Dynamic Adjustment of CEO Incentives and Firm Performance*

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Abstract

In this paper, we investigate whether adjustment costs impede firms from achieving value-maximizing levels of CEO equity incentives and degrade firm performance by sustaining deviations from targeted incentive levels. Specifically, we explore the dynamic adjustment process of CEO incentives and examine implications of speed of adjustment to target for firm performance. Consistent with adjustment frictions sustaining a wedge between target and actual incentives, we find that firm performance decreases in deviations from target incentives, and that firms' active management of incentives towards target only partially closes the gap between target and realized incentives. We then separately consider excess incentives and deficient incentives. We find that while adjustment speed is slower for excess relative to deficient incentives, relative adjustment speed for excess incentives increases significantly for firms with higher monitoring intensity, product competition, and CEO career concerns, and for such firms, performance degradation associated with deviations from target significantly decreases. We also provide evidence that when CEOs have greater incentives to hold unconstrained equity voluntarily, excess (deficient) incentives have slower (faster) adjustment speed and greater (lower) negative influence on firm performance. This last evidence suggests that CEOs' voluntary holding of unconstrained equity is an important source of adjustment costs.

1. Introduction

A large empirical literature explicitly or implicitly assumes that observed incentive levels derived from efficient contracts are designed to provide incentives for CEOs to maximize the net expected value to shareholders. While this may be true on average, it need not hold continuously as efficient incentive levels may change over time or managers' incentives drift away from efficient levels for a variety of reasons (Core and Guay, 1999; Core et al., 2003). In the face of incentive misalignment, firms would presumably seek to quickly reestablish efficient incentive levels. However, the dynamic process governing the adjustment of incentive levels over time will dictate the speed of incentive realignment. If adjustment frictions prevent full attainment of efficient incentive levels, observed incentives will deviate from efficient levels. Our main objective in this paper is to provide insights into the nature of this dynamic adjustment process and to investigate its implications for firm performance.

Uncertainty over the nature of the incentive adjustment process has long plagued the empirical literature examining associations between CEOs' incentives and outcomes such as firm performance. Two distinct perspectives have been emerged that lead to different interpretations of such associations (e.g., Hermalin and Weisbach, 2003; Core et al., 2003). The first, an in-equilibrium perspective, assumes that incentives continuously reflect target incentive levels desired by value-maximizing boards. In this case, there should be no systematic relation between CEO incentives and performance, implying that any empirical association results from correlated omitted variables (e.g., Demsetz, 1983; Himmelberg, Hubbard, and Palia, 1999). The second, an out-of-equilibrium perspective, assumes that observed incentives do not reflect value-maximizing target levels, and therefore performance can be improved by better aligning incentives.[1] Given that misaligned incentives can have negative consequences for shareholders, an out-of-equilibrium perspective requires a credible hypothesis for why deviations from target incentives would persist.

Focusing directly on the incentive adjustment process, we investigate whether adjustment cost frictions impede firms from achieving target levels of CEO equity incentives and degrade firm performance by sustaining deviations from target incentive levels. More specifically, we estimate deviations from target incentives, explicitly model and explore the nature of the dynamic process governing adjustment of misaligned CEO incentives towards target, and examine implications of dynamic adjustment for firm performance.

We build on the observation in Core et al. (2003) and Core and Larcker (2002) that equilibrium and out-of-equilibrium interpretations rest on different assumptions about the extent of frictions associated with incentive adjustment. If CEO incentives drift out of alignment and firms cannot immediately re-establish target incentives, a wedge between observed and target incentives can emerge. In contrast, an equilibrium interpretation assumes that no frictions impede firms' ability to continuously adjust incentives to optimal levels (e.g., Demsetz and Lehn, 1985). Consistent with an out-of-equilibrium interpretation, we document a textured pattern of results consistent with the existence of adjustment costs sustaining deviations from target incentives. In further analyses, we provide novel evidence about underlying sources of adjustment costs.

As noted by Core and Guay (1999), among others, CEOs' equity incentives can become misaligned due to changes in firm and manager characteristics, learning, executives' equity portfolios decisions, and changes in stock price, price volatility and time to maturity, etc. To

[1] In this paper we generally follow the Hermalin and Weisbach (2003) language of in-equilibrium and out-of-equilibrium perspectives. We note however that the term out-of-equilibrium is a misnomer for our purposes. This is the case as we will argue that observed incentive levels reflect the choices of value-maximizing boards constrained by adjustment costs from achieving their desired target incentives.

measure deviations from target incentives, we estimate a model of CEO incentives using an extensive set of time varying firm and CEO characteristics to capture changes in target incentives over time, as well as firm fixed effects to capture time invariant aspects of target incentives. We posit that the incentive gap between predicted incentives from the model and actual incentives captures the extent of incentive misalignment.[2] If firms do target CEO incentives to maximize firm value, then we would expect firm performance to decrease in the magnitude of the incentive gap and its persistence over time.[3] To examine this proposition, we estimate the association between future firm performance (i.e., Tobin's Q and ROA) and our estimate of the incentive gap in the current period. We find that performance is lower when observed incentives exceed target incentives (excess incentives) or when they are too low relative to target (deficient incentives). I.e. any incentive deviation, either above or below target degrades firm value/performance.[4]

Building on this result, we note that when incentives deviate from target, value-maximizing firms will actively seek to realign incentives. Consistent with this, Core and Guay (1999) find that the incentives reflected in future equity grants are negatively related to estimated deviations from target (defined as actual incentives minus estimated incentives). Our point of departure for examining dynamic adjustment of CEO incentives is an extension of Core and Guay (1999) utilizing an augmented model of incentives and a significantly longer sample period. Reaffirming Core and Guay (1999), we find that incentive levels reflected in future equity grants to CEOs are positively related to estimated incentive gaps (defined as estimated

[2] Papers that have taken related approaches to measure deviations from optimal incentives include Core and Guay (1999), Burns and Kedia (2006), Tong (2008), Bushman, Dai, and Zhang (2016) and Peng, Röell, and Tang (2016).
[3] We use the terms incentive gap and deviation from target incentives interchangeably throughout. We define incentives as the estimated delta of a CEO's equity portfolio (i.e., change in CEO wealth for a 1% change in firm value). Incentive gap (deviation from target) is the difference between our model estimate of target incentives and actual incentives. Incentives are presumed to be excessive (deficient) when target incentives < (>) actual incentives.
[4] Tong (2008) and Peng et al. (2016) run related analyses using different specifications.

incentives minus actual incentives). However, while suggesting boards' active management of misaligned incentive, these results provide no insight into the existence of adjustment costs. Specifically, this specification provides no information on the extent to which target incentives are attained or on textured properties of the dynamic adjustment process if they are not.

To overcome these limitations, we estimate speed of incentive adjustment using a partial adjustment model. [5] We hypothesize that if adjustment costs inhibit the restoration of efficient incentives, we would observe only partial adjustment instead of full adjustment back to efficient levels. We estimate the speed of adjustment as the proportion of the gap between target and actual incentives closed over the subsequent year by virtue of changes in incentives deriving from all sources.[6] This analysis documents that on average firms close around 43% of the gap between target and actual incentives over the subsequent year. Disaggregating the gap, we find that around 50% (37%) of the gap is closed for deficient (excess) incentives, suggesting that it is easier to increase incentives that are too low than to decrease incentives that are too high.

Turning to cross-sectional analysis, we hypothesize that speed of adjustment will vary with (1) monitoring intensity as captured by institutional ownership and equity analyst following; (2) product market competition, as competitive pressure imposes discipline to remove slack; and (3) the early years of CEO's tenure, as negative economic consequences of misaligned incentives may be amplified by career concerns of newer CEOs managing talent perceptions of the market. This may lead boards to adjust incentive misalignments faster to mitigate impairment of firm value. Further, because the persistence of deviations from target is a function of adjustment

[5] The technique of speed of adjustment in a partial adjustment model has been widely used to examine capital structure adjustments (e.g., Lemmon, Roberts, and Zender, 2008; Flannery and Rangan, 2006).
[6] The speed with which misaligned incentives adjust depends on both boards' equity granting decisions and CEOs' equity portfolio rebalancing decisions (Li, 2002; Cheung and Wei, 2006). Our approach considers the combined effect of all such decisions on CEO incentives. In section 4 of the paper, we explore the role played by managers in the incentive adjustment process.

speed, we also expect firm characteristics associated with faster (slower) speed of adjustment to be associated with reduced (magnified) negative consequences of deviations from target. Consistent with both expectations, we find that adjustment speed for excess incentives increases significantly for firms with higher monitoring intensity, more competition, and earlier tenured CEOs, and that for such firms, performance degradation associated with deviations from target is mitigated.

Our previous analyses provide evidence consistent with adjustment costs impeding incentive realignment and degrading performance. However, these analyses shed no light on underlying sources of such costs. As noted by Cheung and Wei (2006), adjustment costs facing firms can arise from the CEOs' equity portfolio rebalancing decisions. In this spirit, we explore the possibility that such costs arise from CEOs voluntarily holding equity above amounts explicitly constrained by ownership guidelines or vesting requirements (Armstrong et al., 2018). While such unconstrained holdings are optimal from a CEO's perspective, they can serve as a persistent source of incentive misalignment from a firm's perspective. Armstrong et al. (2018) posit that CEOs have incentives to hold excess equity when they are overconfident, want to signal private information, or have informed trading motivations. Consistent with an adjustment cost story, speed of adjustment is slower (faster) for excess (deficient) incentives when CEOs are more overconfident and for CEOs with higher signaling incentives. With respect to firm performance, we find that firm performance is worse (better) for excess (deficient) incentives when CEOs are more overconfident and when they have higher signaling incentives. That is, performance is worse (better) in the same settings where speed of adjustment is slower (faster). We find no results for informed trading motivations.

In this paper, we extend the literature by providing new evidence consistent with the existence of non-trivial adjustment costs that inhibit boards' active efforts to restore misaligned CEO incentives to target levels in a timely fashion, where such sustained deviations from target degrade firm performance. While prior literature documents that boards use future equity grants to remedy deviations between target and actual incentives (Core and Guay, 1999; Li, 2002), our speed of adjustment analyses show that boards are unable to close such incentive gaps over the subsequent year. Importantly, adjustment cost driven impediments to restoring incentives to target levels are associated with significant degradation of firm performance. Using the speed of adjustment to capture the persistence with which adjustment costs sustain deviations from target, we find that slower speed of adjustment is associated with a more negative impact on firm performance. This evidence supports an out-of-equilibrium interpretation of observed incentives (e.g., Hermalin and Weisbach, 2003) and is consistent with the observation by Core et al. (2003) and Core and Larcker (2002) that equilibrium and out-of-equilibrium interpretations can be distinguished by considering the extent of frictions associated with incentive adjustment.

Our paper also extends the literature by providing novel insights into determinants of the speed of adjustment to target incentives and into underlying sources of adjustment costs (e.g., Cheung and Wei, 2006; Tong 2008; Bushman et al., 2016). With respect to determinants, our cross-sectional analyses provide new evidence of significant variation in the speed of adjustment associated with differences in monitoring intensity, competitive pressure and CEO career concerns. Finally, we provide evidence consistent with adjustment costs emanating from CEOs incentives to hold equity voluntarily in excess of that explicitly constrained by ownership guidelines or vesting requirements. This extends Armstrong et al. (2018) by documenting evidence that unconstrained holdings can serve as a persistent source of incentive misalignment from a firm's perspective.

The rest of the paper is organized as follows. Section 2 discusses the conceptual framework of the paper and its relation to the prior literature. Section 3 discusses the out-of-equilibrium incentives and presents the evidence on the nature of the dynamic adjustment process. Section 4 examines the extent to which CEOs' voluntary holdings of unconstrained equity represent a source of adjustment costs. Section 5 concludes.

2. Conceptual Framework, Related Literature and Predictions

Agency theory posits that separation of management from financiers creates agency conflicts in which managers exploit private information to extract personal benefits (e.g., Jensen and Meckling, 1976). A traditional agency-theory framework posits that firms provide managers efficient contracts that maximize the net expected economic value to shareholders. While it is quite plausible that observed incentives would be efficient on average, this does not imply that incentives continuously reflect efficient levels. Incentive contracting is a dynamic process because efficient incentive levels may evolve over time or managers' incentives drift away from efficient levels for a variety of reasons (Holmstrom, 1999; Core and Guay, 1999; Core et al., 2003). However, if misaligned incentives only slowly adjust to efficient levels, observed incentives at a point in time need not be efficient.

Uncertainty over the nature of the incentive adjustment process has long plagued the empirical literature examining associations between CEOs' incentives and outcomes such as firm performance. Two competing perspectives have emerged. The in-equilibrium perspective posits that value-maximizing firms design optimal incentive structures as a function of exogenous parameters characterizing the firm, manager and economic setting, and that observed incentives continuously reflect optimal levels. In this case there should be no systematic relation between observed CEO incentives and firm performance, conditional on controlling for exogenous determinants of incentives (e.g., Demsetz, 1983; Himmelberg et al., 1999; Demsetz and Villalonga, 2001).[7]

In contrast, the out-of-equilibrium perspective allows that observed incentives do not reflect value-maximizing levels. In this case, empirical associations between observed incentives and performance reflect sub-optimal managerial actions that can be remedied by better incentive alignment. This raises the fundamental question: why would deviations from optimal incentives persist given the negative consequences for firm performance?

As recognized by Hermalin and Weisbach (2003) among others, it is challenging to distinguish in-equilibrium interpretations of empirical associations from out-of-equilibrium interpretations in which persistent deviations from target degrade firm performance. Core et al. (2003) and Core and Larcker (2002) address this challenge by positing that equilibrium and out-of-equilibrium interpretations rest on different assumptions about the extent of adjustment costs associated with adjusting misaligned incentives. In this paper we investigate whether adjustment cost frictions impede firms from achieving target levels of CEO equity incentives and degrade firm performance by sustaining deviations from target incentive levels.

To isolate deviations from efficient incentives, we follow Core and Guay (1999) and Li (2002) who investigate whether observed grants of equity to CEOs are consistent with the theory of optimal contracting. These papers model equity incentives and use residuals from the model to capture deviations from target levels. Consistent with firms actively seeking to realign incentives, Core and Guay (1999) document that grants of new incentives from options and

[7] See also Demsetz (1983), Himmelberg et al. (1999), Demsetz and Villalonga (2001), Villalonga and Amit (2006), and Fahlenbrach and Stulz (2009).

restricted stocks are negatively related to the residuals. Li (2002) extends this result by recognizing that firms and CEOs jointly correct deviations from these optimal levels through equity grants and CEO portfolio rebalancing, and provides evidence consistent with firms and CEOs coordinating their equity-granting and portfolio-rebalancing decisions to manage optimal CEO incentive levels. As discussed further below, we do consider the role played by managers in the incentive adjustment process.

We estimate a model of optimal incentives and posit that deviations from predicted incentives estimated from this model represent deviations from target CEO incentives. We then perform a series of analyses to provide evidence that these residuals plausibly reflect deviations from target incentive levels. First, if firms target CEOs incentives to maximize firm value, then we expect firm performance to decrease in the magnitude of the estimated incentive gap. To examine this proposition, we estimate the association between deviations from target incentive levels and both future Tobin's Q and ROA.

Second, if incentives deviate from firms' desired target, value maximizing firms would take actions to quickly realign incentives by actively managing incentives towards target (e.g., Core and Guay, 1999; Li, 2002). To examine this, we first replicate Core and Guay (1999) utilizing an augmented model of optimal incentives and a significantly longer sample period. However, while this analysis provides evidence consistent with incentive misalignment and firms actively adjusting incentives towards target, it provides no information on whether these adjustments fully restore incentive alignment (i.e., zero adjustment costs) or reflect only partial adjustment (i.e., non-trivial adjustment costs).

If CEO incentives are misaligned and firms' best efforts to restore alignment are hampered by adjustment costs, we would expect to observe only partial adjustment back towards target levels. To explore this, we analyze speed of adjustment in a partial adjustment model by estimating the proportion of the current gap between target and actual CEO incentives that is closed by actual changes in incentives over the subsequent year. While the technique of partial speed of adjustment (SOA) has been widely used to examine firms' capital structure adjustments in the corporate finance literature (e.g., Lemmon et al., 2008; Flannery and Rangan 2006), it has received less attention in an executive compensation context (Cheung and Wei, 2006; Tong, 2008; Bushman et al., 2016).

Our SOA specification is:

$$Delta_t - Delta_{t-1} = \lambda * (Target\,Delta_{t-1} - Delta_{t-1}) + \varepsilon_t \,. \qquad (1)$$

The left hand side of (1) is the actual change in incentives from time t-1 to t, and the difference on the right represents the incentive gap between target and actual incentives. $Target\,Delta_{t\text{-}1}$ represents the target level of incentives estimated using available information at time t-1.Thus, $Target\,Delta_{t-1} - Delta_{t-1}$ represents the incentive gap the firm seeks to close in the future. The coefficient λ captures SOA, where $\lambda = 1$ implies that 100% of the incentive gap at t-1 is closed by the choice of actual CEO incentives at t. Consistent with frictions impeding full adjustment, $\lambda < 1$ implies that only a fraction λ of the incentive gap is closed.

We also run the flowing specification to explore whether the speed of adjustment is the same for excess and deficient incentives.

$$Delta_t - Delta_{t-1} = \alpha + \lambda_1 Deficient\,Delta_{\,t-1} + \lambda_2 Excess\,Delta_{\,t-1} + \varepsilon_t \,. \qquad (2)$$

In (2) the coefficients λ_1 and λ_2 capture speed of adjustment when incentives are too low and too high, respectively. *Deficient (Excess) Delta* is set equal to $Delta\,Gap = Target\,Delta_{t-1} - Delta_{t-1}$ when *Delta Gap* is positive (negative), and equals zero otherwise.

To further explore the dynamic adjustment process, we examine cross-sectional differences in the speed of adjustment across firms. This analysis is based on the premise that speed of adjustment results from a tradeoff between benefits of realigning incentives and adjustment costs, where the nature of this trade-off may differ across firms. First, we conjecture that speed of adjustment will increase in outside monitoring intensity as greater disciplinary pressure imposed on firms shifts the cost-benefit trade-off in favor of faster convergence back to optimal incentives levels. Building on existing literature, we proxy for outside monitoring intensity using two variables: institutional ownership, and equity analyst following. With respect to institutional investors, Barber (2007) documents cumulative announcement period gains of over $3 billion associated with targeting of firms by CalPERS, a large activist institutional investor. Chen, Harford, and Li (2007) show that in the context of mergers, withdrawal of bad bids is more likely in firms with independent long-term institutional investors. Bushee (1998) shows that institutional investors serve a monitoring role in preventing a firm's reduction of R&D spending for short term benefit, a form of real earnings management.[8] Healy and Palepu (2001) suggest that information intermediaries such as analysts engage in private information production that helps to detect managers' misbehavior. Jensen and Meckling (1976, page 353) argue that "as security analysis activities reduce the agency costs associated with the separation of ownership and control, they are indeed socially productive". Yu (2008) finds that firms followed by more analysts manage their earnings less.

Second, we conjecture that speed of adjustment will increase in the intensity of product market competition. Economists have long argued that competitive forces act as a disciplining mechanism, exerting pressure on firms to reduce slack and improve efficiency in order to survive

[8] Hartzell and Starks (2003) provide evidence of a monitoring role played by the institutional investors; they show a positive relation between CEO's pay-performance-sensitivity and institutional ownership.

(e.g., Scherer, 1980; Fama, 1980). Giroud and Mueller (2011) and Jagannathan and Srinivasan (1999) provide evidence that competition mitigates managerial slack. Third, we hypothesize that speed of adjustment will be faster for CEOs earlier in their tenure with the firm. Because career concerns can lead CEOs early in their tenure to manage perceptions of their talent by taking costly actions (e.g., Holmstrom, 1999; Ali and Zhang, 2015), boards may more aggressively manage incentive misalignments to mitigate impairment of firm value. In this analysis, we run

$$Delta_t - Delta_{t-1} = \alpha + \lambda \, Deficient\ Delta_{t-1} + \lambda_1 Deficient\ Delta_{t-1} * CV + \gamma \, Excess\ Delta_{t-1} + \gamma_1 Excess\ Delta_{t-1} * CV + \beta * CV + \varepsilon_t \quad (3)$$

In (3) CV represents one of the cross-sectional variables discussed above.

The basic premise of our analysis is that adjustment speed reflects the amount of time that deviations from target persist, and that any negative influence of deviations on firm performance should increase with persistence of the deviation. To examine this, we extend the analysis described in equation (3) to examine how the influence of incentive gaps on firm performance varies in the cross-section. Specifically, we run specifications of the form:

$$Firm\ Performance_t = \alpha + \lambda \, Deficient\ Delta_{t-1} + \lambda_1 Deficient\ Delta_{t-1} * CV + \gamma \, Excess\ Delta_{t-1} + \gamma_1 Excess\ Delta_{t-1} * CV + \beta * CV + \varepsilon_t \quad (4)$$

In (4), firm performance is either *Tobin's Q* or *ROA*, and *CV* is one of the cross-sectional variables discussed earlier associated with monitoring intensity, product market competition or career concerns. The objective of estimating equation (4) is to examine whether performance is worse (better) in the same settings where speed of adjustment is slower (faster).

While all these analyses help establish the existence of adjustment costs, they shed no light on underlying sources of such costs. Such costs can derive from many sources. For example, in the context of team incentives, Bushman et al. (2016) argue that a board of director's ability to re-align team incentives may confront frictions arising from intense scrutiny focused on executive compensation by investors, media, regulators and politicians (e.g., Murphy, 2012). Cheung and Wei (2006) argue that adjustments costs can be associated with frictions facing executives in rebalancing their equity portfolios, such as insider trading restrictions, short selling constraints and information asymmetry.

We extend the literature by asking whether adjustment costs arise from CEOs voluntarily holding unconstrained equity over and above amounts explicitly constrained by ownership guidelines or vesting requirements. Armstrong et al. (ACG, 2018) provide evidence that CEOs hold significant levels of unconstrained equity. Consistent with these holdings being voluntary rather than explicitly or implicitly required by the firm, ACG provide evidence that CEOs are less than fully compensated for the risk of their total equity holdings. ACG consider several explanations for why CEOs voluntarily hold excess equity that is not risk compensated and they include CEO overconfidence, incentives to signal, and informed trading motivations.

Overconfident CEOs are willing to hold unconstrained equity because they tend to over-estimate the future returns on their stock. ACG follow Malmendier and Tate (2005) who argue that overconfident CEOs, believing that investors have undervalued the firm's stock, are reluctant to make investments when they must fund the projects with new stock. Malmendier and Tate (2005) find that overconfident CEOs exhibit greater investment-to-cash-flow sensitivity, presumably because they are less willing to invest in the absence of internal cash flow. Following ACG, we measure CEO overconfidence using the sensitivity of investment to cash flow, γ_i, for each CEO obtained from the following regression:

$$Investment_{i,t+1} == \gamma_0 + \gamma_i Cash\,Flow_{i,t+1} + \gamma_1 Book\text{-}To\text{-}Market_{i,t} + Controls_{i,t} + \varepsilon_{i,t+1}. \quad (5)$$

In (5), *Investment* is annual capital expenditures (Compustat Item CAPX), scaled by beginning-of-the-year capital (PPENT), and *Cash Flow* is earnings before extraordinary items (IB) plus depreciation (DP) scaled by beginning-of-the-year capital.

The signaling hypothesis posits that CEOs hold unconstrained equity to signal their belief that the firm is fairly valued, or perhaps even undervalued. Following ACG, we use corporate share repurchases as a proxy for the CEO's beliefs about the firm's value. Prior research documents that managers make share repurchases when they believe that their stock is undervalued (e.g., Brav, Graham, Harvey, and Michaely, 2005; Dittmar and Field, 2015). Also, managers' share repurchase decisions and personal portfolio decisions appear to reflect similar information and beliefs about stock valuation (e.g., Core, Guay, Richardson, and Verdi, 2006). We measure stock repurchases as the total value of stock repurchased during the twelve months starting three months after the fiscal year end, scaled by beginning-of-year market value of equity.

With respect to informed trading motives, ACG assess whether CEOs alter their unconstrained equity holdings when they have private information about stock under- or over-valuation, or perhaps when they expect to be able to manipulate the stock price, by including future excess returns (see also Cheung and Wei, 2006). We compute these returns as annual buy-and-hold returns excess over equal-weighed market return starting 3 months after the firm's fiscal year t end in t+1.

Analogous to our earlier cross-sectional analysis, we estimate the following two specifications:

$$Delta_t - Delta_{t-1} = \alpha + \lambda\, Deficient\ Delta_{t-1} + \lambda_1 Deficient\ Delta_{t-1} * DV + \gamma\, Excess\ Delta_{t-1} + \gamma_1 Excess\ Delta_{t-1} * DV + \beta * DV + \varepsilon_t \quad (6)$$

$$Firm\ Performance_t = \alpha + \lambda\ Deficient\ Delta_{t-1}\ + \lambda_1 Deficient\ Delta_{t-1}\ * DV + \gamma\ Excess\ Delta_{t-1}\ + \gamma_1 Excess\ Delta_{t-1}\ * DV + \beta * DV + \varepsilon_t \quad (7)$$

In equations (6) and (7), DV is either the sensitivity of investment to cash flow (CEO overconfidence), share repurchases (signaling) or future excess returns (informed trading motivation). Equation (6) is designed to examine whether incentives to hold unconstrained equity are associated with slower speed of adjustment, while equation (7) examines whether performance is worse (better) in the same settings where speed of adjustment is slower (faster).

3. Misaligned Incentives and the Dynamic Adjustment Process

In section 3.1 we develop our empirical approach for constructing deviations from a firm's target incentives. In section 3.2 we examine whether our estimated incentive gap can plausibly be interpreted as deviations from optimal incentives by investigating the relation between the incentive gap and firm performance. Finally, section 3.3 utilizes a speed of adjustment framework to extensively explore characteristics of the dynamic incentive adjustment process, as captured by speed of adjustment, and the implications of the adjustment process for firm performance.

3.1 Estimating optimal CEO incentives and deviations from optimal

In this section, we estimate a model of CEO incentives. Our compensation data is drawn from the Compustat ExecuComp database for the years 1993 to 2015. We supplement this with firm financial information from Compustat and stock return data from CRSP. We measure incentives based on a CEO's entire portfolio holdings of stock and stock options (exercisable and unexercisable) in the firm. The incentive intensity reflected in an executive's equity portfolio is represented by the *delta* of an executive's equity portfolio, defined as the change in value of the portfolio for a 1% change in the price of the underlying stock. Specifically,

$$delta = (\#\,of\ Shares + \#\,of\ Options \times Option\,Delta) \times (Price \times .01). \quad (8)$$

Option deltas are estimated using the methodology of Core and Guay (2002) and price refers to the firm's year-end stock price. Since *delta* is positive and right skewed, we follow the literature and use the natural log of *delta* in all of our specifications.

To estimate deviations from target incentives, we specify a model of a CEO's optimal incentives that builds on the specifications developed in Core and Guay (1999), Armstrong and Vashishtha (2012) and Armstrong et al. (2018). Specifically,

$$\log(Delta_t) = \beta_0 + \beta_1 FirmSize_{t-1} + \beta_2 BookMarket_{t-1} + \beta_3 \log(IdiosyncraticRisk_{t-1}) + \beta_4 \log(CEOtenure_{t-1}) + \beta_5 \log(CEOcashComp_{t-1}) + \beta_6 Cashscaled\ by\ total\ assets + \beta_7 Return_{t-1} + \beta_8 ROA_{t-1} + \beta_9 Leverage_{t-1} + \beta_{10} Capital_{t-1} + \beta_{11} FreeCashFlowProblem_{t-1} + \beta_{12} CumulativeReturns_{t-1} + \beta_{13} RiskTolerance_{t-1} + FF + YF + \varepsilon \quad (9)$$

Equation (9) incorporates an extensive set of firm and CEO characteristics expected to influence the design of optimal CEO incentives.[9] Firm size, measured as the market value of equity, is included based on the premise that larger firms demand more talented CEOs and that CEOs of larger firms tend to be wealthier (Smith and Watts, 1992; Core and Guay, 1999). We expect a positive relationship between firm size and *delta*. Next, the literature suggests that it is more difficult to monitor managers of firms with greater investment opportunities, leading firms to shift more intensively towards the use of equity incentives (e.g., Smith and Watts, 1992). We include the *Book-to-Market* ratio to proxy for growth opportunities and expect it to be negatively associated with equity incentives. Idiosyncratic stock return risk can have conflicting influences on CEO incentive intensity. On one hand, less predictable environments have been posited to

[9] See the appendix for a detailed description of all variables used in the paper.

have higher monitoring costs that require higher incentives (e.g., Demsetz and Lehn, 1985; Core, and Guay, 2002). On the other hand, the standard principal-agent model, argues that under a set of assumptions we should observe a negative relation between risk and incentives, *ceteris paribus*, as firms trade off "giving incentives" with "efficient risk-sharing" (see, for example, Holmstrom 1979). Jin (2002) documents that idiosyncratic risk is negatively related to pay performance-sensitivity, but finds little relation between systematic risk and incentive level. We thus have no prediction on the sign of the relationship between idiosyncratic risk and *delta*. We control for past performance using both lagged stock returns and return on assets as firms may reward managers for their past performance with restricted stock and options (Armstrong and Vashishtha, 2012).

Following Armstrong et al. (2018), we include a proxy for free cash flow defined as operating cash flow minus common and preferred dividends divided by average total assets. We also control for a firm's cash on hand scaled by total assets. Both greater free cash flows and cash balances may be associated with greater agency problems, implying a positive relation with CEO incentives (Jensen, 1986; Stulz, 1990). On the other hand, cash-constrained firms may use restricted stock and stock options as substitutes for cash compensation (Core and Guay, 1999). Thus, the sign of the relationship of cash levels with equity incentives is ambiguous. CEO tenure captures both CEO career concerns (Gibbons and Murphy, 1992) and potential horizon problems (Dechow and Sloan, 1991). Consistent with prior literature, we predict a positive relationship between CEO tenure and the level of equity incentives.

We include several variables to control for CEOs risk aversion and wealth. First, we follow Armstrong et al. (2018) and include *Cumulative Return* measured as the annual buy-and-hold returns less equal-weighed market return starting from the month after CEO takes the position, and ending in the current fiscal year. The idea here is that firms require wealthier CEOs to hold more equity than less wealthy CEOs. Further, the value of a CEO's stock and option portfolio, and therefore the proportion of wealth invested in firm equity, fluctuates over time as a function of the firm's stock price performance. Although CEOs can rebalance their portfolios over time, frictions will likely prevent CEOs from immediately adjusting their holdings back to target levels (Huddart and Lang, 1996; Ofek and Yermack, 2000; Core et al., 2003). *Cumulative Return* is included to capture these effects. The more recent portion of the cumulative return is expected to capture portfolio rebalancing frictions, and the longer-term component is expected to capture variation in CEO wealth. We expect cumulative returns to exhibit a positive relation with CEOs' incentives. We include cash compensation following Guay (1999), who argues that CEOs with higher cash compensation can more easily diversify their portfolio and will therefore be less risk-averse. We thus predict a positive relationship between cash compensation and delta. Finally, we include the variable *Risk Tolerance,* computed as the ratio of a CEO's firm specific wealth divided by the CEO's total wealth, where CEO's non-firm wealth is estimated following Dittmann and Maug (2007). We do not have a prediction on the sign of the relation between *Risk Tolerance* and delta.

We control for leverage, as discipline from outside creditors may serve as a substitute or complement for equity incentives, and PP&E scaled by total assets to control for the tangibility of the asset base (*Capital*). Firm fixed effects and year fixed effects are also included. We show that all results are robust to substituting industry fixed effects for firm fixed effects.

In Table 2, we estimate equation (9). Summary statistics for all variables used in this analysis are presented in Table 1. We run three nested specifications. In column (1) we run an OLS regression that includes only year fixed effects, and document that economy-wide influences explain around 10% of the variation in CEO *delta.* In column (2) we add firm fixed effects, finding that R^2 increases dramatically to 68% from the 10% explained by year fixed effects alone. In column (3), we further include the time varying firm and manager characteristics discussed earlier and see an increase in R^2 to 74% from the 68% documented in column (2). In column (4), we substitute industry fixed for firm fixed effects, and find that the R^2 drops to 58% from 74% for firm fixed effects. Importantly, all results in the paper are robust to using the industry fixed effects specification.

In all analyses to follow, we use predicted incentives from the specification in column (3) of table 2 to proxy for CEO target incentives based on information available at time t-1 (i.e., $Target_{t-1}$). Using this estimate of $Target_{t-1}$, we compute deviation from target incentives at t-1 as $Delta\,Gap_{t-1} = Target_{t-1} - Actual\,Delta_{t-1}$. Since any deviation can be above or below target, we define the following two variables with the gap variable as: *Deficient (Excess) Delta* is set equal to $Delta\,Gap = (Target\,Delta_{t-1} - Delta_{t-1})$ when *Delta Gap* is positive (negative), and equals zero otherwise.

3.2 Relation between deviations from target incentives and firm performance

The premise of our analysis is that, if target incentives are designed to maximize firm value, then deviations from target sustained through time by adjustment costs should degrade firm value. To examine this, we estimate the association between future performance (*Tobin's Q* or *ROA*) and deviation from target CEO incentives at t-1, *Deficient (Excess)* $Delta_{t-1}$, by running the following specification[10]:

[10] It is important to note that the residual delta variables used in equation (10) are generated regressors from our first stage regression in Table 2, column (3) (Pagan, 1984). Therefore, we follow Faulkender, Flannery, Hankins, and Smith (2012) and use bootstrapped standard errors to account for the generated regressor.

$$Tobin's\,Q_{it}\,(ROA_{it}) = \alpha + \delta_1 Deficient\,Delta_{i,t-1} + \delta_2 Excess\,Delta_{i,t-1} + Tobin's\,Q_{i,t-1} + Other\,Controls + Industry\,\&\,Year\,Fixed\,Effects + \varepsilon_{i,t}. \quad (10)$$

To the extent that our specification captures deviation from target incentives, we expect *Q* and *ROA* to be lower for both deficient and excess delta. Our firm control variables are comparable to those used in Kale, Reis, and Venkateswaran (2009) and include industry homogeneity, firm size, return volatility, leverage, R&D and advertising expenditures, and dividend yield. In addition, we further control for past performance by including lagged Tobin's Q, lagged ROA and lagged annual stock returns. We also control for the deviation from a CEO's equity portfolio vega, $Vega\ Gap_{t-1}$, where we use predicted incentives from the specification in column (5) of table 2 to proxy for CEO target vega based on information available at time t-1. Finally, we include industry and year fixed effects. Descriptive statistics for all variables are reported in Table 1.

We report results from running equation (10) in Table 3. We find that *Deficient Delta* (i.e., incentives too low) is negatively and significantly associated with future *Q/ROA*, while *Excess Delta* (i.e., incentives too high) is positively and significantly associated with future *Q/ROA*. These results suggest an inverted U-shaped relationship between estimated incentive gaps and future firm performance, providing evidence consistent with deviations from target incentives degrading firm value, whether these incentives are either too high or too low. We note that the coefficient on *Excess Delta* in the *Q* regression is substantially greater in absolute magnitude (.157) than the coefficient on *Deficient Delta* (-.022), suggesting that excessive incentives have a more detrimental impact on firm value than incentives that are too low.[11]

[11] Note that the asymmetry between excess incentives and deficient incentives is mostly reflected in Tobin's Q but not in ROA. As we show in Bushman, Dai and Zhang (2019), excess incentives lead to income-increasing earnings management while deficient incentives do not.

We next empirically investigate the nature of the process by which CEO incentives dynamically adjust back towards target incentives.

3.3 Dynamic adjustment process of misaligned incentives

First, in section 3.3.1 we follow Core and Guay (1999) and examine the extent to which firms use future equity grants to move misaligned incentives towards target levels. Second, the presence of non-trivial adjustment costs hinder the efforts of value maximizing firms to immediately restore misaligned incentives, which would result in only partial adjustment of incentives towards target. In section 3.3.2 we examine this possibility in a speed of partial adjustment framework. Finally, in section 3.3.3 we examine cross-sectional variation in the speed of partial adjustment, and in section 3.3.4 cross-sectional variation in the influence of incentive gaps on firm performance.

3.3.1 Incentive gaps and future equity grants

If a CEO's incentives drift away from optimal alignment, one avenue for value-maximizing firms to actively pursue incentive realignment is to adjust CEO's incentives through annual equity grants to CEOs. To examine this, we follow Core and Guay (1999) using an extended model of optimal CEO incentives and a substantially longer sample period that extends from 1993-2015. We run the following specification:

$$\begin{aligned} &Log(1+New\,Grant_{it}) = \\ &\qquad \alpha + \gamma_1 Delta\ Gap_{i,t-1} + Controls_{i,t-1} + Industry\&\,Year\ Fixed\ Effects + \varepsilon_{it}, \end{aligned} \tag{11}$$

where *New Grant* is computed as the portfolio delta of the subsequent year's grant of stock and options to the CEO, and $Delta\,Gap_{t-1}{=}Target_{t-1} - Actual\,Delta_{t-1}$. We predict that γ_1 will be positive as firms use equity grants to counteract deviations from target incentives. Our control variables mirror those in Core and Guay (1999), where all of these variables are described in the Appendix and descriptive statistics reported in Table 1.

The results from estimating equation (11) are reported in Table 4. Consistent with Core and Guay (1999), we document that the coefficient on *Delta Gap* is positive and significant using both an OLS and Tobit specification. However, it is key for our purposes to note while these results are consistent with the notion of firms actively managing incentives towards target, it provides no information on whether these adjustments fully achieve target incentives (i.e., zero adjustment costs) or reflect only partial adjustment (i.e., non-trivial adjustment costs). In the next section we examine this issue more carefully using a speed of adjustment framework.

3.3.2 Estimating Partial Speed of Adjustment (SOA) towards target incentives

If shocks push CEO incentives out of alignment, and firms' efforts to counteract these shocks and restore optimality are subject to adjustment costs, we would expect these shocks to only partially dissipate as boards face frictions in adjusting incentives. To explore this, we estimate how much of incentive gap between target delta and actual delta at time t-1 is closed over the subsequent year. Specifically, we use the following specifications:

$$CEO\ Delta_t - CEO\ Delta_{t-1} = \alpha + \lambda*(Target\ Delta_{t-1} - Delta_{t-1}) + \varepsilon_t, \quad \text{or} \qquad (12a)$$

$$CEO\ Delta_t = \alpha + (1-\lambda)*\ Delta_{t-1} + \lambda*Target\ Delta_{t-1} + \varepsilon_t, \qquad (12b)$$

where $Target\ Delta_{t-1}$ will be based on the estimated value of *CEO Delta* using data available at time t-1 (using the specification in table 2, column (3)). To understand the intuition of this analysis, note that equation (12a) regresses the actual change in *CEO Delta* from $t-1$ to t on the incentive gap between $Target\ Delta_{t-1}$ and actual *Delta* at $t-1$. The coefficient λ in (12a) is referred to as the speed of adjustment (SOA), and can be interpreted as the proportion of the gap between target and actual CEO incentives at time $t-1$ that is closed by the actual change in CEO incentives from year *t-1* to *t* (e.g., Lemmon et al., 2008). Equation (12b) simply rearranges the terms in (12a).

We first follow Flannery and Rangan (2006) and Lemmon *et al.* (2008) to estimate equation (12b) (one-step procedure)[12] and examine how much of the incentive gap in year t-1 is closed by the change of incentives from year t-1 to year t. In Panel A of Table 5, we present the results using both OLS regression and system general method of moments (Blundell and Bond, 1998). GMM is often used due to potential bias associated with OLS in panel data (Hsiao, 2003). We find that the estimates of SOA using OLS and GMM are very close, where SOA is 0.45 (=1-0.55) from OLS and 0.49 (=1-0.51) from GMM.

To facilitate parsimonious presentation of our interaction analyses to follow, we adopt the approach in Faulkender et al. (2012) and use a two-step procedure for estimating speed of adjustment. Specifically, we estimate the specification in equation (12a) using the predicted value of incentives from our estimation of target in Table 2, column (3) to proxy for *Target Delta* at t-1. We again report bootstrapped standard errors to deal with the generated regressor issue. As shown in Table 5, Panel B, we find that estimated SOA (0.45) is identical to the SOA estimates in table 5, Panel A, column (1). We next use this two-step specification to explore the properties of the dynamic incentive adjustment process in more depth.

First, we disaggregate the incentive gap and explore whether the speed of adjustment is symmetric for positive and negative gaps. When incentive gap = ($Target\ Delta_{t-1} - CEO\ Delta_{t-1}$) > 0, incentives are deficient and must be increased to meet target and vice versa for excess delta when ($Target\ Delta_{t-1} - CEO\ Delta_{t-1}$) < 0. The results reported in Table 5, Panel C provide evidence that SOA is characterized by asymmetric responses to positive and negative incentives

[12] Note that estimating equation (12b) in one-step means that we don't have to estimate the target separately and instead we incorporate all determinants of target on the right hand side.

gaps. Specifically, SOA is 0.51 when the gap is positive and 0.39 when the gap is negative, where the difference between these two SOA estimates is statistically significant with p-value of 0.0002 as shown at the bottom of panel C. This suggests that the adjustment is faster when the CEO is under incentivized than when the CEO is over incentivized. This happens for at least two reasons: first, boards cannot grant negative incentives in any given year; second, CEOs may hold unconstrained equity for reasons such as overconfidence, signaling etc., as we will discuss below in section 4 in more details. It is interesting to compare this result with the analysis in Table 3. There we found in the performance regression using *Q* that the coefficient on *Excess Delta* is substantially greater in absolute magnitude (.157) than the coefficient on *Deficient Delta* (-.022), suggesting that excessive incentives have a larger negative impact on firm value than incentives that are too low. The relatively greater performance effect of *Excess Delta* is consistent with the relatively slower SOA for *Excess Delta* documented in table 5, panel C.

3.3.3 Cross-sectional variation in Partial Speed of Adjustment (SOA)

In this section we perform cross-sectional analyses to explore whether the partial speed of adjustment is influenced by differences across firms in monitoring intensity, product market competition and CEO tenure. Based on our earlier arguments, we expect SOA to be faster for (1) firms with higher institutional ownership and greater analyst following due to greater monitoring discipline associated with these mechanisms; (2) firms facing more intense product market competition due to the discipline of competitive pressure; and (3) firms with CEOs earlier in their tenure as boards seek to adjust misalignments faster due to CEO career concerns.

Analyst following is from IBES and institutional ownership is from Reuters 13f. We proxy for product market competition using the total similarity measure from Hoberg and Phillips (2016), which is based on textual analysis of firms'10-K product descriptions. Total similarity is the sum of the pairwise cosine similarities between a given firm's product description and those of all other firms in a given year, where higher values indicate more intense product market competition.[13] CEO tenure is extracted from ExecuComp. Descriptive statistics for these variables are found in Table 1. In Panel A of Table 6 we run the following specification:

$$\begin{aligned} Delta_{it} - Delta_{i,t-1} &= \alpha + \lambda * (Target\, Delta_{i,t-1} - Delta_{i,t-1}) \\ &+ \lambda_1 (Target\, Delta_{i,t-1} - Delta_{i,t-1}) * CV + \lambda_2 CV + \varepsilon_{it}\,, \end{aligned} \qquad (13)$$

where CV is one of the cross-sectional variables described above. In table 6, Panel A we find that coefficient on the interaction term, λ_1, is positive and statistically significant for all of our cross-sectional variables. Specifically, we find that SOA is faster when there is higher analyst following and the institutional investor percentage is higher. We also find that SOA is faster when product market is more competitive and when the CEO is in her early tenure with the firm.

In table 6, panel B we refine the cross-sectional analysis by splitting the deviation from target into the components *Deficient* and *Excess Delta.* We run the following specification (previously shown as equation (3)):

$$\begin{aligned} &Delta_t - Delta_{t-1} = \alpha + \lambda\, Deficient\, Delta_{t-1} + \lambda_1 Deficient\, Delta_{t-1} * CV + \\ &\gamma\, Excess\, Delta_{t-1} + \gamma_1 Excess\, Delta_{t-1} * CV + \beta * CV + \varepsilon_t \end{aligned} \qquad (3)$$

Table 6, panel B shows that SOA for *Excess Delta* is significantly faster when there is higher analyst following, the institutional investor percentage is higher, product market is more competitive and when the CEO is in her early tenure with the firm. For *Deficient Delta* we find no significant differences in SOA in the cross section. These results suggest that there are disciplinary forces to help counter the sluggish speed of adjustment associated with excess

[13] The total similarity data used in our paper was retrieved in July 2017 from the Hoberg-Phillips Data Library (Hoberg and Phillips, 2016) at http://hobergphillips.usc.edu/industryconcen.htm .

incentives, but not deficient incentives. Note that this is important especially considering the fact that it is more difficulty to adjust the excess incentives downward than to adjust the deficient incentives upward.

The analysis in this section documents significant cross-sectional variation in the speed of adjustment. Given that adjustment speed reflects duration that deviations from target persist, we would expect that the negative influence of deviations on firm performance should increase with persistence of the deviation. We examine this in the next section.

3.3.4 Excess versus deficient delta and firm performance: cross sectional variation

In this section, we examine how the influence of incentive gaps on firm performance varies in the cross-section. Specifically, we run specifications of the form (previously shown as equation (4)):

$$Firm\ Performance_t = \alpha + \lambda\ Deficient\ Delta_{t-1} + \lambda_1 Deficient\ Delta_{t-1} * CV + \gamma\ Excess\ Delta_{t-1} + \gamma_1 Excess\ Delta_{t-1} * CV + \beta * CV + \varepsilon_t \quad (4)$$

where firm performance is either *Tobin's Q* or *ROA*. Results are reported in table 7, panels A and B. We find that the negative influence of *Deficient Delta* and *Excess Delta* on firm performance is mitigated for higher analyst following, higher institutional investor percentage, more competitive products markets, and when the CEO is early in her tenure with the firm. This result holds regardless of whether we measure firm performance as *Tobin's Q* or *ROA.* The significant reduction in the negative influence of *Excess Delta* on firm performance is mitigated when there is higher monitoring intensity, competition and career concerns. This is consistent with our earlier result that SOA is also significantly faster for firms sharing these characteristic. The evidence suggests that the negative influence of deviations from target on firm performance is a function of how long such deviations persist, where persistence decreases in the speed of SOA.

4. Are CEOs' voluntary holdings of unconstrained equity a source of adjustment costs?

In this section, we explore one potential source of adjustment costs that may arise from CEOs voluntarily holding equity above amounts explicitly constrained by ownership guidelines or vesting requirements (Armstrong et al., ACG, 2018). While unconstrained holdings are by nature optimal from a CEO's perspective and beyond a firm's control, we hypothesize that these holdings can serve as a source of incentive misalignment from a firm's perspective. As discussed earlier, we follow ACG (2018) who posit that CEOs have incentives to hold excess equity when they are overconfident, when they want to signal private information, and when they have informed trading motivations. Following ACG (2018), we estimate CEO overconfidence as the sensitivity of investment to cash flow, γ_i, for each CEO from the following regression (previously shown as equation (5):

$$Investment_{i,t+1} == \gamma_0 + \gamma_i Cash\,Flow_{i,t+1} + \gamma_1 Book\text{-}To\text{-}Market_{i,t} + Controls_{i,t} + \varepsilon_{i,t+1} \quad . \qquad (5)$$

In (5), Investment is annual capital expenditures (Compustat Item CAPX), scaled by beginning-of-the-year capital (PPENT), and Cash Flow is earnings before extraordinary items (IB) plus depreciation (DP) scaled by beginning-of-the-year capital. We use corporate share repurchases as a proxy for the CEO's beliefs about the firm's value. Finally, informed trading motives are measured by future excess returns. All variables are described in detail in the Appendix.

Similar to our earlier cross-sectional analysis, we estimate the following two specifications (previously shown as equations (6) and (7)):

$$Delta_t - Delta_{t-1} = \alpha + \lambda\, Deficient\ Delta_{t-1} + \lambda_1 Deficient\ Delta_{t-1} * DV +$$
$$\gamma\, Excess\ Delta_{t-1} + \gamma_1 Excess\ Delta_{t-1} * DV + \beta * DV + \varepsilon_t \qquad (6)$$

$$Firm\ Performance_t = \alpha + \lambda\, Deficient\ Delta_{t-1} + \lambda_1 Deficient\ Delta_{t-1} * DV +$$
$$\gamma\, Excess\ Delta_{t-1} + \gamma_1 Excess\ Delta_{t-1} * DV + \beta * DV + \varepsilon_t \qquad (7)$$

In equations (6) and (7), DV is a determinant of voluntary equity holdings, either investment to cash flow sensitivity (CEO overconfidence), share repurchases (signaling) or future excess returns (informed trading motivation).

Results from running equations (6) and (7) are reported in table 8. Table 8, panel A shows that SOA is slower (faster) for excess (deficient) incentives when CEOs are more overconfident and for CEOs with higher signaling incentives. This result is consistent with the CEOs with greater incentives to hold unconstrained equity being more resistant to reductions in their excess equity holdings, and those with deficient incentives being more eager to build up equity holdings.

To the extent that CEOs holdings of unconstrained equity are not in alignment with the preferences of the firm owners, we hypothesize that the slower (faster) SOA for excess (deficient) incentives related to incentives for holding unconstrained equity would result in excess (deficient) incentives having a more (less) negative influence on firm performance. That is, the more persistent excess holdings will be associated with greater negative performance while the less persistent deficient incentives will be associated with a reduced negative impact. Table 8, panels B and C reports results consistent with the hypothesis. Specifically, we find that firm performance (*Tobin's Q, ROA*) is worse (better) for excess (deficient) incentives for more overconfident CEOs and those with higher signaling incentives. That is performance is worse (better) in the same settings where speed of adjustment is slower (faster). However, we find no results for informed trading motivations.

5. Summary

A common and well accepted view in the academic literature is that incentive contracts are always at optimal equilibrium levels because it is assumed that firms can continuously and completely counteract shocks that cause deviations from optimal (e.g., Demsetz and Lehn, 1985). In this paper, we investigate whether adjustment costs impede firms from achieving value-maximizing levels of CEO equity incentives and degrade firm performance by sustaining deviations from targeted incentive levels. Specifically, we explore the dynamic adjustment process of CEO incentives and examine implications of speed of adjustment to target for firm performance.

Consistent with adjustment frictions sustaining a wedge between target and actual incentives, we find that firm performance decreases in deviations from target incentives, and that firms' active management of incentives towards target only partially closes the gap between target and realized incentives. We then separately consider excess incentives and deficient incentives. We find that while adjustment speed is slower for excess relative to deficient incentives, relative adjustment speed for excess incentives increases significantly for firms with higher monitoring intensity, product competition, and CEO career concerns, and for such firms, performance degradation associated with deviations from target significantly decreases. We also provide evidence that when CEOs have greater incentives to hold unconstrained equity voluntarily, excess (deficient) incentives have slower (faster) adjustment speed and greater (lower) negative influence on firm performance. This evidence suggests that CEOs' voluntary unconstrained equity holdings are an important source of adjustment costs.

Our analyses provide evidence that deviations from target significantly influence the speed of incentive adjustment and firm performance. A promising direction for future research is to examine the mechanisms (or managers' behavior) through which the incentive deviation degrades firm performance. This can include managers' risk taking, investment, and earnings management behavior, among others (Bushman et al., 2019).

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Appendix: Variable Definition and Measurement

Dependent Variables:	
Delta	Natural logarithm of one plus the dollar change in the value of the executive's equity portfolio given a 0.01 increase in the underlying stock price, estimated following Core and Guay (1999) model.
Firm Risk	Standard deviation of daily firm returns, multiplied by 100.
New Grants	Delta of the annual grant of stock and options to CEO.
ROA	Return on asset, income before extraordinary items scaled by lagged total asset.
Tobin's Q	Measured as ((Total asset – Book value of equity + Market value of equity)/ Total asset).
Vega	Natural logarithm of one plus the sensitivity of the executives' equity portfolio to a 0.01 standard deviation change in stock volatility, estimated following Core and Guay (2002) model.
Independent Variables:	
Advertising to Capital	Advertising expense divided by Net of PP&E.
Analyst Following	Number of analysts who follow a firm.
BM	Book-to-market ratio of equity.
Capital	Net of PP&E scaled by total asset.
Capital to Sales	Net of PP&E scaled by sales.
Cash	Cash holding scaled by total asset.
Cash Flow Shortfall	Three-year average of [(common and preferred dividends + cash flow from investing - cash flow from operations) / total assets].
CEO Cash Compensation	CEO's cash compensation, including salary and bonus.
CEO Tenure	CEO's tenure in a firm.
Change of Delta	$Delta_t – Delta_{t-1}$
Cumulative Return	Annual buy-and-hold returns excess over equal-weighed market return starting from the month after CEO takes the position, and ending in fiscal year t.
Delta Gap	Predicted delta using information available at t-1 based on column (3) of Table 2 (i.e., $Target\ Delta_{t-1}$) minus actual Delta at t-1. That is: $Target\ Delta_{t-1} - Actual\ Delta_{t-1}$
Deficient (Excess) Delta	Equal to Delta Gap when Delta Gap > 0 (< 0), and zero otherwise. Deficient (Excess) Delta Gap is posited to capture the extent to which a CEO's Delta is too low (high) relative to target Delta.
Vega Gap	Predicted vega using information available at t-1 based on column (5) of Table 2 (i.e., $Target\ Vega_{t-1}$) minus actual vega at t-1. That is: $Target\ Vega_{t-1} – Actual\ Vega_{t-1}$.
Deficient (Excess) Vega	Equal to Vega Gap when Vega Gap > 0 (< 0), and zero otherwise. Deficient (Excess) Vega Gap is posited to capture the extent to which a CEO's Vega is too low (high) relative to target Vega.
Dividend Constraint	Dummy variable that equals to one if the firm is dividend constrained in any of the three years prior to the year the new

	equity grant is awarded, and zero otherwise. Following Core and Guay (1999), we categorize a firm as dividend constrained if [(retained earnings at year-end cash dividends and stock repurchases during the year)/the prior year's cash dividends and stock repurchases], is less than two. If the denominator is zero for all three years, we also categorize the firm as dividend constrained.
Dividend Yield	The dividends per share ex-date divided by close price for the fiscal year.
Early CEO Tenure	Dummy variable which equals one if it is the first 3 years of CEO tenure with the firm, and zero otherwise.
Excess Return	Annual buy-and-hold returns excess over equal-weighed market return starting 3 months after the firm's fiscal year t end in t+1.
Firm Size	Natural logarithm of market capitalization.
Free Cash Flow Problem	Three-year average of [(cash flow from operations minus common and preferred stock dividends)/total assets], if the firm's book-to-market assets ratio is greater than one; otherwise, it is zero.
High Analyst Following	Dummy variable which equals one if Analyst Following is above median of the sample, and zero otherwise.
High Institution Ownership	Dummy variable which equals one if Institutional Ownership is above median of the sample, and zero otherwise.
Idiosyncratic Risk	Standard deviation of the residual from a market model regression estimated over the fiscal year with daily returns.
Industry Homogeneity	Mean partial correlation between firm's returns and an equally weighted industry index, for all firms in the same two-digit SIC industry code, holding market return constant (see Parrino 1997), estimated based on 60 monthly returns prior to sample year.
Institution Ownership	Percentage of outstanding shares held by the institutional investors.
Investment-to-cash-flow Sensitivity	Following Malmendier and Tate (MT, 2005), we estimate: $Investment_{i,t+1} = \gamma_0 + \gamma_i\ Cash\ Flow_{i,t+1} + \gamma_1\ Book\text{-}to\text{-}market_{i,t} + Controls_{i,t} + \varepsilon_{i,t+1}$ We calculate *Investment* as annual capital expenditures (Compustat Item *CAPX*), scaled by beginning-of-the-year capital (*PPENT*), and *Cash Flow* as earnings before extraordinary items (*IB*) plus depreciation (*DP*) scaled by beginning-of-the-year capital. The model is estimated using a random coefficient regression that allows γ_i to take a different value for each CEO. The estimated coefficient measures cash flow sensitivity (*Investment-to-Cash-Flow Sensitivity*) for each of the sample CEOs. Consistent with MT, the control variables include CEO stock ownership, number of CEO vested options, log of market value, year effect, industry effects, and interaction of cash flow with all above variables.
Leverage	Financial leverage, measured as total liability divided by total asset.
Log (Sales)	Natural logarithm of sales
NOL	Net operating loss, a dummy variable which equals one if operating income after depreciation is negative for any of the previous three years, and zero otherwise.

Product Market Competition	Total similarity measure from Hoberg and Phillips (2016) based on text-based analysis of firms'10-K product descriptions. Computed as the sum of the pairwise cosine similarities between the given firm's product description and those of all other firms in the given year. Higher values of total similarity indicate that a firm faces more intense product market competition in a given year.
R&D to Capital	Research & development expenditure divided by net of PP&E.
Return	Annual buy-and-hold return.
Return Volatility	Variance of 60 monthly returns preceding sample year.
Risk Tolerance	$\frac{CEO's\ Firm\ specific\ wealth}{CEO's\ Total\ wealth}$, where CEO's non-firm wealth is estimated following Dittmann and Maug (2007).
Stock Repurchase	Change of treasury stocks, scaled by market capitalization at the beginning of year t.

Table 1 Summary Statistics

This table reports the summary statistics for all variables used in this study. The sample period covers 1992 to 2015 for most of the variables except for board independence (1999-2013). All continuous variables are winsorized at 1% and 99%. See Appendix for variable definition and measurement.

	Mean	Std. Dev.	Median	Q1	Q3
CEO Delta (Raw) $_t$	1144.2	10873.7	66.4	180.7	514.7
CEO Delta (after Log) $_t$	7.527	1.600	6.408	7.411	8.527
CEO Vega (after Log) $_t$	1.271	1.662	0.000	0.000	2.579
Log (New Grant + 1) $_t$	2.788	1.623	3.012	1.778	3.975
Change of Delta$_t$	-0.051	1.046	0.093	-0.255	0.388
Delta Gap$_{t-1}$	-0.003	0.731	-0.025	-0.338	0.285
Deficient Delta$_{t-1}$	0.234	0.519	0.000	0.000	0.286
Excess Delta$_{t-1}$	-0.230	0.390	-0.023	-0.330	0.000
Vega Gap$_{t-1}$	-0.005	0.727	-0.028	-0.341	0.283
Deficient Vega$_{t-1}$	0.230	0.513	0.000	0.000	0.283
Excess Vega$_{t-1}$	-0.236	0.397	-0.028	-0.341	0.000
Tobin's Q$_t$	1.889	1.277	1.491	1.153	2.137
ROA$_t$	0.039	0.105	0.046	0.015	0.083
Tobin's Q$_{t-1}$	1.926	1.495	1.500	1.157	2.159
ROA$_{t-1}$	0.044	0.107	0.048	0.018	0.085
Firm Risk $_t$	2.410	1.145	2.160	1.602	2.954
Firm Size$_{t-1}$	7.389	1.593	7.295	6.294	8.436
Firm Size$^2_{t-1}$	57.142	24.185	53.211	39.609	71.159
Log (Sales)$_{t-1}$	7.368	1.555	7.272	6.272	8.412
BM$_{t-1}$	0.542	0.439	0.458	0.284	0.684
Log(idiosyncratic risk) $_{t-1}$	-3.954	0.496	-3.973	-4.318	-3.614
Log (CEO Tenure) $_t$	2.099	0.587	2.079	1.609	2.485
Early CEO Tenure$_t$	0.179	0.384	0.000	0.000	0.000
Log (CEO Cash Compensation +1)$_{t-1}$	6.785	0.841	6.779	6.386	7.169
Cash scaled by total asset$_{t-1}$	0.136	0.162	0.071	0.022	0.194
Free Cash Flow$_{t-1}$	0.080	0.091	0.077	0.036	0.122
Cash flow shortfall$_{t-1}$	-0.162	0.116	-0.152	-0.227	-0.090
Return$_{t-1}$	0.193	0.643	0.121	-0.097	0.356

$Cumulative\_return_t$	-0.007	0.114	0.000	0.000	0.000
Excess $Return_t$	0.009	0.552	-0.031	-0.236	0.178
Return $Volatility_{t-1}$	0.017	0.031	0.011	0.006	0.020
NOA_{t-1}	0.133	0.339	0.000	0.000	0.000
$Leverage_{t-1}$	0.534	0.211	0.547	0.385	0.684
$Capital_{t-1}$	0.269	0.239	0.197	0.076	0.409
Capital to $Sales_{t-1}$	0.453	0.816	0.202	0.108	0.427
R&D to $Capital_{t-1}$	0.379	2.229	0.000	0.000	0.182
Dividend $constraint_{t-1}$	0.430	0.495	0.000	0.000	1.000
Industry $Homogeneity_{t-1}$	0.214	0.112	0.184	0.126	0.296
Advertising to $Capital_{t-1}$	0.100	0.601	0.000	0.000	0.042
Dividend $Yield_{t-1}$	0.015	0.030	0.008	0.000	0.022
Analyst $Following_{t-1}$	10.635	8.098	9.091	4.400	15.455
Institution $Ownership_{t-1}$	0.682	0.262	0.735	0.561	0.861
Product Market $Competition_{t-1}$	4.305	7.210	1.999	1.301	4.026
Stock $Repurchase_t$	0.007	0.050	0.000	0.000	0.007
Positive Stock $Repurchase_t$	0.363	0.481	0.000	0.000	1.000
Investment-to-Cash-Flow $Sensitivity_t$	-0.001	0.068	-0.007	-0.038	0.029
Risk $Tolerance_{t-1}$	-0.582	0.644	-0.430	-0.862	-0.134

Table 2 Estimating Target Levels of CEO Delta and CEO Vega

In this table we estimate CEOs' target Delta by regressing CEO Delta on lagged determinants of CEO equity incentives. We do the same to estimate target Vega. The sample period covers 1992 to 2015. The OLS regressions are estimated clustered by firm. See Appendix for variable definition and measurement.

Dependent Variable =	CEO Delta $_t$								CEO Vega $_t$	
	(1)		(2)		(3)		(4)		(5)	
	estimate	t-value	estimate	t-value	estimate	t-value	estimate	t-value	estimate	t-value
Intercept					0.573	1.83	-2.600	-8.61	-0.604	-1.52
Firm Size $_{t-1}$					0.435	15.73	0.568	31.10	0.303	8.43
BM$_{t-1}$					0.000	0.01	-0.064	-1.84	-0.033	-0.93
Log(idiosyncratic risk) $_{t-1}$					0.133	3.40	0.255	6.30	0.277	5.22
Log (CEO tenure) $_t$					0.676	24.63	0.834	29.96	0.025	0.82
Log (CEO cash comp +1)$_{t-1}$					0.044	1.37	0.061	1.88	0.119	3.49
Scaled Cash holding $_{t-1}$					0.127	0.90	0.269	1.79	-0.328	-1.85
Return$_{t-1}$					0.048	3.68	0.039	2.87	-0.087	-5.55
ROA $_{t-1}$					0.122	1.22	0.069	0.66	-0.019	-0.14
Leverage $_{t-1}$					-0.049	-0.39	-0.044	-0.42	-0.087	-0.54
Capital $_{t-1}$					-0.150	-0.78	-0.346	-3.25	-0.038	-0.15
Free cash flow $_{t-1}$					0.869	6.33	1.395	9.25	-0.169	-1.07
Cum. return $_{t-1}$					-0.235	-2.04	-0.213	-1.88	-0.177	-1.13
Risk tolerance $_{t-1}$					0.724	29.05	0.775	27.97	0.151	6.70
Firm fixed effects	No		Yes		Yes		No		Yes	
Industry fixed effects	No		No		No		Yes		No	
Year fixed effects	Yes		Yes		Yes		Yes		Yes	
R^2	0.0990		0.6820		0.7397		0.5836		0.4355	
N	22,616		22,616		22,616		22,616		22,616	

Table 3 Excess/Deficient Delta and Firm Performance

In this table we examine whether deficient incentives and excess incentives differentially influence firm performance (Tobin's Q and ROA). Deficient Delta = Delta Gap when Delta Gap > 0 (i.e., $Target_{t-1}$ > Actual $Delta_{t-1}$), and equals zero otherwise. Excess Delta equals Delta Gap when Delta Gap < 0 (i.e., $Target_{t-1}$ < Actual $Delta_{t-1}$), and zero otherwise. Delta Gap = Target $Delta_{t-1}$ minus actual $Delta_{t-1}$, where Target $Delta_{t-1}$ is estimated in column (3) of Table 2 using information available at t-1. The sample period covers 1992-2015. See the appendix for variable definition and measurement. The OLS regressions are estimated clustered by firm. Standard errors are bootstrapped to account for generated regressors.

Dependent =	Tobin's Q_t		ROA_t	
	estimate	t-value	estimate	t-value
Intercept	0.666	3.07	-0.168	-6.54
Deficient $Delta_{t-1}$	-0.022	-2.01	-0.006	-3.55
Excess $Delta_{t-1}$	0.157	7.73	0.005	2.74
Vega Gap_{t-1}	-0.005	-1.32	0.001	2.89
R&D to $Capital_{t-1}$	0.005	1.02	-0.001	-1.31
Industry $Homogeneity_{t-1}$	-0.104	-1.50	-0.020	-2.02
Firm $Size_{t-1}$	0.004	0.10	0.044	7.10
Firm $Size^2_{t-1}$	0.000	0.16	-0.002	-6.54
Return $Volatility_{t-1}$	-0.534	-2.21	-0.157	-1.42
Capital to $Sales_{t-1}$	0.022	1.42	-0.006	-3.95
$Leverage_{t-1}$	-0.247	-3.86	-0.033	-4.54
Advertising to $Capital_{t-1}$	0.016	1.88	0.000	0.29
Dividend $Yield_{t-1}$	0.126	0.38	-0.075	-1.10
Tobin's Q_{t-1}	0.599	11.61	0.011	4.51
ROA_{t-1}	0.541	2.32	0.419	12.87
Industry Fixed Effect	Yes		Yes	
Year Fixed Effect	Yes		Yes	
R^2	0.6123		0.3588	
N	19,182		19,182	

Table 4 Firms' Active Management of CEO Incentives: New Equity Grants

In this table we examine relations between future equity grants to CEOs by boards of directors and Delta Gap. *New Grant* = the delta of the annual grant of stock and options to CEO. Delta Gap = predicted delta using information available at t-1 based on column (3) of Table 2 minus actual delta at t-1. Both columns (1) and (2) replicate the main results in Core and Guay (1999) over a different time frame while column (1) uses OLS and column (2) uses Tobit to take care of truncation problem associated with zero grants. The sample period covers 1992-2015. See appendix for variable definition and measurement. The OLS regressions are estimated clustered by firm. Standard errors are bootstrapped to account for generated regressors.

Dependent Variable =	Log (New Grant + 1) $_t$			
	OLS		Tobit	
	(1)		(2)	
	estimate	t-value	estimate	t-value
Intercept	-0.938	-4.34	-0.882	-5.37
Delta Gap_{t-1}	0.056	2.75	0.077	4.90
Log $(Sales)_{t-1}$	0.507	30.82	0.552	66.35
BM_{t-1}	-0.464	-11.36	-1.022	-18.52
NOL_{t-1}	0.133	2.88	0.092	2.45
Cash Flow $shortfall_{t-1}$	-0.369	-2.12	-0.113	-0.97
Dividend $constraint_{t-1}$	0.095	2.63	0.111	4.49
$Return_{t-1}$	0.306	10.96	0.064	2.15
Industry fixed effects	Yes		Yes	
Year fixed effects	Yes		Yes	
Pseudo R^2 / R^2	0.3049		0.0829	
N	20,126		20,126	

Table 5 Dynamic Adjustment of CEO Incentives: Speed of Adjustment

In this table, we examine the dynamic adjustment of the CEO delta by examining speed of adjustment (SOA). Panel A estimates SOA for CEO incentives using both an OLS and a System GMM specifications, where estimated SOA is given by 1 minus the coefficient on CEO Delta; in panel B we follow Faulkender et al. (2012) and estimate SOA with OLS by first computing the gap between target and actual Delta at year t-1. Target Delta is the predicted value of Delta from Table 2, column 3. Estimated SOA is given by the coefficient on Delta Gap. In panel C we use the Faulkender et al. (2012) OLS specification to consider how SOA varies differentially for deficient incentives relative to excess incentives. Deficient Delta = Delta Gap when Delta Gap > 0 (i.e., $Target_{t-1}$ > Actual $Delta_{t-1}$), and equals zero otherwise. Excess Delta equals Delta Gap when Delta Gap < 0 (i.e., $Target_{t-1}$ < Actual $Delta_{t-1}$), and zero otherwise. The sample period covers 1992-2015. See appendix for variable definition and measurement. The OLS regressions are estimated clustered by firm. Standard errors are bootstrapped to account for generated regressors.

Panel A: Speed of adjustment using OLS and System GMM specifications: $Delta_t = (1-\lambda) * Delta_{t-1} + Controls + \varepsilon_t$ *, where* λ *= Speed of Adjustment.*

Dependent Variable =	CEO Delta $_t$			
	OLS		GMM	
	(1)		(2)	
	estimate	t-value	estimate	t-value
CEO Delta $_{t-1}$	0.547	28.76	0.510	18.53
Firm Size	0.065	3.16	-0.448	-12.45
BM $_{t-1}$	0.057	2.20	-0.027	-0.79
Log(idiosyncratic risk) $_{t-1}$	0.094	3.27	0.041	1.07
Log (CEO Tenure) $_{t-1}$	0.255	10.77	0.205	5.17
Log (CEO Cash Compensation +1) $_{t-1}$	0.044	2.11	0.013	0.64
Cash $_{t-1}$	0.263	2.66	0.430	3.17
Return $_{t-1}$	0.020	1.89	0.007	0.51
ROA $_{t-1}$	-0.077	-0.96	-0.140	-1.27
Leverage $_{t-1}$	-0.067	-0.71	-0.320	-2.40
Capital $_{t-1}$	-0.049	-0.37	-0.115	-0.52
Free Cash Flow Problem $_{t-1}$	0.890	7.59	0.424	3.16
Cumulative_return $_{t-1}$	-0.162	-1.99	-0.038	-0.22
Risk Tolerance $_{t-1}$	0.579	27.42	0.807	42.19
Firm fixed effects	Yes		Yes	
Year fixed effects	Yes		Yes	
R^2	0.7923			
N	17,859		17,859	

Panel B: Speed of Adjustment using the Faulkender et al. (2012) OLS specification: $Delta_t - Delta_{t-1} = \alpha + \lambda * (Target\ Delta_{t-1} - Actual\ Delta_{t-1})$ *where* λ *= Speed of Adjustment.*

Dependent Variable =	Change of Delta $_t$	
	estimate	t-value
Intercept	-0.042	-8.11
Delta Gap $_{t-1}$	0.453	21.72
R^2	0.0788	
N	17,859	

Panel C: Speed of Adjustment using Faulkender et al. (2012) specification $Delta_t - Delta_{t-1} = \alpha + \lambda_1 Deficient\ Delta\ Gap_{t-1} + \lambda_2 Excess\ Delta\ Gap_{t-1}$ *where* λ_1 (λ_2) *= Speed of Adjustment for Deficient (Excess) Delta Gap.*

Dependent Variable =	Change of Delta $_t$	
	estimate	t-value
Intercept	-0.068	-6.29
Deficient Delta $_{t-1}$ (λ_1)	0.505	18.04
Excess Delta $_{t-1}$ (λ_2)	0.389	11.14
p-value for testing $\lambda_1 = \lambda_2$	0.0002	
R^2	0.0795	
N	17,859	

Table 6 Speed of Adjustment and Cross Sectional Variation in Monitoring Intensity, CEO Tenure, and Product Market Competition

In this table, we examine how cross sectional variations in monitoring intensity, CEO tenure, and product market competition affect the dynamic adjustment of CEO incentives as captured by the partial speed of adjustment (SOA). In panel A, we interact Delta Gap with four cross sectional variables: analyst following, institutional ownership, CEO tenure and product market competition. Delta Gap = predicted delta using information available at t-1 based on column (3) of Table 2 minus actual delta at t-1. In panel B we examine cross-sectional effects separately for deficient incentives and excess incentives. Deficient Delta = Delta Gap when Delta Gap > 0 (i.e., $Target_{t-1}$ > Actual $Delta_{t-1}$), and equals zero otherwise. Excess Delta equals Delta Gap when Delta Gap < 0 (i.e., $Target_{t-1}$ < Actual $Delta_{t-1}$), and zero otherwise. The sample period covers 1992-2015. See appendix for variable definition and measurement. The OLS regressions are estimated clustered by firm. Standard errors are bootstrapped to account for generated regressors.

Panel A: Speed of Adjustment and Cross Sectional Variation in Monitoring Intensity, CEO Tenure, and Product Market Competition

Dependent Variable =	Change of $Delta_t$							
	(1)		(2)		(3)		(4)	
	estimate	t-value	estimate	t-value	estimate	t-value	estimate	t-value
Intercept	0.043	5.70	-0.011	-1.20	0.008	1.40	0.066	8.67
Delta Gap_{t-1}	0.366	16.20	0.383	14.17	0.340	17.81	0.273	10.37
Delta Gap_{t-1} * CV	0.157	4.75	0.111	3.27	0.128	2.44	0.232	5.98
CV	0.006	0.53	-0.005	-0.41	0.017	0.54	-0.043	-3.83
Cross sectional variable (CV)	High Analyst Following		High Institution Ownership		Early CEO Tenure		Product Market Competition	
R^2	0.1034		0.0793		0.0632		0.0923	
N	17,859		17,859		17,859		16,286	

Panel B: Speed of Adjustment and Cross Sectional Variation in Monitoring Intensity, Monitoring Intensity, CEO Tenure, and Product Market Competition: Deficient vs. Excess incentives

Dependent Variable =	Change of Delta							
	(1)		(2)		(3)		(4)	
	estimate	t-value	estimate	t-value	estimate	t-value	estimate	t-value
Intercept	-0.067	-5.72	-0.102	-7.03	-0.094	-10.03	-0.046	-3.53
Deficient Delta	0.575	16.45	0.551	14.74	0.553	18.54	0.484	11.67
Excess Delta	0.075	3.39	0.170	5.26	0.069	3.79	-0.04	-1.98
Deficient Delta * CV	-0.046	-0.95	-0.094	-1.52	-0.108	-1.45	0.05	0.93
Excess Delta * CV	0.443	8.66	0.370	6.48	0.431	3.5	0.513	9.04
CV	0.113	6.68	0.103	5.06	0.136	2.89	0.055	2.84
Cross sectional variable (CV)	High Analyst Following		High Institution Ownership		Early CEO Tenure		Product Market Competition	
R^2	0.1132		0.0848		0.0777		0.1027	
N	17,859		17,859		17,859		16,286	

Table 7 Excess versus Deficient Delta and Firm Performance: Cross Sectional Variation in Monitoring Incentives, CEO Tenure, and Product Market Competition

In this table we further examine how cross sectional variations in monitoring intensity affect the relation between Delta Gap and Tobin's Q/ROA. Delta Gap = predicted delta using information available at t-1 based on column (4) of Table 2 minus actual delta at t-1. Deficient Delta = Delta Gap when Delta Gap > 0 (i.e., $Target_{t-1}$ > Actual $Delta_{t-1}$), and equals zero otherwise. Excess Delta equals Delta Gap when Delta Gap < 0 (i.e., $Target_{t-1}$ < Actual $Delta_{t-1}$), and zero otherwise. The four cross sectional variables are analyst following, institutional ownership, CEO tenure and product market competition. In panel A, we consider Tobin's Q as performance measure and in Panel B, we consider ROA as performance measure. Controls are omitted for brevity and they are the same as those included in Table 3. The sample period covers 1992-2015. See the appendix for variable definition and measurement. The OLS regressions are estimated clustered by firm. Standard errors are bootstrapped to account for generated regressors.

Panel A: Tobin's Q: Cross Sectional Variation in Monitoring Intensity, CEO Tenure, and Product Market Competition

Dependent Variable =	Tobin's Q_t							
	(1)		(2)		(3)		(4)	
	estimate	t-value	estimate	t-value	estimate	t-value	estimate	t-value
Intercept	1.613	3.16	1.334	2.93	1.340	3.04	1.319	3.08
Deficient Delta $_{t-1}$ (β_1)	-0.036	-2.09	-0.043	-2.26	-0.042	-2.27	-0.042	-2.20
Excess Delta $_{t-1}$ (β_2)	0.142	2.75	0.141	3.98	0.135	3.78	0.099	2.25
Deficient Delta $_{t-1}$ * CV (β_3)	0.057	2.17	0.062	2.51	0.059	2.11	0.055	2.24
Excess Delta $_{t-1}$ * CV (β_4)	-0.164	-2.50	-0.203	-3.21	-0.120	-2.92	-0.260	-2.39
Controls	Yes		Yes		Yes		Yes	
Cross sectional variable (CV)	High Analyst Following		High Institution Ownership		Early CEO Tenure		Product Market Competition	
p-value for testing $\beta_1 = -\beta_3$	0.296		0.330		0.483		0.459	
p-value for testing $\beta_2 = -\beta_4$	0.349		0.104		0.628		0.057	
R^2	0.5841		0.5714		0.5678		0.5704	
N	19,182		19,182		19,182		16,018	

Panel B: ROA: Cross Sectional Variation in Monitoring Intensity, CEO Tenure, and Product Market Competition

Dependent Variable =	ROA_t							
	(1)		(2)		(3)		(4)	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Intercept	-0.128	-4.91	-0.151	-5.66	-0.136	-5.50	-0.122	-5.73
Deficient Delta $_{t-1}$ (β_1)	-0.008	-3.43	-0.006	-2.93	-0.006	-3.75	-0.006	-2.75
Excess Delta $_{t-1}$ (β_2)	0.007	2.86	0.008	3.78	0.005	2.47	0.010	3.63
Deficient Delta $_{t-1}$ * CV (β_3)	0.007	2.65	0.006	2.15	0.011	3.79	0.008	2.84
Excess Delta $_{t-1}$ * CV (β_4)	-0.007	-2.15	-0.009	-2.85	-0.010	-3.05	-0.008	-2.22
Controls	Yes		Yes		Yes		Yes	
Cross sectional variable (CV)	High Analyst Following		High Institution Ownership		Early CEO Tenure		Product Market Competition	
p-value for testing $\beta_1 = -\beta_3$	0.698		0.813		0.108		0.204	
p-value for testing $\beta_2 = -\beta_4$	0.648		0.668		0.110		0.345	
R^2	0.3738		0.3634		0.3641		0.3439	
N	19,182		19,182		19,182		16,018	

Table 8 Excess/Deficient Delta, SOA and Firm Performance: Cross Sectional Variation in CEOs' Incentives to Hold Unconstrained Equity

In this table we further examine how the relations between Deficient/Excess Delta and both SOA and firm performance (Q/ROA) are influenced by cross sectional variation in the incentives of CEOs to voluntarily hold unconstrained equity. Deficient Delta = Delta Gap when Delta Gap > 0 (i.e., $Target_{t-1}$ > Actual $Delta_{t-1}$), and equals zero otherwise. Excess Delta equals Delta Gap when Delta Gap < 0 (i.e., $Target_{t-1}$ < Actual $Delta_{t-1}$), and zero otherwise. Delta Gap = Target $Delta_{t-1}$ minus actual $Delta_{t-1}$, where Target $Delta_{t-1}$ is estimated in column (3) of Table 2 using information available at t-1. In panel A, we consider how cross sectional variation in the incentives of CEOs to voluntarily hold unconstrained equity affects the SOA; in Panel B (C) we consider how these incentives influence the relation between Deficient/Excess Delta Gap Tobin's Q (ROA). Controls are omitted for brevity and they are the same as those included in Table 3. The sample period covers 1992-2015. See the appendix for variable definition and measurement. The OLS regressions are estimated clustered by firm. Standard errors are bootstrapped to account for generated regressors.

Panel A: Speed of Adjustment Cross Sectional Variation in Voluntary Equity Holdings

Dependent Variable =	Change of $Delta_t$					
	(1)		(2)		(3)	
	estimate	t-value	estimate	t-value	estimate	t-value
Intercept	-0.085	-6.61	-0.034	-2.14	0.007	0.46
Deficient $Delta_{t-1}$ (β_1)	0.529	14.80	0.493	12.52	0.611	12.76
Excess $Delta_{t-1}$ (β_2)	0.558	13.36	0.497	9.55	0.260	6.51
Deficient $Delta_{t-1}$ * DV	0.148	2.48	0.149	2.72	-0.080	-1.00
Excess $Delta_{t-1}$ * DV	-0.195	-2.26	-0.195	-2.95	0.058	0.97
DV	-0.008	-0.32	-0.045	-2.16	0.058	2.62
	Signaling		Overconfidence		Informed Trade	
Voluntary holding determinant variable (DV)	Positive Stock Repurchase		High Investment-to-Cash-Flow Sensitivity		High Excess Return	
p-value for testing $\beta_1 = \beta_2$	0.4748		0.9414		0.0001	
R^2	0.1127		0.0973		0.1564	
N	16,346		16,950		13,623	

Panel B: Tobin's Q: Cross Sectional Variation in Voluntary Equity Holdings

Dependent Variable =	Tobin's Q_t					
	(1)		(2)		(3)	
	estimate	t-value	estimate	t-value	estimate	t-value
Intercept	0.980	3.58	0.849	3.62	1.176	3.90
Deficient Delta $_{t-1}$	-0.031	-2.05	-0.044	-2.32	-0.044	-2.01
Excess Delta $_{t-1}$	0.106	2.44	0.085	2.31	0.199	4.80
Deficient Delta $_{t-1}$ * DV	0.048	2.52	0.053	2.36	-0.020	-0.80
Excess Delta $_{t-1}$ * DV	0.122	2.40	0.103	2.08	-0.062	-1.50
Controls	Yes		Yes		Yes	
ACG Determinant Variable (DV)	Signaling		Overconfidence		Informed Trade	
	Positive Stock Repurchase		High Investment-to-Cash-Flow Sensitivity		High Excess Return	
p-value for testing $\beta_1 = -\beta_3$	0.102		0.553		0.002	
R^2	0.6100		0.6226		0.6022	
N	15,736		18,122		12,131	

Panel C: ROA: Cross Sectional Variation in Voluntary Equity Holdings

Dependent Variable =	ROA					
	(1)		(2)		(3)	
	estimate	t-value	estimate	t-value	estimate	t-value
Intercept	-0.127	-4.91	-0.129	-5.60	-0.161	-6.07
Deficient Delta $_{t-1}$	-0.017	-6.85	-0.010	-3.98	-0.006	-2.80
Excess Delta $_{t-1}$	0.005	2.03	0.006	2.27	0.007	2.78
Deficient Delta $_{t-1}$ * DV	0.019	6.43	0.012	4.60	0.003	1.04
Excess Delta $_{t-1}$ * DV	0.008	1.98	0.007	2.14	-0.003	-1.05
Controls	Yes		Yes		Yes	
ACG Determinant Variable (DV)	Signaling		Overconfidence		Informed Trade	
	Positive Stock Repurchase		High Investment-to-Cash-Flow Sensitivity		High Excess Return	
p-value for testing $\beta_1 = -\beta_3$	0.152		0.106		0.054	
R^2	0.3704		0.3536		0.3730	
N	15,736		18,122		12,131	