Locked-in: The Effect of CEOs’ Capital Gains Taxes on Corporate Risk-Taking

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**Abstract**

I study the effects of CEOs’ unrealized capital gains tax liabilities (tax burdens) on corporate risk-taking. Recent work suggests that high tax burdens discourage CEOs from selling stock. I hypothesize that this causes the executives to become overexposed to firm-specific risk, thereby reducing their willingness to make risky corporate decisions. In a series of tests, I find that corporate risk-taking decreases as CEOs’ personal tax burdens increase. Further, firms with CEOs who are more locked-in to their stock positions (i.e., CEOs with higher tax burdens) experience larger increases in risk-taking following federal and state tax cuts. When I investigate the mechanism behind this relation, I find that tax cuts trigger stock sales by the locked-in executives, allowing for improved diversification. Overall, my findings indicate that the personal tax burdens of CEOs affect the firm by reducing executives’ preferences for risk at the corporate level.

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I. INTRODUCTION

Taxes on capital gains discourage the sale of appreciated assets, leading to distortions in asset prices and in investors’ portfolio allocation decisions (e.g., Feldstein, Slemrod, and Yitzhaki 1980; Dammon, Spatt, and Zhang 2004). This distortionary behavior is commonly referred to as the “lock-in” effect. Existing research in this area tends to focus on the investment decisions of external investors who lack direct control over the firms’ core operations. This focus in prior research overlooks the impact of taxes on another important class of investors – those internal to the firm. Specifically, I predict that investor-level tax effects on managers have potentially important consequences for corporate policies because, unlike most external investors, managers have direct influence on firms’ strategic and operational activities.

In this paper, I study the tax lock-in effect on CEOs and the implications of this effect for corporate risk-taking. CEOs generally own stock in the firms that employ them, and recent work suggests that anticipated tax liabilities discourage CEOs from selling shares (Jin and Kothari 2008; Armstrong, Core, and Guay 2015). I hypothesize that over time, the tax friction causes CEOs to become overexposed to firm-specific risk, and to respond by reducing the firm’s risk to limit their personal risk. Specifically, I predict that unrealized tax liabilities on CEOs’ stock holdings in their firms (hereafter, CEOs’ tax burdens) are negatively associated with corporate risk-taking.

My primary independent variable is the CEO’s tax burden on her stock holdings in the firm. I construct this measure using an approach similar to that in Jin and Kothari (2008), with a few modifications.1 Intuitively, the tax burden reflects the percentage of the CEO’s total equity portfolio that would be owed in tax if the CEO sold all vested stock. As such, the magnitude of the tax burden depends on several factors: the tax rate facing the CEO, the unrealized gain on the CEO’s stock holdings (i.e., the difference between the current price of the shares and the price at

1 The modifications consist of including state taxes along with federal taxes, including the tax liability arising solely from stock while excluding that arising from options, and scaling the anticipated tax liability by the CEO’s total equity holdings (vested and unvested), rather than by the expected proceeds from a sale. I discuss these choices in greater detail in Section 3, and Appendix B describes the calculation of the tax burden in detail.
which the shares were obtained), the number of shares owned by the CEO at each price, and the total value of the CEO’s equity. For my dependent variable, I use three common proxies for corporate risk-taking: stock return volatility, idiosyncratic volatility, and earnings volatility. My inferences are similar when examining corporate policies that have traditionally been used to proxy for corporate risk-taking, including R&D expenditures, leverage, and working capital levels.

In panel analysis, I find a robust negative relation between CEOs’ tax burdens and corporate risk-taking. Specifically, a CEO moving from the 25th to the 75th percentile with respect to the tax burden is associated with a 2.0 percent relative decrease in annualized stock return volatility, and a 2.4 percent relative decrease in idiosyncratic volatility. These results are robust to including firm and year fixed effects, as well as a range of control variables for CEO and firm characteristics shown to be associated with risk-taking (e.g., Armstrong and Vashishtha 2012).

A potential concern with the panel analysis is that an omitted variable could affect CEOs’ tax burdens as well as corporate risk-taking (as proxied by firm volatility). The CEO of a firm that has performed well is more likely to have a higher tax burden than the CEO of a firm that has performed poorly. Since positive performance can lead mechanically to lower future volatility via the “leverage effect” (e.g., Christie 1982), a negative association between CEOs’ tax burdens and risk-taking could be due to a mechanical relation between firms’ past performance and future volatility, rather than to increasingly risk-averse behavior by CEOs. A related concern is that the tax burden is endogenous to CEOs’ portfolio choices. CEOs may hold more stock because they anticipate low volatility in the firm, or they may sell more stock because they expect greater volatility. I exploit two additional settings to mitigate these endogeneity concerns.

First, I examine two federal tax cuts that take place during my sample period.2 Reductions in statutory capital gains tax rates induce variation in CEOs’ tax burdens that is unrelated to the

2 The first federal tax cut was contained in the Taxpayer Relief Act of 1997 (TRA97), which reduced the top individual long-term capital gains tax rate from 28 percent to 20 percent. The second federal tax cut was part of the Jobs and Growth Tax Relief Reconciliation Act of 2003, which further reduced the top capital gains tax rate from 20 percent to 15 percent.
stock’s historical appreciation and executives’ portfolio choices, thus providing plausibly causal evidence of the effect of CEOs’ tax burdens on corporate risk-taking. Although the federal tax cuts affect all CEOs simultaneously, I argue that the impact on risk-taking is likely to be larger for CEOs with higher tax burdens prior to the cuts (i.e., for CEOs who were more locked-in). Consistent with this prediction, I find that firms with high-tax-burden CEOs prior to the 1997 and 2003 federal tax cuts experience relative increases in return and earnings volatility following the cuts compared to firms with low-tax-burden CEOs.

Second, I examine the effects of reductions in individual capital gains tax rates at the state level. I use a two-way fixed effects model with firm and year fixed effects, and I further compare the impact of the tax cuts for high- and low-tax-burden CEOs affected by the tax cuts. Thus, the design provides a comparison of the change in risk-taking for high- and low-tax-burden CEOs affected by the tax cuts, as well as a comparison of both groups of affected CEOs to unaffected CEOs (those located in states without a tax cut). I find that a one percent drop in the tax rate leads to a 1.1 percent average increase in total return volatility over the following three years. However, the increase is driven disproportionately by CEOs with high tax burdens prior to the tax cuts. Affected CEOs with tax burdens at the 25th percentile experience a modest 0.3 percent increase in stock return volatility relative to unaffected firms, whereas affected CEOs with tax burdens at the 75th percentile experience a 1.9 percent increase in volatility.

Having established a robust link between CEOs’ tax burdens and their risk taking behavior, I investigate the mechanism behind the link by analyzing CEO stock selling activity around tax cuts. I find that tax cuts trigger increased stock sales by CEOs, and the impact is significantly stronger for CEOs with high tax burdens (i.e., those CEOs for whom the lock-in effect is alleviated by tax cuts). For CEOs at the 75th percentile of the tax burden, a one percent tax cut leads to increased stock sales representing approximately 1.8 percent of the value of their equity in the year

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3 A maintained assumption is that the CEO resides in the state in which the corporate headquarters is located. To the extent this assumption is inaccurate, my proxy for CEOs’ tax burdens is measured with error.
the tax cut takes effect. Further, I use the predicted stock sales as the first stage in a two-stage-least-squares specification to directly connect CEO stock sales to increased corporate risk-taking.

I perform three additional tests to investigate the nature of the relation between CEOs’ tax burdens and corporate risk-taking. First, I test for cross-sectional variation in the effect of CEOs’ tax burdens, conditional on the executives’ outside wealth. I find that the tax cuts lead to smaller increases in risk-taking when CEOs hold significant wealth outside of the firm, suggesting the tax cuts have a lower marginal benefit for better-diversified CEOs. Next, I find that locked-in CEOs respond to the tax cuts by changing specific corporate policies (e.g., increasing R&D expenditures and leverage, while reducing working capital levels). Finally, I examine the impact of capital gains tax increases on corporate risk-taking. As I discuss in Section 6, tax increases are less likely than tax cuts to cause immediate portfolio changes among locked-in CEOs. Consistent with this prediction, I find tax increases are followed by reduced risk-taking, but the effect is independent of CEOs’ tax burdens.

The use of multiple settings to test my research question provides a range of economic estimates regarding the effects of capital gains tax changes on corporate risk-taking. I find that the federal tax cut contained in TRA97 (an eight percent drop in the top statutory tax rate) leads to a 4.6 percent increase in total return volatility for CEOs at the 75th percentile of the tax burden, suggesting an approximate volatility increase of 0.6 percent in response to a one percent drop in the tax rate. I find a greater sensitivity in the state setting, where my estimates indicate that CEOs at the 75th percentile of the tax burden experience a volatility increase of 1.9 percent in response to a one percent tax cut. Thus, although the different settings have their own unique features and tradeoffs, I consistently find that locked-in CEOs experience the largest increases in risk-taking following capital gains tax reductions. Further, the sensitivity of volatility responses in my tests range from 0.6-1.9 percent following a one percent drop in the capital gains tax rate.

My study contributes primarily to three areas. First, I contribute to the literature on investor-level taxes by shifting the focus from external investors to internal investors, and by
considering implications for the firm (i.e., real effects). Prior work has focused largely on capital market distortions and portfolio allocation effects arising from taxes. Although recent work notes a positive association between unrealized tax liabilities and CEO equity holdings, I build on this research by exploiting federal and state tax cuts to provide more direct evidence of the tax lock-in effect for executives. In addition, I push the literature in a new direction by tying managers’ personal tax incentives to corporate outcomes.

Second, I contribute to the literature on CEO incentive compensation and corporate risk-taking. Greater stock-based compensation increases the sensitivity of CEO wealth to stock price, which can affect risk-taking incentives in two ways. First, higher stock ownership aligns CEO incentives with those of shareholders, providing motivation to increase stock price through optimal risk-taking. Second, higher ownership exposes CEOs to more risk and potentially causes CEOs to be under-diversified with respect to their personal wealth, reducing their risk-taking incentives. Endogeneity concerns have made it difficult to causally identify the relation between stock holdings and risk-taking (e.g., Coles, Daniel, and Naveen 2006). As a result, Edmans and Gabaix (2016) call for more studies using good instruments or quasi-exogenous shocks to CEO incentives to better understand their impact on the firm. My study responds to this call using a series of tax cuts as shocks to CEO diversification and examining the ensuing effects on corporate risk-taking.

The third area I contribute to is a burgeoning literature on taxes and risk-taking. Building on prior theoretical research, two recent papers provide evidence that firms reduce risk-taking in response to higher corporate income taxes (Langenmayr and Lester 2017; Ljungqvist, Zhang, and Zuo 2017). In related, concurrent work, Armstrong, Glaeser, Huang, and Taylor (2017) extend this literature by considering how managers’ personal taxes affect corporate risk-taking. Although my study and Armstrong et al. (2017) investigate related questions, we propose two different, non-mutually exclusive channels through which taxes can affect managers’ incentives to make risky decisions.

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4 A related literature examines the effects of managers’ inside debt compensation on corporate risk-taking. Section 2 discusses this area of research in more detail, as well as the central endogeneity concerns with respect to incentive compensation and risk-taking.
corporate decisions, and we use different methodologies to address our questions. I elaborate on these differences in Section 2.

The rest of the paper proceeds as follows. Section 2 discusses prior research and develops my central hypothesis. Section 3 discusses the data and provides descriptive statistics. Section 4 outlines my empirical strategy and presents results for the main panel analysis, whereas Section 5 examines the tests using federal and state tax cuts as shocks to CEOs’ tax burdens. Section 6 provides additional analyses, and Section 7 concludes.

II. PRIOR RESEARCH AND HYPOTHESIS DEVELOPMENT

Prior Research: Capital Gains Taxes and the Lock-in Effect

Researchers posit that capital gains taxes can affect asset prices in two ways: by decreasing demand for an asset due to the anticipated future tax due upon sale (the capitalization effect), and by decreasing supply of an asset by discouraging the sale of appreciated shares that will trigger a taxable gain (the lock-in effect). Focusing on the capitalization aspect, Lang and Shackelford (2000) and Dhaliwal, Krull, and Li (2007) find that firms’ expected returns are increasing with capital gains taxes. Analyzing the effects of federal tax cuts, the two studies conclude that capital gains taxes put downward price pressure on assets, because investors demand higher returns to compensate for the eventual tax liability. Studies focused on the lock-in effect, in contrast, find that capital gains taxes put upward price pressure on assets by acting as a friction which deters investors from selling shares, thereby restricting the supply of shares (e.g., Feldstein et al. 1980; Landsman and Shackelford 1995). In a study exploiting the 1997 tax act, Dai, Maydew, Shackelford, and Zhang (2008) reconcile the capitalization and lock-in effects by showing the

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5 Capital gains tax deferral offers several value-enhancing strategies that, in some cases, can reasonably be expected to offset the costs of sub-optimal portfolio rebalancing. First, deferral allows the value of the investment to accumulate tax-free over time. Second, an investor with unrealized gains on some investments can refrain from selling until she has a loss on other investments that can be used to offset the gain for tax purposes. Third, in the case of CEOs or other employees with substantial stock ownership, those who work for firms located in a high tax state can choose to defer the sale of stock until they retire, at which point they can move to a low (or no) tax state before selling off shares. And finally, investors can simply hold appreciated investments until their death and take advantage of the tax-free step-up in basis available to the individual’s estate.
equilibrium price impact of capital gains taxes is ambiguous and depends on investors’ expectations. Although the theory and empirical evidence on how capital gains taxes affect investors’ decisions is well developed, extant research has focused largely on the implications for asset prices (Hanlon and Heitzman 2010), or more generally on consequences external to the firm.

Two recent studies examine the tax lock-in effect with respect to internal investors in the firm. Jin and Kothari (2008) find that CEOs’ tax burdens are negatively associated with the sale of equity, suggesting that large tax burdens discourage CEOs from selling shares. Similarly, Armstrong et al. (2015) find a strong positive association between executives’ anticipated tax liability upon sale and the amount of unrestricted equity held. However, both studies rely solely on cross-sectional regressions. I aim to make a more causal statement by providing evidence that CEOs sell more shares following tax cuts that reduce the lock-in effect. Further, I extend the literature by tying managers’ tax lock-in to corporate outcomes.

**Prior Research: Incentive Compensation and Risk**

Early theoretical work (Stulz 1984; Smith and Stulz 1985) proposes that equity holdings create two opposing incentives among managers with regard to risk-taking. The first incentive, which encourages risk-taking, arises from the convexity of the payoff structure. For example, options close to the exercise price and stocks close to financial distress exhibit a convex payoff structure in which the manager benefits substantially from increased firm value but faces relatively little downside risk. On the other hand, deep-in-the-money options and stocks well above financial distress exhibit a linear payoff structure that does little to encourage risk-taking (Lambert, Larcker, and Verrecchia 1991; Carpenter 2000). The second incentive, which deters risk-taking, is the exposure of managerial wealth to firm-specific risk. As noted in prior literature, CEOs of U.S. firms tend to hold a significant portion of their personal wealth in firm equity (e.g., Hall and Murphy 2002; Conyon, Core, and Guay 2011), causing executives to be relatively undiversified. Without proper diversification, risk-averse managers have an incentive to protect their equity investment, as well as their human capital investment, in the firm (Amihud and Lev 1981).
A related literature examines the effect of managers’ inside debt holdings on corporate risk-taking. The term ‘inside debt’ refers to pension benefits and deferred compensation which expose managers to default risk similar to that faced by outside creditors. Overall, the findings to date indicate that higher levels of managerial inside debt are associated with reduced risk-taking, as evidenced by lower stock return volatility, less risky investment, and greater cash holdings (e.g., Sundaram and Yermack 2007; Cassell, Huang, Sanchez, and Stuart 2012; Liu, Mauer, and Zhang 2014). However, as with the literature on equity incentives, the endogenous relation between inside debt compensation and risk-taking has made it difficult to draw causal inferences.

One major source of endogeneity arises because managerial incentives and firm risk are likely jointly determined (Coles et al. 2006), potentially confounding efforts to understand the direction of causality. A recent paper by Shue and Townsend (2017b) attempts to overcome this challenge with regard to the effect of option grants on risk-taking. Using variation in the timing of multi-year option grants, the authors find that an increase in new options granted leads to increased equity volatility.

Prior work examining managerial stock holdings has similarly struggled to identify causality. Using a sample of 226 acquisitions, May (1995) finds that CEOs with more personal wealth invested in firm equity tend to make diversifying acquisitions, which he interprets as CEOs attempting to reduce their personal risk by diversifying the firm. Similarly, Tufano (1996) finds that executives in the gold mining industry who own more stock display greater corporate risk management. While important milestones in the literature, both studies suffer from having small and narrowly defined samples, and do not attempt to establish causality.

I aim to overcome the endogeneity problem plaguing the literature by examining a series of federal and state tax cuts that serve as shocks to CEOs’ stock holdings. I expect tax cuts to reduce the cost of selling appreciated stock, thus triggering increased stock sales and improved diversification for locked-in CEOs. Examining subsequent changes in corporate risk-taking can provide plausibly causal evidence regarding the relation between CEOs’ stock holdings and risk.
Prior Research: Taxes and Risk

Early research on taxes and risk suggests that personal taxes create an asymmetry in payoffs that can affect individuals’ risk-taking choices (Domar and Musgrave 1944; Feldstein 1969; Stiglitz 1969). More recent work by Langenmayr and Lester (2017) and Ljungqvist et al. (2017) considers the effects of corporate taxes on risk-taking. Langenmayr and Lester (2017) provide analytical and empirical evidence that longer tax loss offset periods are associated with greater risk-taking, consistent with loss rules allowing firms to shift some risk to the government. Further, they find that higher tax rates have a positive effect on risk-taking by firms that expect to use losses, but a weakly negative effect on firms that cannot. Ljungqvist et al. (2017), using variation in state corporate income tax laws, find that firms reduce risk-taking in response to tax increases, but this effect is partially mitigated by the availability of tax loss offset rules, consistent with Langenmayr and Lester (2017).

The study most closely related to mine is a concurrent work by Armstrong et al. (2017), who extend this line of research by examining how managers’ personal taxes affect corporate risk-taking. Armstrong et al. (2017) posit that by reducing the variance of managers’ expected pay through taxation, the government shares in the risk arising from corporate decisions, incentivizing risk-averse managers to make riskier investment choices. Using managers’ ordinary income tax rates that vary by state and over time, they find evidence that higher tax rates are associated with higher idiosyncratic risk. My study has a similar flavor in that I also examine the potential consequences of managers’ personal tax considerations for corporate risk-taking, but I propose a different, non-mutually exclusive channel and I investigate it using different methodologies.

Whereas Armstrong et al. (2017) study the effects of ordinary income tax owed on annual compensation, I focus on capital gains tax burdens assessed on CEOs’ accumulated vested stock holdings. Drawing from the literature on the lock-in effect, I posit that large unrealized tax liabilities deter CEOs from selling vested stock and induce overexposure to firm risk. Armstrong et al. (2017) identify their effect using panel analysis exploiting cross-sectional and time-series
variation in state tax rates, as well as predictable cross-sectional variation in the strength of the effect based on firm and CEO characteristics. I begin with a broad panel analysis of the effects of the CEO’s tax burden, and then use federal and state tax cuts as shocks to the tax burden around which I examine changes in risk-taking. In addition, I examine changes in CEO stock sales and perform cross-sectional analysis based on the CEO’s outside wealth. The results in Armstrong et al. (2017) indicate that higher ordinary income tax rates are associated with greater idiosyncratic risk-taking, whereas I find that capital gains tax reductions lead to stock sales and increased risk-taking, but only for formerly locked-in CEOs. Ultimately I view our papers as complementary efforts to understand the incentive effects of managers’ personal taxes on corporate risk-taking.

**Hypothesis Development**

My central hypothesis stems from combining the literature on the capital gains tax lock-in effect with the literature on equity incentives. Building on the intuition that CEOs’ tax burdens act as a friction discouraging stock sales, I conjecture that over time, the tax lock-in causes the executives to become overexposed to firm-specific risk. I predict that CEOs respond to their own personal lack of diversification by becoming increasingly risk-averse with regard to corporate strategies, leading to lower overall volatility. My identification strategy relies on using federal and state tax cuts as shocks to CEOs’ tax burdens. I predict that tax cuts reduce CEOs’ tax burdens thereby alleviating the lock-in effect for affected executives, allowing them to diversify their holdings and take on more corporate risk. Thus, my hypothesis is as follows:

**H:** CEOs’ tax burdens are negatively associated with corporate risk-taking.

There are several reasons to doubt the existence of a negative relation between CEOs’ tax burdens and corporate risk-taking. The first reason is related to the optimal incentive contracting literature. For instance, if corporate boards recognize that the CEO is becoming overweighted in the firm’s equity, they may award more risk-taking incentives such as at-the-money options to counteract risk aversion. There is considerable debate regarding boards’ responsiveness to optimal contracting and incentive alignment concerns. Core and Guay (1999) suggest that firms grant new
equity incentives in order to bring CEOs to optimal equity incentive levels. A recent paper by Shue and Townsend (2017a), however, shows that the number of options granted tends to be quite rigid, indicating a lack of responsiveness to individual CEO incentive alignment concerns. If boards sufficiently adjust CEO compensation in response to frictions imposed by the executives’ tax burdens, this would preclude a negative relation between the tax burden and corporate risk-taking.

A second consideration is that executives can hedge their firm-specific risk by holding derivative instruments designed to offset their insider ownership. Bettis, Bizjak, and Kalpathy (2015) find that executives commonly use certain types of derivative instruments to reduce their exposure to firm risk, including collars, forwards, and exchange funds. Bettis et al. (2015) note that executives residing in states with high tax rates are more likely to use exchange funds, which the authors attribute to the executives seeking diversification while deferring the realization of taxes. If CEOs can sufficiently mitigate firm-specific risk by holding derivative instruments, their tax burdens are unlikely to influence their risk-taking decisions with respect to the firm.

A third consideration that would preclude a negative relation between the CEO’s tax burden and corporate risk-taking is that the incentive effects of additional stock holdings are unclear. CEOs with substantial equity holdings likely desire to reduce the risk to their personal portfolio, but they also do not wish to destroy shareholder wealth (and therefore, their own wealth) by choosing sub-optimal projects. Thus it is not clear ex ante that the risk-aversion effect induced by exposure to firm-specific risk will dominate CEOs’ incentives to maximize shareholder wealth.

III. SAMPLE AND DATA

Sample

My sample begins with all CEO-years in Standard & Poor’s ExecuComp database for years 1993 to 2014. I begin in 1993 because I require at least one year of prior compensation data to compute the CEO’s tax burden on equity holdings, and the database coverage begins in 1992. I use CRSP data to calculate the annual return and return volatility measures. Firm characteristics are drawn from the merged CRSP-Compustat database. Consistent with prior literature regarding
equity incentives and corporate risk-taking, I exclude financial service firms and utilities (SIC codes 6000-6999 and 4900-4999, respectively). Requiring non-missing data for my risk measures and control variables yields a panel of 19,540 CEO-year observations for 2,027 firms.

**Variable Measurement**

**CEO Tax Burden**

My central aim with the CEO tax burden measure is to reflect the role of taxes acting as a friction preventing CEOs from diversifying their portfolios. Prior literature commonly assumes executives display relative risk aversion (Hall and Murphy 2002; Cai and Vijh 2005; Conyon et al. 2011), for whom lack of diversification drives risk-averse behavior. Building on this literature, the tax burden measure should capture the relative importance of the tax disincentive to sell as well as the CEO’s ability to achieve diversification.

Given these objectives, one consideration is whether the tax burden should reflect the dollar value of taxes owed, or instead a percentage of the CEO’s portfolio value (akin to a tax rate). I argue that a percentage-based measure better captures the relative importance of the tax. To best reflect the executive’s ability to diversify, ideally I should scale the anticipated tax liability from sale by the CEO’s total wealth. But since I cannot observe CEO outside wealth, I instead scale the anticipated tax liability by the CEO’s total value of equity. Thus, a higher tax burden reflects a larger share of the CEO’s total equity portfolio that will be owed in tax.

A second consideration derives from the fact that CEOs generally own batches of stock acquired at different points in time and at different prices (and therefore the shares have different tax basis). Investors are typically allowed to choose which specific shares they want to sell, which

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6 As an illustration, suppose there are two CEOs, A and B, who face the same tax liability of $100 thousand upon sale of their respective portfolios. But CEO A owns a portfolio of $1 million (tax burden of 0.10), whereas CEO B owns a portfolio of $5 million (tax burden of 0.02). I argue that the relative importance of the tax disincentive to sell is greater for CEO A, even though the dollar value of the tax liability is the same for both A and B. However, I find that the percentage tax burden measure is highly positively correlated with the dollar value measure (Pearson correlation 0.84) and my inferences are unchanged when using the dollar tax burden measure.

7 I acknowledge that in subsequent tests (i.e., Table 6) I use estimates of CEO outside wealth to perform cross-sectional analyses of the effect of tax cuts on risk-taking. In untabulated analysis, I construct a tax burden measure using CEO total wealth as the scalar variable and I find that my inferences are the same using this alternative measure.
raises the question of what to assume about which set of shares is sold (given that data limitations preclude my knowing precisely the tax basis of any stock sale). My approach is to assume the CEO sold her entire stock portfolio, calculate the tax liability, and use that liability to calculate the average tax rate for a sale. One argument in favor of the average tax rate approach is that it follows a simple heuristic that may approximate the CEO’s decision-making process. In the corporate tax literature, recent evidence indicates that executives are more likely to make incremental investment and financing decisions by considering the firm’s effective (average) tax rate rather than the firm’s marginal tax rate, because it is easier to compute (Graham, Hanlon, Shevlin, and Shroff 2017). Executives might follow a similar strategy with respect to personal investment decisions.

In light of these considerations, I construct the average CEO tax burden measure as the total tax liability from the sale of all vested stock divided by the total value of the CEO’s stock and option holdings (vested and unvested). The measure is similar to that constructed in Jin and Kothari (2008), with three key differences. First, I modify the measure to include state taxes. Second, Jin and Kothari (2008) examine the tax liability arising from all CEO equity holdings (e.g., stock and options), whereas I focus on the component that arises from stock holdings alone. Third, Jin and Kothari (2008) scale the anticipated tax liability by the expected proceeds from the sale (that is, the value of vested equity), but I instead scale the tax liability by the total value of CEO equity (vested and unvested). Specifically, the measure is calculated as:

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8 Another possibility is to make an assumption about which set of shares is sold (for example, assuming the CEO sells the stock with the highest possible basis in order to minimize any potential tax liability), and calculate a “marginal” tax rate based on that assumption. In untabulated analysis, I find similar results when using a marginal tax burden measure computed based on the assumption that the CEO sells the ten percent of her stock with the highest tax basis.

9 I focus specifically on the tax liability with respect to vested stock while excluding that on unvested stock. My rationale is that CEOs do not have the ability to sell unvested stock, so there is no tax lock-in effect at work (that is, the barrier to selling is not due to the tax). In addition, the CEO has relatively little control over whether to incur the tax on unvested stock, as restricted stock is typically taxed upon vesting.

10 Including the tax liability arising from option holdings complicates the interpretation of my results for two reasons. First, unlike with stock, the value of an option changes mechanically as the option’s expiration date draws closer. Thus, it is difficult to attribute continued option holding to the tax lock-in effect. Further, gains on option exercise are subject to ordinary income tax rates rather than capital gains tax rates (as is the case with gains from stock sales), which complicates the analysis using federal and state capital gains tax rate changes.

11 Note that the results are qualitatively similar when I perform the analyses using the tax burden measure as constructed in Jin and Kothari (2008).
\[ CEO \text{ Tax Burden}_t = \frac{\sum_{n=1}^{t} (P_t - P_n) \times N_n \times t_{cg}}{Total \text{ Equity}_t} \]  

Year 1 represents the first year the CEO owns vested stock in the firm. \( P_t \) is the firm’s stock price at the end of year \( t \); \( P_n \) is the price at the end of year \( n \) (the year in which the CEO obtained the stock); \( N_n \) represents the number of unrestricted shares held by the CEO in year \( t \) that were obtained in year \( n \); \( t_{cg} \) is the total capital gains tax rate (federal plus state) faced by the CEO in year \( t \) upon selling the shares; and \( Total \text{ Equity}_t \) is the stock equivalent value from the CEO’s holdings of all stock and options at the end of year \( t \). Appendix B provides a detailed description of how the tax burden is constructed.

Variation in the CEO’s tax burden is driven by several distinct features. The first is the combined federal and state capital gains tax rate facing the CEO upon sale of the shares.\(^{12}\) The second is the difference between the current stock price and the price at which the shares were obtained (i.e., the taxable gain on the shares). The third factor determining the CEO tax burden is the number of shares obtained in any given year \( n \) relative to the total number of vested shares owned by the CEO, which ensures that the shares obtained in any given year are weighted appropriately when computing the tax burden. Finally, the CEO tax burden is influenced by the total value of the CEO’s equity. All else equal, CEOs with more equity have lower tax burdens, reflecting the relative importance of capital gains taxes in affecting their ability to diversify.

**Tax Rate Changes**

To help identify the relation between CEOs’ tax burdens and corporate risk-taking, I examine two federal tax cuts as well as a series of state tax cuts that took place during the sample period. The first federal tax cut was contained in the Taxpayer Relief Act of 1997, effective May 7, 1997, which reduced the top individual capital gains tax rate from 28 percent to 20 percent. The

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\(^{12}\) Compustat’s location data suffers from an error in that it reports the address of a firm’s current principal executive office, not its historic headquarters location. Heider and Ljungqvist (2015) collect corrected firm headquarters data for the years 1989-2011, and Alexander Ljungqvist generously agreed to share the corrected data. Accordingly, my data reflect the corrected historical firm headquarters.
second federal tax cut was part of the Jobs and Growth Tax Relief Reconciliation Act of 2003, which reduced the top individual capital gains tax rate from 20 percent to 15 percent.

For the state-level analysis, I use data on the maximum marginal long-term gain state tax rates from the National Bureau of Economic Research. I classify year-to-year decreases as tax cuts, and increases as tax hikes. To ensure powerful tests, I exclude any tax rate changes smaller than 0.25 percent in magnitude. Additionally, I retain only tax changes up through 2013 in order to leave sufficient time to observe a risk-taking response. These criteria yield a sample of 73 tax cuts in 30 states, and 43 tax increases in 28 states from 1994 to 2013. The average tax cut reduces tax rates by 96 basis points and the average tax increase raises rates by 123 basis points.

**Corporate Risk-Taking**

I use three proxies for corporate risk-taking: total return volatility (Total Vol); idiosyncratic volatility (Idio Vol); and earnings volatility (ROA Vol). Total return volatility is measured as the standard deviation of daily stock returns. Idiosyncratic volatility is constructed as the standard deviation of daily residual returns from the market model, using parameters estimated using the prior 36 months of daily returns. Earnings volatility is measured as the standard deviation of seasonally adjusted quarterly returns on assets (ROA) over a three-year period from \( t \) to \( t+2 \) (Ljungqvist et al. 2017). Appendix A contains details on variable construction.

**Control Variables and Descriptive Statistics**

Following prior research (Armstrong and Vashishtha 2012; Ljungqvist et al. 2017), I include the following standard CEO and firm characteristics as control variables: CEO vega, CEO delta, CEO cash compensation, CEO tenure, firm age, firm size, market-to-book ratio, leverage

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13 The list of maximum state income tax rates is available at [http://users.nber.org/~taxsim/state-rates/](http://users.nber.org/~taxsim/state-rates/).
14 Note that the results in the state tax change tests are not sensitive to this restriction. In untabulated analysis I perform the state tax change tests while retaining any changes greater than 0.10 percent in magnitude, and also while restricting any changes to be greater than 0.50 percent in magnitude. My inferences are the same in all cases.
15 Although the size of the potential tax savings from these tax cuts may seem small, note that prior research finds that executives engage in far riskier behavior for relatively small personal gains. For example, Dhaliwal, Erickson, and Heitzman (2009) show that executives backdate stock option exercise dates in order to reduce their taxes owed. They find that the average (median) tax savings is just $96,000 ($7,000), whereas the tax penalties for such illegal actions can easily exceed $100 thousand, can be considered a felony, and can have serious economic ramifications for shareholders, another risk to executives with significant wealth invested in the firm.
ratio, cash surplus, loss carryforward, sales growth, and annual stock return. In addition, I control for the value of the CEO’s unvested equity holdings, as this amount potentially gives rise to risk-averse behavior and is plausibly correlated with the CEO’s tax burden. I also include controls for CEO overconfidence (Malmendier and Tate 2005), and the proportion of the firm owned by individual shareholders to proxy for the tax sensitivity of the firm’s shareholder base.

Table 1, Panel A presents summary statistics, which are generally consistent with prior research. The average CEO Tax Burden is 0.03, matching the mean of 0.03 in Armstrong et al. (2015). Prior to taking logs, the average Total Vol is 2.7 percent and the average ROA Vol is 5.4 percent, comparable to the respective figures in Bova, Kolev, Thomas, and Zhang (2015).

With respect to the descriptive statistics for the executive compensation variables, my sample has a mean (median) vega of $133,000 ($50,000); delta of $741,000 ($229,000); and cash compensation of $1,131,000 ($858,000), all similar to the figures in Armstrong and Vashishtha (2012). The distributions of firm characteristics in my sample appear similar overall to those in Ljungqvist et al. (2017), with any differences likely attributable to differences in sample composition. For example, the firms in my sample appear slightly older (mean of 22.3 years versus 19.6 years in Ljungqvist et al. 2017), somewhat larger (total assets of $5.38 billion versus $1.75 billion), and carry more cash (9.1 percent of assets versus 3.5 percent of assets). These differences likely arise from the fact that my sample is drawn from firms included in the S&P 1500 index, whereas the sample in Ljungqvist et al. (2017) includes all Compustat firms.

Panel B of Table 1 displays the mean values of key CEO and firm characteristics after partitioning the sample on CEO Tax Burden into quartiles within each year. As CEO Tax Burden increases, Delta and Total Wealth increase monotonically. At the same time, however, CEOs with higher tax burdens appear significantly less diversified than CEOs with low tax burdens (Pct. of Wealth in Equity is 0.79 (0.68) for CEOs in the top (bottom) quartile of tax burdens). This descriptive evidence provides preliminary support for the claim that CEOs with higher tax burdens are those most in need of improved diversification.

Electronic copy available at: https://ssrn.com/abstract=3056793
IV. PANEL ANALYSIS

Panel Analysis: Research Design

To investigate whether CEOs’ tax burdens are associated with reduced risk, I test for the potential relation between risk measures ($Firm Risk_{i,t}$) and CEO tax burden for the previous year ($CEO Tax Burden_{i,t-1}$) and control variables, using the following regression model:

$$Firm Risk_{i,t} = \alpha_i + \alpha_t + \beta_1 CEO Tax Burden_{i,t-1} + \gamma'X_{i,t-1} + \epsilon_{i,t}. \quad (2)$$

In the equation above, $i$ and $t$ index firms and years, respectively. The dependent variable, $Firm Risk$, represents the three measures of corporate risk. $CEO Tax Burden$ represents the CEO’s tax burden on her stock holdings in the firm, and the remaining control variables are drawn from prior research on compensation and corporate risk. To control for firm-specific factors and general macroeconomic time trends, I include both firm and year fixed effects.\(^{16}\) I estimate the model using ordinary least squares with standard errors clustered by executive and year. The variable of interest in Equation 2 is $CEO Tax Burden$ and I predict a negative $\beta_1$, indicating that an increase in $CEO Tax Burden$ in year $t-1$ is associated with reduced risk-taking in year $t$.

Panel Analysis: Results

Table 2 presents the results from estimating Equation 2. The first column of Panel A shows that the coefficient on $CEO Tax Burden$ is negative and statistically significant (coef.=-0.333; t-stat.=-4.22). This result indicates that increases in CEOs’ tax burdens in year $t-1$ lead to lower stock return volatility in year $t$, consistent with my central hypothesis. Similarly, columns 2 and 3 show negative associations between CEOs’ tax burdens and idiosyncratic volatility, as well as earnings volatility. In economic terms, moving from the 25th to the 75th percentile of $CEO Tax Burden$ is associated with a 2.0 percent relative decrease in $Log(Total Vol)$.

Turning to the control variables, I find the coefficients on $Log(Vega)$ are either negative or insignificantly different from zero. Although early work finds that the convexity of the manager’s

\(^{16}\) In untabulated analysis, I estimate Equation 2 while excluding year fixed effects in order to retain the variation in the federal capital gains tax rates over time. In the absence of year fixed effects, the results are slightly stronger but are similar. I include year fixed effects in the tabulated results so as to avoid overstating the magnitudes of the effects.
wealth-performance relation is positively related to risk-taking (e.g., Guay 1999), some studies examining more recent periods show an insignificant or negative relation between vega and volatility (e.g., Hayes, Lemmon, and Qiu 2012; Anderson and Core 2017). Other control variables are largely consistent with prior research (e.g., bigger, older firms with excess cash holdings are less risky, whereas firms with more long-term debt and overconfident CEOs are riskier).

In Panel B of Table 2 I re-estimate Equation 2 after replacing Firm Risk with corporate policies frequently used to proxy for risk-taking, including the levels of R&D expenditures, leverage, and working capital. Economically, I find that moving from the 25th to the 75th percentile of CEO Tax Burden leads to 3.7 percent lower R&D expenditures, 1.7 percent lower leverage, and 2.3 percent higher working capital, all consistent with a greater aversion to risk. Overall, the results in Table 2 provide evidence of a robust negative relation between CEOs’ tax burdens and corporate risk-taking.

Panel Analysis: Potential Confounding Factors

The panel analysis above, while informative, does not rule out the possibility of other confounding factors. A key challenge derives from the construction of the tax burden measure. The CEO’s tax burden has several determinants: the CEO’s capital gains tax rate (federal plus state), the stock’s historical price appreciation during her holding period, the number of shares held that were obtained in each year, and the value of the CEO’s equity holdings. These features make it difficult to infer the causal effect of the tax burden on risk-taking.

One concern is that the negative relation documented in the panel analysis could be due to the firm’s past performance. Christie (1982) suggests that firms which have performed well in the past are likely to experience lower volatility, as the market value of debt relative to equity declines. Known as the “leverage effect” (Aït-Sahalia, Fan, and Li 2013), this relation between firm performance and volatility may confound my inferences, as firms with positive past performance are likely to have CEOs with substantial tax burdens. Another concern is that the measure is partly determined by executives’ past portfolio choices and option exercise behavior, which are also
likely associated with corporate risk-taking. To address these endogeneity concerns, I exploit federal and state tax cuts to isolate the influence of changes in the tax rate on corporate risk-taking.

V. FEDERAL AND STATE TAX CUTS ANALYSIS

Federal Tax Cuts: Research Design

First I examine the federal tax cut contained in the Taxpayer Relief Act of 1997 (TRA97) which reduced the top individual capital gains tax rate on long-term investments from 28 percent to 20 percent, effective May 7, 1997. This tax act has several features which make it a desirable research setting. First, the change in the tax rate is economically significant – nearly a 30 percent relative drop in the maximum rate compared to the previous tax regime. Second, the capital gains tax reduction was the most noteworthy feature of the TRA97, which contained few other provisions.17 Third, the tax reduction was largely unexpected.18 Given the swift and unexpected nature of the enactment of TRA97, it is unlikely that CEOs anticipated the tax cut and adjusted their behavior preemptively.

Although the legislative change affected all CEOs simultaneously, I hypothesize that it had a stronger effect on CEOs with high tax burdens just prior to the tax cut. My rationale is as follows: CEOs with high tax burdens are more likely to be under-diversified as a result of the tax lock-in effect, and thus face the strongest incentives to reduce firm risk. Although a federal tax cut potentially reduces the cost of selling shares for all CEOs, the diversification benefits of selling stock are disproportionately greater for those CEOs who were previously locked-in to their positions (i.e., high-tax-burden CEOs). As a result, I expect high-tax-burden CEOs to experience the largest increases in risk-taking following the tax cut.

17 Other tax legislation included in TRA97 consisted of a child tax credit, estate tax relief, education tax incentives, and an expansion of individual retirement accounts (Dai, Shackelford, and Zhang 2013).
18 On April 30, 1997, the Congressional Budget Office made a surprise announcement that it had reduced the estimate of the 1997 deficit by $45 billion. Two days later, President Clinton and Congressional leaders announced an agreement to balance the budget by 2002 and reduce the capital gains tax rate. The following week, Senate and House leaders announced that the effective date for the tax cut would be May 7, 1997 (Lang and Shackelford, 2000).
I construct a six-year window of observations surrounding the tax cut and require all CEO-firm pairs to have at least four consecutive years of data to be included in the sample. I estimate the following regression:

\[
\text{Firm Risk}_{i,t} = \alpha_i + \beta_1 \text{Post-Fed Tax Cut}_t + \beta_2 \text{Post-Fed Tax Cut}_t \times \text{Pre-Tax Cut Burden}_i + \gamma' X_{i,t-1} + \epsilon_{i,t}. \tag{3}
\]

Year \( t \) runs from 1995 through 2000. Thus Firm Risk\(_{i,t}\) includes firm \( i \)'s risk-taking in two years before, the year of, and three years following the tax cut in order to allow sufficient time for any change in risk-taking to manifest.\(^{19}\) Post-Fed Tax Cut\( _t \) is an indicator variable equal to one for years 1998 onwards, and equal to zero in the earlier years. Pre-Tax Cut Burden is equal to the CEO's tax burden measured as of the end of 1996. Firm Risk is defined as previously, \( X \) represents the same control variables as in Equation 2, and \( \alpha_i \) represents firm fixed effects.\(^{20}\) I predict a positive \( \beta_2 \) indicating that CEOs with higher tax burdens prior to the tax cut will have a larger subsequent increase in risk-taking relative to low-tax-burden CEOs.

Next I perform a similar analysis with regard to the capital gains tax cut contained in the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA), which reduced the top individual capital gains tax rate from 20 percent to 15 percent. Compared with the tax cut in TRA97, JGTRRA is a relatively noisy setting in that the act contained other significant tax legislation that could confound my inferences.\(^{21}\) Nevertheless, it represents a sizeable drop in the capital gains tax rate, and thus a useful setting to help triangulate my findings.

A potential concern related to using the difference-in-differences methodology for the federal tax cut tests is whether firms with high-tax-burden CEOs are comparable to firms with low-tax-burden CEOs. I attempt to mitigate these concerns by partitioning each sample at the

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\(^{19}\) Refer to Figure 1 for a graphical representation of the time periods over which the tests are conducted.

\(^{20}\) Note that the main effect Pre-Tax Cut Burden, is excluded from Equation 3 because it reflects CEO tax burden values measured in just one year for each of the two federal tax cuts (CEO Tax Burden is measured in 1996 and 2002, respectively, for the two federal tax cuts). Thus it is subsumed by firm fixed effects for the federal-level tests.

\(^{21}\) In addition to the reduction in the capital gains tax rate, JGTRRA reduced the top dividends tax rate from 39.6 percent to 15 percent, reduced the top ordinary income tax rate from 38 percent to 35 percent, and introduced bonus depreciation incentives designed to boost corporate investment (Blouin, Raedy, and Shackelford 2011).
median into high and low tax burden CEOs just prior to each tax cut, and using propensity score matching to more closely match the characteristics of the two groups of firms. Panel A of Table 3 shows the results of the matching procedure for the samples used in the 1997 and 2003 federal tax cut tests. In each case, the matched treatment and control groups display no significant differences in any of the matching variables.

**Federal Tax Cuts: Results**

Panel B of Table 3 present the results from estimating Equation 3 for TRA97. The first column shows a positive but insignificant increase in total return volatility following the tax cut for CEOs with a zero tax burden (coef. = 0.018; t-stat. = 1.18). However, the coefficient on Post-Fed Tax Cut × Pre-Tax Cut Burden shows that high-tax-burden CEOs experience a substantially larger increase in corporate risk-taking following the tax cut (coef. = 0.249; t-stat. = 2.56). Economically, I find that a CEO at the 25th (75th) percentile of CEO Tax Burden in 1996 experiences a 2.0 percent (4.6 percent) increase in total return volatility. The results in columns 2 and 3 examining idiosyncratic volatility and earnings volatility yield similar inferences.

Panel C displays the results related to the tax cut contained in JGTRRA. Although the negative coefficients on Post-Fed Tax Cut indicate a decrease in risk-taking following the tax cut for CEOs with zero tax burden, the coefficient on Post-Fed Tax Cut × Pre-Tax Cut Burden is significantly positive, similar to Panel B. The results indicate that relative to firms with low burden CEOs, firms with high burden CEOs experience increased volatility following the tax cut.

The evidence in Table 3 suggests that the federal capital gains tax cuts in 1997 and 2003 disproportionately affected CEOs with higher tax burdens prior to the cuts. I interpret the results

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22 Using the sample of firm-years available just prior to each of the two federal tax cuts (i.e., 1996 and 2002), I match firms with an above-the-median tax burden CEO to a corresponding firm with a below-the-median tax burden CEO. To construct propensity scores, I estimate a probit regression where the dependent variable is an indicator equal to one (zero) for high (low) burden CEOs, and the independent variables include all of the control variables in Equation 2 except for CEO Tax Burden. I use nearest neighbor matching within caliper (set at 0.50).

23 Note that the 25th and 75th percentiles of CEO Tax Burden in 1996 were 0.010 and 0.113. Thus the economic magnitude of the effects can be computed by adding the main effect to the respective interaction effect. For the 25th percentile: 0.018 + 0.010 × 0.249 = 0.020; for the 75th percentile: 0.018 + 0.113 × 0.249 = 0.046.

24 In untabulated analyses, I verify the results in Table 3 are robust to interacting all controls with Post-Fed Tax Cut.
as indicating that the tax cuts reduced the tax cost to selling shares for locked-in CEOs, allowing them to dispose of firm stock at a lower cost, diversify their personal wealth, and take on more corporate risk. Overall, the findings in Table 3 provide evidence consistent with my central prediction that higher CEO tax burdens discourage corporate risk-taking.

**State Tax Cuts: Research Design**

Next I exploit state-level changes in individual capital gains tax rates. Although smaller in magnitude than the federal tax cuts, state tax rate changes provide several advantages in that they change frequently, they are staggered over time, and each tax rate change only affects a subset of CEOs, leaving a plausible counterfactual of unaffected CEOs. Similar to the tests examining federal tax cuts, I predict that state tax cuts differentially affect CEOs with high tax burdens relative to CEOs with low tax burdens. I test my prediction by estimating the following model:

\[
\text{Firm Risk}_{i,s,t} = \alpha_i + \alpha_t + \beta_1|\text{State Tax Rate Cuts}_{s,t}| + \beta_2\text{Pre-Tax Cut Burden}_i + \beta_3|\text{State Tax Rate Cuts}_{s,t}| \times \text{Pre-Tax Cut Burden}_i + \beta_4\text{Pre-Tax Cut Burden}_i + \gamma'X_{i,t-1} + \epsilon_{i,s,t}.
\]  

Equation 4 is a two-way fixed effects model, containing firm and year fixed effects (\(\alpha_i\) and \(\alpha_t\), respectively), with subscript \(s\) representing the state in which the firm is headquartered. \(|\text{State Tax Rate Cuts}_{s,t}|\) equals the magnitude of any reduction in the state’s top capital gains tax rate, and I allow it to equal this value for three years following the tax cut to allow time for any changes in firm risk-taking to manifest (see Figure 1 for a graphical illustration of the time period over which the variables are measured). If no tax cut has taken place in state \(s\) within the previous three years, then \(|\text{State Tax Rate Cuts}_{s,t}|\) is set equal to zero. \(\text{Pre-Tax Cut Burden}_i\) represents the tax burden of firm \(i\)’s CEO in the year prior to the tax cut. \(\text{Firm Risk}_{i,s,t}\) represents the three risk proxies measured in year \(t\). I predict a positive \(\beta_3\) indicating that affected CEOs with high tax burdens experience larger subsequent increases in risk-taking than CEOs with low tax burdens.

**State Tax Cuts: Main Results**

Table 4 presents the results of estimating Equation 4. Consistent with the results from the panel tests in Table 2, the coefficients on \(\text{Pre-Tax Cut Burden}\) are significantly negative indicating that CEOs with higher tax burdens tend to have lower risk. Note that in this table, \(\text{Pre-Tax Cut Burden}\)
Burden is a continuous measure, thus the coefficient on \(|\text{State Tax Rate Cut}|\) can be interpreted as the effect of a state tax cut on corporate risk-taking when the firm’s CEO has a tax burden equal to zero. Although the coefficients on \(|\text{State Tax Rate Cut}|\) are insignificant, the coefficients on \(|\text{State Tax Rate Cut}| \times \text{Pre-Tax Cut Burden}\) are significantly positive for all three measures of risk-taking. The results suggest that tax cuts have the largest effects on CEOs with large embedded gains in their stock (i.e., locked-in CEOs), consistent with my central hypothesis.\(^\text{25}\)

Economically, a one percent drop in the long-term gains tax rate leads to a modest 0.3 percent increase in total return volatility for CEOs at the 25\(^{th}\) percentile of CEO Tax Burden, relative to CEOs in unaffected states. But the same tax cut leads to a statistically significant 1.9 percent volatility increase for CEOs at the 75\(^{th}\) percentile of CEO Tax Burden. The inferences from the estimations using idiosyncratic volatility and earnings volatility in columns 2 and 3 are similar. For the sake of comparison, Ljungqvist et al. (2017) find that a one percent increase in state corporate tax rates reduces earnings volatility by between 2.4 percent and 3.2 percent over the subsequent three years.\(^\text{26}\)

**State Tax Cuts: Small, Medium, and Large Tax Cuts**

To facilitate comparing the magnitude of responses to the size of the tax cuts, I re-estimate Equation 4 after replacing \(|\text{State Tax Rate Cut}|\) with indicator variables for small, medium, and large state tax cuts, defined as those tax cuts ranging in magnitude from 0.25 percent to 0.50 percent, from 0.51 percent to 1.25 percent, and greater than 1.25 percent, respectively. The results are displayed in Table 4 Panel B, and indicate that larger state tax cuts are followed by greater increases in corporate risk-taking for locked-in CEOs. Economically, large state tax cuts lead to a 3.0 percent higher increase in volatility for CEOs at the 75\(^{th}\) percentile of the tax burden compared

\(^{25}\) I verify that the results in Table 4 are robust to interacting all control variables with \(|\text{State Tax Rate Cut}|\).

\(^{26}\) In untabulated analysis, I use propensity score matching to more closely match affected CEOs with below-median tax burdens to those with above-median tax burdens within the same state and year. As in the federal tests, I construct propensity scores by estimating a probit regression where the dependent variable is an indicator equal to one (zero) for high- (low-) tax burden CEOs, the independent variables are the controls from Equation 2 (excluding CEO Tax Burden), and the caliper is set at 0.01. My inferences are unchanged when using this matched sample of firms in the state tax cut tests.
to CEOs at the 25th percentile. The corresponding figures for medium and small state tax cuts are 1.8 percent and 0.8 percent, respectively.

With some caveats, it is possible to compare the magnitudes of responses from the state tax cuts to those from the federal tax cuts. The 1997 and 2003 federal tax cuts reduced the top capital gains tax rate by eight percentage points and five percentage points, respectively. As shown in Table 3 above, the overall response to the 1997 tax cut is a 4.6 percent increase in total return volatility for high-tax-burden CEOs (as reflected in the 2.0 percent increase for low-tax-burden CEOs plus the incremental 2.6 percent increase for high-tax-burden CEOs). The overall response to the 2003 tax cut is actually negative, but the effect is ameliorated for high-tax-burden CEOs who experience a relative increase of 1.5 percent compared to low-tax-burden CEOs. Thus the 1997 federal tax cut induced risk increases comparable to those following the largest state tax cuts, whereas the 2003 federal tax cut induced changes comparable to those following medium-sized state tax cuts.

An advantage of using multiple settings is that it provides a range of estimates regarding the economic effect of tax cuts on locked-in CEOs. My finding that the 8 percent federal tax cut contained TRA97 leads to a 4.6 percent volatility increase suggests a sensitivity of approximately 0.6 percent volatility increase in response to a one percent tax drop. The results from the state setting suggest a higher sensitivity – approximately a 1.9 percent volatility increase in response to a one percent tax drop for high-tax-burden CEOs. Caution is warranted in making direct comparisons between different settings and tests, due to both observable and unobservable differences in the economic and political environments of each setting. But collectively, my

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27 An example of an observable difference between settings is that the distribution of CEO tax burdens varies over time, with the 75th percentile equal to 0.11 just prior to TRA97, but equal to 0.03 just prior to JGTRRA03. And as evidenced throughout the analyses, the strength of response to any tax cut is likely to depend in part on the magnitude of CEOs’ tax burdens. An unobservable difference between settings is that the impact of a tax cut likely depends on CEOs’ expectations about any future tax rate changes. For example, if CEOs expect tax rates to continue to decrease in the future they may continue to wait to sell stock, whereas if they think the tax cut will be short-lived, they will likely respond with greater urgency.

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estimates suggest volatility increases ranging from 0.6-1.9 percent in response to a one percent drop in the top capital gains tax rate for locked-in CEOs.

**State Tax Cuts: S&P 500 Firms**

One potential concern with the analysis so far is that increases in volatility following federal and state tax cuts may be driven by the tax incentives of outside shareholders rather than those of inside managers. This is certainly a concern in the federal tax cut setting, but it is somewhat less of a concern in the state tax changes setting because investors are taxed based on where they reside, not where the firm is headquartered. Although prior work documents the existence of a local (e.g., within-state) home bias in investor portfolios, the effect tends to be stronger among smaller firms with less publicly available information, and weaker among larger, more visible firms that have more analyst following, more press coverage, and greater institutional ownership (e.g., Coval and Moskowitz 1999, 2001; Ivkovic and Weisbenner 2005).²⁸

In untabulated analysis, I re-estimate Equation 4 after restricting the sample to firms in which investor home bias should be weakest (i.e., those in the S&P 500 index). Rather than finding a more muted response to the tax cuts among S&P 500 firms, I find that the response is somewhat larger than that for the whole sample of firms. This finding helps to mitigate (but does not rule out entirely) concerns that the equity volatility response to the state tax cuts is driven by outside shareholders who are also residents of the state.²⁹

**State Tax Cuts: Neighboring States Falsification Test**

Another potential concern with the above analysis is that high- and low-tax-burden CEOs are not comparable, and risk-taking would diverge for these firms regardless of whether or not a tax cut takes place. To address this concern, I construct a falsification test in which I assign

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²⁸ Specifically, Ivkovic and Weisbenner (2005) find that individual investors place 18 percent of their actual portfolios into local S&P 500 stocks (where local is defined as firms headquartered within 250 miles of the investor’s household), whereas these stocks would make up 10 percent of the portfolio if the households invested in the market.

²⁹ In further untabulated analysis, I investigate the interaction of the firm’s shareholder tax sensitivity with the state tax cuts and find that firms with more individual (i.e., tax sensitive) shareholders have a slightly larger increase in risk-taking following the tax cuts, consistent with the tax incentives of outside shareholders incrementally affecting firm risk. However, the effect is not always significant and it does not affect my main inferences regarding CEOs.
“pseudo-tax cuts” to states neighboring the “true” tax cut states. For example, in 2010, New Jersey reduced its top long-term gain tax rate from 10.75 percent to 8.97 percent. Thus I assign the tax cut to CEOs of firms headquartered in states that share a border with New Jersey (i.e., New York, Pennsylvania, and Delaware).

In untabulated analysis, I re-estimate Equation 4 using the pseudo-tax cuts, and I find that the coefficients on $|State Tax Rate Cut| \times Pre-Tax Cut Burden$ are indistinguishable from zero for all measures of risk-taking. Given this result, an alternative explanation must explain not only why risk-taking trends diverge among high- and low-tax-burden CEOs in affected states, but also why there is no corresponding divergence among firms headquartered in neighboring states.

**Tax Cuts Analysis: Other Potential Confounding Factors**

Additional concerns related to the tax changes analysis stem from concurrent events that plausibly affect risk-taking incentives. For example, recent research suggests that both corporate and ordinary income taxes affect corporate risk-taking (Langenmayr and Lester 2017; Ljungqvist et al. 2017; Armstrong et al. 2017). In separate untabulated analyses, I verify that the results in Table 4 Panel A are qualitatively similar after excluding all capital gains tax cuts coinciding with corporate tax changes and with ordinary income tax changes.30

Finally, another potential concern is whether firms adjust compensation in response to the changes in tax incentives. Untabulated analysis shows increases in new delta, new vega, and total compensation awarded in the years following the tax cuts (but no change in total cash compensation). However, there appears to be no difference in the new compensation awarded for

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30 Although state corporate tax changes do not overlap heavily with long-term gain tax changes (just 14 out of 73 capital gains tax cuts occur within three years of a corporate tax cut in the same state), I find that ordinary income tax and long-term gain tax rates often move together (in 61 out of 73 cases), because a large number of states use the same tax rate for both types of income. Evidence in Armstrong et al. 2017 suggests that simultaneous reductions in ordinary income tax rates are likely to attenuate my results with respect to the lock-in effect, because higher tax rates facilitate risk-sharing with the government. In order for my prediction to dominate when both the ordinary income and capital gains tax rates decrease, the risk-inducing effect of reduced tax lock-in (arising from lower capital gains tax rates) must outweigh the risk-deterring effect of reduced risk-sharing with the government (arising from lower ordinary income tax rates).
high- versus low-tax-burden CEOs, mitigating concerns that changes in newly awarded compensation are driving the differential effect of the tax cuts for high and low burden CEOs.

VI. ADDITIONAL ANALYSIS

In this section, I perform several additional analyses that serve two main purposes. First, I aim to shed light on the mechanism underlying the relation between capital gains tax changes and corporate risk-taking. Second, I hope to further rule out alternative explanations that could account for my primary results. With these objectives in mind, I study CEO stock sales, the strength of firm responses to the tax cuts conditional on CEO outside wealth, changes in corporate policies as other proxies for risk-taking, and firm responses to tax increases.\footnote{For the sake of brevity, I present the results for all additional analysis using the state tax changes setting. In untabulated analysis, I perform all tests using the two federal tax cuts and my inferences are generally similar.}

CEO Stock Sales

To directly connect tax cuts, CEO stock sales, and corporate risk-taking, I perform a two-stage-least-squares procedure to first estimate the magnitude of CEO stock sales in response to the tax cuts, and then examine the impact of the predicted stock sales on subsequent risk-taking. I modify the specification from Equation 4 to include additional controls that help explain managers’ equity holdings (Armstrong et al. 2015), and by replacing \(|State Tax Rate Cut|\) with \(|State Tax Rate Cut|\ at \(t=0\).\footnote{Recall that in previous tests, \(|State Tax Rate Cut|\ is set equal to the absolute value of the drop in the state’s capital gains tax rate for three years following the tax cut (i.e., for years \(t=+1\) to \(t=+3\) where \(t=0\) is the year in which the tax cut takes effect), in order to capture changes in risk-taking that manifest over time.} My rationale for the modification is that I expect CEOs to respond rapidly to the tax cuts by selling appreciated stock, and thus a large portion of the stock sales induced by the tax cuts will take place in the first year the tax cuts take effect (i.e., year \(t=0\)).

I use two proxies for CEO stock sales: the number of shares sold in each year (to capture changes in the absolute magnitude of stock sold), and the proportion of the CEO’s total equity portfolio sold (to capture the relative shift in the CEO’s total portfolio holdings, or diversification). CEO stock sales are estimated using data from Thomson Financial Insiders Data Feed.
Table 5 Panel A presents the results from the first stage regression, in which I estimate the impact of state tax cuts on CEO stock sales. The results indicate a spike in stock sales in year \( t=0 \), displaying positive coefficients for \( \text{Pre-Tax Cut Burden} \times |\text{State Tax Rate Cut}| \) at \( t=0 \) with respect to both the number of shares sold and the percentage of CEOs’ total equity sold. Economically, a one percent drop in the long-term gains tax rate spurs affected CEOs at the 75th percentile of CEO Tax Burden to sell incremental stock worth 1.8 percent of their total equity portfolio compared to CEOs at the 25th percentile of the tax burden.33

Next I use the predicted values of stock sales in year \( t=0 \) obtained from the first stage to examine the impact on subsequent risk-taking in the second stage regression. Table 5 Panel B presents the second stage results, using predicted values of both Num Shares Sold and Pct. Equity Sold to measure stock sales, and \( \log(\text{Total Vol}) \) and \( \log(\text{ROA Vol}) \) measured over three years to proxy for risk-taking. In all cases, I find that larger predicted stock sales lead to statistically significant increases in risk-taking in the three years following the tax cuts.

**Cross-Sectional Variation: CEO Diversification**

Next I conjecture that when CEOs hold more personal wealth outside of the firm, they have greater opportunities to diversify despite the tax-induced lock-in effect on their equity holdings in the firm. As a result, I predict that high tax burdens have a weaker risk-deterring effect on CEOs with significant outside wealth, and tax cuts induce a milder increase in risk-taking. I estimate each CEO’s diversification by dividing the value of her equity portfolio by her total wealth (Pct. of

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33 To illustrate how predicted stock sales are determined from state tax cuts and CEO tax burdens, consider an example in which CEOs at the 25th and 75th percentiles of the tax burden (tax burden values of 0.00 and 0.06, respectively) are affected by a small and a large tax cut (Ohio in 2005 and New Jersey in 2010 experienced tax cuts of 0.31 percent and 1.78 percent, respectively). The Table 5 Panel A results suggest that in response to the Ohio tax cut, the predicted percentage of equity sold for 75th percentile CEOs is 0.53 percent higher than for 25th percentile CEOs. The calculation is as follows: Predicted Pct. Equity Sold = fitted coefficient \( \times \text{Pre-Tax Cut Burden} \times |\text{State Tax Rate Cut}| \), or 0.289 \( \times 0.6 \times 0.31 = 0.53 \) percent for the 75th percentile CEO compared to 0.289 \( \times 0.00 \times 0.31 = 0.00 \) percent for the 25th percentile CEO. The corresponding calculation for CEOs affected by the New Jersey tax cut suggests that predicted equity sold is 3.09 percent higher for 75th percentile CEOs compared to 25th percentile CEOs (0.289 \( \times 0.06 \times 1.78 = 3.09 \) percent versus 0.289 \( \times 0.00 \times 1.78 = 0.00 \) percent).
Wealth in Equity).\footnote{Estimates of CEO total wealth are obtained by adding together the total value of CEO equity held in the firm and CEO outside wealth. CEO outside wealth is obtained by cumulating past compensation as described in Dittmann and Maug (2007), and missing values are imputed following Armstrong et al. (2015).} I then annually partition the sample of CEOs using Pct. of Wealth in Equity, and classify executives above (below) the median as CEOs with (low) high diversification.

Table 6 presents the results of estimating Equation 4 for the Low Diverse and High Diverse groups. In column 1, I find that the coefficient on $|\text{State Tax Rate Cut}| \times \text{Pre-Tax Cut Burden}$ for the Low Diverse group is larger than for the High Diverse group, although the difference is marginally significant (coef.=0.514 versus coef.=0.265; p-value=0.10 for the difference). I find similar results using $\log(\text{ROA Vol})$. Overall, the cross-sectional results indicate that the tax cuts induce a weaker increase in corporate risk-taking when the executives have greater outside wealth, and thereby have the potential to diversify their personal holdings in spite of the tax lock-in.

**Channels of Risk-Taking: Corporate Policies**

Next I examine the effect of the state tax cuts on firm policies commonly used as proxies for corporate risk-taking: R&D expenditures, leverage, and working capital. Prior literature finds that R&D investment and leverage are increasing in firm risk, whereas working capital is decreasing in firm risk (Coles et al. 2006; Cassell et al. 2012). As displayed in Table 7, the results are consistent with the state tax cuts leading to riskier corporate policies for firms with previously locked-in CEOs. A one percent tax cut induces no significant change in R&D investment for a CEO at the 25th percentile of CEO Tax Burden, but a 3.7 percent relative increase in R&D investment for a CEO at the 75th percentile. Similarly, a CEO at the 75th percentile of CEO Tax Burden experiences a 1.3 percent relative increase in leverage, and a 1.4 percent relative decrease in working capital.

**State Tax Increases**

Next I perform an analysis of state tax increases. It is important to note that the response to tax increases will not necessarily be symmetric to that for tax cuts, due to the nature of the lock-in effect. Although tax cuts provide immediate relief to investors with large unrealized gains, they
provide little immediate benefit to investors without gains. Hence, the previous tests show that tax cuts are followed by immediate stock sales and increased risk-taking by CEOs with substantial locked-in gains (but generally the tests show no change in stock sales or risk-taking for CEOs without locked-in gains). Tax increases, however, are less likely to trigger an immediate shift in stock ownership among CEOs with unrealized gains.

To illustrate the above point, Figure 2 plots a measure of CEO diversification (the percentage of a CEO’s total wealth held in the firm’s stock) in each year surrounding a state tax change, ranging from $t=-3$ to $t=+3$, where $t=0$ is the year in which the tax change takes effect. Panel A (B) of Figure 2 shows average values for high- and low-tax-burden CEOs in the years surrounding state tax cuts (increases). In both panels, the percentage of CEO wealth held in the firm’s stock is noticeably higher for high-tax-burden CEOs than for low-tax-burden CEOs, consistent with the tax lock-in effect. Panel A shows that high-tax-burden CEOs experience a marked decrease in the percentage of CEO wealth held in the firm’s stock in year $t=0$ relative to years $t-3$ through $t-1$, indicating a stock sell-off as soon as the tax cut takes effect. Panel B, however, does not show a sudden shift in stock holdings in response to state tax increases for either high- or low-tax-burden CEOs. Rather, there seems to be a steady, gradual increase in stock holdings for both high- and low-tax-burden CEOs, consistent with the above argument.

To examine the impact on risk-taking, I estimate a model similar to Equation 4 in which I replace state tax cuts with state tax increases, but in light of the above considerations, I make no prediction with regard to the sign of the coefficients. Similar to the state tax cut analysis, I set $|State Tax Rate Inc|$ and Pre-Tax Inc Burden equal to their respective values for three years following the tax increases to observe any change in risk that manifests over time. In Table 8, the main effect of $|State Tax Rate Inc|$ for CEOs with no tax burden is negative and statistically significant (coef.=-0.030; t-stat.=-3.65). But there appears to be no disparity in the effect for high-tax-burden CEOs compared to low-tax-burden CEOs (coef.=0.114; t-stat.=0.94).
Overall, the results suggest an asymmetric effect of capital gains tax cuts and increases on corporate risk-taking, due to the nature of the tax lock-in effect. In particular, tax cuts trigger a sudden shift in incentives for previously locked-in CEOs thus affecting their risk tolerance, but any incentive changes generated by tax increases take longer to manifest and ultimately affect CEOs regardless of their prior tax burden.

**Alternative Measures of Tax Burden**

The tax burden measure is calculated as the tax based on selling all vested stock scaled by the CEO’s total equity holdings. Although I believe this construction has a solid theoretical and institutional foundation, there are reasonable alternative design choices. In untabulated robustness tests, I construct several alternative tax burden measures and use them to re-estimate Equation 4.

The first alternative is simply an unscaled tax burden measure (i.e., the dollar amount of taxes owed on the sale of vested stock). For the second alternative measure, I replace the denominator (the CEO’s total equity holdings in the firm), with an estimate of CEO total wealth, using the outside wealth estimates as computed following Dittmann and Maug (2007) and used in Table 6. For the third alternative measure, I aim to mitigate concerns about outlier values affecting the results by creating an indicator variable based on above- and below-median values of CEO Tax Burden. And for the fourth alternative measure, I construct a “marginal” tax burden measure assuming the CEO sells just the first ten percent of her equity portfolio (assuming she chooses to sell the 10% of the portfolio with the highest tax basis to minimize any potential gain on the sale).

The results (untabulated, but available upon request) show that regardless of which tax burden measure is used, the inferences are the same. Higher tax burdens are associated with lower-risk-taking, and risk-taking increases following tax cuts for CEOs with high tax burdens.

**VII. CONCLUSION**

In this paper, I study the effects of CEOs’ unrealized tax liabilities on corporate risk-taking. Building on recent work showing that large anticipated tax obligations discourage CEOs from selling stock, I conjecture that the tax lock-in effect causes the executives to become overexposed
to firm-specific risk. In response, I predict that CEOs make more conservative decisions with regard to the firm in an effort to limit their own personal risk.

Consistent with this hypothesis, I find that corporate risk-taking decreases as CEOs’ personal tax burdens increase. Further, I find that risk-taking increases following individual capital gains tax cuts at the federal and state levels, and the effect is driven by CEOs with significant unrealized tax liabilities. The evidence indicates that tax cuts alleviate the lock-in effect on CEOs by lowering the tax cost of selling stock, thereby allowing the executives to reduce their holdings in the firm and diversify their personal wealth.

My study contributes primarily to three literatures. First, it extends the literature on the effects of investor-level taxes by switching the focus from external investors to internal investors. Few studies have examined the impact of taxes on corporate insiders, and to the extent that taxes affect managers’ incentives and decision-making, this seems an economically important and fruitful area for future research. Second, it contributes to the literature on incentive compensation and corporate risk-taking. Research in this area has struggled to causally identify the effects of ownership incentives on risk-taking. By introducing a setting of tax shocks that affect CEO stock holdings, I improve upon existing research. Third, it adds to a growing literature examining the incentive effects of taxes on risk-taking. Finally, my findings have implications for corporate boards in that they should be aware of the role played by managers’ personal taxes in influencing incentive alignment. Although my findings do not speak to whether locked-in CEOs create or destroy value for the firm, the evidence suggests that taxes do affect their incentives to make risky corporate decisions.
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APPENDIX A
Variable Definitions

This table provides a detailed description of the procedures used to compute each variable used in my analyses. The data are obtained through Compustat, ExecuComp, CRSP, and Thomson Reuters. In addition, I use estimates of CEO wealth taken from the website of Ingolf Dittmann, and corrected Compustat headquarters location data from Alexander Ljungqvist. All continuous variables are winsorized at the 1 percent and 99 percent levels of the distribution.

Primary Risk-Taking Variables:

| Variable  | Definition                                                                                                                                                                                                 |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Total Vol | The standard deviation of daily returns in fiscal year $t$. An alternative measure is constructed over the window $t$ to $t+2$.                                                                                  |
| Idio Vol  | The standard deviation of daily residual returns in fiscal year $t$. Residual returns are calculated as the difference between expected and realized returns. Expected returns are calculated in fiscal year $t$ based on the parameters of the market model which are estimated using daily firm return data 36 months prior to the beginning of fiscal year $t$ (Cassell et al. 2012). An alternative measure is constructed over the window $t$ to $t+2$. |
| ROA Vol   | The standard deviation of the difference between quarterly ROA and ROA for the same quarter of the previous year, computed over a three-year period $t$ to $t+2$. ROA (return on assets) is defined as income before extraordinary items (Compustat item $ibq$) over the book value of assets (Compustat item $atq$). I annualize ROA volatility by multiplying it by $\sqrt{4}$ (Ljungqvist et al. 2017). |

Additional Risk-Taking Variables:

| Variable       | Definition                                                                                                                                                                                                 |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R&D Exp        | The ratio of research and development expenditures (Compustat item $xrd$) to total assets (Compustat item $at$).                                                                                         |
| Leverage       | The ratio of total debt (Compustat item $at - ceq$) to total assets ($at$).                                                                                                                                   |
| Working Capital| Current assets (Compustat item $act$) minus current liabilities ($lct$) scaled by total assets ($at$).                                                                                                    |
APPENDIX A (continued)

| Variable                  | Definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| **Independent Variables:**|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| **Variable**              | **Definition**                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| CEO Tax Burden            | The CEO Tax Burden measure is computed as:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                           | \[ CEO \text{ Tax Burden}_t = \frac{\sum_{t=1}^{t}(P_t - P_n) \times N_n \times t_{cg}}{\text{Total Equity}_t} \]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                           | Where \( P_t \) is the firm’s stock price at the end of year \( t \); \( P_n \) is the price at which the CEO obtained the stock; \( N_n \) is the number of unrestricted shares held by the CEO in year \( t \) that were obtained in year \( n \); \( t_{cg} \) is the total capital gains tax rate (maximum federal plus state) faced by the CEO in year \( t \) upon selling shares; and \( \text{Total Equity}_t \) is the stock equivalent value from the CEO’s holdings of all vested and unvested stock and options held at the end of year \( t \). Past grants of CEO option holdings are estimated following the approximation method in Core and Guay (2002). |
| Post-Fed Tax Cut          | An indicator variable equal to one for three years following a federal capital gains tax cut, and equal to zero in earlier years. Thus for the analysis of the Taxpayer Relief Act of 1997, it is equal to zero in years 1995, 1996, and 1997, and equal to one in years 1998, 1999, and 2000. In the analysis of the Jobs and Growth Tax Relief Reconciliation Act of 2003, it is equal to zero in years 2001, 2002, and 2003, and equal to one in 2004, 2005, and 2006. |
| [State Tax Rate Cut]      | The absolute value of the decrease in the top individual state capital gains tax rate. The variable is set equal to this value for a three-year period following the tax cut. If the state has not experienced a tax cut within the previous three years, then the variable is set equal to zero.                                                                                                                                                                                                                                                                                                                                                                                                   |
| [State Tax Rate Inc]      | The absolute value of the increase in the top individual state capital gains tax rate. The variable is set equal to this value for a three-year period following the tax increase. If the state has not experienced a tax increase within the previous three years, then the variable is set equal to zero.                                                                                                                                                                                                                                                                                                                                                                                      |
| Pre-Tax Cut Burden        | For the three years following a federal or state tax cut, this is set equal to the CEO’s tax burden computed at the end of the fiscal year prior to the year in which the tax cut takes effect. In all other years, it is simply the tax burden for that year.                                                                                                                                                                                                                                                                                                                                                                               |
| Pre-Tax Inc Burden        | For the three years following a state tax increase, this is set equal to the CEO’s tax burden computed at the end of the fiscal year prior to the year in which the tax increase takes effect. In all other years, it is simply the tax burden for that year.                                                                                                                                                                                                                                                                                                                                                                                      |
| Vega                     | The change in the risk-neutral value of the CEO’s portfolio of stock options for a 0.01 change in the standard deviation of the return of the underlying stock.                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Delta                    | The change in the risk-neutral value of the CEO’s equity portfolio of stock and options for a 1 percent change in the price of the underlying stock.                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Unvested Equity           | The total value of the CEO’s unvested stock and options held at the end of year \( t \).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Cash Compensation         | The total value of cash the CEO received during the year.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| CEO Tenure                | The number of years in which the current CEO has held the office.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Firm Age                 | The firm’s age (in years) from Compustat.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Total Assets              | The book value of assets (Compustat item \( at \)).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Market-to-Book            | The ratio of the market value of equity (Compustat items \( prce \times csho \)) to the book value of equity (Compustat item \( ceq \)).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| LT Debt                   | Long-term debt (Compustat item \( dltt \)) over the book value of assets (Compustat item \( at \)).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
### APPENDIX A (continued)

| Independent Variables (continued): | Definition |
|-----------------------------------|------------|
| **Cash Surplus**                  | Cash from assets-in-place (Compustat items `oancf` – `dpc` + `xrd`) over the book value of assets (Compustat item `at`). |
| **Loss Carryforward**             | An indicator set equal to one if the firm has a positive net operating loss carryforward (Compustat item `tcf`), and zero otherwise. |
| **Sales Growth**                  | Current year sales minus last year’s sales, all divided by last year sales (Compustat item `sale`). |
| **Annual Return**                 | Cumulative monthly returns over the 12-month period ending at the fiscal-year end (measured using data from CRSP). |
| **Holder67**                      | An indicator set equal to one if the CEO holds unexercised exercisable options that are more than 67 percent in the money twice over the period and zero otherwise. The CEO is classified as overconfident beginning with the first time the CEO exhibits this behavior (Campbell, Gallmeyer, Johnson, Rutherford, and Stanley 2011). |
| **SH Tax Sensitivity**            | An estimate of the proportion of the firm’s shareholders that are taxable individuals. Constructed as one minus the firm’s level of institutional ownership as a percentage of its total shares outstanding (Dhaliwal et al. 2007). |

### Additional CEO Equity Holding Variables:

| Additional CEO Equity Holding Variables: | Definition |
|----------------------------------------|------------|
| **Total Equity**                      | A stock equivalent value from the CEO’s holdings of all vested and unvested stock and options at the end of each year (i.e., the value of stock that would need to be held to give the executive the same incentive from their stock and option holdings). |
| **Outside Wealth**                    | An estimate of accumulated past CEO compensation as developed by Dittmann and Maug (2007). Non-firm wealth figures are available on Ingolf Dittmann’s website [http://people.few.eur.nl/dittmann/data.htm](http://people.few.eur.nl/dittmann/data.htm). I use these estimates to impute non-firm wealth for the remaining executives not covered in the data (Armstrong et al. 2015). |
| **Total Wealth**                      | The CEO’s total equity plus outside wealth. |
| **Pct. of Wealth in Equity**          | The CEO’s total equity divided by total wealth. |
| **Num Shares Sold**                   | The number of the CEO’s shares sold during the year. The stock sale data is drawn from Thomson Financial Insiders Data Feed. I include all sales by CEOs and aggregate the number of the CEO’s shares sold within each year to obtain a total number of shares sold for each CEO-year. |
| **Pct. Equity Sold**                  | The value of the CEO’s shares sold during the year divided by the CEO’s total equity held at the beginning of the year. The stock sale data is drawn from Thomson Financial Insiders Data Feed. I include all sales by CEOs, and aggregate the value of the CEO’s shares sold within each year to obtain a total value of stock sold for each CEO-year. |
| **MVE**                               | Market capitalization of the firm at fiscal year end (Compustat items `prc_f` × `csho`). |
| **Idiosyncratic Vol**                 | The standard deviation of the residual return from a market model regression using monthly returns during the 36 months prior to the fiscal year end. |
| **Book-to-Market**                    | The ratio of book value of total assets (Compustat item `at`) to market value of total assets (Compustat items `at` + `prc_f` × `csho` - `ceq` - `txdb`) at the end of the fiscal year. |
| **Free Cash Flow**                    | Operating cash flow (Compustat item `oancf`) minus common and preferred dividends (Compustat item `dv`) divided by average total assets. |
| **Future Return**                     | Cumulative monthly returns over the 12-month period following the fiscal-year end of the current period (measured using data from CRSP). |
APPENDIX B
Description of Tax Burden Computation

Description of Tax Burden Computation
The tax burden is constructed from the tax liability arising from the sale of the executive’s vested stock holdings. The intuition behind the tax burden measure is that it represents the percentage of the CEO’s total equity (including vested and unvested stock and options) held in the firm that would be owed in tax upon the sale of all vested stock. Year 1 represents the first year in which the CEO receives vested stock in the firm. The computation of the tax burden measure is described in detail below.

Tax burden arising from stock:

\[ CEO \text{ Tax Burden}_t = \frac{\sum_{n=1}^{t} (P_t - P_n) \times N_n \times t_{cg}}{Total \text{ Equity}_t} \]

| Variable   | Description                                                                 |
|------------|-----------------------------------------------------------------------------|
| \( P_t \)  | The stock price at the end of year \( t \).                                  |
| \( P_n \)  | The stock price at the end of year \( n \) (i.e., the executive’s basis in the stock). |
| \( N_n \)  | The number of unrestricted shares held by the CEO in year \( t \) that were obtained in year \( n \). |
| \( t_{cg} \) | The combined maximum federal and state capital gains tax rate facing the executive in year \( t \). |
| Total Equity\(_t\) | A stock equivalent value from the CEO’s holdings of all stock and options (including both vested and unvested stock and options) held in year \( t \). |

Tax Burden of vested stocks
I assume that a restricted stock grant enters the tax calculation only when it becomes vested. The executive owes ordinary income tax on the entire value of the restricted stock at the time of vesting. Any appreciation subsequent to the vesting date accrues capital gains tax. I collect ExecuComp information on CEOs’ holdings of unrestricted stock at the end of each fiscal year from 1992 to 2014. From these, I estimate the tax basis, with the simplifying assumption that all vested shares during a year were vested at the fiscal year end, with the fiscal-year-end stock price as the new tax basis. If any vested stock is sold during a year, I assume that CEOs sell first the shares with the highest tax basis, which minimizes realized capital gains or maximizes realized capital losses.

Following Jin and Kothari (2008), the unrestricted stock held by a CEO in the first year of data available on ExecuComp is assumed to have been granted 5 years earlier. For example, if the CEO first appears in ExecuComp in 1993, I assume the reported unrestricted stock in 1993 was granted in 1988. This approximation is necessary due to the lack of more detailed data in ExecuComp.
FIGURE 1
Graphical Illustration of Timeline for Federal and State Tax Cuts

The figure in Panel A depicts the sample period for the test using the federal tax cut contained in the Taxpayer Relief Act of 1997. The figure in Panel B shows the sample period for the test using the federal tax cut contained in the Jobs and Growth Tax Relief Reconciliation Act of 2003. The figure in Panel C represents an example of the timing used to measure variables in the tests using the state tax cuts. In this example, the state tax cut represented is a reduction in the Arkansas top marginal long-term gains tax rate from 6.21 percent to 5.05 percent, effective in 1999.

Panel A: Taxpayer Relief Act of 1997

Panel B: Jobs and Growth Tax Relief Reconciliation Act of 2003

Panel C: State Tax Cuts

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FIGURE 2
CEO Diversification in years surrounding State Tax Changes

In the figures below, the x-axis represents time (years relative to state tax changes, which take effect in year \( t=0 \)) and the y-axis represents the average percentage of each CEO’s total wealth held in the firm’s stock (where total wealth is the sum of the CEO’s total equity in the firm plus the CEO’s outside wealth, estimated following Dittmann and Maug 2007 and as described in Appendix A). Panel A displays visually the comparison of CEO stock holdings for two groups: CEOs with high tax burdens (in the top third of an annual partition) who experience a tax cut; and CEOs with low tax burdens (in the bottom third of an annual partition) who experience a tax cut. For each group, average values are calculated and displayed for the years surrounding the tax cuts (years \( t=-3 \) to \( t=+3 \) where the state tax cut takes effect in year \( t=0 \)). Panel B displays a similar comparison for CEOs who experience a state tax increase.

Panel A: Years surrounding State Tax Cuts

Panel B: Years surrounding State Tax Increases
Panel A presents the descriptive statistics for all my variables of interest. The sample reflects all CEO-years which contain the necessary data for my tests for the years 1993 to 2014. Panel B presents mean values for CEO and firm characteristics after sorting the sample by *CEO Tax Burden* into quartiles within each year. Details of variable construction are contained in Appendix A.

### Panel A: Univariate Statistics

| Variables                      | N   | Mean  | SD   | P25  | P50  | P75  |
|--------------------------------|-----|-------|------|------|------|------|
| **Primary Risk-Taking Measures** |     |       |      |      |      |      |
| Log(Total Vol)                 | 19,540 | -3.71 | 0.44 | -4.02 | -3.73 | -3.42 |
| Log(Idio Vol)                  | 19,540 | -3.85 | 0.48 | -4.18 | -3.87 | -3.53 |
| Log(ROA Vol)                   | 19,540 | -4.31 | 1.11 | -5.12 | -4.42 | -3.59 |
| **Additional Risk-Taking Measures** |     |       |      |      |      |      |
| R&D Exp                        | 19,540 | 0.03  | 0.07 | 0.00  | 0.00  | 0.04 |
| Leverage                       | 19,540 | 0.48  | 0.23 | 0.33  | 0.50  | 0.64 |
| Working Capital                | 19,540 | 0.22  | 0.20 | 0.06  | 0.20  | 0.35 |
| **CEO and Firm Characteristics** |     |       |      |      |      |      |
| CEO Tax Burden                 | 19,540 | 0.03  | 0.09 | 0.00  | 0.01  | 0.06 |
| Vega                           | 19,540 | 133   | 225  | 15    | 50    | 144  |
| Delta                          | 19,540 | 741   | 1,741| 89    | 229   | 615  |
| Unvested Equity                | 19,540 | 8,060 | 13,889| 883   | 3,171 | 8,780|
| Cash Comp                      | 19,540 | 1,131 | 958  | 567   | 858   | 1,297|
| CEO Tenure                     | 19,540 | 4.82  | 3.39 | 2.00  | 4.00  | 6.00 |
| Firm Age                       | 19,540 | 22.34 | 14.91| 10.00 | 19.00 | 33.00|
| Total Assets                   | 19,540 | 5,378 | 12,935| 462   | 1,216 | 3,952|
| MTB                            | 19,540 | 3.34  | 3.28 | 1.54  | 2.37  | 3.81 |
| LT Debt                        | 19,540 | 0.18  | 0.16 | 0.02  | 0.16  | 0.28 |
| Cash Surplus                   | 19,540 | 0.09  | 0.09 | 0.03  | 0.08  | 0.14 |
| Loss Carryforward              | 19,540 | 0.40  | 0.49 | 0.00  | 0.00  | 1.00 |
| Sales Growth                   | 19,540 | 0.09  | 0.20 | 0.00  | 0.08  | 0.18 |
| Annual Return                  | 19,540 | 0.19  | 0.45 | -0.05 | 0.18  | 0.41 |
| Holder67                       | 19,540 | 0.48  | 0.50 | 0.00  | 0.00  | 1.00 |
| SH Tax Sensitivity             | 19,540 | 0.40  | 0.33 | 0.14  | 0.30  | 0.58 |
TABLE 1 (continued)

Panel B: CEO and Firm Characteristics by CEO Tax Burden Quartile

|                        | CEO Tax Burden | Quartile 1 | Quartile 2 | Quartile 3 | Quartile 4 |
|------------------------|----------------|------------|------------|------------|------------|
| **CEO Characteristics**|                |            |            |            |            |
| CEO Tax Burden         | -0.03          | 0.01       | 0.04       | 0.13       |            |
| Vega                   |                | 110        | 177        | 154        | 102        |
| Delta                  |                | 281        | 456        | 588        | 1,670      |
| Uninvested Equity      |                | 6,791      | 10,255     | 9,085      | 6,664      |
| Cash Comp              |                | 1,009      | 1,281      | 1,231      | 1,047      |
| CEO Tenure             |                | 4.20       | 4.12       | 4.99       | 5.96       |
| Total Equity           |                | 21,927     | 33,295     | 46,609     | 153,742    |
| Outside Wealth         |                | 6,198      | 6,511      | 9,401      | 24,923     |
| Total Wealth           |                | 28,289     | 39,922     | 56,181     | 177,975    |
| Pct. of Wealth in Equity|              | 0.68       | 0.74       | 0.76       | 0.79       |
| **Firm Characteristics**|               |            |            |            |            |
| Total Assets           |                | 5,223      | 7,276      | 5,762      | 3,563      |
| Firm Age               |                | 22.42      | 24.55      | 23.74      | 18.99      |
| MTB                    |                | 2.66       | 3.49       | 3.57       | 3.77       |
| LT Debt                |                | 0.19       | 0.19       | 0.18       | 0.15       |
| Cash Surplus           |                | 0.07       | 0.09       | 0.09       | 0.11       |
| Loss Carryforward      |                | 0.47       | 0.41       | 0.39       | 0.34       |
| Sales Growth           |                | 0.04       | 0.09       | 0.11       | 0.14       |
| Annual Return          |                | 0.07       | 0.20       | 0.26       | 0.27       |
| Holder67               |                | 0.34       | 0.41       | 0.55       | 0.63       |
| SH Tax Sensitivity     |                | 0.42       | 0.40       | 0.36       | 0.40       |

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TABLE 2
Effect of CEO Tax Burden on Corporate Risk-Taking

This table presents the results from regressing measures of firm risk on CEOs’ tax burdens and other known determinants of risk. Panel A shows the results for the primary risk-taking proxies, and Panel B shows the results for the additional risk-taking proxies. The independent variables in this table are measured in year \( t-1 \), whereas the dependent variables are measured in year \( t \). Variables are defined in Appendix A. All specifications include firm and year fixed effects. The \( t \)-statistics are reported below coefficient estimates in parentheses and are calculated based on standard errors clustered by executive and year. ***, **, * indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively, using a two-tailed \( t \)-test.

### Panel A: Primary Risk-Taking Proxies

| Dependent Variable | Pr. Sign | Log(Total Vol) | Log(Idio Vol) | Log(ROA Vol) |
|-------------------|----------|----------------|---------------|--------------|
| CEO Tax Burden    | -0.333*** | -0.387*** | -0.794*** |
|                   | (-4.22)   | (-4.82) | (-4.83) |
| Log(Vega)         | -0.021*** | -0.019*** | -0.008 |
|                   | (-5.17)   | (-4.81) | (-0.75) |
| Log(Delta)        | 0.006     | -0.000   | -0.022*    |
|                   | (1.31)    | (-0.05)  | (-1.74) |
| Log(Unvested Equity) | 0.003* | 0.002 | -0.005 |
|                   | (1.69)    | (1.04)   | (-1.04) |
| Log(Cash Comp)    | -0.011    | -0.006   | -0.019     |
|                   | (-0.95)   | (-0.70)  | (-1.58) |
| Log(CEO Tenure)   | 0.005     | 0.010    | -0.015     |
|                   | (0.70)    | (1.64)   | (-0.72) |
| Log(Firm Age)     | -0.098*** | -0.069*** | -0.095*    |
|                   | (-4.34)   | (-2.88)  | (-1.74) |
| Log(Total Assets) | -0.067*** | -0.087*** | 0.002      |
|                   | (-3.88)   | (-5.46)  | (0.05) |
| Log(MTB)          | -0.016    | -0.021   | 0.060      |
|                   | (-0.76)   | (-1.01)  | (1.61) |
| LT Debt           | 0.096**   | 0.135*** | -0.165     |
|                   | (2.07)    | (2.80)   | (-1.35) |
| Cash Surplus      | -0.455*** | -0.489*** | -0.708***  |
|                   | (-6.51)   | (-6.89)  | (-5.21) |
| Loss Carryforward | 0.013     | 0.013    | 0.016      |
|                   | (1.59)    | (1.52)   | (0.67) |
| Log(Sales Growth) | 0.012     | 0.036    | -0.049     |
|                   | (0.35)    | (1.53)   | (-1.00) |
| Annual Return     | 0.019     | 0.006    | -0.107***  |
|                   | (1.08)    | (0.44)   | (-4.36) |
| Holder67          | 0.027***  | 0.019**  | 0.012      |
|                   | (3.05)    | (2.05)   | (0.38) |
| SH Tax Sensitivity | 0.114*** | 0.113*** | 0.227*** |
|                   | (6.14)    | (6.54)   | (3.82) |

Firm & Year Fixed Effects: Yes
S.E. Clustered by Executive & Year: Yes
No. of Observations: 19,540
Adj. R-Squared: 71.1%
Table 2 (continued)

Panel B: Additional Risk-Taking Proxies

| Dependent Variable                  | Pr. Sign | R&D Exp | Leverage | Working Capital |
|-------------------------------------|----------|---------|----------|----------------|
| CEO Tax Burden                      | -,-,+    | -0.018** | -0.129*** | 0.074**        |
|                                     | (-2.48)  | (-4.85) | (2.49)   |                |
| Log(Vega)                           | 0.000    | -0.005** | -0.002*  |                |
|                                     | (1.03)   | (-2.25) | (-1.67)  |                |
| Log(Delta)                          | -0.002***| 0.003    | 0.010*** |                |
|                                     | (-2.86)  | (1.02)   | (4.44)   |                |
| Log(Unvested Equity)                | -0.000   | 0.010*** | 0.004*** |                |
|                                     | (-1.00)  | (9.92)   | (4.90)   |                |
| Log(Cash Comp)                      | -0.000   | 0.002    | -0.002   |                |
|                                     | (-0.47)  | (0.87)   | (-0.58)  |                |
| Log(CEO Tenure)                     | 0.002*   | -0.034***| -0.022***|                |
|                                     | (1.73)   | (-9.10)  | (-6.99)  |                |
| Log(Firm Age)                       | 0.004*   | 0.051*** | -0.023***|                |
|                                     | (1.74)   | (5.88)   | (-3.63)  |                |
| Log(Total Assets)                   | -0.012***| -0.014***| -0.037***|                |
|                                     | (-7.25)  | (-2.77)  | (-8.33)  |                |
| Log(MTB)                            | 0.010*** | 0.036*** | -0.012***|                |
|                                     | (4.23)   | (4.38)   | (-2.67)  |                |
| LT Debt                             | -0.006   | 0.507*** | -0.050***|                |
|                                     | (-1.24)  | (20.11)  | (-3.94)  |                |
| Cash Surplus                        | 0.058*** | -0.138***| -0.005   |                |
|                                     | (5.09)   | (-5.40)  | (-0.24)  |                |
| Loss Carryforward                   | 0.001    | 0.002    | -0.007** |                |
|                                     | (1.58)   | (0.69)   | (-2.26)  |                |
| Log(Sales Growth)                   | -0.009***| 0.019**  | 0.002    |                |
|                                     | (-2.92)  | (2.11)   | (0.42)   |                |
| Annual Return                       | -0.006***| -0.020***| 0.011*** |                |
|                                     | (-4.30)  | (-4.23)  | (3.92)   |                |
| Holder67                            | -0.000   | -0.005   | 0.014*** |                |
|                                     | (-0.16)  | (-1.00)  | (3.90)   |                |
| SH Tax Sensitivity                  | 0.004*** | 0.011    | -0.004   |                |
|                                     | (2.80)   | (1.00)   | (-0.65)  |                |

Firm & Year Fixed Effects          Yes  Yes  Yes  
S.E. Clustered by Executive & Year Yes  Yes  Yes  
No. of Observations               19,540 19,540 19,540  
Adj. R-Squared                    79.2%  60.4%  74.3%  

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This table presents the results from regressing firm risk on federal tax cuts interacted with CEOs’ tax burdens prior to the tax cut. Panel A presents the means for the relevant variables after propensity score matching the sample of below-median tax burden CEOs at the end of 1996 and 2002 to the sample of above-median tax burden CEOs. Panel B displays the results for the six-year period surrounding the Taxpayer Relief Act of 1997 (year \( t \) includes 1995 through 2000), which reduced the top individual capital gains tax rate from 28 percent to 20 percent. Panel C displays the results for the six-year period surrounding the Jobs and Growth Tax Relief Reconciliation Act of 2003 (year \( t \) includes 2001 through 2006), which reduced the top individual capital gains tax rate from 20 percent to 15 percent. All CEO-firm pairs must be present for at least four consecutive years to be included in the sample. Post-Fed Tax Cut is an indicator variable set equal to zero in the first three years of each sample period (i.e., 1995, 1996, 1997 and 2001, 2002, 2003), and equal to one for the last three years of each sample period. Pre-Tax Cut Burden is set equal to each CEO’s tax burden at the end of fiscal year 1996 and 2002, for the respective tests. All other independent variables are measured in year \( t-1 \), whereas the dependent variables are measured in year \( t \). Variables are defined in Appendix A. All specifications include firm fixed effects. The \( t \)-statistics are reported below coefficient estimates in parentheses and are calculated based on standard errors clustered at the executive level. \(^{*}\), \(^{**}\), \(^{***}\) indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed \( t \)-test.

### Panel A: Propensity Score Matched Samples

| Dependent Variable: | TRA 97 | JGTRRA 03 |
|---------------------|--------|----------|
|                     | Low Burden | High Burden | Difference | Low Burden | High Burden | Difference |
| Log(Total Vol)      | -3.550   | -3.673    | 0.123    *** | -3.848   | -3.989    | 0.141    *** |
| Log(Idio Vol)       | -3.630   | -3.748    | 0.118    *** | -3.963   | -4.114    | 0.151    *** |
| Log(ROA Vol)        | -4.474   | -4.810    | 0.336    *** | -4.226   | -4.764    | 0.538    *** |
| CEO Tax Burden      | 0.006    | 0.124    | -0.118    *** | -0.029   | 0.043    | 0.072    *** |

| Matching Variables: |
|---------------------|
| Log(Vega)           | 3.412    | 3.262    | 0.150    |
| Log(Delta)          | 5.336    | 5.313    | 0.023    |
| Log(Unvested Equity)| 7.234    | 6.908    | 0.326    |
| Log(Cash Comp)      | 6.834    | 6.763    | 0.071    |
| Log(CEO Tenure)     | 1.416    | 1.397    | 0.019    |
| Log(Firm Age)       | 2.792    | 2.775    | 0.017    |
| Log(Total Assets)   | 7.040    | 6.922    | 0.118    |
| Log(MTB)            | 1.367    | 1.353    | 0.014    |
| LT Debt             | 0.175    | 0.176    | -0.001   |
| Cash Surplus        | 0.083    | 0.075    | 0.008    |
| Loss Carryforward   | 0.189    | 0.199    | -0.010   |
| Log(Sales Growth)   | 0.135    | 0.141    | -0.006   |
| Annual Return       | 0.229    | 0.202    | 0.027    |
| Holder67            | 0.453    | 0.453    | 0.000    |
| SH Tax Sensitivity  | 0.576    | 0.585    | -0.009   |

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TABLE 3 (continued)

Panel B: Taxpayer Relief Act of 1997

| Dependent Variable: | Pr. Sign | Log(Total Vol) | Log(Idio Vol) | Log(ROA Vol) |
|---------------------|----------|----------------|---------------|--------------|
| Post-Fed Tax Cut    | 0.018    | 0.031**        | 0.052         |
|                     | (1.18)   | (2.05)         | (0.99)        |
| Post-Fed Tax Cut × Pre-Tax Cut Burden + | 0.249** | 0.240**        | 0.868**       |
|                     | (2.56)   | (2.49)         | (2.41)        |
| Log(Vega)           | -0.009   | -0.005         | -0.012        |
|                     | (-0.91)  | (-0.48)        | (-0.37)       |
| Log(Delta)          | 0.052*** | 0.055***       | 0.000         |
|                     | (2.67)   | (2.63)         | (0.00)        |
| Log(Unvested Equity)| 0.002    | 0.001          | 0.000         |
|                     | (0.71)   | (0.41)         | (0.02)        |
| Log(Cash Comp)      | -0.040*  | -0.041*        | -0.262***     |
|                     | (-1.78)  | (-1.79)        | (-3.42)       |
| Log(CEO Tenure)     | 0.407*** | 0.432***       | 0.137         |
|                     | (13.55)  | (14.09)        | (1.24)        |
| Log(Firm Age)       | -0.222***| -0.338***      | 0.064         |
|                     | (-2.80)  | (-4.10)        | (0.23)        |
| Log(Total Assets)   | 0.028    | 0.015          | 0.237***      |
|                     | (0.92)   | (0.43)         | (2.62)        |
| Log(MTB)            | 0.031    | 0.067***       | 0.212**       |
|                     | (1.06)   | (2.03)         | (1.97)        |
| LT Debt             | 0.079    | 0.086          | -0.294        |
|                     | (0.93)   | (0.95)         | (-1.02)       |
| Cash Surplus        | 0.190**  | 0.161*         | 0.128         |
|                     | (1.99)   | (1.67)         | (0.40)        |
| Loss Carryforward   | 0.030    | 0.034          | 0.142*        |
|                     | (1.32)   | (1.47)         | (1.73)        |
| Log(Sales Growth)   | 0.028    | 0.024          | -0.141        |
|                     | (0.75)   | (0.64)         | (-1.22)       |
| Annual Return       | -0.017   | -0.037*        | -0.201***     |
|                     | (-0.88)  | (-1.86)        | (-3.21)       |
| Holder67            | -0.003   | 0.011          | -0.148        |
|                     | (-0.12)  | (0.41)         | (-1.57)       |
| SH Tax Sensitivity  | 0.050    | 0.046          | 0.020         |
|                     | (1.47)   | (1.27)         | (0.15)        |

Firm Fixed Effects: Yes  Yes  Yes
S.E. Clustered by Executive: Yes  Yes  Yes
No. of Observations: 2,058  2,058  2,058
Adj. R-Squared: 75.6%  74.7%  58.5%

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### TABLE 3 (continued)

Panel C: Jobs and Growth Tax Relief Reconciliation Act of 2003

| Dependent Variable | Pr. Sign | Log(Total Vol) | Log(Idio Vol) | Log(ROA Vol) |
|--------------------|----------|----------------|---------------|--------------|
| Post-Fed Tax Cut   | -0.035** | -0.016         | -0.022        |
|                    | (-2.23)  | (-0.97)        | (-0.52)       |
| Post-Fed Tax Cut × Pre-Tax Cut Burden | +       | 0.545**        | 0.551**       | 1.512*       |
|                    | (2.11)   | (2.12)         | (1.77)        |
| Log(Vega)          | -0.068***| -0.056***      | -0.024        |
|                    | (-4.24)  | (-3.85)        | (-0.61)       |
| Log(Delta)         | 0.022    | 0.019          | 0.030         |
|                    | (0.88)   | (0.87)         | (0.60)        |
| Log(Unvested Equity) | 0.005  | 0.002          | -0.019**      |
|                    | (1.28)   | (0.68)         | (-2.12)       |
| Log(Cash Comp)     | 0.009    | 0.011          | -0.011        |
|                    | (0.59)   | (0.81)         | (-0.29)       |
| Log(CEO Tenure)    | -0.292***| -0.298***      | -0.205*       |
|                    | (-7.23)  | (-7.37)        | (-1.84)       |
| Log(Firm Age)      | -0.242***| -0.216***      | -0.073        |
|                    | (-3.21)  | (-2.95)        | (-0.32)       |
| Log(Total Assets)  | 0.090**  | 0.059          | 0.241**       |
|                    | (2.49)   | (1.55)         | (2.28)        |
| Log(MTB)           | 0.187*** | 0.156***       | 0.343***      |
|                    | (4.53)   | (3.98)         | (4.04)        |
| LT Debt            | -0.480***| -0.430***      | -1.034***     |
|                    | (-5.68)  | (-5.06)        | (-3.80)       |
| Cash Surplus       | -0.436***| -0.433***      | -0.536*       |
|                    | (-4.60)  | (-4.45)        | (-1.93)       |
| Loss Carryforward  | 0.046**  | 0.050**        | 0.058         |
|                    | (2.15)   | (2.37)         | (0.93)        |
| Log(Sales Growth)  | 0.135*** | 0.142***       | 0.070         |
|                    | (4.70)   | (4.73)         | (0.92)        |
| Annual Return      | -0.076***| -0.070***      | -0.153***     |
|                    | (-4.91)  | (-4.45)        | (-3.70)       |
| Holder67           | -0.013   | -0.038         | 0.121         |
|                    | (-0.30)  | (-0.86)        | (0.83)        |
| SH Tax Sensitivity | 0.050    | 0.077          | 0.295**       |
|                    | (1.07)   | (1.57)         | (2.33)        |

Firm Fixed Effects: Yes  Yes  Yes
S.E. Clustered by Executive: Yes  Yes  Yes
No. of Observations: 2,504  2,504  2,504
Adj. R-Squared: 71.6%  73.6%  67.4%

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TABLE 4
Effect of State Capital Gains Tax Rate Cuts on Corporate Risk-Taking

Panel A presents the results from regressing firm risk on state tax cuts interacted with CEOs’ tax burdens prior to the tax cut. \[\text{State Tax Rate Cut}\] is set equal to the absolute value of the drop in the state individual capital gains tax rate for a three-year period following the tax cut. If the state has not experienced a tax cut within the previous three years, then the variable is set equal to zero. \[\text{Pre-Tax Cut Burden}\] is measured as the CEO’s tax burden just prior to the tax cut. All other independent variables are measured in year \(t - 1\), whereas the dependent variables are measured in year \(t\). Panel B repeats the analysis using indicator variables for three groups of state tax cuts based on the magnitude of the rate change: small (0.25 percent to 0.50 percent); medium (0.51 percent to 1.25 percent); and large (greater than 1.25 percent). All variables are defined in Appendix A. All specifications include firm and year fixed effects. The \(t\)-statistics are reported below coefficient estimates in parentheses and are calculated based on standard errors clustered by executive and year. \(*, **, ***\) indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed \(t\)-test.

Panel A: State Tax Cuts

| Dependent Variable: | Pr. Sign | \(\log(\text{Total Vol})\) | \(\log(\text{Idio Vol})\) | \(\log(\text{ROA Vol})\) |
|---------------------|---------|--------------------------|--------------------------|--------------------------|
| \[\text{State Tax Rate Cut}\] | 0.003 | -0.010 | 0.011 |
| \[\text{Pre-Tax Cut Burden}\] | (0.37) | (-1.16) | (0.48) |
| \[\text{State Tax Rate Cut} \times \text{Pre-Tax Cut Burden}\] | -0.297*** | -0.336*** | -0.839*** |
| \[\text{Log(Vega)}\] | (4.05) | (-4.45) | (-4.96) |
| \[\text{Log(Delta)}\] | 0.275*** | 0.282*** | 0.565*** |
| \[\text{Log(Unvested Equity)}\] | (2.92) | (3.18) | (2.33) |
| \[\text{Log(Cash Comp)}\] | -0.021*** | -0.018*** | -0.007 |
| \[\text{Log(Firm Age)}\] | (5.00) | (-4.57) | (-0.66) |
| \[\text{Log(CEO Tenure)}\] | 0.005 | -0.002 | -0.023* |
| \[\text{Log(Firm Age)}\] | (1.00) | (-0.43) | (-1.73) |
| \[\text{Log(Total Assets)}\] | 0.004* | 0.002 | -0.004 |
| \[\text{Log(CEO Tenure)}\] | (1.89) | (1.22) | (-1.01) |
| \[\text{Log(Total Assets)}\] | -0.025 | -0.014 | -0.054*** |
| \[\text{Log(CEO Tenure)}\] | (-1.18) | (-0.83) | (-2.64) |
| \[\text{Log(CEO Tenure)}\] | 0.006 | 0.011* | -0.011 |
| \[\text{Log(Unvested Equity)}\] | (0.90) | (1.67) | (-0.53) |
| \[\text{Log(Unvested Equity)}\] | -0.093*** | -0.067*** | -0.102* |
| \[\text{Log(MTB)}\] | (4.16) | (-2.76) | (-1.82) |
| \[\text{Log(MTB)}\] | -0.065*** | -0.086*** | 0.016 |
| \[\text{Cash Surplus}\] | (3.64) | (-5.24) | (0.37) |
| \[\text{Cash Surplus}\] | -0.017 | -0.022 | 0.060 |
| \[\text{LT Debt}\] | (-0.79) | (-1.08) | (1.56) |
| \[\text{Loss Carryforward}\] | 0.093* | 0.134*** | -0.179 |
| \[\text{Loss Carryforward}\] | (1.96) | (2.73) | (-1.41) |
| \[\text{Cash Surplus}\] | -0.451*** | -0.488*** | -0.728*** |
| \[\text{Cash Surplus}\] | (-6.33) | (-6.84) | (-5.03) |
| \[\text{Log(Sales Growth)}\] | 0.013 | 0.014 | 0.016 |
| \[\text{Log(Sales Growth)}\] | (1.63) | (1.57) | (0.67) |
| \[\text{Log(Annual Return)}\] | 0.013 | 0.035 | -0.037 |
| \[\text{Log(Annual Return)}\] | (0.35) | (1.47) | (-0.69) |
| \[\text{Holder67}\] | 0.019 | 0.005 | -0.108*** |
| \[\text{Holder67}\] | (1.05) | (0.36) | (-4.26) |
| \[\text{SH Tax Sensitivity}\] | 0.026*** | 0.019** | 0.009 |
| \[\text{SH Tax Sensitivity}\] | (2.93) | (2.02) | (0.27) |
| \[\text{SH Tax Sensitivity}\] | 0.113*** | 0.113*** | 0.231*** |
| \[\text{SH Tax Sensitivity}\] | (6.45) | (6.80) | (3.83) |

Firm & Year Fixed Effects | Yes | Yes | Yes |
S.E. Clustered by Executive & Year | Yes | Yes | Yes |
No. of Observations | 19,540 | 19,540 | 19,540 |
Adj. R-Squared | 71.1% | 72.9% | 58.4% |
TABLE 4 (continued)

Panel B: Small, Medium, and Large State Tax Cuts

| Dependent Variable: | Pr. Sign | Log(Total Vol) | Log(Idio Vol) | Log(ROA Vol) |
|---------------------|----------|----------------|---------------|--------------|
| Large State Tax Cut | 0.005    | -0.029         | 0.063         |              |
|                     | (0.21)   | (-1.24)        | (1.08)        |              |
| Medium State Tax Cut| 0.023    | 0.024          | -0.048        |              |
|                     | (1.42)   | (1.63)         | (-0.86)       |              |
| Small State Tax Cut | -0.020   | -0.031*        | -0.092*       |              |
|                     | (-1.09)  | (-1.73)        | (-1.88)       |              |
| Pre-Tax Cut Burden | -0.312***| -0.352***      | -0.848***     |              |
|                     | (-4.29)  | (-4.85)        | (-5.34)       |              |
| Large State Tax Cut × Pre-Tax Cut Burden | + | 0.496*** | 0.519*** | 1.211*** |
|                     | (3.18)   | (3.28)         | (2.41)        |              |
| Medium State Tax Cut × Pre-Tax Cut Burden | 0.293*** | 0.260* | 0.437 |
|                     | (2.06)   | (1.82)         | (1.48)        |              |
| Small State Tax Cut × Pre-Tax Cut Burden | 0.123    | 0.177          | 0.308         |              |
|                     | (0.88)   | (1.17)         | (0.75)        |              |
| Log(Vega)           | -0.018***| -0.016***      | -0.010        |              |
|                     | (-4.83)  | (-4.76)        | (-1.01)       |              |
| Log(Delta)          | 0.005    | 0.000          | -0.023*       |              |
|                     | (1.22)   | (0.03)         | (-1.73)       |              |
| Log(Uninvested Equity) | 0.001 | 0.000         | -0.006        |              |
|                     | (0.53)   | (0.30)         | (-1.56)       |              |
| Log(Cash Comp)      | -0.022   | -0.013         | -0.053***     |              |
|                     | (-1.06)  | (-0.79)        | (-2.58)       |              |
| Log(CEO Tenure)     | 0.002    | 0.006          | -0.011        |              |
|                     | (0.37)   | (1.16)         | (-0.54)       |              |
| Log(Firm Age)       | -0.097***| -0.075***      | -0.094*       |              |
|                     | (-4.25)  | (-2.90)        | (-1.67)       |              |
| Log(Total Assets)   | -0.062***| -0.084***      | 0.018         |              |
|                     | (-3.80)  | (-5.59)        | (0.42)        |              |
| Log(MTB)            | -0.014   | -0.019         | 0.058         |              |
|                     | (-0.71)  | (-1.02)        | (1.51)        |              |
| LT Debt             | 0.092**  | 0.133***       | -0.181        |              |
|                     | (2.10)   | (2.93)         | (-1.42)       |              |
| Cash Surplus        | -0.419***| -0.453***      | -0.725***     |              |
|                     | (-6.44)  | (-7.04)        | (-5.01)       |              |
| Loss Carryforward   | 0.013*   | 0.012          | 0.019         |              |
|                     | (1.70)   | (1.54)         | (0.80)        |              |
| Log(Sales Growth)   | 0.007    | 0.028          | -0.038        |              |
|                     | (0.21)   | (1.28)         | (-0.72)       |              |
| Annual Return       | 0.022    | 0.009          | -0.109***     |              |
|                     | (1.25)   | (0.74)         | (-4.46)       |              |
| Holder67            | 0.028*** | 0.022***       | 0.004         |              |
|                     | (3.20)   | (2.48)         | (0.11)        |              |
| SH Tax Sensitivity  | 0.106*** | 0.108***       | 0.233***      |              |
|                     | (6.62)   | (7.12)         | (3.90)        |              |

Firm & Year Fixed Effects | Yes | Yes | Yes |
S.E. Clustered by Executive & Year | Yes | Yes | Yes |
No. of Observations | 19,540 | 19,540 | 19,540 |
Adj. R-Squared | 71.1% | 72.9% | 58.4% |
Panel A presents the results from regressing CEO stock sales on state tax cuts interacted with the CEO’s tax burden prior to the tax cuts. Panel B presents the results from regressing measures of firm risk-taking on predicted CEO stock sales in year $t = 0$. $|\text{State Tax Rate Cut}|$ at $t = 0$ is set equal to the absolute value of the drop in the state individual capital gains tax rate for the year in which the tax cut takes effect (year $t = 0$). If the state does not experience a tax cut in the relevant year, then the variable is set equal to zero. Pre-Tax Cut Burden is set equal to each CEO’s tax burden at the end of the fiscal year prior to the relevant tax cut. Predicted CEO Sales at $t = 0$ represents the predicted stock sales in year $t = 0$ from the first stage regression, as determined by the magnitude of any state tax cut, the CEO’s tax burden prior to the state tax cut, and the other determinants of stock sales present in the first stage regression. All other independent variables are measured in year $t-1$, whereas the dependent variables are measured in year $t$. Note that in addition to the control variables shown in the table, the specification in Panel A includes the additional controls used in Panel B of Table 5. Similarly, the specification in Table 5 Panel B includes the additional control variables listed in Table 5 Panel A. Variables are defined in Appendix A. All columns include firm and year fixed effects. The $t$-statistics are reported below coefficient estimates in parentheses and are calculated based on standard errors clustered by executive and year. ***,*** indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed $t$-test.
### TABLE 5 (continued)

**Panel B: Second Stage Regression of Risk-Taking on Predicted CEO Stock Sales**

| Dependent Variable: | Log(Total Vol) 3 yrs | Log(ROA Vol) 3 yrs |
|---------------------|----------------------|--------------------|
| State Tax Rate Cut at t = 0 | Pr. Sign | Num Shares Sold | Pct. Equity Sold | Pr. Sign | Num Shares Sold | Pct. Equity Sold |
| Pre-Tax Cut Burden | -0.125*** | -0.155*** | -0.560*** | -0.807*** |
| | (-1.87) | (-1.73) | (-5.12) | (-3.33) |
| Predicted CEO Sales at t = 0 | 0.161** | 0.452** | 0.640** | 1.919* |
| | (2.18) | (2.28) | (2.11) | (1.83) |
| Log(Vega) | -0.013*** | -0.004 | 0.010 | 0.041 |
| | (-3.23) | (-0.53) | (0.79) | (1.32) |
| Log(Delta) | 0.008 | 0.077** | -0.048** | 0.214 |
| | (1.43) | (2.19) | (-2.43) | (1.44) |
| Log(Unvested Equity) | 0.000 | 0.002 | -0.005 | 0.008 |
| | (0.29) | (1.19) | (-1.15) | (0.97) |
| Log(Cash Comp) | 0.000 | 0.009 | 0.072*** | 0.039 |
| | (-0.04) | (0.83) | (-3.14) | (-1.19) |
| Log(CEO Tenure) | -0.021*** | -0.072* | -0.062*** | -0.251 |
| | (-3.03) | (-1.98) | (-2.10) | (-1.59) |
| Log(Firm Age) | -0.080*** | -0.050 | -0.048 | 0.101 |
| | (-2.89) | (-1.12) | (-0.82) | (0.73) |
| Log(Total Assets) | 0.047* | 0.029 | 0.048 | -0.212 |
| | (1.68) | (1.23) | (0.89) | (-1.37) |
| Log(MTB) | 0.071*** | 0.066** | 0.043 | -0.213 |
| | (3.36) | (2.58) | (0.88) | (-1.19) |
| LT Debt | -0.080** | -0.062 | -0.160 | 0.317 |
| | (-2.57) | (-1.59) | (-1.20) | (0.94) |
| Cash Surplus | -0.455*** | -0.543*** | -0.796*** | -1.261*** |
| | (-6.61) | (-3.78) | (-4.15) | (-2.96) |
| Loss Carryforward | 0.008 | 0.002 | 0.027 | 0.011 |
| | (1.18) | (0.26) | (1.12) | (0.33) |
| Log(Sales Growth) | 0.010 | -0.027 | -0.113 | -0.290* |
| | (0.38) | (-0.70) | (-1.55) | (-1.76) |
| Annual Return | 0.001 | 0.003 | -0.126*** | -0.162*** |
| | (0.11) | (0.28) | (-3.71) | (-3.05) |
| Holder67 | 0.036*** | 0.021* | 0.027 | -0.061 |
| | (4.77) | (1.79) | (0.81) | (-1.09) |
| SH Tax Sensitivity | 0.089*** | 0.100*** | 0.226*** | 0.306*** |
| | (5.38) | (4.65) | (3.35) | (3.40) |

Other Control Variables from First Stage: Yes, Yes, Yes, Yes
Firm & Year Fixed Effects: Yes, Yes, Yes, Yes
S.E. Clustered by Executive & Year: Yes, Yes, Yes, Yes
No. of Observations: 19,540, 19,540, 19,540, 19,540
Adj. R-Squared: 79.0%, 79.0%, 59.8%, 59.8%

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TABLE 6
Cross-sectional Variation in the Effect of CEO Tax Burden on Corporate Risk-Taking

This table presents the results from regressing firm risk on state tax cuts interacted with CEOs’ tax burdens prior to the tax cut, after partitioning the sample into CEOs with high vs. low outside wealth. Using an estimate of each CEO’s wealth held in the firm’s equity (Dittmann and Maug 2007), I bifurcate the CEO-year sample within each year based on the percent of the CEO’s wealth held in the firm’s equity. I classify CEOs above the median as Low Diverse, and those below the median as High Diverse. The independent variables are measured in year $t-1$, whereas the dependent variables are measured in year $t$. Variables are defined in Appendix A. All specifications include firm and year fixed effects. The $t$-statistics are reported below coefficient estimates in parentheses and are calculated based on standard errors clustered by executive and year. *,**,*** indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed $t$-test.

| Dependent Variable:                  | Low Diverse | High Diverse | Low Diverse | High Diverse |
|--------------------------------------|-------------|--------------|-------------|--------------|
| | Pr. Sign | Log(Total Vol) | Log(ROA Vol) |
| $\text{State Tax Rate Cut}$ | 0.012 | -0.000 | 0.027 | 0.005 |
| | (1.11) | (-0.03) | (0.83) | (0.22) |
| $\text{Pre-Tax Cut Burden}$ | -0.263*** | -0.178** | -0.705** | -0.291 |
| | (-3.02) | (-2.36) | (-2.50) | (-1.64) |
| $\text{State Tax Rate Cut} \times \text{Pre-Tax Cut Burden}$ | 0.514*** | 0.265** | 1.678*** | 0.064 |
| | (3.08) | (2.07) | (3.76) | (0.24) |
| $\text{Log(Vega)}$ | -0.013*** | -0.010* | 0.022 | -0.010 |
| | (-3.04) | (-1.97) | (1.61) | (-0.60) |
| $\text{Log(Delta)}$ | 0.018*** | -0.005 | -0.001 | -0.034* |
| | (2.75) | (-0.86) | (-0.09) | (-1.93) |
| $\text{Log(Unvested Equity)}$ | 0.004* | 0.002 | -0.008 | -0.005 |
| | (1.84) | (0.69) | (-1.41) | (-0.78) |
| $\text{Log(Cash Comp)}$ | -0.026 | -0.047** | -0.054* | -0.071** |
| | (-0.98) | (-2.51) | (-2.08) | (-2.29) |
| $\text{Log(CEO Tenure)}$ | -0.012 | 0.014 | -0.016 | -0.007 |
| | (-1.29) | (1.38) | (-0.46) | (-0.23) |
| $\text{Log(Firm Age)}$ | -0.087*** | -0.151*** | -0.242** | -0.059 |
| | (-3.52) | (-5.42) | (-2.83) | (-0.92) |
| $\text{Log(Total Assets)}$ | -0.043** | -0.043** | 0.020 | 0.122** |
| | (-2.11) | (-2.40) | (0.34) | (2.43) |
| $\text{Log(MTB)}$ | -0.006 | -0.033* | 0.126** | -0.004 |
| | (-0.24) | (-1.75) | (2.26) | (-0.09) |
| $\text{LT Debt}$ | 0.110* | 0.126* | 0.009 | -0.352*** |
| | (1.90) | (1.98) | (0.06) | (-2.07) |
| $\text{Cash Surplus}$ | -0.286*** | -0.443*** | -0.343* | -0.786*** |
| | (-3.18) | (-5.24) | (-1.66) | (-4.91) |
| $\text{Loss Carryforward}$ | 0.013 | 0.005 | 0.044 | -0.018 |
| | (1.06) | (0.46) | (1.14) | (-0.44) |
| $\text{Log(Sales Growth)}$ | 0.010 | -0.003 | -0.160*** | -0.040 |
| | (0.24) | (-0.09) | (-2.20) | (-0.71) |
| $\text{Annual Return}$ | 0.028 | 0.008 | -0.144*** | -0.079*** |
| | (1.03) | (0.56) | (-3.22) | (-3.40) |
| $\text{Holder67}$ | 0.040*** | 0.008 | 0.015 | 0.019 |
| | (3.07) | (0.67) | (0.34) | (0.52) |
| $\text{SH Tax Sensitivity}$ | 0.081*** | 0.149*** | 0.138** | 0.297*** |
| | (4.31) | (5.75) | (2.06) | (3.76) |

$p$-Value: 0.10 0.01

| | Firm & Year Fixed Effects | Yes | Yes | Yes | Yes |
| | S.E. Clustered by Executive & Year | Yes | Yes | Yes | Yes |
| | No. of Observations | 9,758 | 9,782 | 9,758 | 9,782 |
| | Adj. R-Squared | 73.5% | 67.8% | 56.0% | 60.7% |

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TABLE 7
Effect of CEO Tax Burden on Investment, Financing, and Operating Choices

This table presents the results from regressing specific corporate policies associated with firm risk on state tax cuts interacted with CEOs’ tax burdens prior to the tax cut. The independent variables in this table are measured in year \( t-1 \), whereas the dependent variables are measured in year \( t \). Variables are defined in Appendix A. All specifications include firm and year fixed effects. The t-statistics are reported below coefficient estimates in parentheses and are calculated based on standard errors clustered by executive and year. ***,*** indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed t-test.

| Dependent Variable: | Pr. Sign | R&D Exp | Leverage | Working Capital |
|---------------------|----------|---------|----------|-----------------|
| State Tax Rate Cut  | -0.000   | -0.004  | 0.003    |                 |
|                     | (-0.82)  | (-0.92) | (1.08)   |                 |
| Pre-Tax Cut Burden  | -0.006***| -0.069***| 0.073***|                 |
|                     | (-2.01)  | (-3.69) | (2.66)   |                 |
| [State Tax Rate Cut] \times Pre-Tax Cut Burden | 0.018***| 0.102***| -0.049*  |
|                     | (2.57)   | (2.63)  | (-1.73)  |                 |
| Log(Vega)           | 0.000**  | -0.004**| -0.002*  |
|                     | (2.25)   | (-2.03) | (-1.66)  |                 |
| Log(Delta)          | -0.001***| 0.001   | 0.010*** |
|                     | (-3.06)  | (0.35)  | (4.47)   |                 |
| Log(Uninvested Equity) | 0.000   | 0.009***| 0.004*** |
|                     | (0.64)   | (9.52)  | (4.65)   |                 |
| Log(Cash Comp)      | -0.001   | 0.009** | -0.002   |
|                     | (-1.52)  | (2.19)  | (-0.40)  |                 |
| Log(CEO Tenure)     | 0.001**  | -0.032***| -0.022***|
|                     | (2.44)   | (-8.10) | (-6.98)  |                 |
| Log(Firm Age)       | 0.004*** | 0.047***| -0.024***|
|                     | (3.40)   | (5.58)  | (-3.64)  |                 |
| Log(Total Assets)   | -0.009***| -0.022***| -0.038***|
|                     | (-9.80)  | (-4.11) | (-8.34)  |                 |
| Log(MTB)            | 0.004*** | 0.030***| -0.013***|
|                     | (4.51)   | (3.64)  | (-2.79)  |                 |
| LT Debt             | -0.003   | 0.538***| -0.045***|
|                     | (-1.53)  | (17.16) | (-3.45)  |                 |
| Cash Surplus        | 0.038*** | -0.148***| -0.002   |
|                     | (7.80)   | (-5.29) | (-0.08)  |                 |
| Loss Carryforward   | 0.001    | 0.000   | -0.007** |
|                     | (1.49)   | (0.06)  | (-2.15)  |                 |
| Log(Sales Growth)   | -0.004***| 0.015*  | 0.003    |
|                     | (-4.35)  | (1.66)  | (0.45)   |                 |
| Annual Return       | -0.004***| -0.021***| 0.012*** |
|                     | (-8.59)  | (-4.94) | (4.07)   |                 |
| Holder67            | 0.000    | -0.003  | 0.014*** |
|                     | (0.09)   | (-0.72) | (3.78)   |                 |
| SH Tax Sensitivity  | 0.003*** | 0.013   | -0.003   |
|                     | (2.75)   | (1.10)  | (-0.55)  |                 |

Firm & Year Fixed Effects: Yes
S.E. Clustered by Executive & Year: Yes
No. of Observations: 19,540
Adj. R-Squared: 91.3%
TABLE 8
Effect of State Capital Gains Tax Rate Increases on Corporate Risk-Taking

This table presents the results from regressing firm risk on state tax increases interacted with CEOs’ tax burdens prior to the tax cut. [State Tax Rate Inc] is set equal to the rise in the state individual capital gains tax rate for a three-year period following the tax increase. If the state has not experienced a tax increase within the previous three years, then the variable is set equal to zero. Pre-Tax Inc Burden is measured as the CEO’s tax burden just prior to the tax increase. All other independent variables are measured in year t-1, whereas the dependent variables are measured in year t. Variables are defined in Appendix A. All specifications include firm and year fixed effects. The t-statistics are reported below coefficient estimates in parentheses and are calculated based on standard errors clustered by executive and year. ***,*** indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed t-test.

| Dependent Variable: | Pr. Sign | Log(Total Vol) | Log(Idio Vol) | Log(ROA Vol) |
|---------------------|----------|---------------|---------------|--------------|
| State Tax Rate Inc  | -0.030*** | -0.028***     | -0.060***     |
|                     | (-3.65)  | (-3.89)       | (-2.95)       |
| Pre-Tax Inc Burden | -0.248*** | -0.290***     | -0.595***     |
|                     | (-3.59)  | (-4.07)       | (-3.49)       |
| State Tax Rate Inc  | 0.114 | 0.145 | 0.116 |
| × Pre-Tax Inc Burden | (0.94) | (1.13) | (0.42) |
| Log(Vega)           | 0.004 | -0.017*** | -0.004 |
|                     | (-4.85) | (-4.41) | (-0.40) |
| Log(Delta)          | 0.003 | 0.002 | -0.005 |
|                     | (0.87) | (-0.57) | (-2.08) |
| Log(Unvested Equity)| -0.025 | -0.014 | -0.053*** |
|                     | (-1.16) | (-0.81) | (-2.59) |
| Log(CEO Tenure)     | 0.005 | 0.010 | -0.014 |
|                     | (0.82) | (1.61) | (-0.62) |
| Log(Firm Age)       | -0.095*** | -0.068*** | -0.106* |
|                     | (-4.24) | (-2.84) | (-1.93) |
| Log(Total Assets)   | -0.065*** | -0.086*** | 0.015 |
|                     | (-3.66) | (-5.28) | (0.35) |
| Log(MTB)            | -0.018 | -0.023 | 0.057 |
|                     | (-0.84) | (-1.13) | (1.48) |
| LT Debt             | 0.095** | 0.136*** | -0.170 |
|                     | (2.07) | (2.85) | (-1.36) |
| Cash Surplus        | -0.446*** | -0.483*** | -0.723*** |
|                     | (-6.26) | (-6.73) | (-4.96) |
| Loss Carryforward   | 0.013 | 0.014 | 0.017 |
|                     | (1.61) | (1.54) | (0.70) |
| Log(Sales Growth)   | 0.011 | 0.033 | -0.042 |
|                     | (0.31) | (1.39) | (-0.80) |
| Annual Return       | 0.020 | 0.005 | -0.107*** |
|                     | (1.10) | (0.41) | (-4.13) |
| Holder67            | 0.026*** | 0.018* | 0.009 |
|                     | (2.92) | (1.94) | (0.27) |
| SH Tax Sensitivity  | 0.116*** | 0.114*** | 0.240*** |
|                     | (6.18) | (6.57) | (4.03) |

Firm & Year Fixed Effects: Yes
S.E. Clustered by Executive & Year: Yes
No. of Observations: 19,540
Adj. R-Squared: 71.2%