the interaction of the tax shock and above-yearly-median-MTB dummies is positive (0.088, $p = 0.058$).

Comparing the firm and the CEO, it appears that locational opportunities and preferences of the CEO have more power than firm characteristics (such as profitability and MTB ratios) to explain the compensation responses to a state personal income tax increase. These results are consistent with a CEO supply curve that is more elastic than the firm's demand curve.

[17] Furthermore, a CEO in a more-profitable focal firm will be evaluated and benchmarked for pay relative to a more generous external benchmark based on comparison firms in the same industry that are similar in size and performance (Bizjak, Lemmon, and Naveen, 2008; Faulkender and Yang, 2010; Murphy, 1999).

6.2. Agency and Rent Extraction: Governance

Ill-conceived or ineffective governance provides a context for opportunism and rent extraction. For governance we use two conventional measures, the E-index (Bebchuk et al., 2009) and board independence (Weisbach, 1988). A higher value of the entrenchment index and a lower proportion of non-employee and other non-conflicted directors on the board are conventionally understood to indicate less effective governance.

In Table 8, the coefficients of interest are those on the interaction of the tax increase dummy and the measure of governance effectiveness. The estimates in both columns are positive and economically and statistically significant. An E-Index above the yearly median is associated with a 10.8% (p = 0.003) abnormal increase in pay two years following a large increase in the state personal income tax rate. Similarly, the estimate on the interaction of the lagged state personal income tax increase with a dummy for board independence being lower than the yearly median indicates a 6.7% abnormal increase (p = 0.049).

6.3. Agency and Rent Extraction: Named Executive Officer (NEO) Pay Versus CEO Pay

We investigate the compensation tax effects for non-CEO named executive officers . In terms of the threat to leave for another position in a low-tax state, CEOs can seek CEO positions (or take a demotion to CFO) in low-income tax states, while CFOs can seek CFO positions or lower in other states and also, perhaps, move up into the role of CEO. Let us suppose that non-CEO NEOs have a set of outside opportunities similar to that of CEOs. Then, if there is a difference in the extent to which a CEO versus a non-CEO NEO in the compensation response to the state income tax shock, it is more likely attributable to differences in the executive's influence, power, and ability to extract rents. We predict that NEOs are less able to extract rents than CEOs.

Columns 1 and 2 of Table 9 report that the effect on abnormal non-CEO NEO pay of state income tax changes economically modest and mainly statistically insignificant. For an increase in state tax rate, the estimate of the response in non-CEO NEO pay to a state tax increase (columns 1 and 3) is approximately 2.5% , about one-third of the response for CEOs, while decreases in the state tax rate have negligible effect on pay for both CEOs and other NEOs (columns 2 and 3). In sum, tax increases (decreases) matter less (the same) for non-CEO NEO pay than for CEO pay. This suggests that CEOs possess additional ability, beyond that of other NEOs, to extract rents, under existing governance arrangements, whatever they may be, and that they utilize that ability to obtain a larger upside response in CEO pay to a state income tax rate increase.

7. International Evidence: National Personal Income Tax Shocks

To further frame the DiD results on US state personal income tax shocks, we examine the response of CEO compensation to large national tax changes. In the face of an increase in the national tax rate, if a CEO can relocate to a different country with a lower national income tax rate at low cost then we would expect the estimates on the inverse ratio of net-of-tax rates to be positive. Furthermore, if agency problems and associated rent extraction are considerable, the estimates again would be positive.

We collect changes in the top national personal income tax rate for the US and 20 additional countries or regions across the 2011-2022 period.[18] Over the sample period there were 14

[18] The countries and regions are Belgium, Bermuda, Canada, the Czech Republic, Germany, Denmark, Spain, Finland, France, Great Britain, Hong Kong, Ireland, Israel, Italy, Luxembourg, the Netherlands, Norway, Portugal, Singapore, and Sweden.

increases in 8 different countries and 9 decreases in 6 different countries. To remove potentially confounding effects of state tax shocks, we exclude US CEOs experiencing state tax changes.

Table 10 displays the results. Like state tax shocks in the US, pay is unresponsive downward. For national tax rate increases, the parameter estimates indicate a significant positive response two years after the tax increases. In our sample of CEOs and firms in 21 countries, CEO compensation increases in response to an increase in national income tax rates.

To compare the response in pay for US state tax shocks versus international national tax shocks, we e normalize the coefficients on the large state (Table 2) and national (Table 10) income tax indicators by size of the tax shock. The twice-lagged US state (international national) coefficient estimate of 7.4% (8.3%) is 3.79 (1.99) times the average US state (international) tax increase, 3.96 (2.08) times the median, and 2.51 (1.28) times the range of large tax shocks. The response in US CEO pay to US state tax increases appears to be larger per unit of tax rate increase than for international CEOs to national personal income tax rate increases. One likely reason is that the costs of relocating across national borders for international CEOs are likely larger than the costs for US CEOs relocating across states.

8. Further Considerations

8.1. Data

Several data items warrant brief attention. First, a departing or arriving CEO could introduce noise into our empirical analysis. CEOs who move obtain higher pay (e.g., Fee and Hadlock, 2013; Coles et al., 2018), and the former paper reports that the compensation change can be explained in part by reimbursement for the equity position forfeited at the prior employer and by the prior employer's performance. Accordingly, we have restricted observations on the change in

compensation to include those for which the CEO stays at the same firm for the two years following the relevant change in the personal income tax rate. Second, about 2.5% of our sample of CEO-year observations have a tax change in two consecutive years. First-differencing removes unobserved firm-specific fixed effects in the corresponding levels equation.

Third, significant elements of our empirical analysis rely on the idea that changes in TDC1 reflect pay adjustments that arise in response to changes in the personal income tax rate. Total compensation includes some or all of annual salary, annual bonus, and long-term cash bonus, as well as the grant date fair value (GDFV) estimates for stock and option awards. While annual salary and bonus are part of taxable income in the year they are paid, the grant date fair values of stock and option grants need not be. Under standard time-based vesting, the receipt of stock and options occurs in the future, with the actual taxable date and taxable value possibly being uncertain at the time of the award.[19] Performance-vesting provisions (Bettis et al., 2010, 2018), under which the number of units of cash, stock, or options ultimately received depends on one or more accounting or market performance metrics, introduce additional uncertainty about actual taxable income.

In estimating the value of stock and option awards, compensation committees and consultants often apply standard SEC- and FASB-sanctioned methods to capture the range and likelihood of possible outcomes (Bettis et al., 2018). The very act of generating a grant date fair value to disclose requires some understanding of these uncertainties. Thus, GDFV potentially provides a reasonable

[19] In our sample period, a stock award is taxed at the ordinary rate at market value at the time it vests. If the executive holds the stock, then subsequent tax is based on the gain or loss since vesting at either the ordinary income tax rate or the capital gains rate, depending on holding period since vesting. Most options are issued at the money and are taxed at exercise, with the ordinary rate applied to the difference between the market value of the stock acquired net of the exercise price. Again, if the executive continues to hold the stock, then subsequent tax is based on the gain or loss since exercise and either the ordinary income tax rate or the capital gains rate applies, depending on the holding period.

estimate of the present discounted taxable value of those awards. Furthermore, even if GDFV is biased one way or another relative to the present value of taxable income, if the bias is similar from year to year then there is some hope that using the *change* in GDFV removes that bias. Then $\Delta Ln(y_{m,t})$ would be a reasonable proxy for the change in the discounted value of taxable income, which reinforces the use of $\Delta Ln(y_{m,t})$ on the left-hand side of regression specifications.

8.2. Do Locational Choices Attenuate the Estimates?

The large, estimated response in CEO pay to a state income tax increase is consistent with low locational frictions and a credible threat by the CEO of moving to another job in a low-tax state. Locational considerations, however, potentially have a countervailing effect. Some executives may already be taxed in another state or can move to another state that differs from the firm's domicile and was not treated with an income tax shock but still serve as CEO.

To supplement Table A4 (Appendix 2), we argue further that such pre-emptive tax avoidance is unlikely to attenuate significantly our estimates of the sensitivity of executive pay to changes in the personal state income tax rate. First, there are not many relevant state reciprocity tax agreements. Likewise, one-way agreements appear in only 2.51% of the 2,550 possible one-way arrangements among the 50 states and Washington, DC. Moreover, a number of states, including New York, have erected additional barriers to the locational approach to avoiding state income tax. Second, Duchin and Sosyura (2021) define a "long-distance CEO" as one who commutes at least 50 miles each way to corporate headquarters and does not own a residence within 50 miles of headquarters. Duchin and Sosyura (2021) report that the percentage of CEO-firm-years with such a commuter CEO is 1.82%, which likely represents an upper bound on the proportion of CEOs who preemptively avoid a state tax increase in their work state. Third, we find in our sample

that in 99.3% of CEO-year cases the CEO owns a residence located in the same state as the corporate headquarters.

We conclude that our coefficient estimates on the effect of state personal income tax changes on CEO pay are unlikely to be attenuated by the presence in the sample of a significant number of CEOs avoiding taxes by way of prior locational choices.[20]

8.3. Components of Pay

Figure A4 (Appendix 2) tracks the components of CEO compensation over time, with stock pay becoming the largest component starting 2006. To supplement the results in Table 2 on total CEO compensation, we investigate the response of the components of CEO compensation to large changes in state personal income tax rates. We estimate variants of equation (1) for the individual components of pay (annual salary and bonus, long-term cash bonus, stock, options).

Including controls and CEO-firm and industry-year fixed effects, both long-term incentive plan (NonEqIncent) cash pay (Table A8, column 3) and stock pay (column 4) increase significantly two years following a large increase in the personal income tax rate. Relative to the base (spotless) control sample, two years after a large tax increase NonEqIncent increases by 10.9% (12.2%) and GDFV stock pay increases by 6.6% (6.0%). In contrast, the coefficients for yearly salary, annual bonus, GDFV of options awards, and perquisites on a state income tax increase are negligible.[21]

8.4. Cleansing the Sample of State-level Corporate Income Taxes and Recession Years

During our sample period, there were some large shocks to state-level corporate income tax rates, which could influence corporate decisions, including executive compensation. Thus, we

[20] Appendix 3 contains a more detailed discussion of whether preemptive tax avoidance attenuates the estimates. Therein we also address CEO departure, retention, and subsequent firm performance

[21] Further examination of the data suggests that the increase in stock awards is not "replacement grants".

exclude firms headquartered in states with large shocks (no less than one percentage point) to state-level corporate income tax rates in any year of the sample. The DiD regression results remain robust for both tax increases and tax decreases (see Table A9, Appendix 2). The Table 2 results also are robust to dropping Covid and other recession years (Table A10, Appendix 2).

9. Conclusion

Depending on the empirical specification, the firm pays nearly all or more than all of the increase in the CEO's state personal income taxes. The estimates are consistent with a demand curve for managerial input that is highly inelastic compared to the supply curve. The extensive margin for CEO labor supply, driven by outside employment options in low-tax domiciles, appears to confer substantial market power to CEOs. In stark contrast we find that income tax rate decreases have minimal effects on CEO pay. The effects on CEO pay of tax increases and decreases are decidedly asymmetric.

With triangulating empirical models, we quantify the degree to which (1) labor market forces, on the one hand, and (2) agency problems, governance, and rent seeking, on the other, shape the way that CEO pay responds to shocks to state and federal personal income tax rates. Evidence that highlights labor market forces includes:

- a relatively elastic CEO supply curve, presumably on the extensive margin, relative to the firm demand curve;
- a small US federal elasticity, which likely reflects the absence of outside options in the US for US CEOs;
- the pay increase is larger when there are more CEO positions in the same industry and when the CEO is not the founder of the firm; and
- the pay increase is larger when the firm has higher margins and higher market-to-book ratios.

Evidence pertaining to agency costs, governance issues, and rent extraction includes:

- the increase in CEO pay more than fully compensates the CEO for the increase in state tax rate;
- the lack of a decline in CEO and NEO pay growth when the state personal income tax declines;
- similar results for CEOs for declines in the US federal personal income tax rate and for international CEOs when the national income tax rate declines;
- the pay increase in response to a state personal income tax increase is larger when corporate governance, measured by board independence and the E-index, is weaker; and
- non-CEO NEOs, who likely have outside options like those of CEOs but less ability to extract rents, receive smaller pay increases than CEOs when there is a state tax increase.

That international CEO pay increases with increases in the national personal income tax rate is consistent with both (1) and (2).

A question we are unable to address without more data is the incidence at the firm level of the changes in CEO pay. To know the extent to which the cost to the firm is spread across shareholders, bondholders, employees, other factors of production, customers, or suppliers would require additional data. We leave this issue for future research.

Our analysis has implications for policy. For example, there are recent calls at the state and federal level to increase income tax rates for high earners, such as CEOs and other NEOs. Our results highlight the fact that whether changing income tax rates would reduce the inequalities in earnings between top executives and the median or rank-and-file worker depends on the elasticities of firm demand and supply for each type of employee.

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Figure 1. Large State Personal Income Tax Rate Shocks Over Time

This figure shows the yearly number of large increases and decreases in state-level personal income tax rates between 1992 and 2022, where the large changes are those exceeding one percentage point for earners in the top tax bracket. The blue (orange) bars are for increases (decreases) in tax rates.

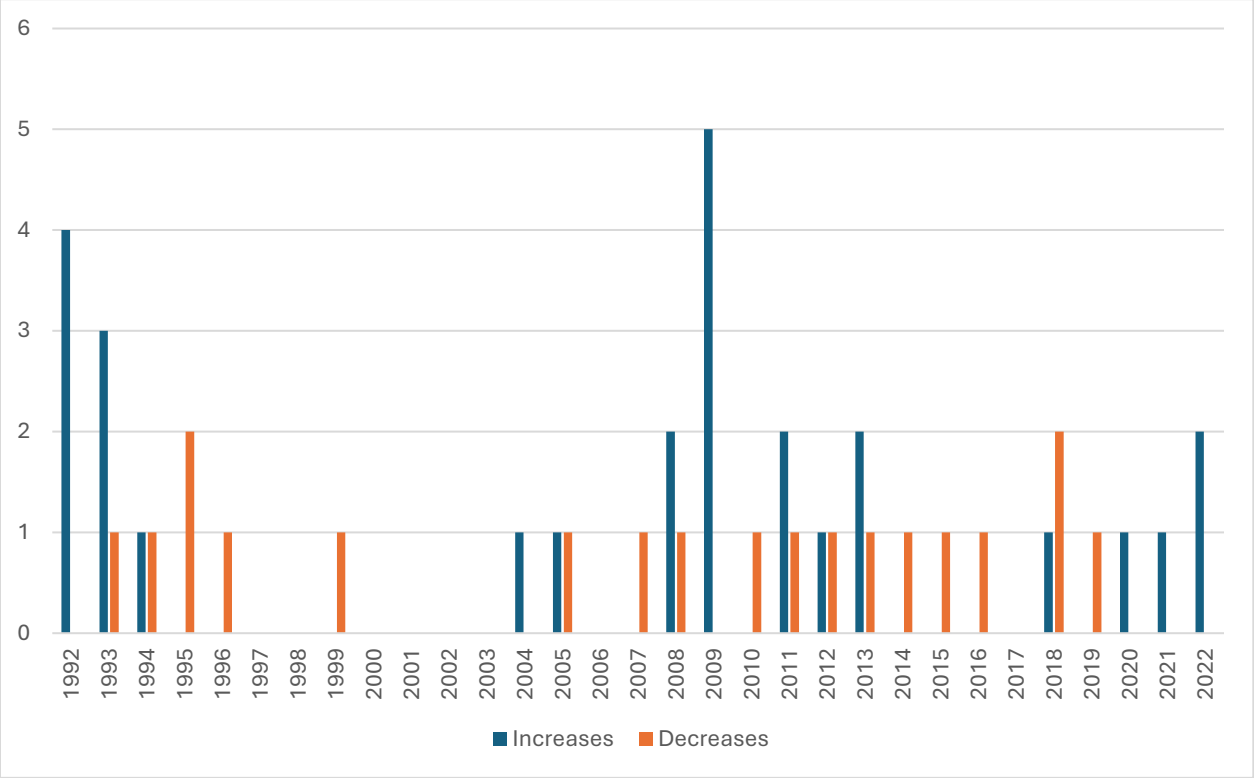
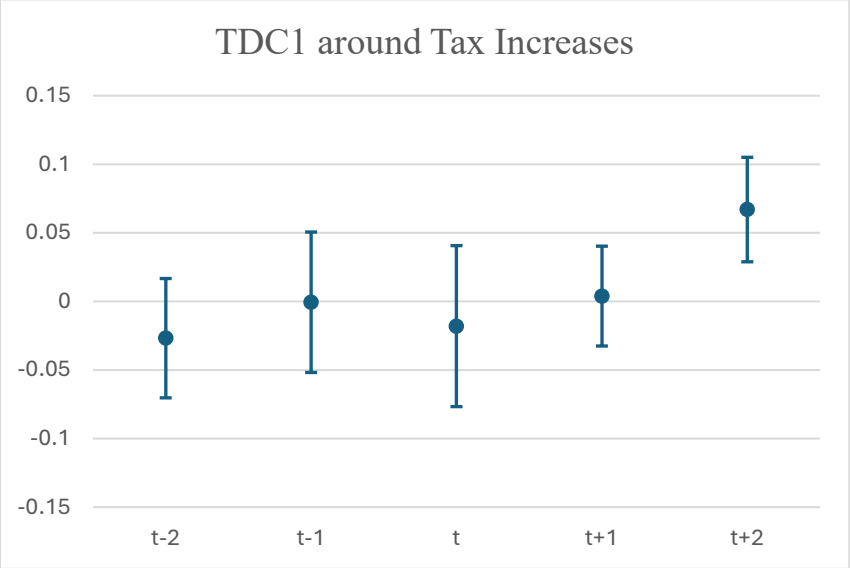


Figure 2. Differences in CEO Pay Changes Between Treated and Control Groups in Years Around Tax Changes

This figure shows the differences in CEO pay changes between the treated group and control group around tax changes. The treated group includes CEOs in firms headquartered in states experiencing large personal income tax rate changes (greater than one percentage point). The control group includes CEOs in firms headquartered in states without personal income tax changes. Panel A (B) is for tax increases (decreases). The x-axis shows the year relative to an event year (as year t). The y-axis shows the difference in CEO pay changes [Δln(TDC1), to be used as the dependent variable in DiD analysis]. The dots represent the average yearly differences in Δln(TDC1) between treated and control groups. The bars show the 90% confidence intervals.

Panel A. Tax increases



Panel B. Tax decreases

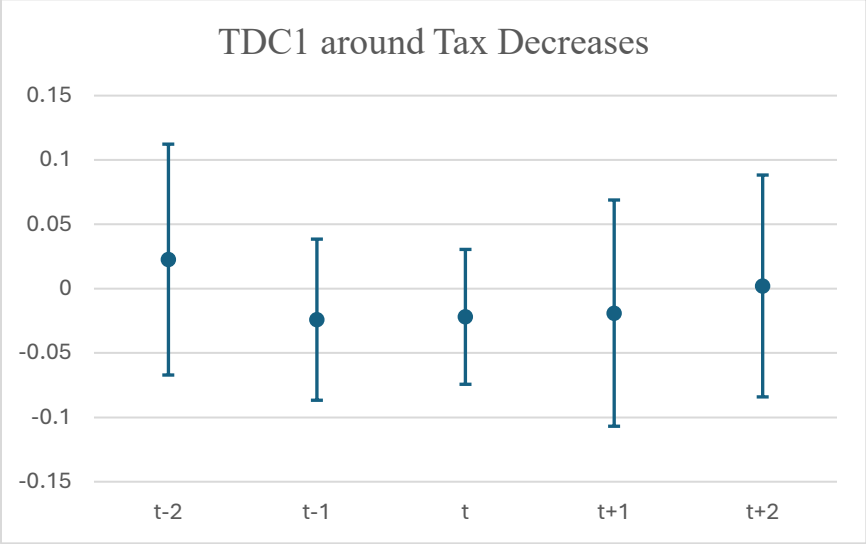


Table 1. Summary Statistics

This table presents summary statistics for US data for state tax shocks (Panels A and B) and international data on national tax shocks (Panel C). Panel A displays changes in the top personal income tax rates at the state and federal levels. Panel B provides summary statistics for the US at the level of CEO-firm-year on compensation, personal income tax rate changes and firm characteristics. The US sample consists of firms in the intersection of Execucomp and Compustat for the years 1992 – 2022 inclusive. The compensation-related variables are in thousands of US dollars. Assets are in millions of dollars. The international data sample is based on national tax shocks for 21 countries (including US) for the years 2011– 2022 (Panel C). Variables (except dummy variables) are winsorized at the 1st and 99th percentile values. Variable definitions are in Appendix 1.

Panel A: Top State and US Federal Personal Income Tax Rate Changes

	US STATE Mean | Count		
	Mean Increase	Mean Decrease	Both
Large	1.95% | 27	-1.60% | 19	NA | 46
Small	0.22% | 89	-0.22% | 236	NA | 325
Total	0.62% | 116	-0.32% | 255	NA | 371

	US FEDERAL Mean | Count		
	Mean Increase	Mean Decrease	Both
Large	6.60% | 2	-3.10% | 2	NA | 4
Small	NA	-0.50% | 2	NA | 2
Total	6.60% | 2	-1.80% | 4	NA | 6

Panel B: CEO-Firm-Year Summary Statistics, US Sample

Variable	Mean	SD	p25	p50	p75	N
CEO-Firm-Year						
Large State Tax Increase (0, 1)	0.026	0.160	0	0	0	22,291
Large State Tax Decrease (0, 1)	0.013	0.114	0	0	0	22,291
Small State Tax Increase (0, 1)	0.051	0.219	0	0	0	22,291
Small State Tax Decrease (0, 1)	0.135	0.342	0	0	0	22,291
Total Pay (TDC1) ($1,000s)	5,879	6,070	1,836	3,925	7,611	22,291
Salary ($1,000s)	769	357	501	725	990	22,291
Bonus ($1,000s)	335	732	0	0	374	22,291
Noneq Incentives ($1,000s)	837	1,363	0	198	1,162	22,291
Stock Pay ($1,000s)	1,971	3,155	0	558	2,673	22,291
Option Pay ($1,000s)	1,609	3,004	0	540	1,838	22,291
Perquisites ($1,000s)	237	665	13	52	180	22,291
Firm-Year						
Assets ($1,000,000s)	6,489	19,635	552	1,477	4,531	22,291
MTB	2.189	1.468	1.279	1.711	2.536	22,291
ROA	0.047	0.104	0.021	0.057	0.095	22,291

Panel C: CEO-Firm-Year Summary Statistics, International Sample

Variable	Mean	SD	p25	p50	p75	N
CEO-Firm-Year						
Large National Tax Increase (0, 1)	0.080	0.271	0	0	0	6,884
Large National Tax Decrease (0, 1)	0.077	0.267	0	0	0	6,884
Total Pay (TDC1) ($1,000s)	5,953	3,919	2,874	5,185	8,373	6,884
Salary ($1,000s)	878	368	630	862	1,056	6,883
Bonus ($1,000s)	98	395	0	0	0	6,368
Noneq Incentives ($1,000s)	1,152	1,248	235	840	1,657	6,360
Stock Pay ($1,000s)	2,831	2,742	687	2,035	4,218	6,360
Option Pay ($1,000s)	788	1,313	0	0	1179	6,360
Perquisites ($1,000s)	227	610	18	61	186	6,360
Firm-Year						
Assets ($1,000,000s)	9,807	29,152	824	2335	7,353	6,884
MTB	2.144	1.515	1.242	1.657	2.454	6,884
ROA	0.045	0.098	0.017	0.051	0.088	6,884

Table 2. CEO Compensation Responsiveness to State Personal Income Tax Changes (DiD)

This table shows the effects of changes in personal US state income tax rates on CEO compensation. *Tax Increase* (*Decrease*) is a dummy variable that equals one if a CEO's state personal income tax rate increases (decreases) by at least one percentage point in a year and zero otherwise. TDC1 is total pay from the Execucomp database. The dependent variable is Δln(TDC1) and the control variables are transformed Assets, MTB, and ROA, Δ denotes difference, and Ln(.) is the natural logarithm. All specifications include CEO-Firm and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Variables are defined in Appendix 1. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Base Control Sample			Spotless Control Sample		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable	ΔLn(TDC1)			ΔLn(TDC1)		
Tax Increase$_{t-1}$	0.008		0.008	0.013		0.012
	[0.41]		[0.41]	[0.61]		[0.60]
Tax Increase$_{t-2}$	0.064***		0.066***	0.072***		0.074***
	[3.75]		[3.89]	[4.76]		[5.13]
Tax Decrease$_{t-1}$		-0.011	-0.014		-0.013	-0.016
		[-0.32]	[-0.43]		[-0.28]	[-0.37]
Tax Decrease$_{t-2}$		0.016	0.021		0.013	0.020
		[0.44]	[0.58]		[0.31]	[0.47]
ΔLn(Assets)	0.328***	0.327***	0.328***	0.336***	0.335***	0.336***
	[12.35]	[12.34]	[12.29]	[10.63]	[10.55]	[10.54]
ΔMTB	0.074***	0.074***	0.074***	0.072***	0.072***	0.072***
	[9.61]	[9.55]	[9.59]	[8.58]	[8.52]	[8.53]
ΔROA	0.392***	0.394***	0.392***	0.303***	0.304***	0.303***
	[5.88]	[5.88]	[5.89]	[5.37]	[5.38]	[5.39]
Observations	22,291	22,291	22,291	15,563	15,563	15,563
R-squared	0.196	0.196	0.196	0.212	0.212	0.212
CEO-Firm FE	Y	Y	Y	Y	Y	Y
Industry-Year FE	Y	Y	Y	Y	Y	Y

Table 3. Stacked DiD: CEO Compensation Responsiveness to State Personal Income Tax Changes

This table shows the effects of changes in personal US state income tax rates on CEO compensation, using a stacked DiD approach (Cengiz et.al., 2019). For each large tax increase or decrease (at least 1%), a [-2, +2] stack window is used. States with any large changes (increases or decreases) at any point within a stack window are excluded (for example, if a state has large tax changes in both 2010 and 2012, both shocks are excluded from the test sample). CEOs of firms headquartered in states with large changes are in the treatment group. The remaining CEOs are in the control group. For each stack, Tax Increase (Decrease) is a dummy variable that equals one if a CEO's state personal income tax rate increases (decreases) by at least one percentage point at the central year of the stack, and zero otherwise. $Post_1$ ($Post_2$) is an indicator variable for the first (second) year following a large tax shock. TDC1 is total pay from Execucomp. The dependent variable is Δln(TDC1) and the control variables are transformed Assets, MTB, and ROA, Δ denotes difference, and Ln(.) is the natural logarithm. All specifications include CEO-Firm and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Variables are defined in Appendix 1. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1) ΔLn(TDC1)	(2) ΔLn(TDC1)
Tax Increase x $Post_1$	-0.010	
	[-0.30]	
Tax Increase x $Post_2$	0.073***	
	[4.11]	
Tax Decrease x $Post_1$		-0.015
		[-0.29]
Tax Decrease x $Post_2$		0.017
		[0.55]
ΔLn(Assets)	0.279***	0.263***
	[6.17]	[8.47]
ΔMTB	0.107***	0.084***
	[7.93]	[7.58]
ΔROA	0.516***	0.444***
	[4.69]	[4.51]
Observations	22,609	34,394
R-squared	0.271	0.272
CEO-Firm FE	Y	Y
Industry-Year FE	Y	Y

Table 4. Elasticity of US CEO Compensation in the US Inverse Net-of-Tax Rate

This table shows the elasticity of US CEO compensation in the net-of-personal-income-tax rate. The dependent variable is transformed CEO total compensation, Δln(TDC1), control variables include Assets, MTB, and ROA, Δ denotes difference, Ln(.) is the natural logarithm, and NOT_t is the after-tax multiple for pay $(1-\tau_{m,f,t}-\tau_{m,s,t})$ for CEO m in year t (f (s) denotes federal (state)). In columns 1 and 2 we consider large tax rate changes only (at least one percentage point) and so set $NOT_{t-s}/NOT_{t-(s-1)}$ = 1 for all CEO-year observations when the tax rate change is less than one percentage point. In column 3 the calculation of NOT_t considers all tax changes of any size. All specifications include CEO-Firm and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Appendix 1 provides variable definitions. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
	Large (≥1%) State Tax Changes		All State Tax Changes
Variables	ΔLn(TDC1)		ΔLn(TDC1)
Ln(NOT_{t-2}/ NOT_{t-1})	0.041	0.096	0.315
	[0.08]	[0.20]	[0.75]
Ln(NOT_{t-3}/ NOT_{t-2})	0.906**	0.730**	0.405
	[2.30]	[2.01]	[1.20]
ΔLn(Assets)		0.327***	0.327***
		[12.42]	[12.41]
ΔMTB		0.074***	0.074***
		[9.55]	[9.57]
ΔROA		0.393***	0.393***
		[5.87]	[5.87]
Observations	22,575	22,291	22,291
R-squared	0.177	0.196	0.196
CEO-Firm FE	Y	Y	Y
Industry-Year FE	Y	Y	Y

Table 5. Elasticity of US CEO Compensation in the US Inverse Net-of-Tax Rate, Adjusted for SALT

This table reports the robustness tests for the elasticity of US CEO compensation in the net-of-personal-income-tax rate, accounting for changes in federal tax rules governing the deductibility of State and Local Taxes (SALT). The dependent variable is transformed CEO total compensation, Δln(TDC1), and control variables include Assets, MTB, and ROA. Δ denotes difference and Ln(.) is the natural logarithm. NOT_t is the after-tax multiple for pay, which equals to $(1-\tau_{m,f,t})(1-\tau_{m,s,t})$ in or before 2017 and $(1-\tau_{m,f,t}-\tau_{m,s,t})$ in years after 2017 for CEO m in year t (f (s) denotes federal (state)). We consider large tax rate changes only (at least one percentage point) and so set $NOT_{t-s}/NOT_{t-(s-1)} = 1$ for all CEO-year observations when the tax rate change is less than one percentage point. All specifications include CEO-Firm and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Appendix 1 provides variable definitions. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1) ΔLn(TDC1)	(2) ΔLn(TDC1)
Ln(NOT_{t-2}/NOT_{t-1})	-0.102	-0.227
	[-0.21]	[-0.49]
Ln(NOT_{t-3}/NOT_{t-2})	1.159***	0.835**
	[3.07]	[1.98]
ΔLn(Assets)		0.327***
		[12.40]
ΔMTB		0.074***
		[9.55]
ΔROA		0.393***
		[5.88]
Observations	22,575	22,291
R-squared	0.177	0.196
CEO-Firm FE	Y	Y
Industry-Year FE	Y	Y

Table 6. Elasticity of US CEO Compensation in the Federal Net-of-Tax Rate

This table shows the elasticity of US CEO compensation in the net-of-personal-income-tax rate following the framework by Frydman and Molloy (2011). The dependent variable is transformed CEO total compensation, Δln(TDC1), control variables include Assets, MTB, and ROA, Δ denotes difference, Ln(.) is the natural logarithm, and NOT_t is the after-tax multiple for pay $(1 - \tau_{m,f,t})$ for CEO m in year t (f denotes federal). Columns 1 and 2 do not include fixed effects. Columns 3 and 4 include firm and year fixed effects. Robust standard errors are clustered at the state level. Appendix 1 provides variable definitions. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	US Federal Tax Changes Only			
Variables	ΔLn(TDC1)			
Ln(NOT_{t-2}/ NOT_{t-1})	-0.231	-0.238	-0.047	-0.076
	[-1.43]	[-1.47]	[-0.07]	[-0.12]
Ln(Initial Pay)		-0.002		0.016**
		[-0.53]		[2.11]
ΔLn(Assets)	0.375***	0.373***	0.346***	0.347***
	[16.82]	[16.63]	[16.92]	[16.95]
ΔMTB	0.073***	0.073***	0.075***	0.075***
	[11.74]	[11.73]	[14.36]	[14.42]
ΔROA	0.428***	0.428***	0.392***	0.390***
	[8.80]	[8.79]	[9.38]	[9.32]
Observations	23,384	23,382	23,187	23,185
R-squared	0.035	0.035	0.090	0.090
Firm FE	N	N	Y	Y
Year FE	N	N	Y	Y

Table 7. Supply and Demand, Relative Bargaining Power, and CEO Compensation

This table shows triangulating estimates of the effects of tax increases on CEO compensation. *Non Founder* is a dummy variable equal to one if a CEO is not a firm founder, and zero otherwise. *High # Firms in Ind* is a dummy variable equal to one if the number of firms in its industry is above median in a year, and zero otherwise. *High Margin* is a dummy variable equal to one if a firm's profit margin is above median in a year, and zero otherwise, where the profit margin is defined as (Sale – COGS)/Sale and industry is classified at the two-digit SIC level. *High MTB* is a dummy variable equal to one if a firm's market-to-book ratio (MTB) is above median in a year, and zero otherwise. *Tax Increase* is a dummy variable that equals one if a CEO's state personal income tax rate increases by at least one percentage point in a year and zero otherwise. The dependent variable is Δln(TDC1). The control variables are transformed Assets, MTB, and ROA, Δ denotes difference, and Ln(.) is the natural logarithm. All specifications include CEO-Firm fixed effects and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Variables are defined in the Appendix. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1)	(2)	(3)	(4)
	ΔLn(TDC1)			
	Non-Founder	# Firms in Industry	Profit Margin	MTB
Tax Increase$_{t-2}$	-0.056	0.017	0.028	0.017
	[-1.49]	[0.62]	[0.90]	[0.47]
Tax Increase$_{t-2}$ x Non Founder	0.146***			
	[3.70]			
Tax Increase$_{t-2}$ x High # Firms in Ind		0.089**		
		[2.49]		
Tax Increase$_{t-2}$ x High Margin			0.070*	
			[1.69]	
Tax Increase$_{t-2}$ x High MTB				0.088*
				[1.90]
ΔLn(Assets)	0.337***	0.327***	0.328***	0.323***
	[12.25]	[12.51]	[12.42]	[12.50]
ΔMTB	0.073***	0.073***	0.074***	0.071***
	[9.35]	[9.49]	[9.62]	[8.61]
ΔROA	0.386***	0.373***	0.393***	0.385***
	[5.68]	[5.66]	[5.89]	[5.60]
Observations	21,708	22,291	22,291	22,291
R-squared	0.198	0.197	0.196	0.197
CEO-Firm FE	Y	Y	Y	Y
Industry-Year FE	Y	Y	Y	Y

Table 8. Agency/Governance Concerns and CEO Compensation

This table shows the role of governance in the effects of tax increases on CEO compensation. *High E Index* is a dummy variable equal to one if a firm's E Index is above median in a year, and zero otherwise. *Low BoD Indep* is a dummy variable equal to one if board independence is below median in a year, and zero otherwise. *Tax Increase* is a dummy variable that equals one if a CEO's state personal income tax rate increases by at least one percentage point in a year and zero otherwise. The dependent variable is Δln(TDC1). The control variables are transformed Assets, MTB, and ROA, Δ denotes difference, and Ln(.) is the natural logarithm. All specifications include CEO-Firm fixed effects and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Variables are defined in the Appendix. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1)	(2)
	ΔLn(TDC1)	
	E Index	Board Independence
Tax Increase$_{t-2}$	-0.018	0.016
	[-0.97]	[0.59]
Tax Increase$_{t-2}$ x High E Index	0.108***	
	[3.02]	
Tax Increase$_{t-2}$ x Low BoD Indep		0.067**
		[1.97]
ΔLn(Assets)	0.309***	0.288***
	[10.02]	[7.28]
ΔMTB	0.072***	0.075***
	[8.71]	[8.01]
ΔROA	0.463***	0.471***
	[6.30]	[7.57]
Observations	16,665	15,226
R-squared	0.210	0.216
CEO-Firm FE	Y	Y
Industry-Year FE	Y	Y

Table 9. NEO (Non-CEO) Compensation Responsiveness to Personal Income Tax Changes

This table shows the effects of changes in US state personal income tax rates on non-CEO named executive officer (NEO) total compensation. *Tax Increase* (*Decrease*) is a dummy variable that equals one if a NEO's state personal income tax rate increases (decreases) by at least one percentage point in a year and zero otherwise. TDC1 is total pay from Execucomp. The dependent variable is Δln(TDC1), the control variables are transformations of Assets, MTB, and ROA, Δ denotes difference, and Ln(.) is the natural logarithm. All specifications include NEO-Firm and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Variables are defined in Appendix 1. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
VARIABLES		ΔLn(TDC1)	
Tax Increase$_{t-1}$	-0.023		-0.022
	[-1.16]		[-1.07]
Tax Increase$_{t-2}$	0.024		0.025*
	[1.52]		[1.73]
Tax Decrease$_{t-1}$		0.003	-0.001
		[0.08]	[-0.03]
Tax Decrease$_{t-2}$		0.032	0.032
		[0.67]	[0.69]
ΔLn(Assets)	0.250***	0.250***	0.250***
	[11.51]	[11.40]	[11.38]
ΔMTB	0.063***	0.063***	0.063***
	[8.69]	[8.73]	[8.72]
ΔROA	0.335***	0.336***	0.335***
	[3.79]	[3.81]	[3.79]
Observations	75,934	75,934	75,934
R-squared	0.212	0.212	0.212
NEO-Firm FE	Y	Y	Y
Industry-Year FE	Y	Y	Y

Table 10. CEO Compensation and *International* National Personal Income Tax Changes: DiD Analysis

This table shows the effects of changes in national personal income tax rates on CEO compensation. *Tax Increase* (*Decrease*) is a dummy variable that equals one if a CEO's national personal income tax rate increases (decreases) by at least one percentage point in a year and zero otherwise. The dependent variable is ΔLn(TDC1) from Execucomp (US) or a transformed component of CEO compensation from Incentive Lab Europe, the control variables are transformed Assets, MTB, and ROA, Δ denotes difference, and Ln(.) is the natural logarithm. All specifications include CEO-Firm and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Variables are defined in Appendix 1. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
VARIABLES		ΔLn(TDC1)	
Tax Increase$_{t-1}$	0.003		0.004
	[0.08]		[0.09]
Tax Increase$_{t-2}$	0.085**		0.083**
	[2.13]		[2.14]
Tax Decrease$_{t-1}$		0.015	0.020
		[0.42]	[0.56]
Tax Decrease$_{t-2}$		-0.043	-0.036
		[-1.45]	[-1.14]
ΔLn(Assets)	0.221***	0.221***	0.222***
	[7.63]	[7.75]	[7.66]
ΔMTB	0.040***	0.040***	0.039***
	[13.06]	[12.10]	[11.95]
ΔROA	0.252***	0.252***	0.251***
	[7.12]	[7.18]	[7.17]
Observations	7,358	7,358	7,358
R-squared	0.200	0.199	0.200
CEO-Firm FE	Y	Y	Y
Industry-Year FE	Y	Y	Y

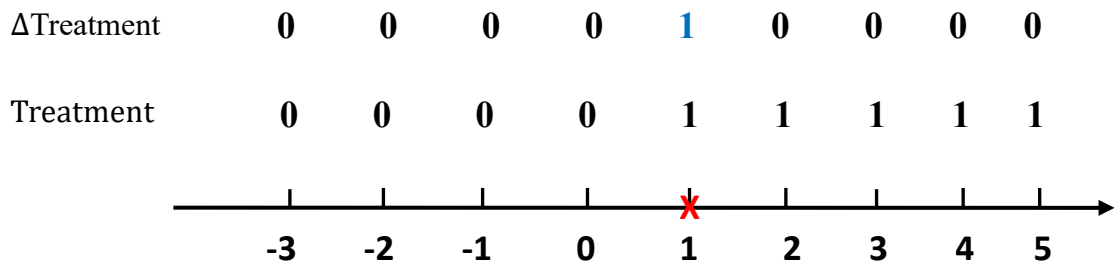
Appendix 1: Variable Definitions

Assets	total book value of assets
Bonus	CEO discretionary bonus
Democrat Gov	dummy variable equal to one if the state had a democratic governor in a particular year, zero otherwise
NonEqIncent	value of a CEO's cash performance pay in a given year
NOT	$NOT_t \equiv (1 - \tau_{f,t} - \tau_{s,t})$ means "net of tax" rate, where $\tau_{f,t}$ ($\tau_{s,t}$) is the top marginal federal (state) tax rate at time *t*
Options	value of a CEO's options awards in a given year
Population	the total state population within a specific year
MTB	market value of equity plus book value of debt divided by the sum of the book values of debt and equity
ROA	net income scaled by total assets
SCash	the total cash of a given state in a specific year
SDebt	the total debt of a given state in a specific year
State GDP	the gross domestic product within a state-year
Stock	value of a CEO's stock awards in a given year
Tax Increase	a dummy variable equal to one if a CEO experienced a personal income tax rate increase (in some instances only if the tax rate increase is at least as large as one percentage point), and zero otherwise
Tax Decrease	a dummy variable equal to one if a CEO experienced a personal income tax rate decrease (in some instances only if the tax rate decrease is at least as large as one percentage point), and zero otherwise
Tax Revenue	total tax revenue within a state-year
TDC1	total CEO compensation in a given year
Unemployment	the percentage of workers that are unemployed within a state-year

Appendix 2: Supplemental Figures and Tables

Figure A1. The First-difference Setting of the DiD Analysis

This figure illustrates the correspondence of the level of treatment dummy and the first difference in the treatment dummy. The upper (lower) panel shows the event study based on a single (two) event(s) as indicated by the red cross(es) on the time axis. *Treatment* is the treatment dummy (counter) variable that equals one (the number of treatments) after the corresponding shock(s). *ΔTreatment* is the first difference in *Treatment* and indicates an appearance of a new shock.



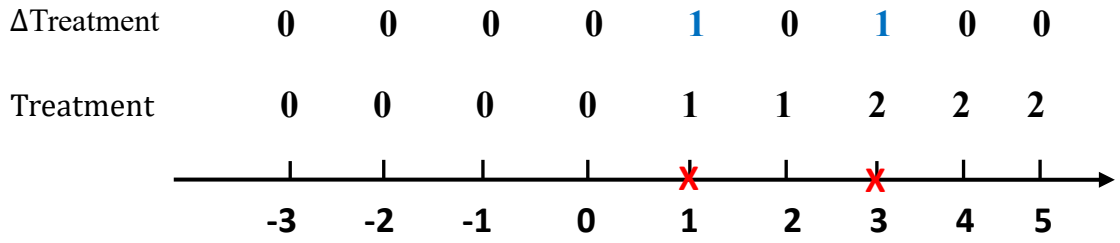
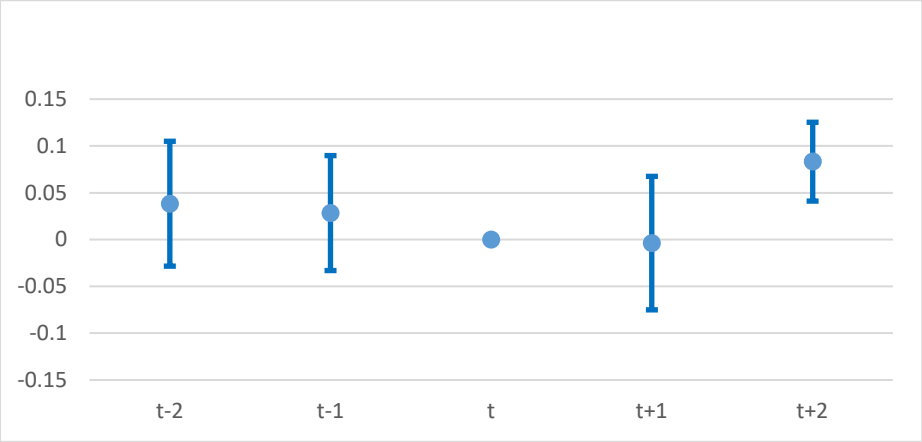


Figure A2. Pre-trends for Stacked DiD Analysis: Personal Income Tax Shocks and CEO Compensation

This figure illustrates the effect of US state personal income tax rates on CEO compensation. Using a stacked DiD approach, ΔLn(TDC1) is regressed on yearly indicator variables (relative to the year of a tax shock), and CEO-firm and industry-year fixed effects included. The y-axis plots the coefficient estimates on each yearly indicator variable. The x-axis shows the year relative to the shock to state personal income tax rates. Year *t* is the benchmark year. The sample is at the CEO-firm-year level. Treated firms are those headquartered in states with large changes in personal income tax rates (at least 1%), and control firms are those headquartered in remaining states. The error bars illustrate the 90% confidence intervals of the coefficient estimates. The confidence intervals are based on standard errors clustered at the state level.

Panel A. Tax Increases



Panel B. Tax Decreases

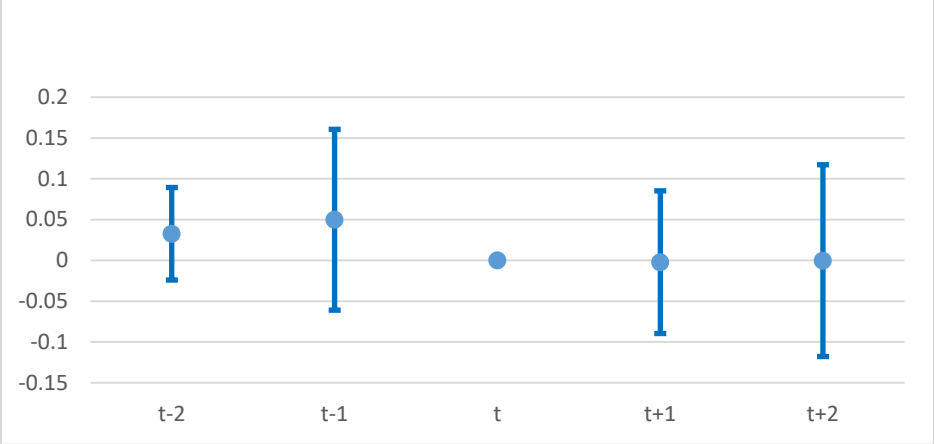


Figure A3. Examples for Neighbor States Without Tax Shocks

This figure shows examples for neighboring control states for treated states with tax increases or increases. For example, North Dakota (ND) had a tax increase [in Red]; Montana (MT) and South Dakota (SD) are neighbors without shocks [in Yellow]; Minnesota (MN) had a tax increase, so is not designated as a neighbor control state. In our sample, in total we have 15 (14) unique states with large tax increases (decreases) and correspondingly have 20 (21) unique neighboring control states without tax shocks.

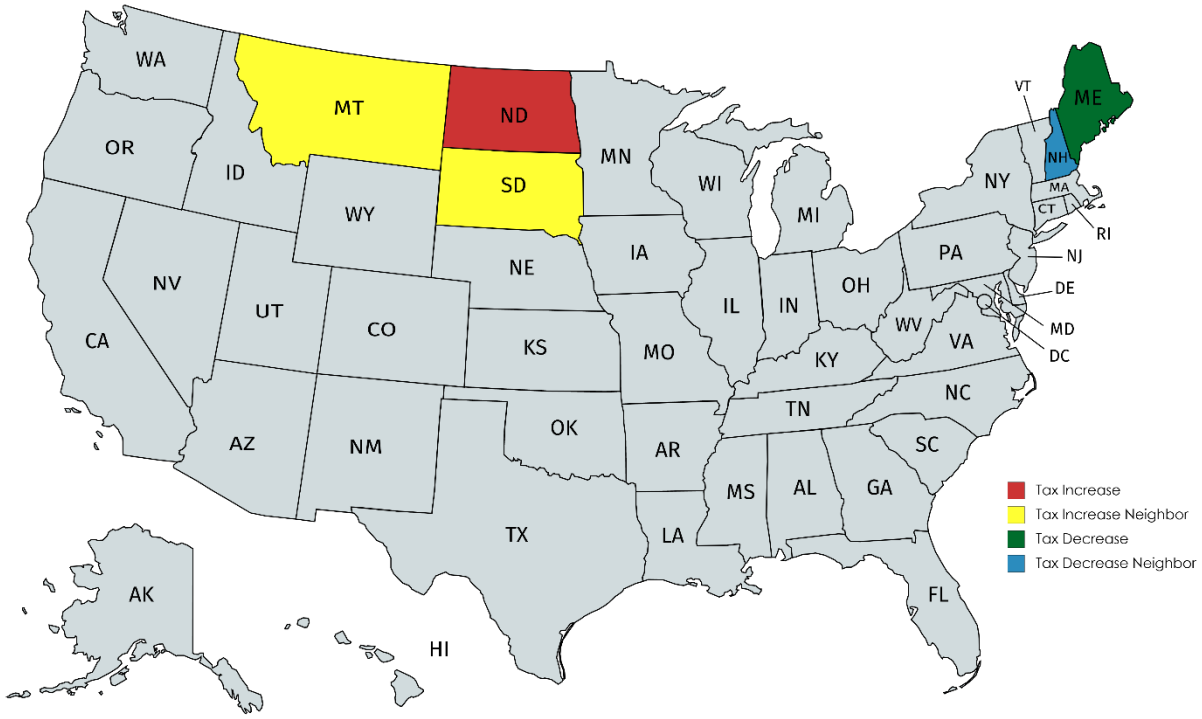


Figure A4. Components of CEO Compensation

This figure illustrates the yearly average values of the components of CEO compensation between 1992 and 2022 inclusive. The components include salary, bonus, non-equity incentives, stock, and options in thousands of US dollars. The data are from Execucomp.

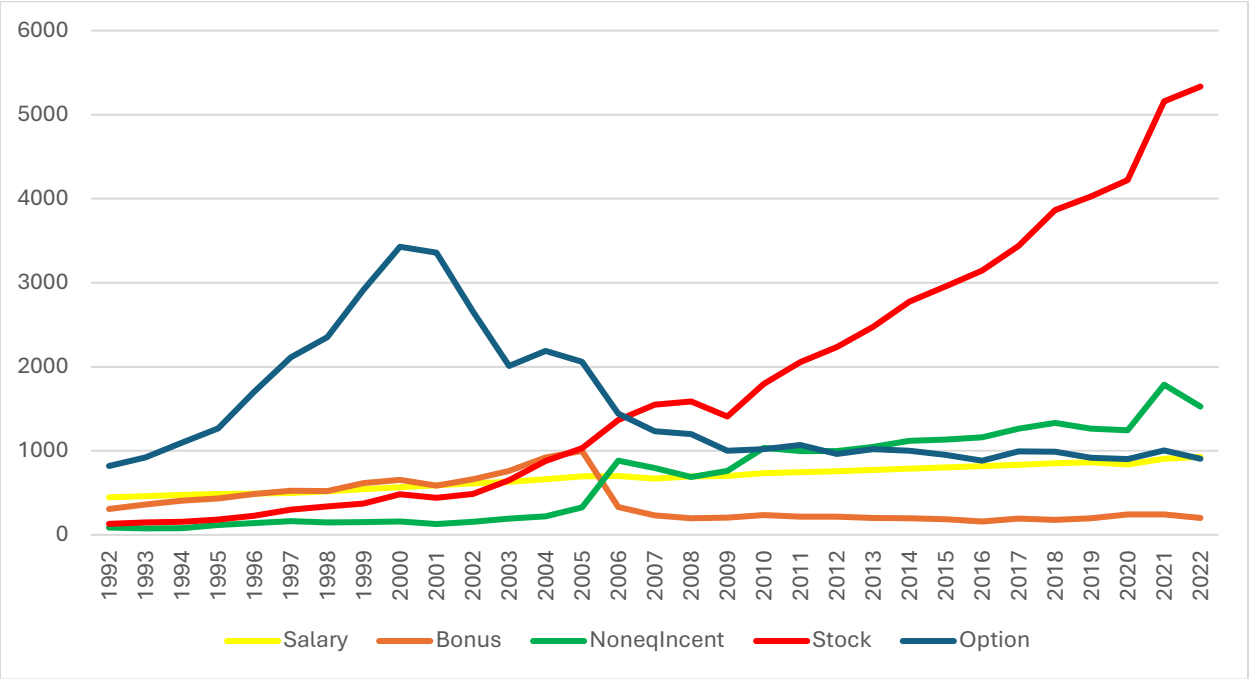


Table A1. Do CEO Pay Changes Precede State Personal Income Tax Rate Changes

This table shows the relationship between US state personal income tax rate changes and prior CEO pay changes. Tax Increase (Decrease) is a dummy variable, which equals one if a state experiences an increase (decrease) in personal income tax rate greater than one percentage point in a year and zero otherwise. The CEO pay growth (ΔCEO pay) is the average change in firm-level CEO pay within a state-year. The test sample is at the state-year level. We use the linear probability model. State-level controls include transformed debt, state GDP, tax revenues, cash savings, population, democrat government indicator, and unemployment rate. Δ denotes the first difference. All specifications include state fixed effects and year fixed effects. State financial data is from the Urban Institute. The sample period is 1997 to 2021. Robust standard errors are clustered at the state level. Appendix 1 provides variable definitions. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
VARIABLES	Tax Increase	Tax Decrease
ΔCEO pay$_{t-1}$	0.024	-0.019
	[1.36]	[-1.17]
ΔCEO pay$_{t-2}$	-0.008	-0.031
	[-0.73]	[-1.63]
ΔLn(State GDP)	0.188	-0.096
	[1.22]	[-0.83]
ΔLn(Population)	0.003	-0.201
	[0.01]	[-0.58]
ΔDemocrat Gov	0.014	-0.028*
	[1.03]	[-1.71]
ΔUnemployment	0.003	-0.050
	[0.10]	[-1.38]
ΔLn(SDebt)	0.025	0.056
	[0.52]	[1.31]
ΔLn(Tax Revenue)	-0.088	0.015
	[-1.64]	[0.77]
ΔLn(SCash)	-0.031	0.022
	[-1.36]	[0.77]
Observations	1,129	1,129
R-squared	0.114	0.066
State FE	Y	Y
Year FE	Y	Y

Table A2. CEO Pay and State Tax Shocks: A Narrative Approach

This table shows the effects of changes in personal income tax rates on CEO compensation. We define exogenous state tax shocks following the narrative approach by Romer and Romer (2010) and Giroud and Rauh (2019), and only these shocks are included in the test sample. Specifically, 38 (out of 46) large tax changes in our sample are identified as exogenous tax changes. *Tax Increase* (*Decrease*) is a dummy variable that equals one if a CEO's state personal income tax rate increases (decreases) by at least one percentage point in a year and zero otherwise. TDC1 is total pay from Execucomp. The dependent variable is Δln(TDC1) or a transformed component of CEO compensation, the control variables are transformed Assets, MTB, and ROA, Δ denotes difference, and Ln(.) is the natural logarithm. All specifications include CEO-Firm and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Variables are defined in Appendix 1. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Base Control Sample			Spotless Control Sample		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable	ΔLn(TDC1)			ΔLn(TDC1)		
Tax Increase$_{t-1}$	0.012		0.012	0.017		0.016
	[0.72]		[0.71]	[0.84]		[0.80]
Tax Increase$_{t-2}$	0.068***		0.069***	0.081***		0.083***
	[3.94]		[4.15]	[5.21]		[5.80]
Tax Decrease$_{t-1}$		-0.006	-0.008		-0.012	-0.014
		[-0.16]	[-0.24]		[-0.25]	[-0.32]
Tax Decrease$_{t-2}$		0.018	0.024		0.016	0.025
		[0.48]	[0.65]		[0.38]	[0.58]
ΔLn(Assets)	0.325***	0.327***	0.326***	0.333***	0.335***	0.333***
	[12.29]	[12.37]	[12.27]	[10.48]	[10.55]	[10.39]
ΔMTB	0.074***	0.074***	0.074***	0.072***	0.072***	0.072***
	[9.63]	[9.52]	[9.58]	[8.63]	[8.52]	[8.58]
ΔROA	0.393***	0.394***	0.394***	0.304***	0.304***	0.304***
	[5.92]	[5.87]	[5.92]	[5.49]	[5.36]	[5.48]
Observations	22,228	22,275	22,212	15,498	15,558	15,493
R-squared	0.196	0.196	0.196	0.212	0.212	0.212
CEO-Firm FE	Y	Y	Y	Y	Y	Y
Industry-Year FE	Y	Y	Y	Y	Y	Y

Table A3. CEO Pay and State Tax Shocks: Neighboring Control States

This table shows the effects of changes in US state personal income tax rates on CEO compensation using neighboring control states. *Tax Increase* (*Decrease*) is a dummy variable that equals one if a CEO's state personal income tax rate increases (decreases) by at least one percentage point in a year and zero otherwise. The left (right) panel reports the results using the base (spotless) control sample. Column 1 (4) includes tax-increase treated states and neighboring control states (that have never had a tax rate change). Column 2 (5) includes tax-decrease treated states and neighboring control states (that have never had a tax rate change). Column 3 (6) includes tax-increase treated states, tax-decrease treated states and neighboring control states to both tax-increase and tax-decrease states (that have never had a tax rate change). TDC1 is total pay from Execucomp. The dependent variable is Δln(TDC1). The control variables are transformed Assets, MTB, and ROA, Δ denotes difference, and Ln(.) is the natural logarithm. All specifications include CEO-Firm and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Variables are defined in Appendix 1. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Base Control Sample			Spotless Control Sample		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable	ΔLn(TDC1)			ΔLn(TDC1)		
Tax Increase$_{t-1}$	0.006		0.004	0.009		0.008
	[0.31]		[0.20]	[0.44]		[0.40]
Tax Increase$_{t-2}$	0.069***		0.064***	0.072***		0.073***
	[4.26]		[3.91]	[5.15]		[5.34]
Tax Decrease$_{t-1}$		-0.006	-0.008		-0.011	-0.014
		[-0.17]	[-0.26]		[-0.24]	[-0.33]
Tax Decrease$_{t-2}$		0.009	0.016		0.006	0.013
		[0.26]	[0.47]		[0.16]	[0.34]
ΔLn(Assets)	0.306***	0.317***	0.315***	0.320***	0.320***	0.321***
	[10.41]	[12.22]	[11.80]	[9.84]	[9.82]	[9.83]
ΔMTB	0.072***	0.073***	0.073***	0.071***	0.071***	0.071***
	[8.35]	[9.05]	[9.18]	[8.29]	[8.28]	[8.29]
ΔROA	0.316***	0.353***	0.355***	0.291***	0.293***	0.292***
	[5.85]	[5.81]	[5.87]	[4.97]	[4.99]	[4.99]
Observations	17,827	20,403	20,598	14,696	14,735	14,735
R-squared	0.207	0.202	0.201	0.215	0.215	0.215
CEO-Firm FE	Y	Y	Y	Y	Y	Y
Industry-Year FE	Y	Y	Y	Y	Y	Y

Table A4. Distance to State Border, Tax Increases, and CEO Compensation

This table shows the effects of changes in personal income tax rates on CEO compensation. *Tax Increase* is a dummy variable that equals one if a CEO's state personal income tax rate increases by at least one percentage point in a year and zero otherwise. *Miles to nearest state border* is the number of miles from a firm's address to its nearest neighbor state border. TDC1 is total pay from Execucomp. The dependent variable is Δln(TDC1). The control variables are transformed Assets, MTB, and ROA, Δ denotes difference, and Ln(.) is the natural logarithm. All specifications include CEO-Firm and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Variables are defined in Appendix 1. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1) Base Control Sample	(2) Spotless Control Sample
Dep. Variable	ΔLn(TDC1)	ΔLn(TDC1)
Tax Increase$_{t-1}$	0.013	0.022
	[0.65]	[0.96]
Tax Increase$_{t-2}$	0.062**	0.068**
	[2.00]	[2.31]
Tax Increase$_{t-2}$ × Miles to nearest border state	0.000	0.000
	[0.16]	[0.31]
ΔLn(Assets)	0.322***	0.329***
	[12.71]	[11.04]
ΔMTB	0.072***	0.069***
	[7.45]	[6.42]
ΔROA	0.370***	0.282***
	[5.35]	[4.83]
Observations	20,776	14,519
R-squared	0.198	0.214
CEO-Firm FE	Y	Y
Industry-Year FE	Y	Y

Table A5: Placebo Test

This table reports the results of placebo tests of the effect of US state personal income tax shocks on CEO pay. We randomly assign tax increases and decreases to CEOs, setting the mean of the increases and decreases equal to the actual sample mean at the CEO-year level, and regress ΔLn(TDC1) on the simulated tax shocks. *Tax Increase (Tax* Decrease) is a dummy variable that equals one if a CEO's allocated personal income tax rate increases (decreases) by at least one percentage point in a year and zero otherwise. The control variables are transformed Assets, MTB, and ROA, Δ denotes difference, and Ln(.) is the natural logarithm. All specifications include CEO-Firm and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Variables are defined in Appendix 1. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
VARIABLES	ΔLn(TDC1)	ΔLn(TDC1)	ΔLn(TDC1)
Tax Increase$_{t-1}$	-0.010		-0.009
	[-0.52]		[-0.50]
Tax Increase$_{t-2}$	0.008		0.008
	[0.25]		[0.26]
Tax Decrease$_{t-1}$		0.028	0.028
		[0.68]	[0.67]
Tax Decrease$_{t-2}$		0.017	0.017
		[0.39]	[0.39]
ΔLn(Assets)	0.327***	0.327***	0.327***
	[12.43]	[12.38]	[12.42]
ΔMTB	0.074***	0.074***	0.074***
	[9.56]	[9.55]	[9.53]
ΔROA	0.394***	0.394***	0.394***
	[5.87]	[5.88]	[5.87]
Observations	22,291	22,291	22,291
R-squared	0.196	0.196	0.196
CEO-Firm FE	Y	Y	Y
Industry-Year FE	Y	Y	Y

Table A6. Stacked DiD: CEO Pay and State Tax Shocks (A Narrative Approach)

This table shows the effects of changes in personal income tax rates on CEO compensation using a stacked DiD approach (Cengiz et.al., 2019). We define exogenous state tax shocks following the narrative approach by Romer and Romer (2010) and Giroud and Rauh (2019), and only these shocks are included in the test sample. For each large tax increase or decrease (at least 1%), a [-2, +2] stack window is used. States with any large changes (increases or decreases) at any point within a stack window are excluded (for example, if a state has large tax changes in both 2010 and 2012, both shocks are excluded from the test sample). CEOs of firms headquartered in states with large changes are in the treatment group. The remaining CEOs are in the control group. For each stack, Tax Increase (Decrease) is a dummy variable that equals one if a CEO's state personal income tax rate increases (decreases) by at least one percentage point at the central year of the stack, and zero otherwise. $Post_1$ ($Post_2$) is an indicator variable for the first (second) year following a large tax shock. TDC1 is total pay from Execucomp. The dependent variable is Δln(TDC1) and the control variables are transformed Assets, MTB, and ROA, Δ denotes difference, and Ln(.) is the natural logarithm. All specifications include CEO-Firm and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Variables are defined in Appendix 1. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
VARIABLES	ΔLn(TDC1)	ΔLn(TDC1)
Tax Increase x $Post_1$	0.001	
	[0.04]	
Tax Increase x $Post_2$	0.084***	
	[5.25]	
Tax Decrease x $Post_1$		0.004
		[0.08]
Tax Decrease x $Post_2$		0.005
		[0.13]
ΔLn(Assets)	0.276***	0.217***
	[6.03]	[6.90]
ΔMTB	0.107***	0.086***
	[7.88]	[5.84]
ΔROA	0.517***	0.419***
	[4.67]	[4.27]
Observations	22,491	27,044
R-squared	0.271	0.268
CEO-Firm FE	Y	Y
Industry-Year FE	Y	Y

Table A7. Stacked DiD: CEO Pay and State Tax Shocks Using Neighboring Control States

This table shows the effects of changes in personal income tax rates on CEO compensation using a stacked DiD approach (Cengiz et.al., 2019). Only neighboring control states are included in the test sample. For each large tax increase or decrease (at least 1%), a [-2, +2] stack window is used. States with any large changes (increases or decreases) at any point within a stack window are excluded (for example, if a state has large tax changes in both 2010 and 2012, both shocks are excluded from the test sample). CEOs of firms headquartered in states with large changes are in the treatment group. The remaining CEOs are in the control group. For each stack, Tax Increase (Decrease) is a dummy variable that equals one if a CEO's state personal income tax rate increases (decreases) by at least one percentage point at the central year of the stack, and zero otherwise. $Post_1$ ($Post_2$) is an indicator variable for the first (second) year following a large tax shock. TDC1 is total pay from Execucomp. The dependent variable is Δln(TDC1) and the control variables are transformed Assets, MTB, and ROA, Δ denotes difference, and Ln(.) is the natural logarithm. All specifications include CEO-Firm and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Variables are defined in Appendix 1. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
VARIABLES	ΔLn(TDC1)	ΔLn(TDC1)
Tax Increase x $Post_1$	-0.013	
	[-0.39]	
Tax Increase x $Post_2$	0.058**	
	[2.48]	
Tax Decrease x $Post_1$		-0.043
		[-0.81]
Tax Decrease x $Post_2$		-0.022
		[-0.52]
ΔLn(Assets)	0.281***	0.268***
	[6.57]	[10.83]
ΔMTB	0.105***	0.086***
	[6.17]	[6.55]
ΔROA	0.463***	0.460***
	[2.84]	[4.25]
Observations	12,368	27,886
R-squared	0.310	0.288
CEO-Firm FE	Y	Y
Industry-Year FE	Y	Y

Table A8. CEO Compensation Components and Large State Personal Income Tax Changes

This table shows the effects of changes in US state personal income tax rates on the components of CEO compensation. *Tax Increase* (*Decrease*) is a dummy variable that equals one if a CEO's state personal income tax rate increases (decreases) by at least one percentage point in a year and zero otherwise. The dependent variable is the change in the logarithm of the component of CEO compensation. The control variables are transformed Assets, MTB, and ROA, where Δ denotes difference, and Ln(.) is the natural logarithm. All specifications include CEO-Firm and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Variables are defined in Appendix 1. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Base Control Sample

	(1)	(2)	(3)	(4)	(5)
VARIABLES	ΔLn(Salary)	ΔLn(Bonus)	ΔLn(NonEqIncent)	ΔLn(Stock)	ΔLn(Option)
Tax Increase$_{t-1}$	-0.008	-0.064	0.017	-0.035	-0.049
	[-0.71]	[-0.63]	[0.40]	[-0.74]	[-1.37]
Tax Increase$_{t-2}$	-0.012	0.014	0.109***	0.066**	0.008
	[-0.76]	[0.20]	[2.88]	[2.35]	[0.20]
ΔLn(Assets)	0.027*	0.360***	0.315***	0.182***	0.386***
	[2.00]	[6.16]	[6.75]	[5.06]	[8.57]
ΔMTB	0.002	0.135***	0.179***	0.028	0.045***
	[1.33]	[8.16]	[6.35]	[1.59]	[4.32]
ΔROA	0.073***	1.445***	1.060***	0.173	0.175***
	[3.07]	[7.51]	[7.45]	[1.56]	[2.86]
Observations	22,201	7,473	9,745	11,469	12,453
R-squared	0.315	0.343	0.303	0.247	0.279
CEO-Firm FE	Y	Y	Y	Y	Y
Industry-Year FE	Y	Y	Y	Y	Y

Panel B: Spotless Control Sample

	(1)	(2)	(3)	(4)	(5)
VARIABLES	ΔLn(Salary)	ΔLn(Bonus)	ΔLn(NonEqIncent)	ΔLn(Stock)	ΔLn(Option)
Tax Increase$_{t-1}$	-0.009	-0.147	0.013	-0.015	-0.067*
	[-0.75]	[-1.46]	[0.32]	[-0.34]	[-1.78]
Tax Increase$_{t-2}$	-0.012	-0.029	0.122***	0.060**	0.033
	[-0.70]	[-0.54]	[3.76]	[2.18]	[0.98]
ΔLn(Assets)	0.016	0.311***	0.326***	0.207***	0.408***
	[1.00]	[3.41]	[6.30]	[4.38]	[8.83]
ΔMTB	0.001	0.138***	0.168***	0.035	0.037***
	[0.87]	[7.43]	[5.91]	[1.57]	[3.16]
ΔROA	0.087***	1.442***	0.831***	0.218	0.131**
	[2.94]	[6.35]	[6.66]	[1.69]	[2.33]
Observations	15,477	5,123	6,690	7,796	8,803
R-squared	0.320	0.373	0.305	0.264	0.291
CEO-Firm FE	Y	Y	Y	Y	Y
Industry-Year FE	Y	Y	Y	Y	Y

Table A9. CEO Compensation Responsiveness to State Personal Income Tax Changes: Drop Large Shocks to State-level Corporate Income Tax Rates

This table reports the robustness tests for the effects of US state personal income tax on CEO compensation, dropping firms headquartered in states with large shocks (no less than one percentage point) to state-level corporate income tax rates in any year of the sample. Tax Increase (Decrease) is a dummy variable that equals one if a CEO's state personal income tax rate increases (decreases) by at least one percentage point in a year and zero otherwise. TDC1 is total pay from Execucomp. State corporate income tax data is from the Tax Foundation (https://taxfoundation.org/). The dependent variable is ΔIn(TDC1) and the control variables are transformed Assets, MTB, and ROA, Δ denotes difference, and Ln(.) is the natural logarithm. All specifications include CEO-Firm and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Variables are defined in Appendix 1. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
VARIABLES	ΔLn(TDC1)	ΔLn(TDC1)	ΔLn(TDC1)
$\text{Tax Increase}_{t-1}$	0.038		0.039
	[1.63]		[1.60]
$\text{Tax Increase}_{t-2}$	0.072***		0.075***
	[4.01]		[4.25]
$\text{Tax Decrease}_{t-1}$		-0.021	-0.012
		[-0.38]	[-0.21]
$\text{Tax Decrease}_{t-2}$		0.045	0.057
		[0.79]	[1.05]
ΔLn(Assets)	0.322***	0.320***	0.322***
	[10.43]	[10.34]	[10.41]
ΔMTB	0.072***	0.072***	0.072***
	[8.25]	[8.23]	[8.22]
ΔROA	0.287***	0.287***	0.288***
	[6.55]	[6.55]	[6.54]
Observations	14,405	14,405	14,405
R-squared	0.218	0.218	0.218
CEO-Firm FE	Y	Y	Y
Industry-Year FE	Y	Y	Y

Table A10. CEO Compensation Responsiveness to State Personal Income Tax Changes: Drop COVID-19 Period and other Recession Years

This table reports the robustness tests for the effects of US state personal income tax on CEO compensation, dropping the years during COVID-19 and other recession years (i.e., 2001, 2007, 2008, 2009, 2020, 2021, and 2022). The recession years follow the business cycle dating defined by NBER (https://www.nber.org/research/business-cycle-dating). Tax Increase (Decrease) is a dummy variable that equals one if a CEO's state personal income tax rate increases (decreases) by at least one percentage point in a year and zero otherwise. TDC1 is total pay from Execucomp. The dependent variable is Δln(TDC1) and the control variables are transformed Assets, MTB, and ROA, Δ denotes difference, and Ln(.) is the natural logarithm. All specifications include CEO-Firm and Industry-Year fixed effects. Robust standard errors are clustered at the state level. Variables are defined in Appendix 1. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
VARIABLES	ΔLn(TDC1)	ΔLn(TDC1)	ΔLn(TDC1)
$\text{Tax Increase}_{t-1}$	-0.003		-0.002
	[-0.17]		[-0.10]
$\text{Tax Increase}_{t-2}$	0.076***		0.078***
	[3.81]		[3.88]
$\text{Tax Decrease}_{t-1}$		-0.007	-0.010
		[-0.21]	[-0.34]
$\text{Tax Decrease}_{t-2}$		0.032	0.038
		[0.74]	[0.88]
ΔLn(Assets)	0.340***	0.340***	0.340***
	[14.03]	[13.94]	[13.91]
ΔMTB	0.090***	0.090***	0.090***
	[10.12]	[10.14]	[10.10]
ΔROA	0.346***	0.347***	0.346***
	[4.40]	[4.41]	[4.42]
Observations	16,883	16,883	16,883
R-squared	0.217	0.217	0.218
CEO-Firm FE	Y	Y	Y
Industry-Year FE	Y	Y	Y

Appendix 3

Preemptive Locational Choice

One possible reason for the high responsiveness of CEO pay to state personal income tax shocks is that CEOs can threaten to quit for another position in a state with a lower top tax rate. If the costs of relocating are low, then such a threat is credible. Locational considerations, however, potentially have a countervailing effect. Some executives may already be taxed in another state or can move to another state that differs from the firm's domicile and was not treated with an income tax shock but still serves as CEO. Some reciprocal state tax agreements can make this feasible.[22,23] Such a prior preemptive locational choice would eliminate the need for the firm to compensate the CEO for an increase in the state personal income tax rate and would attenuate our parameter estimates of the effect of a tax shock on CEO pay. We argue that locational choices that insulate

[22] For example, until 2017 Pennsylvania and New Jersey operated under a reciprocity agreement. If a Pennsylvania (New Jersey) resident worked in New Jersey (Pennsylvania), that person was taxed in their state of residence. Pennsylvania's top rate was 3.07% while the top rate in New Jersey was 8.97%. Pennsylvanians (New Jersey residents) who worked in New Jersy (Pennsylvania) paid a top rate of 3.07% (8.97%). All else (such as property taxes) equal, the incentive for a CEO of a Garden State firm to live in the Pennsylvania would have been substantial. States are fully aware of the incentive to shop for low-tax tax domicile and to source employment income in a low-tax state. Not surprisingly, New Jersey abrogated the New Jersey side of the reciprocity agreement, though the Pennsylvania side remains. After nearly forty years, in September 2016 New Jersey Governor Chris Christie terminated the New Jersey agreement with Pennsylvania, effective January 1, 2017. While at the time Governor Christie's office declined to provide an estimate of the gain in tax revenue, a former State Treasurer of New Jersey estimated that ending the agreement could generate an additional $180 million annually for New Jersey. Since then, New Jersey has increased the top personal income tax rate further to 10.97% (2024). See https://www.inquirer.com/philly/news/politics/20160903_Christie__seeking_revenue__ends_40-year_tax_agreement_with_Pa_.html.

[23] On the other hand, some interstate tax agreements are asymmetric. For example, if a CEO worked in Arizona but lived in California, Indiana, Oregon, or Virginia, the CEO could ask for an exemption from Arizona state personal income tax and withholding of that tax. Then a tax increase in Arizona would not affect the CEO. The reverse is not true. If the CEO worked in California but was a resident of Arizona, California did not accord symmetric treatment. The CEO would pay state income tax to California. If the rate in the state of residence were higher than that in California, the tax paid to California would be credited towards the tax due in the state of residence and the CEO would pay any shortfall to the state of residence. In cases such as this, the effective top income tax rate is the higher of the two state tax rates.

executives from state tax shocks are unlikely to attenuate significantly our estimates of the sensitivity of executive pay to changes in the personal state income tax rate.

First, there are not many relevant state reciprocity agreements. As of the end of 2016, in 17 states including the District of Columbia, nonresident workers who live in reciprocal states did not have to pay state taxes in the work state.[24] Moreover, one-way agreements are infrequent. In 2016 there were 64 ordered state pairs with an asymmetric one-way arrangement, which was only 2.51% of the 2,550 possible one-way arrangements among 51 jurisdictions, the 50 states and Washington, DC. States have erected additional barriers to the locational avoidance of state income tax.[25]

Second, Duchin and Sosyura (2021) examine how remote management by CEOs affects their financial decisions and ability to create shareholder value. They define a "long-distance CEO" as one who commutes at least 50 miles each way to corporate headquarters and does not own a residence within 50 miles of headquarters. Because some corporate headquarters are farther than 50 miles from the nearest bordering state, such long-distance CEOs are likely to live in their work state. Thus, the set of long-distance CEOs should contain almost all CEOs who would be insulated from a state personal income tax increase in their work state, as well as other commuting CEOs who still would be subject to a state tax change. Duchin and Sosyura (2021) find 1,925 long-distance CEO-firm-years among US domiciled firms listed in the US over the period 2000 – 2020. Over that period there were 105,819 US-firm-year US listings, so the percentage of firm years with

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[24] See https://www.thebalance.com/state-with-reciprocal-agreements-3193329.

[25] We have in mind, for example, New York's "convenience of the employer" rule. New York is one of several states with a statute that specifies whether an employee working from a home office outside of the state is liable for nonresident income tax. (See https://taxnews.ey.com/news/2020-2543-new-york-issues-guidance-on-the-nonresident-income-tax-liability-to-employees-working-temporarily-outside-of-the-state-due-to-covid-19.) Under this test, nonresident income tax applies if the employee is working outside of the state for the employee's own convenience rather than the necessity of the employer and the employee spends at least one day in New York in the calendar year. Conversely, if the remote work arises from the convenience or necessity of the employer, nonresident NY income tax does not apply.

a commuter CEO is 1.82%. We view this small percentage as an upper bound on the proportion of CEOs who preemptively avoid a state tax increase in their work state.

Third, as did Duchin and Sosyura (2021), we obtain the CEO residential address data used by Bernile, Bhagwat, and Yonker (2018).[26] In our sample, we find that in 99.3% of CEO-year cases the CEO owns a residence located in the same state as the corporate headquarters. While it is possible that some of these CEOs reside in another abode in a different state, almost all CEOs have the option to make their work state their tax domicile as well. Fourth, Duchin and Sosyura (2021) report that long-distance CEOs do not perform as well as local CEOs. One reason for why there are so few long-distance CEOs is that it is likely that some firms require their CEO to be local.

In summary, our coefficient estimates on the effect of state personal income tax changes on CEO pay are unlikely to be attenuated by the presence in the sample of a significant number of CEOs avoiding taxes by way of prior locational choices.

CEO Retention, Departures, and Firm Performance

A CEO experiencing an increase in state personal income tax rate who fails to get a pay raise in the current firm will be more likely to depart. One possibility is that the affected firm "invites" the CEO to voluntarily depart by not adjusting pay in response to a tax increase. Under this narrative, the firm benefits from the departure. In contrast, perhaps the firm is distressed or otherwise constrained in the extent to which it can raise pay to the prevailing after-tax market pay for a CEO. A CEO turnover under such circumstances is more likely to damage the firm.

[26] We thank Scott Yonker for sharing data on executives' home addresses.

We compare the likelihood of CEO turnover across two groups: CEOs who receive a pay increase within two years of the income tax increase versus those who do not. Controlling for prior firm performance, as well as the other standard covariates, in the regression models, CEOs receiving pay raises are significantly less likely to depart than those who do not receive a raise following a tax increase. Including controls, ROA and stock return are significantly higher for firms that increase CEO pay following a large personal income tax increase. These findings are consistent with the idea that boards can offset personal income tax shocks and, by doing so, retain valuable talent to facilitate firm performance.

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