Trading Away Incentives*

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Abstract

Equity pay has been the primary component of managerial compensation packages at US public firms since the early 1990s. Using a comprehensive sample of top executives from 1992-2020, we estimate to what extent they trade firm equity held in their portfolios to neutralize increments in ownership due to annual equity grants. Executives accommodate ownership increases linked to options awards. Conversely, increases in stock holdings linked to option exercises and restricted stock grants are largely neutralized through comparable sales of unrestricted shares. Variation in stock trading responses across executives hardly appears to respond to diversification motives. From a theoretical standpoint, these results challenge (i) the common, generally implicit assumption that managers cannot undo their incentive packages, (ii) the standard modeling practice of treating different equity pay items homogeneously, and (iii) the often taken for granted the crucial role of diversification motives in managers' portfolio choices.

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1 Introduction

The functioning of executive compensation at public corporations is a first-order concern for economists, policy-makers, and the public. CEOs and other high-ranking executives are the top decision-makers in listed firms that generate a large fraction of GDP (Kuvshinov and Zimmermann, 2022). How they are remunerated has considerable real effects in shaping their choices. Against this backdrop, performance- and especially equity-based pay of executives- has played a primary role since the early 1990s (Frydman, 2019), and its dynamics map changes in the level of top incomes and of people's perception of income inequality in the economy (Frydman and Papanikolaou, 2018).

Executive equity-based pay performs two main functions: (i) attracting and retaining talented managers and (ii) incentivizing them to act in the best interest of shareholders (Xia, 2019). With respect to (i), equity-based pay allows shareholders to economize on remuneration while still meeting the participation constraint of managers (Oyer, 2004). Whether managers bear the risk linked to their firm's equity securities is not essential to (i). By contrast, such a condition is at the core of the incentive-compatibility constraint implied by (ii). In principle, managers can undo the incentive constraint by entering derivative hedges or by simply selling their equity securities, especially for annual equity grants. Anecdotal evidence suggests that the former are widespread among managers but largely barred to high-ranking executives (e.g., New York Times, 2011), who may then resort to more visible, direct sales to lower their exposure to firm risk.[1] The empirical literature pays surprisingly little attention to how executives' selling behavior impacts their exposure to their firms.

In a typical static executive compensation model setting, a well-diversified and risk-neutral principal offers the manager a (take-it-or-leave-it) incentive contract at the be-

[1] We cannot rule out the possibility that managers could invest in their competitors' stock to "hedge". However, it is almost impossible to observe in most countries.

ginning. The risk-averse and under-diversified manager is normally assumed not to have the ability to undo the incentive contracts that the principal offers. The manager chooses the optimal costly effort level according to the incentive pay. In the end, the manager liquidates the incentive pay and consumes it. Since it is a static model, the incentive level is constant, and by assumption, the manager does not have the option to trade and, therefore, will not adjust her holding. An alternative way to interpret this model is that CEOs and shareholders keep interacting like this in every period. At the end of each period, because of the diversification incentive, CEOs liquidate all their stakes and receive a new incentive in the next period. This alternative interpretation suggests that managers will sell every equity grant they receive because of diversification motive.

In a dynamic model of executive compensation with private savings, managers' optimal contracts could be implemented using an incentive account rebalancing at the end of each period to ensure a target incentive level, and inter-temporal consumption smoothing (Edmans, Gabaix, Sadzik, and Sannikov, 2012). Thus, CEOs' selling behavior is related to the shocks they receive. If there is a negative shock with managers' shareholdings relative to the target, the firm will grant more, and the manager will sell less; if there is a positive shock, the firm will grant less, and the manager will sell more. The target incentive level allows for a region of optimal inaction within which the manager can adjust her shareholdings to absorb unexpected liquidity needs and smooth out consumption.[2]

The above models typically consider a risk-averse manager who is incentivized to diversify away the exposure to her firm's equity. Because of the theoretical tension between such a diversification motive and the difficulty inherent to models to accommodate for the manager's endogenous trading response to incentive compensation, it is important to empirically understand whether executives actively reduce their exposure to their firms

[2]Although consumption smoothing is mostly rejected for the whole population in empirical tests (Parker, 2017). Still, high-income people are more likely to smooth consumption than low-income people as they are more resilient to negative and positive shocks. (Ganong, Jones, Noel, Greig, Farrell, and Wheat, 2020)

and why they are doing so. A clear grasp of the phenomenon is key to developing and calibrating models that can fruitfully inform policy-makers.

The goal of this paper is twofold. First, we revisit existing research on top executives' stock trading response to annual equity pay at US public firms. Early evidence from 1992-1995 by Ofek and Yermack (2000) is that back then, high-ownership executives undid most of the new equity incentives they received by selling an economically equivalent amount of unrestricted firm's shares. We investigate if dynamics in compensation practices, major political events, and various economic shocks observed over the last three decades impacted executives' stock trading responses associated with equity grants.[3] Second, we examine whether the theoretical tenets that executives cannot undo their incentive packages and that their personal portfolio choices follow the diversification principle are borne out in the data.

Using a comprehensive sample of top executives from ExecuComp stretching from 1992 to 2020, we revisit the problem and estimate to what extent executives actively deviate from the equity exposure entailed in their compensation packages. By looking at the whole executive team rather than CEOs alone, we can track these professionals for a longer period and potentially capture their promotion to the CEO level. We find that executives neutralize increments in ownership stemming from option exercises and, to a large extent, from restricted shares awards in line with Ofek and Yermack (2000). Conversely, the dramatic growth of stock options of the late 1990s appears to have come with a major shift in executives' trading response to them, which is by now overall passive.

It is helpful to assess the economic magnitude of the phenomenon coarsely. Focusing

[3]After the study of Ofek and Yermack (2000), scholars' attention has mostly focused on derivative hedges (e.g., Bettis, Bizjak, and Lemmon, 2001; Gao, 2010) or on trading per se (e.g., Jenter, 2005), leaving a gap in our knowledge of the incentivization implications of executives' trading over a period comprising the explosion of equity pay (e.g., Eisfeldt, Falato, and Xiaolan, 2021) and a steady increase in income inequality and managerial remuneration (e.g., Piketty, 2014; Bloom, Ohlmacher, Tello-Trillo, and Wallskog, 2021), as well as major crises like the Internet crash, the Great Recession, and the COVID-19 recession.

on CEOs, Figure 1 shows the evolution of different measures of fractional ownership through tenure.[4] For an average CEO, stock ownership goes from 0.33% at the time of appointment to around 1.22% after 10 years (solid line). Suppose we account for CEOs' option holdings and assume that the conversion ratio from one option to one share is 0.6 (Ofek and Yermack, 2000). In that case, we obtain an upper bound for effective ownership going from 0.89% at the appointment year to 2.44% after 10 years (long-dashed line). We can then construct a counterfactual measure of ownership by assuming that CEOs do not engage in any equity sale in a given year. We do so by adding options and restricted stock awards for that year to the previous year's ownership upper bound (short-dashed line). The wedge between the last two ownership measures captures the annual adjustment to equity exposure pursued by the average CEO (net of shares voluntarily purchased with own funds). Whereas the average wedge is small in absolute terms, its consequences for fractional and dollar ownership are far from trivial.[5] For example, at the 8th year of tenure, the average wedge is 0.2% (2.41% - 2.21%), suggesting that CEOs actively lower their ownership by around 9%. The dollar value of this 9% reduction in ownership is \$11.5 million ($= 0.2\% \times \$5,741$ million), or 8.3 times the average cash compensation (salary plus bonuses) of CEOs in their 8th year (\$1.38 million).

[4] It is worth noting that this back-of-the-envelope exercise is subject to a survivorship bias. The sample considered grows smaller with tenure because of the CEO attrition rate.

[5] Zhou (2001) argues that annual changes to executive fractional ownership are usually too small to affect executives' incentives substantially. However, for large companies like those in our sample, the economic effects of even small changes in fractional ownership can be sizable.

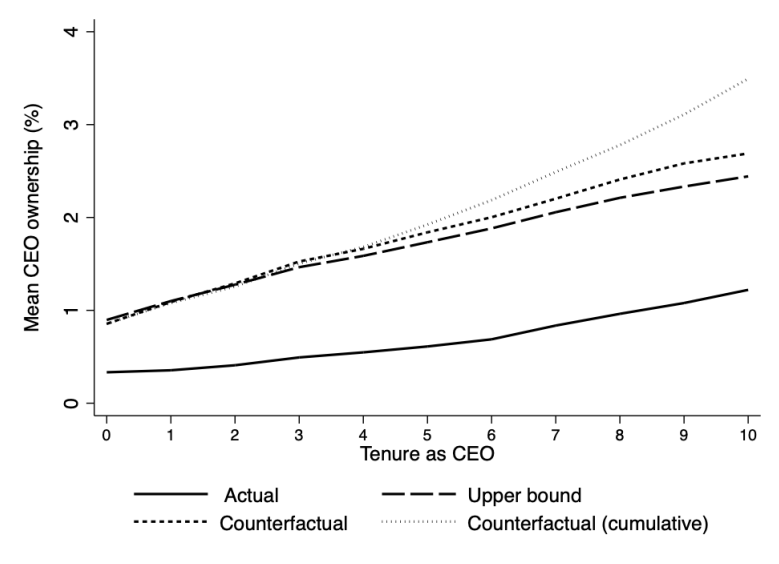

Figure 1: Evolution of CEO stock ownership over tenure
This figure shows average CEO stock ownership over tenure based on a sample of US public firms covered by ExecuComp between 1992 and 2020. The solid line represents actual fractional ownership. The long-dashed line represents the upper bound for fractional ownership calculated, assuming that all options in the CEO's portfolio have a delta of one. The short-dashed line represents a counterfactual measure of fractional ownership, obtained by adding options awards and restricted shares granted (assuming a delta of 0.6 for options (Ofek and Yermack, 2000)) in tenure year t to the upper bound of ownership at the end of tenure year $t-1$. The dotted line represents another counterfactual measure of fractional ownership, obtained by adding options awards and restricted shares granted (assuming a delta of 0.6 for options (Ofek and Yermack, 2000)) over tenure to the upper bound of ownership at the beginning of the CEO's term.

As a similar adjustment occurs throughout the CEO's tenure, equity awards do not seem to serve as a pure incentive device. An alternative counterfactual measure of fractional ownership in Figure 1 speaks directly to this point (dotted line). In particular, holding fixed the upper bound of ownership at the time of appointment, we cumulatively add to it ownership changes implied by annual option awards and restricted stock awards. The wedge between this measure and the upper bound gauges how "wasteful" incentive packages are. For example, in the 8th year of tenure, the wedge amounts to 0.48% or 23% of the upper bound to CEO ownership of 2.09%. Thus, between appointment and the 8th year, shareholders relinquish an amount as high as \$27.6 million ($= 0.48\% \times \$5,741$ million) to achieve a 2.09% ownership for the average CEO.[6] Put differently, if equity pay

[6]Appendix Figure A.1 shows that similar conclusions can be reached by looking at the median CEO (Panel A), at the mean externally-hired CEO (Panel B), or at the mean CEO of the top 100 companies in the sample by market capitalization (Panel C). Focusing on the median CEO of the top 100 companies

is optimally set, a significant fraction of it seems devoted to attracting and retaining—rather than incentivizing—executives.[7]

Furthermore, we investigate executives' motives for actively managing their exposure to their own firm's equity. Differently from Ofek and Yermack (2000), we document that personal under-diversification—as proxied by equity ownership and measures of firm-specificity of human capital—does not seem to drive cross-section variation in executives' trading responses to annual equity pay. This finding resonates with two studies. Jin and Kothari (2008) show that tax considerations trump diversification ones in determining CEOs' sales of firm equity. Klein and Maug (2020) document that the diversification motive cannot explain executives' option-exercising behavior, which instead reflects behavioral biases and, more importantly, institutional constraints. That is more, tax considerations could also related to maintaining (optimal) target incentive levels and smooth consumption motivations. Variations in tax levels change executives' expected value of existing equity holdings and move the post-tax change expected incentive level away from the optimal level, and at the same time, influence the expected consumption level upon equity liquidation. We then explore how tax changes could influence variations in executives' trading responses to annual incentive grants. Utilizing the events of state-level ordinary income tax and long-term capital gain tax changes, we do not find strong evidence to support the hypothesis that tax considerations or optimal incentive/consumption smoothing motivations are the main drivers for variations in executives' trading responses to annual incentive grants. We also explore whether behavior biases that are related to executive market-timing trading patterns could explain our findings

(Panel D), a similar result holds at the 10th year of tenure. In some instances, the upper bound for ownership may exceed our two counterfactual measures: this happens when the sum of voluntary purchases of shares and net retained annual equity incentives exceed annual equity incentives alone.

[7]This result raises the question—beyond the scope of the paper—of whether shareholders anticipate executives' stock sales and rationally overshoot equity incentives to achieve their desired level of incentivization. Another relevant issue will be to understand if such an overshooting behavior is an efficient way to attract and retain executives (see Oyer, 2004).

in executive trading responses. Although we find some evidence suggesting overconfidence motivation and executives' preferences on risk and uncertainty could explain part of their trading responses, the overall economic effect is still small. Nonetheless, executives' trading responses are remarkably stable over our sample period, characterized by an impressive string of macroeconomic and regulatory shocks.

In summary, we contribute some stylized facts on top executives' stock trading activity in response to equity pay. We show that executives largely neutralize option exercises and restricted shares while accommodating option awards. This disparate reaction to different compensation items is hard to rationalize within most existing theories of managerial compensation, which generally assume managers' inability to undo incentive packages and that there is only one type of equity pay.[8] Executives' trading behavior does not conform with the traditional, theoretical view that puts diversification motives center stage. Also, tax, behavior biases, risk preferences, and regulatory changes do not seem to be the main drivers of executives' trading behavior in response to annual equity grants. Our analysis—admittedly not causal in nature—unearths a set of correlations across endogenous quantities that challenge the common modeling approach to executive compensation and encourage the incorporation of dynamics into these theories.

Our results also speak to the two functions supposedly performed by equity compensation: incentivization and attraction/selection of executives. Whereas equity awards are ultimately valuable to executives because they can liquidate them, their incentive value is intrinsically linked to their holding period. Put differently, executives' skin in the game is the incentive mechanism that retains and motivates them to perform. Liquidation of current equity holdings—although allowing for higher current consumption—leads to a lower continuation value for executives and a higher cost for firms to achieve incentive compatibility in the next period.

[8] One notable exception is the optimal contracting framework of Dittmann and Maug (2007), who distinguish between stock and option compensation.

2 Background

Contract theory applied to managerial compensation packages typically assumes that the agent (i.e., the manager) cannot undo her equity incentives. In standard contracting problems à la Holmstrom and Milgrom (1987), the agent is risk-averse, so, if given the possibility, she would try to hedge all risks involved in her compensation package via hedging. This is implicitly assumed away by the static nature of these settings. Gao (2010) extends such a basic framework to allow for an intermediate stage in which the manager can hedge and show how the hedging cost affects managerial decisions. Jin (2002) develops a model with risk-averse managers and shareholders in which the former can trade the market portfolio, studying how this possibility feeds back on the optimal level of incentives. Similarly, using a general equilibrium model, Acharya and Bisin (2009) partially relaxes the no-hedging assumption by allowing the manager to hedge against systematic risk entailed in her pay (e.g., through index funds), but not to trade in her own firm's stock, effectively prohibiting hedging against idiosyncratic risk. Dye and Sridhar (2016) study a principal-agent problem in which the CEO can hedge her position via different types of hedges contracted with an investment bank.

In a fully dynamic setup—absent any friction preventing her from hedging—the manager would perfectly hedge and de facto receive only a fixed salary. Edmans et al. (2012) consider a dynamic model and allow the manager to save at the risk-free rate, but not on firms' stocks, limiting managers' insider trading and hedging activities. Cvitanić, Henderson, and Lazrak (2014) show that under some conditions—namely CARA preferences of the manager or zero initial capital to hedging and observable manager actions—there exist optimal contracts that induce the manager not to hedge. Not even these dynamic settings, however, allow managers to trade in their own stock, motivating such an assumption with, e.g., insider trading laws banning these transactions.

Managers may deviate from shareholders' incentive goals and reduce their exposure

to their own company's equity by carrying out hedging transactions through derivatives or, more simply, by selling (part of) their portfolio of equity securities. In practice, both alternatives may be hard to access for executives. Hedging activities through derivatives fall in a grey zone from an institutional perspective. Schizer (2000) conclude that contractual arrangements, securities law, and tax provisions typically hinder executives' option hedges with basic derivatives (with single-stock options or with basket instruments). By contrast, hedges on shares purchased by executives with their own funds are largely possible; restricted stock awards are treated as salary under tax law and thus subject to the same unfavorable treatment as option hedges. Throughout the years, investment banks have widened their menu of derivative transactions aimed at hedging executives' equity holdings while staying within legal boundaries. Bettis et al. (2001) consider a sample of insiders—including executives—and identify 89 hedging transactions with zero-cost collars and equity swaps between 1996 and 1998. Bettis, Bizjak, and Kalpathy (2015) expand the analysis to prepaid variable forwards and exchange funds and single out around 2,000 hedging transactions by insiders between 1996 and 2006. Whereas Securities and Exchange Commission (SEC) disclosure obligations on basic hedges have been in place since 1996 (Schizer, 2000), these have become more wide-ranging over time. In 2006, SEC made it mandatory for insiders to disclose pledges of their own company's shares.[9] Fabisik (2019) provides a large sample analysis of such pledges, documenting that only 3.5% of them are used to fund hedging positions. New York Times (2011) provides anecdotal evidence that hedging deals is common among bankers, but most banks have policies that ban these transactions for top executives. Fahlenbrach and Stulz (2011) confirm this view, finding no derivative-based hedges by CEOs in a sample of 98 large US financial institutions at the onset of the Great Recession. In 2018, the SEC mandated companies to disclose their hedging policies to directors and employees.[10] We manually collected

[9] See https://www.sec.gov/rules/final/2006/33-8732a.pdf.
[10] See https://www.sec.gov/rules/final/2018/33-10593.pdf.

such information (available upon request) from SEC filings of a small, random sample of companies for the fiscal year 2019, finding that hedging by executives is overwhelmingly prohibited. All in all, although financial institutions steadily devise new ways for executives to hedge against ownership, and these transactions are likely to be under-reported, it seems unlikely that top executives extensively use derivative hedges.[11]

Alternatively, executives may limit their exposure by selling their equity securities while complying with insider trading laws.[12] In the case of shares, this could happen via an open-market sale as long as they are already vested. In the case of options, which are typically non-tradable, executives can exercise them (early) and then sell the acquired shares. However, tax law de facto discourages this practice for nonqualified options (Schizer, 2000).[13] Evidence from the 1990s is that executives do actively sell their received equity grants (Ofek and Yermack, 2000). The motives behind this trading activity may be multifarious: diversification, tax provisions, market timing, behavioral, target ownership (e.g., Jenter, 2005; Jin and Kothari, 2008; Klein and Maug, 2020). To some extent, the same motives appear to explain why US executives hold large amounts of unrestricted shares, larger than what would be implied by the risk premium contained in their pay packages (Armstrong, Core, and Guay, 2015). Despite their visibility to outside investors and the negative signal they may convey to the market, direct sales of stock appear to be the primary path for US executives to manage personal exposure to firm risk.

Motivated by recent advancements in dynamic contract theory and existing evidence,

[11] A related strand of the literature empirically investigates how the availability of hedging opportunities—as proxied by the presence of exchange-traded options on the firm's stock—impacts executive compensation structure and corporate policies (Gao, 2010; Hung, Pan, and Wang, 2019; Park, Kim, and Tsang, 2022).

[12] Interestingly, the introduction and enforcement of insider trading laws come with higher use of equity incentives in executive compensation (Denis and Xu, 2013).

[13] Most options awarded to executives are nonqualified, whereas, below executive-level, incentive stock options are also common and subject to a more favorable tax regime in case of exercise (Schizer, 2000; Murphy, 2013).

we empirically investigate to what extent executives trade their own stock, i.e., their equilibrium responses to the equity incentives provided by shareholders over a large and recent sample. Our analysis can motivate further theoretical work capturing the equilibrium trading activity of top executives in their own stocks.

3 Data

The entire analysis relies on standard databases. We obtain information on executives' compensation packages as well as annual company financials and monthly stock returns on common shares for US public firms from S&P ExecuComp and the Center for Research in Security Prices/Compustat (CCM), respectively. In other words, we typically look at top-five executives from firms belonging to the S&P 1,500 index.[14] Rather than levering insider trading filings with the SEC, we rely on executive compensation and equity holdings reports to infer these individuals' trading activity on their own firm's stocks as covered by ExecuComp annual data. Our goal, indeed, is not to capture how the informational advantages of executives feed into their short-term trading choices but to capture whether, how, and to which extent they react to incentive packages set by shareholders over their tenure. We supplement the dataset with macroeconomic information such as the Consumer Price Index (CPI) and the CBOE Volatility Index (VIX) from Federal Reserve Economic Data (FRED).

We consider the longest period available on ExecuComp, namely 1992 to 2020. We trim variables at the 2nd and 98th percentile to mitigate the impact of outliers. All monetary variables are expressed in 2020 US dollars ($), and returns are in real terms,

[14]Note that ExecuComp also covers a non-negligible number of firms outside of the S&P 1,500 index. This may happen for two reasons. First, S&P customers may request ExecuComp coverage for specific companies out of the index. Second, the presence of non-S&P 1,500 firms relates to the backfilling bias issue in ExecuComp inasmuch information on several years before the firm's inclusion in the index is generally added to the database (Gillan, Hartzell, Koch, and Starks, 2018) Below, we examine the sensitivity of our findings to removing such observations. In some instances, ExecuComp may cover more than five executives per firm-year.

based on the CPI. The sample excludes firm-year observations with missing information on total assets, sales, the stock price at fiscal year-end, the number of common shares outstanding, and executive-year observations with no information on age or the year-on-year change in personal equity holdings. Because we focus on such a change, the final sample effectively starts in 1993, covering 169,776 executive-year level observations from 3,632 firms, 32,229 executives, and 35,167 executive-firm pairs. Data definitions are in the Appendix Table A.1.

Table 1 shows summary statistics on equity incentives, salary, bonuses, and personal characteristics of top managers, as well as on firm stock performance and total assets. In Panel A, we consider the entire sample. The mean (and median) change in shares owned by executives is positive. Still, a non-negligible fraction of executive-year observations come with a negative change, as shown by the 25th percentile. Another interesting stylized fact is the relatively low frequency of option exercises (median at zero), whereas the median number of options or restricted shares granted per year is positive. These patterns combined point to the relevant role of executives' trading on their own firm's stock (even besides stock sales linked to option exercises). This is prima facie evidence of the active role played by executives' equilibrium response to compensation packages chosen by shareholders in shaping incentives. Executive fractional stock ownership—without accounting for options—is on average 0.37% (median of 0.075%). Assuming that options in executives' portfolios have a delta of one, we obtain an upper bound for ownership with a mean of 0.79% (median of 0.31%). These values line up well with the existing evidence (e.g., Murphy, 2013) and, though small, are economically significant. Given the sheer size of firms covered by ExecuComp, average dollar stock ownership is around \$7.5M (median of \$2M), well above the average annual cash compensation of around \$0.8M (median of \$0.5M). Roughly a fifth of executive-year observations are from CEOs. As we would expect, Panel B shows that CEOs receive (and hold in their

portfolios) more equity incentives, earn higher salaries and bonuses, are older, and have longer tenure. All these differences are statistically significant at conventional levels.

4 Main results

The main analysis aims to track the executives' responses to changes in their exposure to firms' equity induced by new option awards, new restricted stock awards, or option exercises. Our research design follows closely that of Ofek and Yermack (2000) and relies on the specifications of this form:

$$\Delta\text{Shares owned}_{ijt} = \alpha + \sum_{k} \beta_k \cdot \text{Equity pay item}(k)_{ijt} + \theta \cdot r_{jt} + \gamma_{i(j)t} + \varepsilon_{ijt}, \quad (1)$$

where $\Delta\text{Shares owned}_{ijt}$ is the annual change in the total number of shares owned by the executive i at the firm j in fiscal year t.[15]. Equity pay item$(k)_{ijt}$ is the annual flow of equity compensation item k, with k referring to options awarded, options exercised by the executive, and restricted shares awarded over the year. We control for the firm's annual stock return, r_{jt}, to roughly filter out speculative trading activities and focus on changes in shares owned relating to executives' desired level of incentives. After estimating equation (2) with year and firm fixed effects, we include firm-by-year, and firm-by-executive fixed effects denoted by $\gamma_{i(j)t}$. In its most saturated form, the specification effectively accounts for time-varying macroeconomic conditions and firm-level characteristics (e.g., absorbing variation in r_{jt}), as well as for time-invariant characteristics of executive-firm matches (e.g., intrinsic skills and risk preferences of the executive, initial compensation contract features, etc.). Yet, our preferred specification features only year and firm fixed to exploit within-firm variation across executives in terms of remuneration fully. Because

[15]The number of shares also includes non-vested restricted shares, but it excludes option awards. Below, we conduct a robustness test excluding unvested shares. We choose to include them in the baseline analysis because of the non-synchronicity in how the total number of shares and the number of vested shares are reported in ExecuComp (Ofek and Yermack, 2000).

remuneration schemes are likely to be correlated across executives of the same firm, we cluster standard errors at the firm level.

In our baseline analysis, following Ofek and Yermack (2000), we exclude managers who are not awarded any stock option or restricted stock or do not exercise any options during the year. Moreover, we restrict the sample to those executives who own a large enough number of shares to potentially offset the positive effect on their own equity exposure of new options, option exercises, and new restricted shares. Specifically, when looking at new options or restricted shares awarded, we require executives to own at least as many shares in the prior year.[16] Similarly, when looking jointly at the three drivers of equity incentives (new options awarded, options exercised by the executive, and restricted shares awarded over the year), we require executives to own a number of shares as least as large as the sum of new options and restricted shares awarded. The rationale for these sample restrictions is to ensure that executives are, at least in principle, able to fully neutralize the increase in their equity incentives by offloading shares from their portfolios. Note that these restrictions will likely introduce a bias in our sample, which will be tilted away from early-tenure executives. Nonetheless, by focusing on these samples, we can focus on those executives who do have the possibility—at least in principle—to respond and neutralize firms' equity grants.

We are interested in the coefficients β_k, i.e., the change in the number of shares owned per unit of Equity pay item$(k)_{ijt}$. Let us consider two corner cases, again in the spirit of Ofek and Yermack (2000). Under the first, managers' and shareholders' interests are fully aligned. Namely, managers will not trade in response to equity grants, as it will lead to a divergence in incentives. Under this situation, we expect β_k to be equal to 0 for new option awards (as they are generally unexercisable when awarded) and to be

[16] By contrast, when analyzing option exercises alone, we do not apply any sample restriction on prior stock ownership because executives can simply shed off the shares so acquired without the need to tap into stock holdings to neutralize the increase in exposure to firm risk.

equal to 1 for option exercises and restricted stock grants. The other corner case is that of "full neutralization" of changes in effective ownership. We expect β_k to equal -1 for restricted shares awards and options exercised and $-\Delta$ for option awards, where Δ is their average delta. Standard financial theory predicts that because of her high exposure to her firm's stock, a manager actively tries to mitigate underdiversification and thus—at least partially—neutralizes newly awarded equity incentives. The specification in (2) verifies where the average US executive positions herself between these extremes. It is worth noting that no causal interpretation should be attached to our estimates. Rather, we empirically characterize the equilibrium responses of executives to shareholders' choices about compensation.

In Table 2, we explore executives' ownership change when receiving new equity incentives. In columns 1 and 2, we start by regressing the change in the number of shares the executive owns on the number of new options granted to her over the year. Our results suggest that, for 1,000 options awarded, the number of shares owned by executives increases by between 51 (column 1, with firm and year fixed effects) to 69 (column 2, with firm-by-year and executive fixed effects over the restricted sample) shares. Put differently, instead of undoing the future expected incentive, executives slightly increase their share ownership. Still, the estimated effects are economically small, indicating that executives are, on average, passive in responding to option grants, largely consistent with the corner case of no endogenous adjustment.[17]

We then examine executives' stock trading behavior in response to option exercises in columns 3 and 4. For 1,000 options exercised by the executive, the increment in shareholdings ranges from 50 to 59 shares. Although statistically significant, our results are

[17]The small positive and significant coefficient estimates for $\beta_{\text{No. options granted}}$ may stem from a fraction of options becoming exercisable already within the year of the award. Concurrently, this positive relationship may arise from the correlation between option awards instances and other forms of equity compensation raising the number of shares. Below, we empirically evaluate this second possibility by encompassing the different forms of equity incentives in the same specification.

again economically small, suggesting that executives are unlikely to hold shares acquired upon option exercises. Because executives' options are not directly traded in the market, they cannot sell them directly and need to pay the exercise price to convert them into shares instead. Consistently with previous literature (Ofek and Yermack, 2000; Edmans, Fang, and Lewellen, 2017; Ladika and Sautner, 2020), these findings suggest that executives actively sell shares acquired through option conversions.

In columns 5 and 6, we look at the last component of equity incentives, namely restricted stock grants. For 1,000 restricted shares awarded, executives hold 202 to 211 more shares. The reaction to these awards is in between the two corner cases: managers appear to undo up to four-fifths of shareholder-induced incentive changes actively but still accommodate a non-negligible increase in their exposure to firm idiosyncratic risk.[18]

Finally, in columns 7 and 8, we estimate equation (2). By including the three different forms of equity incentives in the same specification, we are able to account for possible correlation patterns in their prevalence within compensation packages. Even after controlling for this, we obtain qualitatively and quantitatively similar results. For instance, we still observe a statistically significant—albeit small—increase in shares owned in conjunction with new option awards, mitigating concerns that this pattern is a byproduct of a positive correlation with option exercises and restricted shares awards.[19]

While statistically robust, our findings paint a mixed picture of managerial endogenous adjustment to equity incentives. On the one hand, the average executive does not appear to contrast the increased firm risk exposure linked to new options. Conversely,

[18]This setting does not allow us to determine whether the latter increase is the result of them embracing shareholder-approved incentive plans or of their inability to dodge these plans (e.g., because of bylaws prohibiting such trades or, more mundanely, because most of their equity holdings are unvested).

[19]Appendix Table A.2 illustrates that these results are robust to estimating equation (2) using different samples (with respect to executive ownership and to the type of annual equity award s they receive) and without fixed effects. In Appendix Table A.3, we verify the sensitivity of our baseline analysis to the backfilling bias of ExecuComp uncovered by Gillan et al. (2018). Following their recommended criteria, we remove from the sample those executive-years with information on salary but not on total compensation (item `tdc1` in ExecuComp) as well as those firm-years that are not part of the S&P 1,500. Again, our estimates remain qualitatively unchanged.

the economically modest increase in executive ownership associated with option exercises and restricted shares is consistent with the neutralization hypothesis.

The results above are broadly consistent with the early evidence provided by Ofek and Yermack (2000), who find evidence of full neutralization against option exercises (proposing tax, liquidity, and market timing motives as drivers) and partial neutralization against restricted shares. Our findings depart most distinctly from Ofek and Yermack (2000) in the case of option awards to high-ownership executives, for whom they find evidence of full neutralization (assuming option deltas of around 0.6).[20] Put differently, the analysis above portrays a rather puzzling constellation, with executives accepting shareholder-decided incentives if in the form of options while largely offsetting them if in the form of restricted shares.[21]

Various reasons could underlie executives' differential responses to options and restricted share awards (from fully rational tax planning to behavioral factors). However, these are unlikely to pertain to differences in preferences or intrinsic skills across exec-

[20] Ofek and Yermack (2000) find a statistically significant positive but small reaction for low-ownership executives, as we do (see column 4 of Appendix Table A.2).

[21] The picture is largely confirmed in Appendix Table A.4, in which we capture executives' response to equity incentives by means of alternative margins. In columns 1 and 2, we use the net number of shares sold by the executive—in the spirit of Clementi and Cooley (2009)—as the dependent variable. To obtain such a quantity, we implement an adjustment for vesting, concurrent option exercises, and restricted shares granted over the year. Therefore, we only look at the number of options granted as explanatory variables. The specification with firm and year fixed effects in column 1 suggests that executives reduce their exposure to own equity in response to option awards, especially when restricting the sample to individuals with high ownership. Put differently, after accounting for the concurrent change in other equity incentives and for vesting, executives seem to neutralize a relevant fraction of firm risk exposure linked to options in line with Ofek and Yermack (2000). However, this result is sensitive to the inclusion of finer fixed effects in column 2, where we obtain a statistically significant estimate of an increase in stockholding by 154 shares, economically more similar to the baseline result in Table 2. In columns 3 and 4, we consider the change in the number of *vested* shares as the dependent variable, computed by subtracting an executive's unvested shares from her total shareholdings. The coefficient estimates broadly support the baseline results, with the noteworthy difference that the response to restricted shares is quantitatively less important, if not indistinguishable from zero, pointing to a higher degree of neutralization. Yet, the timing mismatch in the reporting of total (as of a date between fiscal-year end and the proxy) and unvested (as of fiscal year-end) shareholdings—information needed to compute both the net number of shares sold and the change in the number of vested shares—may introduce a substantial measurement error due to contemporaneous vesting of other shares (Ofek and Yermack, 2000), so these coefficient estimates ought to be interpreted with caution.

utives receiving one or the other form of equity incentives. Indeed, the specification in column 8 of Table 2 features firm-by-executive fixed effects, effectively capturing time-invariant risk attitudes of executives over their tenure at the firm and/or their deep personal preferences over specific pay items. At the same time, firm-by-year fixed effects absorb changes over time in the pay mix of executives working at the same firm. Our coefficient estimates thus evaluate how executives who receive at least once each of the three forms of equity pay items over their tenure at the firm react to them, controlling for time-varying firm-level conditions. In other words, this mitigates concerns that the disparate reactions to options and restricted shares purely stem from executives self-selecting into different pay structures (e.g., specific types matching with firms that tend to award restricted shares) or about firms tilting their compensation packages towards restricted shares at different rates—in particular after the 2005 adoption of FAS 123R on the accounting treatment of options (Hayes, Lemmon, and Qiu, 2012).[22] The very same executives that act passively when receiving options largely neutralize the increased exposure resulting from restricted shares.

Regardless of the motives behind equilibrium managerial responses to equity grants and heterogeneity across them—which we explore in the next section—, the evidence presented here calls for further theoretical work to incorporate such responses in dynamic contracting models.

5 Economic mechanisms

In this section, we explore a non-exhaustive list of economic channels that might drive executives' trading response to equity incentives: diversification, optimal incentive, market

[22]By contrast, the estimates in the less saturated specifications of Table 2 are likely to reflect also these forces. Yet, a substantial overlap exists between executive-firm pairs receiving options and those receiving restricted shares. In particular, our dataset comprises 35,167 executive-firm pairs (as indexed by `co_per_rol` in ExecuComp), 32,347 of which are awarded options or restricted shares over their tenure. Those that receive both forms of equity incentives are 16,574.

timing, and major regulatory shocks.

5.1 Diversification

The diversification motive is one of the most important reasons for executives to unload their current holdings in response to receiving new equity incentives. The modern portfolio theory suggests that executives whose wealth (also in terms of human capital) is most concentrated in their own firm should be more prone to reduce their exposure to firm risk (e.g. Lambert, Larcker, and Verrecchia, 1991; Hall and Murphy, 2002). When executives receive new equity grants, the diversification motive predicts that the higher the level of an executive's under-diversification, the more equity the executive is willing to sell, therefore leading to a lower increase or even decrease in the annual change in the total amount of shares owned by the executive (ΔShares owned).

To this end, as we do not observe the complete portfolio of managers, we proxy for personal under-diversification in multiple ways. First, in Table 3, we augment specification (2) by interacting each equity pay item with the previous year's executive ownership in fractional and dollar terms, i.e., firm-specific wealth-performance sensitivity.[23] Contrary to the aforementioned theoretical prior, executives that are more under-diversified—as measured by their stock ownership—tend to accommodate more increases in exposure to firm risk stemming from option awards and exercises (columns 1 to 4). Only in the case of restricted shares do we find evidence supportive of the under-diversification story (columns 5 and 6), with both fractional and dollar ownership associating with more pronounced neutralization. Nonetheless, these effects are economically negligible. If we take, for instance, the case of restricted shares in column 5, moving from the 25th to the 75th percentile of fractional ownership induces a differential response of a mere 12

[23]For these tests, we do not impose any restriction on the number of shares owned by executives in the previous year. However, the results remain unscathed if we do introduce restrictions on prior ownership as in Table 2.

$(= (0.243 - 0.021) \times -0.055 \times 1,000)$ more shares sold. The magnitude is similar if we consider the coefficient estimates for dollar ownership in column 6. It is also worth noting that these results are unlikely to be an artifact of the well-known disparate correlations of fractional and dollar ownership with firm size (Edmans, Gabaix, and Landier, 2009), as coefficient signs are aligned for the two measures.[24]

Second, in Table 4, we seek to capture how firm-specific the human capital of each executive is, another prominent dimension of under-diversification. Given the inherent unobservability of such a quantity, we resort to two coarse empirical proxies, such as tenure at the firm and age. The intuition is that older executives or those who have been in office for longer periods are more likely to have developed a set of skills specific to the businesses of their firms, which are harder to redeploy elsewhere. At odds with this intuition, longer tenures appear to come with significantly weaker neutralization of option awards and exercises (columns 1 and 3), whereas they do not induce remarkable differences in the reaction to restricted shares (column 5). In the case of age, we do find some evidence that older executives—who are arguably more likely to have spent a higher fraction of their career at the firm—are more prone to neutralizing equity incentives, especially in the case of option exercises and restricted shares (columns 4 and 6), whereas the differential effect is statistically indistinguishable from zero in the case of option awards (column 2). Based on the estimates in column 6, the magnitude of the differential

[24]In Appendix Table A.5, we specialize our analysis to executives who are presumably highly under-diversified. In particular, in columns 1, 2, and 3, we look at executives whose previous year's stock ownership is above 1%, 3%, and 5%, respectively. Because ExecuComp covers relatively large firms, it is likely that equity stakes of such magnitudes represent a substantial (if not dominant) share of executives' personal wealth. In each column, the sample size is significantly smaller than in the benchmark specification reported in column 7 of Table 2, pointing to the fact that we are looking at a peculiar group of professionals. Yet, coefficient estimates remain qualitatively similar to the baseline ones. If anything, we find that executives highly exposed to firm risk neutralize less equity incentives. It is worth noting that firm founders tend to hold high stakes in the firm (Fahlenbrach, 2009) and are thus likely to be over-represented among our highly under-diversified executives. Founder executives' portfolio choices may be driven by the goal of retaining some degree of control over the firm, which in turn could confound our findings. Nonetheless, we also trim our fractional ownership measure at the 2nd and 98th percentile, which largely mutes this concern.

effect is more relevant though still modest: a 60-year-old executive, on average, sells 100 ($= (60 - 40) \times -0.005 \times 1,000$) more shares than a 40 year old one after being granted 1,000 restricted shares.

Then, in Table 5, we verify if CEOs' responses differ from those of other executives. Serving as the CEO can be seen as a proxy for under-diversification, as these managers tend to hold more of company equity and to be older, but the ongoing trend towards CEOs with more general skills may substantially reduce the firm-specificity of their human capital (Custódio, Ferreira, and Matos, 2013). At the same time, CEOs' trading choices may be subject to more intense scrutiny by market participants: a CEO shedding off her own firm's stock could convey a negative signal to investors and trigger a drop in market capitalization. Across specifications, we observe that CEOs tend to neutralize significantly fewer new equity incentives, except for option awards, for which the difference relative to other executives is insignificant. Although serving as the CEO is an imperfect measure of how tied to the firm the executive's human capital is, these patterns appear to be at odds with diversification motives.[25]

5.2 Optimal incentive

Another important reason for executives to sell their equity holdings in response to receiving new equity incentives is that executives are dynamically adjusting their optimal target level ownership to hedge against income shocks and smooth out consumption (e.g. Ofek and Yermack, 2000; Kahl, Liu, and Longstaff, 2003; Edmans et al., 2012; Klein and Maug, 2020). We evaluate this motivation in a setting that could impact executives' income and then influence their incentives to sell equity when receiving new grants: state-level personal tax change.

[25] In Appendix Table A.6, we focus on CEOs and distinguish between internally-promoted and externally-hired ones. Although these two groups of CEOs arguably have different degrees of personal under-diversification levels, their trading response to annual equity incentives is outstandingly similar.

If executives are at the optimal ownership level, a unit of equity grant will automatically trigger the selling behavior of existing vested holdings to remain at the optimal level. When personal tax changes, the expected incentive for newly granted equity also changes, and the need to liquidate corresponding vested equity to restore optimal incentive level will change accordingly.

Specifically, executives' stocks and options are taxed at different rates. Stocks held by executives for more than 1 year are taxed under long-term capital gain tax upon liquidation, while options are normally taxed under ordinary income tax when exercised. We assume executives are tax-registered in the state where the firm's headquarters are located. We also assume that executives are at the highest marginal state tax rate for their ordinary income and long-term capital gain taxes. We use the maximum state income tax rates from NBER's Taxsim table and focus on ordinary income tax changes and long-term capital gain tax changes that are larger than 1 percentage point.

To analyze how tax changes impact executives' trading behavior in response to equity grants, we augment specification (1) by interacting the timing of tax change with each equity pay component. Specifically, we use the actual tax change year as the benchmark, evaluating two years before the tax change and two years after the tax change as in specification (2) below:

$$\begin{aligned}\Delta\text{Shares owned}_{ijt} = \alpha + \kappa \cdot \sum_{\mu}^{-1,-2,+1,+2} \text{Tax change}_{\tau+\mu} \cdot \sum_{k} \cdot \text{Equity pay item}(k)_{ijt} \qquad (2)\\ + \lambda \cdot \sum_{\mu}^{-1,-2,+1,+2} \text{Tax change}_{\tau+\mu} + \sum_{k} \beta_k \cdot \text{Equity pay item}(k)_{ijt} + \theta \cdot r_{jt} + \gamma_{i(j)t} + \varepsilon_{ijt},\end{aligned}$$

In Table 6, we report the estimation result when the tax change is the state ordinary income tax increase by more than 1 percentage point. When income tax increases, the value of after-tax options decreases, and the incentive effect will be smaller than the pre-tax level. Executives are expected to liquidate fewer shares than the pre-tax level

to restore optimal incentive levels when they receive new option grants or exercise options. Contrary to our prior, we find the opposite for executives' trading behavior in response to options exercised in Columns (2) and (4): Compared with the benchmark year, executives liquidate around 370 shares more for 1,000 options exercised. Although the magnitude of the effect significantly shrinks in the second year after the tax increase, the sign of the coefficients is also against our prior. We only find some supporting evidence of the optimal incentive story in column (4) for option grants: Compared with the benchmark year, executives liquidated 247 shares less for 1,000 options exercised during the second year after the tax increase. We also perform the analysis for state ordinary income tax decreases by more than 1 percentage point and report the estimation results in Table 7. We do not find evidence associated with tax cuts supporting the optimal incentive motivation for executive trading responses to option grants or exercises.

We further analyze the impact of state long-term capital gain tax changes. Because there are only limited cases with capital gain tax change and keeping ordinary income tax fixed, we focus on events in which both capital gain tax and ordinary income tax increase by more than 1 percentage point or both decrease by 1 percentage point. When the capital gain tax increases, executives' existing ownership becomes less valuable and lowers their incentives. Therefore, executives are expected to retain more equity when they receive new stock grants after capital gain tax increases. Similarly, executives are expected to retain less equity when they receive new stock grants after capital gain tax decreases. We report our analysis results in Table 8 and Table 9 for tax increases and tax decreases, respectively. However, we do not find evidence to support the optimal incentive motivation for executive trading responses when receiving equity grants.[26]

[26]We obtain similar results if we use one-year or two-years before tax change: $\tau - 1$ or $\tau - 2$, as the benchmark year.

5.3 Market timing

In this section, we test the role of market timing related managerial behavior biases and preferences in shaping executives' equilibrium response to equity incentives. Executives could time the market in mainly two ways depending on different behavioral biases. One behavioral bias is the overconfidence effect (Malmendier and Tate, 2005). If executives are overconfident, they are more likely to attribute recent positive stock returns as their ability and expect higher returns in the future, making the liquidation of existing equity holdings unattractive. Therefore, we expect the overconfidence effect to lead to executives selling less equity when they receive new grants. The other behavioral bias is the disposition effect (see Shefrin and Statman, 1985; Barberis and Xiong, 2009). Executives with disposition bias might sell more equity associated with recent positive stock returns and keep more equity when recent stock returns are negative.

We test the above predictions in Table 10. We focus on past stock returns, decomposing them into idiosyncratic and market components, and consider a longer three-year horizon. Regarding option awards (columns 1 to 3), managers tend to keep a larger fraction of equity incentives in their portfolios following a year of good stock returns, driven by the idiosyncratic component and with a pronounced persistence of the effect over the three-year horizon. Evidence is weaker and generally insignificant in the case of option exercises (columns 4 to 6) and restricted shares (columns 7 to 9). The results of the above estimate suggest that overconfidence could explain part of the executive trading responses for option grants.

Instead of behavior biases, executives' trading behavior could also influenced by timing market or firm risk and uncertainty based on their risk preferences. In Table 11, we investigate the relationship of executives' trading response with uncertainty over firm valuation and size. We resort to firm-level stock volatility and the VIX to proxy for uncertainty. We capture firm size using an indicator for the top 100 companies by market

capitalization in a given year. In turn, such an indicator can provide insights into the role of stock liquidity and the availability of hedging opportunities (e.g., in the form of exchange-traded derivative instruments), which are both arguably higher in the case of large companies (e.g., Chordia, Huh, and Subrahmanyam, 2007). After receiving option awards, executives reduce their exposure significantly more in the presence of volatile returns, whereas their behavior does not change significantly with market volatility as proxied by the VIX or with firm size (columns 1 to 3). Moving to option exercises, executives respond to higher firm- and market-level volatility by keeping more of the shares acquired upon exercises, whereas their reaction is not affected by firm size (columns 4 to 6). By contrast, the trading response to restricted shares does not vary significantly with volatility, whereas executive at larger firms limit more their resulting holdings (columns 7 to 9).

5.4 Regulatory shocks

This section discusses how regulation and other major events may have shaped executives' stock trading behavior in response to equity compensation. In the US, the period going from 1992 to 2020 covered by our sample was dense with regulatory shocks directly affecting executive compensation practices as well as other relevant events, among which corporate scandals, the buildup and the burst of the Internet bubble in 2000, the Great Recession in 2007-2009, and the COVID-19 recession in 2020.

From the standpoint of our analysis, the most relevant phenomena that occurred over the sample period were the dramatic growth of option awards up to the early 2000s and the subsequent shift to restricted stocks, together with the concurrent dynamics of the stock market. The extensive use of options in the 1990s drove a sustained increase in executive pay, tilting it away from fixed components. This trend was arguably occasioned by various factors, such as shareholder activism asking for a strong link between executive

pay and equity performance, Clinton's $1M cap on non-performance-based compensation, or favorable accounting rules for expensing options coupled with tax advantages for companies awarding them. The Internet bubble burst in 2000, and the option-led increasing trend in executive pay ended. The stock crash was followed by reduced use of options in compensation packages amid intensifying scrutiny over compensation practices by politicians and the general public. From 2002, this coincided with the widespread and voluntary adoption of fair-value expensing for options, also in anticipation of the corresponding mandatory rule, which became effective in 2005 with FAS 123R. Fair-value expensing increased transparency on the economic cost of option awards borne by firms, closing the gap with the accounting treatment of restricted shares, which have become increasingly common since then (without replacing options, though).[27]

In Figure 2, we augment the baseline specifications of Table 2 to allow for time-varying coefficients and explore how executives' stock trading response to equity pay evolved over time. Starting with option awards in Panel A, we generally observe close-to-zero and often statistically insignificant coefficient estimates. There are, however, remarkable exceptions: (i) substantially positive point estimates of around 0.25 between 1997 and 2000 and (ii) negative point estimates of around -0.2 in 2009 and 2020. In other words, executives appear to have willingly increased their exposure to firm risk in the buildup of the 2000 stock market crash. This probably drives the positive and significant, albeit economically smaller, coefficient estimates for option awards in Table 2. By contrast, executives do not seem to have behaved in the same way during subsequent periods of steady stock market growth.[28] Coinciding with the fall of the market in 2009 and 2020, executives actively neutralized their exposure to firm risk. Moreover, the trading

[27] See Murphy (2013) for an exhaustive overview of relevant regulatory and macroeconomic events and how their stratification over time reflected and impacted executive compensation level and structure trends.

[28] Such a change in the sensitivity trading responses to general stock market trends could underline the insignificant coefficient estimates for the interaction term with market return in Appendix Table 10.

response remained stable around 2002, when the Sarbanes-Oxley Act de facto passage banned in-house cashless options (Murphy, 2013). We document similar patterns for shares acquired upon exercising options (Panel B). In the case of restricted shares (Panel C), coefficient estimates are invariably significantly positive (except in 2013), in line with baseline results in Table 2. It is interesting to highlight that point estimates: (i) are above 0.4 up to 2004, exceeding 1.2 in multiple years, but with large confidence intervals; (ii) become smaller at around 0.2 from 2005 and with much narrower confidence intervals. Whereas the large point estimates in the earlier years of the sample ostensibly reflect higher stock valuations over that period, their improved precision from 2002 onward is a byproduct of the broad adoption of restricted stock awards since then.[29]

[29]We specifically test three major regulatory changes in Appendix Table A.8 for the FAR123R accounting rule changes for options expense in 2006, Appendix Table A.9 for the JOBS Act section 409A, which limited the deferred compensation withdraw in 2004, and Appendix Table A.10 for the NYSE listing requirement changes that requires shareholder voting on equity-plans for top executives. overall, we do not find systematic executives' trading responses change after different regulations are passed.

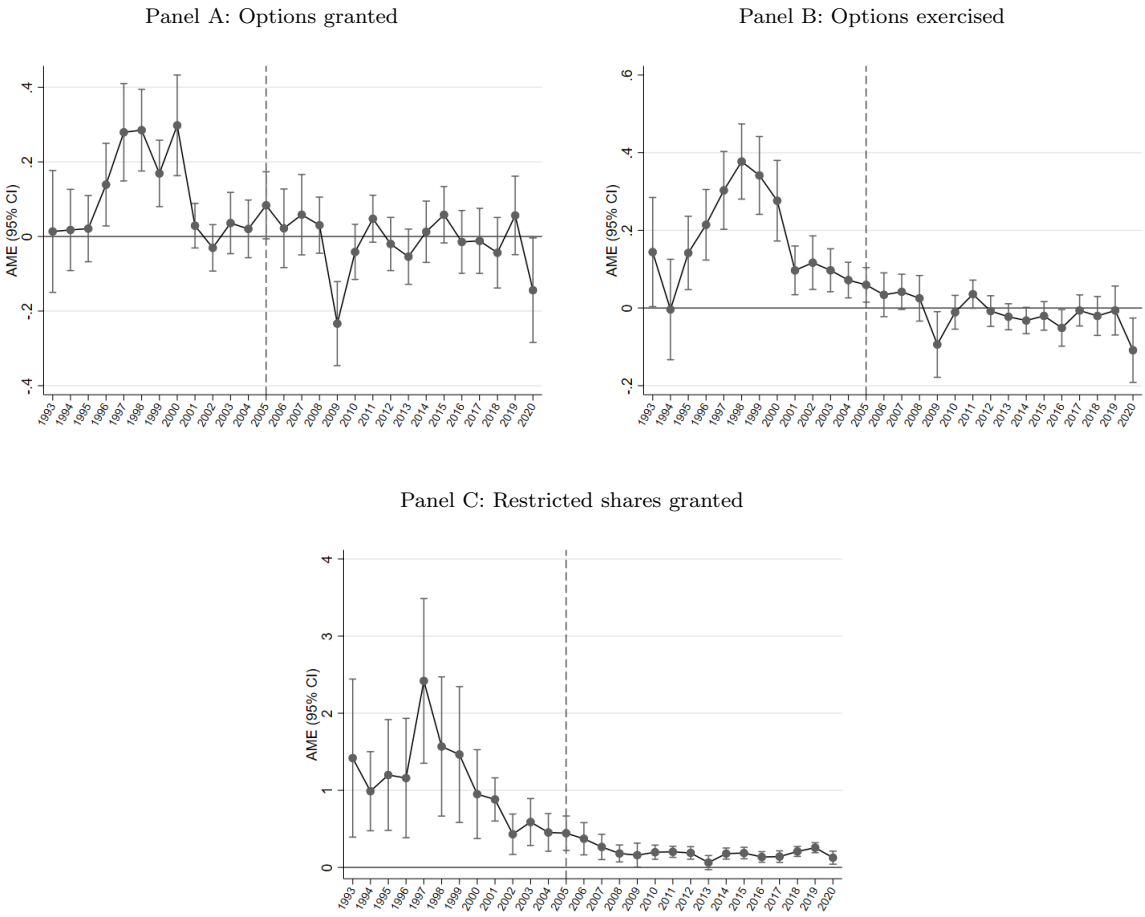

Figure 2: Executives' stock trading response to equity incentives over time
This figure shows the average marginal effect (AME) of receiving equity pay item k on the annual change in the shareholdings of executives over time, based on the following specification:

$$\Delta\text{Shares owned}_{ijt} = \alpha + \sum_{t} \beta_{kt} \cdot \text{Equity pay item}(k)_{ijt} \times \mathbf{1}_{\{\text{Year}=t\}} + \theta \cdot r_{jt} + \gamma_j + \gamma_t + \varepsilon_{ijt},$$

which includes firm (γ_j) and year (γ_t) fixed effects. The specification is estimated for k = No. options granted in Panel A, for k = No. options exercised in Panel B, and for k = No. restricted shares granted in Panel C. The reference year is 2005 (denoted by the dashed vertical line), when FAS 123R was adopted. The vertical bars denote 95% confidence intervals, based on standard errors clustered by firm.

Apart from a higher propensity to hold firm equity in the late 1990s, the trading response of executives is quite stable over time, thus exhibiting limited sensitivity to the numerous regulatory shocks that affected executive performance-based compensation between 1992 and 2020.[30] Executives' tendency to neutralize option exercises and restricted

[30]In Appendix Table A.7 we examine trading responses across different sectors. We use the Fama-

shares while accommodating option awards appears to be a deep feature of their behavior.

Overall, we find limited support for the conjecture that less diversified executives are more prone to undoing equity incentives. No matter how we capture their degree of diversification (fraction or dollar ownership, tenure, age, CEO status), supposedly less diversified executives do not exhibit economically meaningful differences in their response to equity pay. If anything, the observed patterns point to an opposite effect towards higher equity exposure by them. Our findings revamp evidence by Ofek and Yermack (2000), who illustrated that in the early 1990s, diversification represented a major driver of executives' trading response.

Using state-level personal tax change as a shock to executives' optimal incentive level, we do not find a significant change in executives' equity trading responses. This is especially the case when both ordinary income tax and long-term capital gain tax change simultaneously, whereas ordinary income tax mainly affects options, and long-term capital gain tax mainly affects stocks. We also didn't find major regulation changes significantly impact executives' trading responses upon equity grants across time. The average trading responses of executives are relatively stable, especially after 2000.

Despite the small economic magnitude, We find some suggestive evidence that aligns with the hypothesis that executives' behavior biases and risk preferences contribute to part of the cross-sectional variations of their trading responses. Whereas returns—at least for option awards—load positively on subsequent shareholdings, firm- and market-level volatility as well as firm size (a proxy for liquidity and hedging opportunities) exhibit disparate correlation signs depending on the type of equity award. These results

French 12 industry groups, to which we assign firms based on their historical SIC codes (this allows us to include industry-fixed effects besides firm-fixed effects). Executives of financial institutions (the reference group, FF11) exhibit coefficient estimates broadly in line with the baseline, and other industries line up pretty closely. Only executives from the business equipment (FF6) and telecommunication (FF7) industries deviate, with a distinctly stronger propensity to neutralize equity incentives. These two industry groups comprise many of the Internet companies that were most exposed to the 2000 stock crash.

complement the empirical analysis by Jenter (2005), who illustrates that managers hold contrarian views about the valuation of their firms and trade their own stocks accordingly.

6 Conclusion

Executive compensation packages typically aim at attracting, retaining, and incentivizing managers. In this respect, equity pay has come center stage over the last three decades in US public firms, also as an important driver of incomes at the top end of the income distribution. We assess to what extent equity incentives are retained or neutralized by top executives via trading on their personal holdings of firm equity over the period 1992-2020. We document that they actively manage their personal exposure to firm risk. Specifically, they neutralize ownership changes linked to option exercise and, to a large extent, restricted stock awards. This result calls into question the standard, implicit assumption in models of compensation contracting that managers cannot dodge exposure to firm risk stemming from equity pay. Put differently, early option exercises and the increasingly common restricted stock awards may primarily fulfill an attraction/retention function rather than an incentive one.

Our estimates suggest that executives' stock trading response to option awards instead accommodates the ensuing increments in effective ownership, a relevant departure from the benchmark of neutralization. This is another challenge to existing (mathematical) theories, which rarely distinguish between different forms of equity pay. A final challenge to received wisdom is the lack of evidence that more underdiversified executives are more prone to shed off firm equity to avoid ownership increments from annual equity grants. We suspect that institutional and/or behavioral factors may underlie both of these patterns.

We hope that our results will stimulate further research into more realistic theoretical frameworks of managerial compensation contracting and empirical analyses on the motives underlying executives' trading response to annual equity pay.

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Table 1: Summary statistics

This table shows summary statistics on top executives' stock trading activity, compensation, and characteristics for a sample of US public firms covered by ExecuComp between 1992 and 2020. Panel A reports summary statistics over the whole sample, together with selected firm-level variables from CCM. Panel B distinguishes between CEOs and non-CEO executives, with the last two columns reporting differences across the two groups and the corresponding *t*-statistics. Refer to Appendix Table A.1 for variable definitions.

Panel A: Whole sample

	Obs.	Mean	SD	P5	P25	P50	P75	P95
Executive-level information								
Δ Shares owned	169,776	10.865	72.348	-68.500	-0.511	2.936	18.517	109.483
Δ Vested shares owned	168,622	8.143	68.338	-67.434	-1.378	0.813	14.566	101.010
Net shares sold	167,096	43.148	121.025	-60.697	-1.595	9.912	54.746	264.555
No. options granted	166,744	39.827	79.593	0.000	0.000	4.503	45.000	197.000
No. options exercised	166,050	22.046	54.578	0.000	0.000	0.000	15.000	130.749
No. restricted shares granted	166,585	20.944	42.688	0.000	0.000	3.363	22.143	102.284
Ownership (%)	169,776	0.367	1.055	0.000	0.021	0.075	0.243	1.619
Ownership at upper bound (%)	169,019	0.792	1.394	0.017	0.112	0.311	0.820	3.283
Ownership ($M)	168,547	7.459	17.614	0.000	0.518	1.977	6.368	32.878
Salary ($M)	169,776	0.598	0.381	0.232	0.364	0.503	0.732	1.260
Bonus ($M)	169,776	0.282	0.946	0.000	0.000	0.000	0.233	1.283
Tenure (years)	169,776	7.569	7.416	1.000	3.000	5.000	10.000	23.000
Age (years)	169,776	53.108	7.434	41.000	48.000	53.000	58.000	65.000
CEO	169,776	0.211	0.408	0.000	0.000	0.000	0.000	1.000
Firm-level information								
Return	42,973	0.110	0.424	-0.503	-0.149	0.074	0.308	0.839
Volatility	43,035	0.394	0.200	0.173	0.253	0.344	0.477	0.791
Total assets ($M)	43,448	6,179.105	10,572.933	186.984	721.581	2,096.991	6,459.299	27,488.746

Panel B: CEOs vs. non-CEOs

	CEOs			Non-CEOs			Mean-comparison test	
	Obs.	Mean	SD	Obs.	Mean	SD	Diff.	*t*-stat
Δ Shares owned	35,760	24.890	104.175	134,016	7.123	60.570	17.767	41.469
Δ Vested shares owned	35,210	18.265	100.168	133,412	5.471	56.749	12.794	31.337
Net shares sold	34,593	71.294	169.511	132,503	35.800	103.483	35.494	48.921
No. options granted	33,939	74.305	117.498	132,805	31.016	63.597	43.289	91.645
No. options exercised	33,985	33.057	72.215	132,065	19.213	48.622	13.844	41.922
No. restricted shares granted	34,090	35.729	60.951	132,495	17.140	35.561	18.589	72.839
Ownership (%)	35,760	0.874	1.661	134,016	0.232	0.766	0.642	105.644
Ownership at upper bound (%)	35,408	1.827	2.083	133,611	0.518	0.974	1.309	170.062
Ownership ($M)	35,075	16.477	26.194	133,472	5.089	13.582	11.389	111.673
Salary ($M)	35,760	0.921	0.434	134,016	0.511	0.313	0.410	201.378
Bonus ($M)	35,760	0.521	1.410	134,016	0.218	0.765	0.303	54.213
Tenure (years)	35,760	11.695	9.277	134,016	6.468	6.399	5.227	123.642
Age (years)	35,760	55.755	6.938	134,016	52.401	7.402	3.353	77.109

Table 2: Executives' stock trading response to equity incentives

This table shows coefficient estimates from panel regressions of the change in the shareholdings of executives on different types of equity incentives received over the year. The dependent variable is the annual change in own company's shares owned by the executive. In each specification, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. In columns 1 and 2, the sample comprises only executives with previous year's shareholdings larger than the number of shares potentially purchasable via the options granted over the year. In columns 3 and 4 on option exercises, no restriction is imposed on executive previous year's shareholdings. In columns 5 and 6, the sample comprises only executives with previous year's shareholdings larger than the number of restricted shares granted over the year. In columns 7 and 8, the sample comprises only executives with previous year's shareholdings larger than the sum of (i) the number of shares potentially purchasable via the options granted over the year and (ii) the number of restricted shares granted over the year. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
No. options granted	0.051***	0.069***					0.024*	0.074***
	(4.29)	(3.20)					(1.89)	(2.90)
No. options exercised			0.059***	0.050***			0.060***	0.061***
			(8.01)	(6.24)			(6.40)	(4.60)
No. restricted shares granted					0.202***	0.211***	0.223***	0.255***
					(13.80)	(8.46)	(13.81)	(8.23)
Return	-2.457**		-2.450***		1.816**		0.460	
	(-2.08)		(-2.94)		(2.08)		(0.37)	
Year FE	Yes	No	Yes	No	Yes	No	Yes	No
Firm FE	Yes	No	Yes	No	Yes	No	Yes	No
Firm-by-year FE	No	Yes	No	Yes	No	Yes	No	Yes
Firm-by-executive FE	No	Yes	No	Yes	No	Yes	No	Yes
Mean(y)	10.30	10.66	11.55	11.49	9.50	9.63	6.51	7.16
SD(y)	77.79	74.64	68.62	67.83	72.16	71.23	75.30	71.50
Observations	95,223	85,979	134,650	131,158	116,614	109,607	75,867	64,172
Adjusted R^2	0.05	0.36	0.05	0.34	0.05	0.31	0.07	0.36
Executive sample	High own.	High own.	All	All	High own.	High own.	High own.	High own.

Table 3: Executives' stock trading response to equity incentives and stock ownership
This table shows coefficient estimates from panel regressions of the change in the shareholdings of executives on different types of equity incentives received over the year, conditional on the level of executive prior stock ownership. The dependent variable is the annual change in own company's shares owned by the executive. Specifications in odd (even) columns interact the relevant equity pay item with previous year's fractional (dollar) ownership of the executive. In each specification, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned					
	(1)	(2)	(3)	(4)	(5)	(6)
No. options granted × Ownership (%)	0.002					
	(0.31)					
No. options granted × Ownership (M)		0.001***				
		(3.61)				
No. options exercised × Ownership (%)			0.024**			
			(2.23)			
No. options exercised × Ownership (M)				0.001**		
				(1.99)		
No. restricted shares granted × Ownership (%)					-0.055***	
					(-3.40)	
No. restricted shares granted × Ownership (M)						-0.002***
						(-2.82)
Ownership (%)	-1.022		-1.338**		-0.700	
	(-1.41)		(-2.08)		(-1.10)	
Ownership (M)		-0.131***		-0.090**		0.031
		(-2.82)		(-2.15)		(0.67)
No. options granted	0.073***	0.059***				
	(12.40)	(10.02)				
No. options exercised			0.050***	0.046***		
			(6.67)	(5.61)		
No. restricted shares granted					0.236***	0.234***
					(21.44)	(21.98)
Return	-0.613	-0.609	-2.447***	-2.421***	1.996**	2.044**
	(-0.76)	(-0.75)	(-2.95)	(-2.94)	(2.52)	(2.57)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean(y)	11.57	11.65	11.57	11.64	10.93	11.02
SD(y)	70.25	69.41	68.51	67.77	68.89	67.99
Observations	135,246	134,485	134,514	133,825	135,122	134,340
Adjusted R^2	0.05	0.05	0.05	0.05	0.05	0.05

Table 4: Executives' stock trading response to equity incentives and firm-specificity of human capital
This table shows coefficient estimates from panel regressions of the change in the shareholdings of executives on different types of equity incentives received over the year, conditional on the degree of firm-specificity of executive human capital. The dependent variable is the annual change in own company's shares owned by the executive. Specifications in odd (even) columns interact the relevant equity pay item with tenure at the firm (age) of the executive. In each specification, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. In columns 1 and 2, the sample comprises only executives with previous year's shareholdings larger than the number of shares potentially purchasable via the options granted over the year. In columns 3 and 4 on option exercises, no restriction is imposed on executive previous year's shareholdings. In columns 5 and 6, the sample comprises only executives with previous year's shareholdings larger than the number of restricted shares granted over the year. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned					
	(1)	(2)	(3)	(4)	(5)	(6)
No. options granted × Tenure	0.003***					
	(3.05)					
No. options granted × Age		-0.000				
		(-0.04)				
No. options exercised × Tenure			0.003***			
			(3.68)			
No. options exercised × Age				-0.002**		
				(-2.04)		
No. restricted shares granted × Tenure					-0.001	
					(-0.48)	
No. restricted shares granted × Age						-0.005***
						(-2.65)
Tenure	-0.182***		-0.127***		0.033	
	(-2.96)		(-2.70)		(0.65)	
Age		-0.223***		-0.072*		-0.039
		(-4.46)		(-1.87)		(-0.85)
No. options granted	0.010	0.057				
	(0.56)	(0.67)				
No. options exercised			0.026***	0.169***		
			(2.72)	(3.13)		
No. restricted shares granted					0.210***	0.468***
					(9.20)	(4.60)
Return	-2.495**	-2.480**	-2.363***	-2.547***	1.828**	1.821**
	(-2.12)	(-2.10)	(-2.84)	(-3.05)	(2.10)	(2.09)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean(y)	10.30	10.30	11.55	11.55	9.50	9.50
SD(y)	77.79	77.79	68.62	68.62	72.16	72.16
Observations	95,223	95,223	134,650	134,650	116,614	116,614
Adjusted R^2	0.05	0.05	0.05	0.05	0.05	0.05
Executive sample	High own.	High own.	All	All	High own.	High own.

Table 5: Executives' stock trading response to equity incentives (CEOs vs. non-CEOs)
This table shows coefficient estimates from panel regressions of the change in the shareholdings of executives on different types of equity incentives received over the year, distinguishing between CEOs and non-CEO executives. The dependent variable is the annual change in own company's shares owned by the executive. Each specification interacts the relevant equity pay item with an indicator variable equal to one if the executive is the CEO of the firm, and zero otherwise. In each specification, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. In column 1, the sample comprises only executives with previous year's shareholdings larger than the number of shares potentially purchasable via the options granted over the year. In column 2 on option exercises, no restriction is imposed on executive previous year's shareholdings. In column 3, the sample comprises only executives with previous year's shareholdings larger than the number of restricted shares granted over the year. In column 4, the sample comprises only executives with previous year's shareholdings larger than the sum of (i) the number of shares potentially purchasable via the options granted over the year and (ii) the number of restricted shares granted over the year. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned			
	(1)	(2)	(3)	(4)
No. awarded options × CEO	0.008			0.014
	(0.38)			(0.65)
No. options granted	0.006			-0.003
	(0.33)			(-0.17)
No. options exercised × CEO		0.041***		0.071***
		(3.39)		(4.24)
No. options exercised		0.028***		0.024**
		(3.14)		(2.12)
No. restricted stocks × CEO			0.094***	0.090***
			(4.07)	(3.40)
No. restricted shares granted			0.089***	0.138***
			(3.88)	(5.34)
CEO	17.554***	15.289***	11.394***	2.248*
	(18.32)	(21.96)	(13.69)	(1.87)
Return	-2.427**	-2.005**	1.442*	0.221
	(-2.06)	(-2.40)	(1.66)	(0.18)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Mean(y)	10.30	11.55	9.50	6.51
SD(y)	77.79	68.62	72.16	75.30
Observations	95,223	134,650	116,614	75,867
Adjusted R^2	0.06	0.06	0.05	0.07
Executive sample	High own.	All	High own.	High own.

Table 6: Executives' stock trading response to equity incentives and state income tax increases ($> 1\%$)
This table shows coefficient estimates from panel regressions of the change in the shareholdings of executives on different types of equity incentives received over the year, conditional on whether there is a state-level ordinary income tax increase by more than 1 percentage point. The dependent variable is the annual change in own company's shares owned by the executive. Each specification contains the relevant equity pay items that interact with the timeline from year $t-2$ to year $t+2$ around the state-level ordinary income tax increases by more than 1 percentage point. In each specification, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned			
	(1)	(2)	(3)	(4)
No. options granted × Income tax increase t-2	0.205			0.255*
	(1.21)			(1.84)
No. options granted × Income tax increase t-1	-0.016			-0.082
	(-0.08)			(-0.49)
No. options granted × Income tax increase t+1	-0.148			-0.185
	(-0.59)			(-0.82)
No. options granted × Income tax increase t+2	0.145			0.247**
	(1.14)			(2.36)
No. options exercised × Income tax increase t-2		0.094		0.193
		(0.46)		(1.43)
No. options exercised × Income tax increase t-1		0.378		0.331
		(1.48)		(1.33)
No. options exercised × Income tax increase t+1		-0.376*		-0.359**
		(-1.90)		(-1.97)
No. options exercised × Income tax increase t+2		-0.102		-0.129
		(-1.10)		(-1.39)
No. restricted shares granted × Income tax increase t-2			0.211	0.305
			(0.94)	(1.39)
No. restricted shares granted × Income tax increase t-1			-0.367***	-0.353***
			(-3.29)	(-3.30)
No. restricted shares granted × Income tax increase t+1			0.186	0.177
			(0.93)	(0.95)
No. restricted shares granted × Income tax increase t+2			0.142*	0.163**
			(1.84)	(2.09)
Return	-10.033***	-10.296***	-6.470***	-6.964***
	(-6.31)	(-6.45)	(-4.15)	(-4.45)
Non-interacted terms	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Mean(y)	2.92	3.13	1.98	2.18
SD(y)	82.70	80.27	80.33	77.99
Observations	57,543	56,328	56,281	55,139
Adjusted R^2	0.05	0.06	0.06	0.07
Executive sample	High own.	High own.	High own.	High own.

Table 7: Executives' stock trading response to equity incentives and state income tax decrease ($> 1\%$)
This table shows coefficient estimates from panel regressions of the change in the shareholdings of executives on different types of equity incentives received over the year, conditional on whether there is a state-level ordinary income tax decrease by more than 1 percentage point. The dependent variable is the annual change in own company's shares owned by the executive. Each specification contains the relevant equity pay items that interact with the timeline from year $t-2$ to year $t+2$ around the state-level ordinary income tax decreases by more than 1 percentage point. In each specification, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned			
	(1)	(2)	(3)	(4)
No. options granted × Income tax decrease t-2	0.391			0.453*
	(1.25)			(1.77)
No. options granted × Income tax decrease t-1	-0.317			-0.097
	(-1.23)			(-0.47)
No. options granted × Income tax decrease t+1	-0.183			-0.215
	(-0.79)			(-0.82)
No. options granted × Income tax decrease t+2	0.310***			0.322**
	(2.67)			(2.13)
No. options exercised × Income tax decrease t-2		0.091		0.065
		(0.49)		(0.62)
No. options exercised × Income tax decrease t-1		-0.204		0.191
		(-0.48)		(0.50)
No. options exercised × Income tax decrease t+1		-0.167		-0.035
		(-1.04)		(-0.19)
No. options exercised × Income tax decrease t+2		-0.124		-0.062
		(-0.33)		(-0.18)
No. restricted shares granted × Income tax decrease t-2			0.204	0.270
			(0.65)	(1.01)
No. restricted shares granted × Income tax decrease t-1			0.318	0.323
			(1.07)	(1.15)
No. restricted shares granted × Income tax decrease t+1			0.269*	0.219
			(1.90)	(1.55)
No. restricted shares granted × Income tax decrease t+2			0.122	0.111
			(0.55)	(0.52)
Return	-9.558***	-9.878***	-5.980***	-6.452***
	(-6.02)	(-6.19)	(-3.84)	(-4.12)
Non-interacted terms	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Mean(y)	2.94	3.14	2.00	2.19
SD(y)	82.85	80.42	80.49	78.16
Observations	57,405	56,189	56,138	54,995
Adjusted R^2	0.05	0.06	0.06	0.07
Executive sample	High own.	High own.	High own.	High own.

Table 8: Executives' stock trading response to equity incentives and both state income and long-term capital gain tax increases (both $> 1\%$)

This table shows coefficient estimates from panel regressions of the change in the shareholdings of executives on different types of equity incentives received over the year, conditional on whether the state-level ordinary income tax and the state-level long-term capital gain tax both increase by more than 1 percentage point. The dependent variable is the annual change in own company's shares owned by the executive. Each specification contains the relevant equity pay items that interact with the timeline from year $t-2$ to year $t+2$ around the event that both the state-level ordinary income tax and the state-level long-term capital gain increase by more than 1 percentage point. In each specification, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned			
	(1)	(2)	(3)	(4)
No. options granted × Income and capital tax increase t-2	-0.183***			-0.214***
	(-3.17)			(-2.93)
No. options granted × Income and capital tax increase t-1	-0.104*			-0.078
	(-1.76)			(-1.37)
No. options granted × Income and capital tax increase t+1	-0.024			-0.014
	(-0.27)			(-0.16)
No. options granted × Income and capital tax increase t+2	-0.065			-0.059
	(-0.80)			(-0.66)
No. options exercised × Income and capital tax increase t-2		-0.004		0.039
		(-0.08)		(0.80)
No. options exercised × Income and capital tax increase t-1		-0.031		-0.000
		(-0.55)		(-0.01)
No. options exercised × Income and capital tax increase t+1		-0.065		-0.070
		(-1.37)		(-1.37)
No. options exercised × Income and capital tax increase t+2		0.034		0.050
		(0.70)		(1.03)
No. restricted shares granted × Income and capital tax increase t-2			-0.155**	-0.177**
			(-2.17)	(-2.49)
No. restricted shares granted × Income and capital tax increase t-1			-0.052	-0.063
			(-0.63)	(-0.74)
No. restricted shares granted × Income and capital tax increase t+1			-0.053	0.023
			(-0.57)	(0.25)
No. restricted shares granted × Income and capital tax increase t+2			-0.002	-0.000
			(-0.03)	(-0.00)
Return	-10.176***	-10.301***	-6.695***	-6.972***
	(-6.91)	(-6.96)	(-4.62)	(-4.80)
Non-interacted terms	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Mean(y)	2.71	2.93	1.69	1.92
SD(y)	82.62	79.94	80.25	77.74
Observations	63,695	62,191	62,224	60,829
Adjusted R^2	0.06	0.06	0.07	0.07
Executive sample	High own.	High own.	High own.	High own.

Table 9: Executives' stock trading response to equity incentives and both state income and long-term capital gain tax decrease (both $> 1\%$)

This table shows coefficient estimates from panel regressions of the change in the shareholdings of executives on different types of equity incentives received over the year, conditional on whether the state-level ordinary income tax and the state-level long-term capital gain tax both decrease by more than 1 percentage point. The dependent variable is the annual change in own company's shares owned by the executive. Each specification contains the relevant equity pay items that interact with the timeline from year $t-2$ to year $t+2$ around the event that both the state-level ordinary income tax and the state-level long-term capital gain decrease by more than 1 percentage point. In each specification, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned			
	(1)	(2)	(3)	(4)
No. options granted × Income and capital tax decrease t-2	-0.068			-0.091
	(-0.70)			(-0.74)
No. options granted × Income and capital tax decrease t-1	-0.104			-0.212
	(-0.59)			(-1.20)
No. options granted × Income and capital tax decrease t+1	-0.316***			-0.166
	(-2.69)			(-1.59)
No. options granted × Income and capital tax decrease t+2	-0.214			-0.202
	(-0.89)			(-0.77)
No. options exercised × Income and capital tax decrease t-2		0.198*		0.221*
		(1.67)		(1.88)
No. options exercised × Income and capital tax decrease t-1		0.090		0.087
		(1.02)		(0.99)
No. options exercised × Income and capital tax decrease t+1		0.090		0.289*
		(0.49)		(1.92)
No. options exercised × Income and capital tax decrease t+2		0.109		0.124
		(1.00)		(1.11)
No. restricted shares granted × Income and capital tax decrease t-2			-0.084	0.028
			(-0.55)	(0.20)
No. restricted shares granted × Income and capital tax decrease t-1			0.084	0.050
			(0.74)	(0.48)
No. restricted shares granted × Income and capital tax decrease t+1			-0.051	-0.062
			(-0.34)	(-0.39)
No. restricted shares granted × Income and capital tax decrease t+2			-0.075	-0.010
			(-0.57)	(-0.09)
Return	-9.807***	-10.114***	-6.258***	-6.745***
	(-6.24)	(-6.42)	(-4.07)	(-4.36)
Non-interacted terms	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Mean(y)	2.55	2.77	1.62	1.82
SD(y)	83.06	80.60	80.73	78.35
Observations	58,708	57,435	57,411	56,213
Adjusted R^2	0.06	0.06	0.07	0.07
Executive sample	High own.	High own.	High own.	High own.

Table 10: Executives' stock trading response to equity incentives and stock returns

This table shows coefficient estimates from panel regressions of the change in the shareholdings of executives on different types of equity incentives received over the year, conditional on the firm's stock return. The dependent variable is the annual change in own company's shares owned by the executive. Each specification interacts the relevant equity pay item with different measures of stock returns, such as the firm's total return over the previous year, the firm's idiosyncratic return (total return minus market return) and the market return over the previous year, and the firm's total return over the previous three years. Coefficient estimates for non-interacted terms are not reported for brevity. In each specification, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. In columns 1 to 3, the sample comprises only executives with previous year's shareholdings larger than the number of shares potentially purchasable via the options granted over the year. In columns 4 to 6 on option exercises, no restriction is imposed on executive previous year's shareholdings. In columns 7 to 9, the sample comprises only executives with previous year's shareholdings larger than the number of restricted shares granted over the year. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
No. options granted × Return	0.057*								
	(1.74)								
No. options granted × Idiosyncratic return		0.076**							
		(2.14)							
No. options granted × Market return		-0.065							
		(-1.20)							
No. options granted × 3-year return			0.367***						
			(6.92)						
No. options exercised × Return				0.003					
				(0.18)					
No. options exercised × Idiosyncratic return					0.011				
					(0.69)				
No. options exercised × Market return					-0.064				
					(-1.60)				
No. options exercised × 3-year return						0.156***			
						(4.71)			
No. restricted shares granted × Return							-0.007		
							(-0.21)		
No. restricted shares granted × Idiosyncratic return								0.003	
								(0.07)	
No. restricted shares granted × Market return								-0.031	
								(-0.37)	
No. restricted shares granted × 3-year return									-0.045
									(-0.69)
Non-interacted terms	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean(y)	10.30	10.30	10.43	11.55	11.55	11.51	9.50	9.50	9.56
SD(y)	77.79	77.79	76.78	68.62	68.62	68.03	72.16	72.16	71.38
Observations	95,223	95,223	97,174	134,650	134,650	135,056	116,614	116,614	117,170
Adjusted R^2	0.05	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05
Executive sample	High own.	High own.	High own.	All	All	All	High own.	High own.	High own.

Table 11: Executives' stock trading response to equity incentives, stock volatility, and firm size

This table shows coefficient estimates from panel regressions of the change in the shareholdings of executives on different types of equity incentives received over the year, conditional on stock (market) volatility and firm size. The dependent variable is the annual change in own company's shares owned by the executive. Each specification interacts the relevant equity pay item with different measures of volatility and firm size, such as the firm's volatility of stock returns, the VIX, and an indicator variable for the top 100 firms by market capitalization in a given year. Coefficient estimates for non-interacted terms are not reported for brevity. In each specification, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. In columns 1 to 3, the sample comprises only executives with previous year's shareholdings larger than the number of shares potentially purchasable via the options granted over the year. In columns 4 to 6 on option exercises, no restriction is imposed on executive previous year's shareholdings. In columns 7 to 9, the sample comprises only executives with previous year's shareholdings larger than the number of restricted shares granted over the year. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
No. options granted × Volatility	-0.102**								
	(-2.18)								
No. options granted × VIX		-0.001							
		(-0.39)							
No. options granted × Top 100 firm			-0.020						
			(-0.71)						
No. options exercised × Volatility				0.109***					
				(2.74)					
No. options exercised × VIX					0.006***				
					(4.63)				
No. options exercised × Top 100 firm						-0.008			
						(-0.35)			
No. restricted shares granted × Volatility							0.051		
							(0.65)		
No. restricted shares granted × VIX								-0.001	
								(-0.21)	
No. restricted shares granted × Top 100 firm									-0.128**
									(-2.42)
Return	-2.623**	-2.517**	-2.406**	-2.917***	-2.697***	-2.454***	1.596*	1.606*	1.838**
	(-2.22)	(-2.10)	(-2.04)	(-3.69)	(-3.20)	(-2.96)	(1.86)	(1.84)	(2.11)
Non-interacted terms	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean(y)	10.32	10.04	10.30	11.53	11.37	11.55	9.45	9.21	9.50
SD(y)	77.96	77.35	77.79	68.76	68.36	68.62	72.30	71.72	72.16
Observations	92,949	93,946	95,223	131,263	132,199	134,650	113,567	114,219	116,614
Adjusted R^2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Executive sample	High own.	High own.	High own.	All	All	All	High own.	High own.	High own.

Appendix for "Trading Away Incentives"

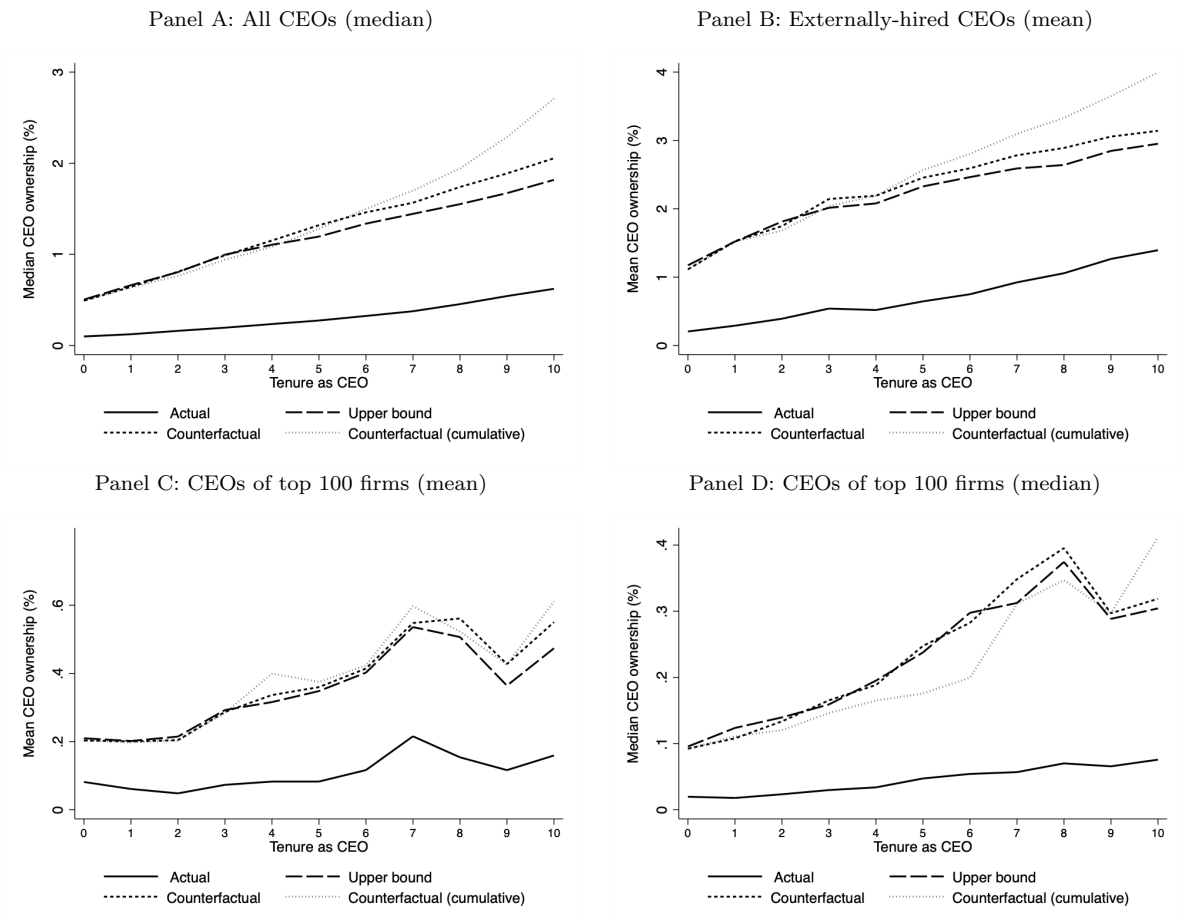

Figure A.1: Evolution of CEO stock ownership over tenure
This figure shows CEO stock ownership over their tenure based on a sample of US public firms covered by ExecuComp between 1992 and 2020. The solid line represents actual fractional ownership. The long-dashed line represents the upper bound for fractional ownership calculated assuming that all options in the portfolio of the CEO have a delta of one. The short-dashed line represents a counterfactual measure of fractional ownership, obtained by adding options awards and restricted shares granted (assuming a delta of 0.6 for options (Ofek and Yermack, 2000)) in tenure year t to the upper bound of ownership at the end of tenure year $t-1$. The dotted line represents another counterfactual measure of fractional ownership, obtained by cumulatively adding options awards and restricted shares granted (assuming a delta of 0.6 for options (Ofek and Yermack, 2000)) over tenure to the upper bound of ownership at the beginning of the CEO's term. Panel A plots the median of these quantities over tenure for all CEOs in the sample. Panel B plots the average of these quantities over tenure only for externally-hired CEOs. Panel C plots the average of these quantities over tenure for CEOs of the top 100 firms by market capitalization. Panel D plots the median of these quantities over tenure for CEOs of the top 100 firms by market capitalization.

Table A.1: Definition of variables
This table provides definitions of the main variables used in the analysis. Original items from databases are indicated in `typewriter font`. References to variables constructed in the paper are indicated in *italic type*.

Variable	Databases	Definition
Executive-level variables		
Δ Shares owned	ExecuComp	Annual change in the number of shares owned by the executive. The annual balance of shares is given by shrown_excl_opts.
Δ Vested shares owned	ExecuComp	Annual change in the number of vested shares owned by the executive. The annual balance of vested shares is defined as $\max(0, \texttt{shrown\_excl\_opts} - \texttt{stock\_unvest\_num})$.
Net shares sold	ExecuComp	Net number of shares sold by the executive over the year. This quantity is computed as $(\texttt{shrown\_excl\_opts}_{t-1} + \texttt{opt\_exer\_num}_t + Vest_t) - \texttt{shrown\_excl\_opts}_t$, where *Vest* is $(\texttt{stock\_unvest\_num}_{t-1} + \textit{No. restricted shares granted}_t) - \texttt{stock\_unvest\_num}_t$.
No. options granted	ExecuComp	Number of options granted to the executive over the year, option_awards_num.
No. options exercised	ExecuComp	Number of options exercised by the executive over the year, opt_exer_num.
No. restricted shares granted	ExecuComp	Number of restricted shares granted to the executive over the year, defined as rstkgrnt/prccf under the old SEC reporting format, and as stock_awards_num/prccf under the new SEC reporting format.
Ownership (%)	ExecuComp, CCM	Fractional ownership of the executive defined as $100 \times [\texttt{shrown\_excl\_opts} / (\texttt{csho} \times 1,000)]$.
Ownership at upper bound (%)	ExecuComp, CCM	Upper bound for fractional ownership of the executive defined as $100 \times [(\texttt{shrown\_excl\_opts} + \texttt{opt\_unex\_unexer\_num} + \texttt{opt\_unex\_exer\_num}) / (\texttt{csho} \times 1,000)]$.
Ownership ($M)	ExecuComp, CCM	Dollar ownership of the executive defined as $100 \times [\texttt{shrown\_excl\_opts} / (\texttt{csho} \times 1,000)] \times \texttt{prccf}$.
Salary ($M)	ExecuComp	Base salary earned by the executive over the year, salary.
Bonus ($M)	ExecuComp	Bonus earned by the executive over the year, bonus.
Tenure (years)	ExecuComp	Tenure of the executive defined as the maximum between (i) the current year minus the earliest year in which she joined the company based on joined_co and becameceo, when available, (ii) the current year minus the earliest year in which she is covered by the database. Note that this measure of tenure with the firm is different from the variable *Tenure as CEO* used in Figure 1.
Age (years)	ExecuComp	Age of the executive, age. If missing, age is inferred from page.
CEO	ExecuComp	Indicator variable equal to one if the executive served as the CEO of the firm over the year based on ceoann, and zero otherwise. If a firm-year is not assigned a CEO, information in becameceo is used. If a firm-year has multiple CEOs, the highest paid one is classified as the CEO based on total annual compensation, tdc1.
Firm-level variables		
Return	CCM	Annual stock return of the firm computed from monthly total returns, ret.
Volatility	CCM	Annualized volatility based on the last 36 months or, if missing, at least 12 months of total stock returns. If missing, it is replaced with the average volatility over the whole cross-section in the year.
Total assets ($M)	CCM	Total assets of the firm, at.
Top 100 firm	ExecuComp, CCM	Indicator variable equal to one if the firm is among the top 100 ones in the final sample by market capitalization at the end of the year, prccf × csho.

Table A.2: Executives' stock trading response to equity incentives (alternative samples)
This table shows coefficient estimates from panel regressions of the change in the shareholdings of executives on different types of equity incentives received over the year for alternative samples. The dependent variable is the annual change in own company's shares owned by the executive. In column 1, no sample restriction is imposed on the annual compensation structure of executives. In columns 2 to 4, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero as in the study of Ofek and Yermack (2000, OY). In columns 1 and 2, no restriction is imposed on executive previous year's shareholdings. In column 3, the sample comprises only executives with the previous year's shareholdings larger than the sum of (i) the number of shares potentially purchasable via the options granted over the year and (ii) the number of restricted shares granted over the year. In column 4, the sample comprises only executives with the previous year's shareholdings smaller than the sum of (i) the number of shares potentially purchasable via the options granted over the year and (ii) the number of restricted shares granted over the year. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned			
	(1)	(2)	(3)	(4)
No. options granted	0.061***	0.061***	0.048***	0.051***
	(13.73)	(13.60)	(4.09)	(11.21)
No. options exercised	0.051***	0.051***	0.049***	0.069***
	(8.01)	(7.95)	(5.52)	(8.87)
No. restricted shares granted	0.187***	0.188***	0.171***	0.200***
	(22.65)	(22.29)	(11.86)	(23.64)
Return	-0.471	-0.102	-1.144	1.456**
	(-0.73)	(-0.15)	(-1.01)	(2.28)
Year FE	No	No	No	No
Firm FE	No	No	No	No
Mean(y)	8.83	9.87	6.52	14.58
SD(y)	64.68	64.16	75.36	43.32
Observations	149,908	130,025	76,064	53,961
Adjusted R^2	0.02	0.02	0.01	0.07
Executive sample	All	All	High own.	Low own.
OY sample restr.	No	Yes	Yes	Yes

Table A.3: Executives' stock trading response to equity incentives (backfilling bias adjustment)
This table shows coefficient estimates from panel regressions of the change in the shareholdings of executives on different types of equity incentives received over the year, removing observations that are likely to be backfilled in the ExecuComp database. Due to limited data availability on historical S&P 1,500 constituents from Compustat, the sample period is from 1995 and 2015. An observation is assumed to be backfilled and removed from the baseline sample of Table 2 if it corresponds to (i) an executive-year with information on salary but not on total compensation (item `tdc1` in ExecuComp), or (ii) a firm-year that is not part of the S&P 1,500. The dependent variable is the annual change in own company's shares owned by the executive. In column 1, no sample restriction is imposed on the annual compensation structure of executives. In columns 2 to 6, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero as in the study of Ofek and Yermack (2000, OY). In columns 1 and 2, no restriction is imposed on executive previous year's shareholdings. In columns 3 to 6, the sample comprises only executives with the previous year's shareholdings larger than the sum of (i) the number of shares potentially purchasable via the options granted over the year and (ii) the number of restricted shares granted over the year. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned					
	(1)	(2)	(3)	(4)	(5)	(6)
No. options granted	0.064***	0.064***	0.056***	0.052***	0.037**	0.102***
	(12.53)	(12.26)	(4.12)	(9.98)	(2.47)	(3.27)
No. options exercised	0.061***	0.060***	0.057***	0.079***	0.074***	0.080***
	(8.10)	(7.97)	(5.40)	(8.62)	(6.60)	(4.90)
No. restricted shares granted	0.182***	0.180***	0.144***	0.211***	0.201***	0.250***
	(15.52)	(15.15)	(6.80)	(17.84)	(7.98)	(5.09)
Return	-0.060	-0.091	-1.229	1.560**	0.427	
	(-0.07)	(-0.10)	(-0.82)	(1.97)	(0.25)	
Year FE	No	No	No	No	Yes	No
Firm FE	No	No	No	No	Yes	No
Firm-by-year FE	No	No	No	No	No	Yes
Firm-by-executive FE	No	No	No	No	No	Yes
Mean(y)	9.69	10.81	7.33	15.30	7.29	7.64
SD(y)	69.41	68.96	82.39	45.82	82.40	78.31
Observations	96,200	84,969	47,838	37,131	47,637	38,356
Adjusted R^2	0.02	0.02	0.01	0.07	0.07	0.34
Executive sample	All	All	High own.	Low own.	High own.	High own.
OY sample restr.	No	Yes	Yes	Yes	Yes	Yes

Table A.4: Executives' adjusted stock trading response to equity incentives
This table shows coefficient estimates from panel regressions of the adjusted change in the shareholdings of executives on different types of equity incentives received over the year. The dependent variables are the net number of shares sold by the executive adjusted for vesting, concurrent option exercises, and restricted shares granted over the year (columns 1 and 2) and the annual change in own company's vested shares owned by the executive (columns 3 and 4). In each specification, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. In columns 1 and 2, the sample comprises only executives with the previous year's shareholdings larger than the sum of (i) the number of shares potentially purchasable via the options granted over the year and (ii) the number of restricted shares granted over the year. In columns 3 and 4, the sample comprises only executives with the previous year's vested shareholdings larger than the sum of (i) the number of shares potentially purchasable via the options granted over the year and (ii) the number of restricted shares granted over the year. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Net shares sold		Δ Vested shares owned	
	(1)	(2)	(3)	(4)
No. options granted	0.175***	-0.154***	0.022	0.048
	(9.01)	(-4.11)	(1.54)	(1.35)
No. options exercised			0.103***	0.103***
			(10.15)	(5.91)
No. restricted shares granted			0.043*	-0.014
			(1.89)	(-0.28)
Return	-2.671		-3.519**	
	(-1.45)		(-2.39)	
Year FE	Yes	No	Yes	No
Firm FE	Yes	No	Yes	No
Firm-by-year FE	No	Yes	No	Yes
Firm-by-executive FE	No	Yes	No	Yes
Mean(y)	54.86	53.78	3.57	4.86
SD(y)	130.52	126.46	78.62	74.36
Observations	93,762	77,265	59,398	41,834
Adjusted R^2	0.15	0.50	0.07	0.35
Executive sample	High own.	High own.	High vest. own.	High vest. own.

Table A.5: Stock trading response of highly underdiversified executives to equity incentives
This table shows coefficient estimates from panel regressions of the change in the shareholdings of highly underdiversified executives on different types of equity incentives received over the year. The dependent variable is the annual change in own company's shares owned by the executive. In each specification, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. In column 1, the sample comprises only executives with the previous year's fractional ownership larger than 1%. In column 2, the sample comprises only executives with the previous year's fractional ownership larger than 3%. In column 3, the sample comprises only executives with the previous year's fractional ownership larger than 5%. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned		
	(1)	(2)	(3)
No. options granted	0.098***	0.001	0.047
	(3.32)	(0.03)	(0.58)
No. options exercised	0.185***	0.217***	0.373***
	(5.35)	(3.00)	(3.52)
No. restricted shares granted	0.329***	0.334*	0.610
	(4.77)	(1.75)	(1.44)
Return	0.943	-6.453	-2.053
	(0.21)	(-0.75)	(-0.16)
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Mean(y)	5.43	5.38	12.56
SD(y)	135.54	152.53	168.76
Observations	8,422	2,541	1,121
Adjusted R^2	0.11	0.13	0.18
Executive sample	Own. $>$ 1%	Own. $>$ 3%	Own. $>$ 5%

Table A.6: CEOs' stock trading response to equity incentives (internal promotions vs. external hires)
This table shows coefficient estimates from panel regressions of the change in the shareholdings of CEOs on different types of equity incentives received over the year, distinguishing between internally-promoted and externally-hired CEOs. The dependent variable is the annual change in own company's shares owned by the CEO. A CEO is classified as internally promoted if she joined the firm at least one year before she was appointed as the CEO (columns 1 and 2), and as externally hired otherwise. In each specification, the sample is restricted to CEO-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned			
	(1)	(2)	(3)	(4)
No. options granted	0.042***	0.045***	0.045**	0.043*
	(3.26)	(3.33)	(2.11)	(1.88)
No. options exercised	0.104***	0.114***	0.086***	0.097***
	(5.73)	(5.91)	(2.94)	(3.18)
No. restricted shares granted	0.270***	0.275***	0.198***	0.209***
	(8.18)	(8.32)	(3.16)	(3.78)
Return	-2.291	-3.417	-3.822	-5.321
	(-0.77)	(-1.14)	(-0.78)	(-1.04)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	No	Yes	No
Firm-by-CEO FE	No	Yes	No	Yes
Mean(y)	18.21	18.13	14.00	14.13
SD(y)	89.42	89.18	103.43	103.15
Observations	10,581	10,522	3,797	3,753
Adjusted R^2	0.06	0.07	0.07	0.05
Hire type	Internal	Internal	External	External

Table A.7: Executives' stock trading response to equity incentives by industry
This table shows coefficient estimates from panel regressions of the change in the shareholdings of executives on different types of equity incentives received over the year, conditional on the industry in which the firm operates. The dependent variable is the annual change in own company's shares owned by the executive. Each specification interacts the relevant equity pay item (indicated below) with indicator variables for the Fama-French 12 industry groups: consumer nondurables (FF1), consumer durables (FF2), manufacturing (FF3), oil, gas, and coal extraction and production (FF4), chemicals and allied products (FF5), business equipment (FF6), telephone and television transmission (FF7), utilities (FF8), wholesale, retail, and some services (FF9), healthcare, medical equipment, and drug (FF10), money and finance (FF11), and other (FF12). The reference group is FF11. In each specification, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. In column 1, the sample comprises only executives with the previous year's shareholdings larger than the number of shares potentially purchasable via the options granted over the year. In column 2 on option exercises, no restriction is imposed on the executive previous year's shareholdings. In column 3, the sample comprises only executives with the previous year's shareholdings larger than the number of restricted shares granted over the year. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned		
	(1)	(2)	(3)
Equity pay item × FF1 industry group	-0.066	-0.009	0.071
	(-1.27)	(-0.20)	(1.01)
Equity pay item × FF2 industry group	-0.100	-0.048	0.069
	(-1.64)	(-1.03)	(0.92)
Equity pay item × FF3 industry group	-0.175***	-0.031	0.067
	(-3.93)	(-0.99)	(1.17)
Equity pay item × FF4 industry group	0.041	0.050	0.004
	(0.55)	(0.99)	(0.06)
Equity pay item × FF5 industry group	-0.072	-0.027	0.102
	(-1.11)	(-0.75)	(1.60)
Equity pay item × FF6 industry group	-0.135***	-0.071**	-0.116**
	(-3.04)	(-2.45)	(-2.32)
Equity pay item × FF7 industry group	-0.144**	-0.119***	-0.050
	(-2.30)	(-2.85)	(-0.58)
Equity pay item × FF8 industry group	-0.041	0.059	0.070
	(-0.41)	(1.24)	(1.16)
Equity pay item × FF9 industry group	-0.091**	-0.046	-0.061
	(-2.14)	(-1.44)	(-1.05)
Equity pay item × FF10 industry group	-0.027	-0.020	-0.039
	(-0.62)	(-0.56)	(-0.78)
Equity pay item × FF12 industry group	-0.066	-0.030	-0.001
	(-1.42)	(-0.89)	(-0.01)
Equity pay item	0.125***	0.091***	0.219***
	(3.80)	(3.48)	(6.17)
Return	-2.503**	-2.448***	1.813**
	(-2.15)	(-2.95)	(2.08)
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Industry group FE	Yes	Yes	Yes
Equity pay item	No. opt. gr.	No. opt. exer.	No. restr. sh. gr.
Mean(y)	10.30	11.55	9.50
SD(y)	77.79	68.62	72.16
Observations	95,223	134,650	116,614
Adjusted R^2	0.05	0.05	0.05
Executive sample	High own.	All	High own.

Table A.8: Executives' stock trading response to equity incentives and FAR123R
This table shows coefficient estimates from panel regressions of the change in the shareholdings of executives on different types of equity incentives received over the year, conditional on the timing of FAR123R implementation in 2005, where the accounting rule change for option expenses. The dependent variable is the annual change in own company's shares owned by the executive. In each specification, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned			
	(1)	(2)	(3)	(4)
No. options granted × FAR123R t-2	-0.170***			-0.097
	(-2.69)			(-1.62)
No. options granted × FAR123R t-1	-0.025			-0.088
	(-0.48)			(-1.46)
No. options granted × FAR123R t+1	-0.042			-0.071
	(-0.65)			(-0.96)
No. options granted × FAR123R t+2	0.008			-0.038
	(0.10)			(-0.42)
No. options exercised × FAR123R t-2		0.043		0.060
		(0.69)		(0.96)
No. options exercised × FAR123R t-1		0.112		0.136*
		(1.55)		(1.82)
No. options exercised × FAR123R t+1		-0.025		-0.036
		(-0.43)		(-0.59)
No. options exercised × FAR123R t+2		-0.032		-0.019
		(-0.73)		(-0.40)
No. restricted shares granted × FAR123R t-2			-0.022	0.008
			(-0.06)	(0.02)
No. restricted shares granted × FAR123R t-1			0.121	-0.030
			(0.46)	(-0.10)
No. restricted shares granted × FAR123R t+1			0.013	0.038
			(0.08)	(0.23)
No. restricted shares granted × FAR123R t+2			-0.059	-0.049
			(-0.54)	(-0.44)
Return	-16.202***	-16.135***	-12.944***	-13.130***
	(-4.07)	(-4.09)	(-3.27)	(-3.32)
Non-interacted terms	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Mean(y)	2.81	3.16	1.30	1.66
SD(y)	105.92	102.55	103.03	99.81
Observations	14,693	14,300	14,329	13,963
Adjusted R^2	0.10	0.09	0.10	0.10
Executive sample	High own.	High own.	High own.	High own.

Table A.9: Executives' stock trading response to equity incentives and JOBS Act section 409A
This table shows coefficient estimates from panel regressions of the change in the shareholdings of executives on different types of equity incentives received over the year, conditional on the timing of JOBS Act section 409A implementation in 2004 that limits executives' deferred compensation withdrawals. The dependent variable is the annual change in own company's shares owned by the executive. In each specification, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned			
	(1)	(2)	(3)	(4)
No. options granted × JOBS Act t-2	-0.069			0.010
	(-1.33)			(0.17)
No. options granted × JOBS Act t-1	-0.076			0.015
	(-1.31)			(0.25)
No. options granted × JOBS Act t+1	0.067			0.111*
	(1.05)			(1.79)
No. options granted × JOBS Act t+2	-0.028			-0.049
	(-0.44)			(-0.66)
No. options exercised × JOBS Act t-2		0.016		0.016
		(0.20)		(0.20)
No. options exercised × JOBS Act t-1		0.091		0.061
		(1.44)		(0.99)
No. options exercised × JOBS Act t+1		-0.006		-0.041
		(-0.12)		(-0.76)
No. options exercised × JOBS Act t+2		-0.009		-0.046
		(-0.16)		(-0.76)
No. restricted shares granted × JOBS Act t-2			0.236	0.266
			(0.98)	(1.15)
No. restricted shares granted × JOBS Act t-1			0.289	0.252
			(1.15)	(0.97)
No. restricted shares granted × JOBS Act t+1			-0.092	-0.146
			(-0.41)	(-0.67)
No. restricted shares granted × JOBS Act t+2			0.038	0.053
			(0.23)	(0.30)
Return	-14.173***	-13.539***	-12.008***	-12.253***
	(-3.35)	(-3.15)	(-2.84)	(-2.88)
Non-interacted terms	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Mean(y)	1.89	2.40	0.32	0.87
SD(y)	109.39	105.52	106.73	103.05
Observations	12,749	12,385	12,411	12,073
Adjusted R^2	0.10	0.10	0.11	0.11
Executive sample	High own.	High own.	High own.	High own.

Table A.10: Executives' stock trading response to equity incentives and NYSE listing rule
This table shows coefficient estimates from panel regressions of the change in the shareholdings of executives on different types of equity incentives received over the year, conditional on the timing of the NYSE listing requirement that requires voting for top executives' equity plans from 1998. The dependent variable is the annual change in own company's shares owned by the executive. In each specification, the sample is restricted to executive-years in which at least one of the considered equity pay items (options awards, options exercised, restricted shares) is larger than zero. The fixed effect scheme used in each specification is indicated below. The t-statistics (in parentheses) are obtained from standard errors clustered by firm. Significance at the 10%, 5%, and 1% levels is denoted as *, **, and ***, respectively. Refer to Appendix Table A.1 for variable definitions.

	Δ Shares owned			
	(1)	(2)	(3)	(4)
No. options granted × NYSE listing t-2	0.136*			0.151
	(1.70)			(1.62)
No. options granted × NYSE listing t-1	-0.045			0.021
	(-0.83)			(0.37)
No. options granted × NYSE listing t+1	0.110**			0.158***
	(1.99)			(2.66)
No. options granted × NYSE listing t+2	0.018			0.092*
	(0.31)			(1.67)
No. options exercised × NYSE listing t-2		0.075		0.091
		(0.82)		(0.90)
No. options exercised × NYSE listing t-1		0.027		0.064
		(0.25)		(0.58)
No. options exercised × NYSE listing t+1		0.045		0.022
		(0.48)		(0.23)
No. options exercised × NYSE listing t+2		-0.015		-0.074
		(-0.16)		(-0.75)
No. restricted shares granted × NYSE listing t-2			0.337	0.376
			(0.57)	(0.61)
No. restricted shares granted × NYSE listing t-1			0.285	0.472
			(0.46)	(0.73)
No. restricted shares granted × NYSE listing t+1			-0.718	-0.913*
			(-1.34)	(-1.82)
No. restricted shares granted × NYSE listing t+2			-0.029	-0.067
			(-0.06)	(-0.14)
Return	-11.688***	-13.611***	-11.088***	-12.618***
	(-3.21)	(-3.62)	(-2.99)	(-3.36)
Non-interacted terms	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Mean(y)	-1.77	-1.76	-3.47	-3.40
SD(y)	108.76	105.56	105.41	102.37
Observations	9,829	9,558	9,471	9,221
Adjusted R^2	0.17	0.18	0.18	0.19
Executive sample	High own.	High own.	High own.	High own.