

CEO Compensation and the Threat of Institutional Investors

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Abstract

The role of institutional investors is theoretically ambiguous in two ways. On one hand, the more concentrated their ownership, the more likely they exercise direct intervention in the governance of a firm. On the other hand, when their ownership is dispersed, multiple institutional investors may compete with each other by trading on the common signal they observe to exploit trading profits. In effect, they abide by the “Wall Street rule.” Either way, managerial behaviour could be disciplined. In this paper we investigate how these two seemingly competing forces discipline management by examining the impact of both institutional investors’ concentration and “churning” on executive compensation structure (measured by pay-for-performance sensitivity, PPS) and pay levels in the United States. We provide a theoretical framework and show that the more intense the informed institution churns the lower the PPS. This result is confirmed by our empirical test. Our paper not only tackles the differential monitoring mechanism (“voice” vs. “Threat of exit”) driven by the institutions but also helps shed light on the association between stock price informativeness and managers’ compensation.

1. Introduction

Traditional theories argue that concentrated ownership helps alleviate the agency problems embedded in the manager-shareholder relationship in a firm, because only large shareholders have incentives to monitor the manager through direct intervention, or “voice”, as termed by Hirshman (1970). For example, Shleifer and Vishny (1986), Admati, Pfleider and Zechner (1994), Maug (1998), Kahn and Winton (1998), and Mello and Repullo (2004) all explain the improvement in corporate governance from large shareholder activism.

However, the assumption that a firm is owned by one large, controlling shareholder, along with many other small shareholders is in stark contrast with what we observe from U.S. data. By defining a blockholder as a shareholder with at least 5% of the firm’s equity, we find from 1992 to 2007, on average, 79% of firms in the ExecComp¹ universe have multiple (i.e. at least two) blockholders as shown in Table 1. Notably, the proportion of firms having only one large blockholder decreases consistently from 32% in 1992 to 19% in 2007.² As shown in Figure 1, what has been increasing is the proportion of firms with multiple blockholders over the same period of time. This finding is also shared with Dlugosz et al. (2006) using U.S. data from 2001 to 2006. A free-rider problem seems unavoidable under such setting of multiple blockholders as each individual blockholder and small investor now has insufficient incentives to bear the cost of monitoring or coordinate to share the cost. In other words, splitting a block reduces the effectiveness of exerting “voice” in governance. Recent research shows the possibility of an alternative channel through which multiple blockholders may still exert effective governance despite the power of using “voice” is reduced. By following the “Wall Street Rule”, or “taking the Wall Street walk”, blockholders can pose a credible threat to the manager *ex ante* since they can punish the manager’s “value-decreasing” decisions *ex post* by selling down their shareholdings. The sell-off drives down the stock price, reducing the manager’s equity-based pay. This alternative monitoring mechanism has been confirmed in many empirical works. For example, Parrino, Sias and Starks (2003) show that some institutional investors engage in the biggest sell-off in a firm four quarters immediately before the CEO is fired. With a different focus but in a similar vein, Chen, Hart and Li (2007) show that

¹ We only examine institutional investor’s, rather than the individual holdings here.

² Also interestingly, the proportion of firms with no blockholder (i.e. the ownership structure is extremely diffused) also decreases from 35% in 1992 to 8% in 2007.

some institutional investors will sell their stakes in a firm when they anticipate a large enough value reduction. Sias, Starks and Titman (2006) provide evidence that institutional investors possess information that impacts permanently on prices. Gopalan (2008) evidences that institutional selling is a predictor of subsequent poor performance and firm takeover. In a survey conducted by McCahery, Saunter and Starks (2009), they find that 80% of responding institutional investors are willing to use “exit” by selling their holdings as a governance mechanism. Yan and Zhang (2008) find that short-term trading by institutional investors forecast future returns. Gallagher, Gardner and Swan (2009) document that “stock churning” by informed traders indeed improves the subsequent performance of a firm and is profitable even after costs with the use of Australian data. Hartzell and Starks (2003) and Almazan, Hartzell and Starks (2005) find a positive relationship between institutional ownership and sensitivity of manager’s equity-based pay. On the link between informed trading and the managerial incentives, Smith and Swan (2008) find that smaller holdings of active traders—hence short-term investors for whom the “threat of exit” is highest—are associated with an increase in CEO incentives. Ferreira, Laux and Markarian (2009) show sensitivity of manager’s equity-based pay is decreasing in institutional trading.

On the front of theory development, Holmstrom and Tirole (1993) can be viewed as one of the first paper that deals with the link between stock prices and managerial efforts. Calcagno and Heider (2008) extend the Holmstrom and Tirole model by arguing the information impounded in stock prices tend to be garbled up by noise trading and suggest that stock prices become less informative about managerial performance. CEO’s equity-based incentives weaken, leading to a lower level of managerial effort and worse firm performance. Both Admati and Pfleiderer (2009) and Edmans (2009) focus on a single blockholder that exert “exit” Whereas Noe (2002) and Edmans and Manso (2009) (EM, henceforth) both consider the setting of multiple blockholders who can intervene (“voice”) as well as trade (“exit”). The former, however, does not consider the common informational signal observed by all blockholders which forms the cornerstone of our approach.

In the EM’s model, the higher the number of blockholders, the greater the trading volume, accordingly more information is impounded into prices. Greater stock informativeness means that the stock price serves as a more precise signal to reflect the firm’s fundamental value, which is actually the output of the manager’s effort. In

other words, blockholders' self-interested trading now works as a commitment device to the manager because it rewards (punishes) the manager who owns stock (or stock equivalent incentives) in the firm *ex post* if she makes value-enhancing (decreasing) decisions *ex ante*. Seeing that, the manager would exert more efforts to increase the firm value *ex ante*. Therefore, higher number of blockholders should lead to an increase in the sensitivity of the manager's equity-based pay, an increase in managerial effort, and the rise of the firm's value.

In this paper we propose a model of multiple blockholders based on EM but differs from theirs in two aspects. First, instead of modeling a risk-neutral manager, we introduce a risk-averse manager in our setting. Second, we endogenize the manager's equity-based pay as well as non-equity-based pay, rather than treating them as exogenous. Our richer contracting environment provides a number of new insights. Although as in EM, the manager's optimal effort is still jointly determined by the number of informed investors and the manager's equity-based pay, now the latter is affected by the manager's degree of risk aversion. Moreover, the non-equity pay is also affected by the manager's degree of risk aversion in our setting. Consequently, as stock price sensitivity increases due to aggressive trading by informed investors, the sensitivity of the manager's equity-based compensation to the firm's value actually falls because the manager becomes more risk averse. Nonetheless, managerial efforts still increase so that firm value rises. Because the increasing stock informativeness due to more intense informed trading also contributes to optimal managerial contracting. The manager's effort would increase as a result of higher pay.

Our model hence predicts that the higher number of informed investors, the more aggressive they trade, and the higher the volatility of stock price to a risk averse manager, and the lower the sensitivity of her equity-based pay to the firm's value. The manager's non-equity-based incentives (e.g. bonus pay), however, rises as a result of more aggressive informed trading because more information is impounded in the stock price. In the light of this theory, we construct two hypotheses. The first hypothesis (H1) is that the higher the trade aggressiveness induced by informed traders, the *lower* the manager's equity-based compensation; our second hypothesis (H2) is the higher the trade aggressiveness induced by informed traders, the *higher* the manager's bonus pay awarded by the firm.

We follow Gallagher, Gardner and Swan (2009) (GGS henceforth) and define an institutional investor engaging in the particular "Buy-Sell-Buy" or "Sell-Buy-Sell"

trade sequence in a year as an informed trader since these two sequences are the most likely ones among all the other sequences to pose a “threat” to the manager. We do find that the more aggressively our defined informed traders trade the lower the equity-based compensation, but the higher the manager’s bonus pay. Therefore our two hypotheses have been confirmed.

The organization of the paper is as follows. Section 2 presents the theoretical framework that forms the basis of our testable hypotheses. Section 3 discusses our data source and the construction of several institutional investor- and manager-related variables. Section 4 provides the rationale of using the “buy-sell-buy” and “sell-buy-sell” trade sequence as the proxy for “threat of exit”. We present our empirical tests in Section 5. In Section 6 we conclude.

2. Optimal Contracting With Informed Traders

Our model is a modified and extended version of EM, who consider the trading behavior of a group of multiple informed investors receiving a signal concerning the firm’s future fundamental value that is more reflected in the contemporaneous stock price the larger the number of informed traders. As in EM’s model, we view a blockholder simply as a shareholder who has greater information than the market and does not require her to hold a certain proportion (e.g. 5%) of a firm; we refer to blockholders as simply informed investors or traders in our model. Note that EM take the risk-neutral manager to receive a fixed proportion of the firm’s shares only, with no fixed or non-share-price based compensation. This is because for their main predictions they can safely dispense with the compensation contract as we show. We introduce an optimal managerial contract for a risk-averse manager who is rewarded for stock price performance. In the first stage the manager takes actions $a \in [0, \infty]$ that affect firm value, \tilde{v} :

$$\tilde{v} = \mu + \tilde{\eta}. \quad (1)$$

Nature determines a value v for the firm’s equity from a normally distributed value \tilde{v} with mean $\mu \equiv \phi_a a + \phi_b \log \sum_i b_i$ and variance, $\sigma_{\tilde{\eta}}^2$.³ The signal of managerial effort is garbled by the random shocks, $\tilde{\eta}$, which also raise the risk borne by the risk averse

³ Note that in the EM formulation, firm value depends on the log of effort rather than its level.

manager. Hence, it is desirable to eliminate the impacts of these shocks from a contracting perspective. Additionally, there are N symmetric informed traders (speculators) who only observe an imperfect signal, s , of the firm's future value, $\tilde{s} = \tilde{v} + \tilde{\varepsilon}$, where $\varepsilon \sim N(0, \sigma_\varepsilon^2)$. There is also a non-price signal, $y = \tilde{v} + \tilde{\theta}$, where $\theta \sim N(0, \sigma_\theta^2)$. The mean μ depends on unobservable effort taken by the firm manager ($\phi_a a$, *i.e.*, costly effort a , scaled by productivity, ϕ_a), and public actions taken by N symmetric investors ($\phi_b \log \sum_i b_i$, *i.e.*, investor i 's costly effort in the form of intervention or voice, $\log b_i$, scaled by investor productivity, ϕ_b) in the first (*action*) period.

The manager's total income, I , consists of a fixed salary, α_0 , an equity share, α_p , with the reward based on the stock price, p , and a bonus rate, α_y , based on a non-price performance measure, y , consisting of the (e.g., accounting) value of the asset measured net of the other aspects of CEO pay at the time the CEO leaves the company:

$$I = \alpha_0 + \alpha_p p + \alpha_y y, \quad (2)$$

where $\alpha_y y = \alpha E[v - \alpha_0 - \alpha_p p | y, p]$. The manager is paid an amount in cash, $\alpha_0 + \alpha_p p$, plus an amount $\alpha E[v - \alpha_0 - \alpha_p p | y, p]$ in shares when he leaves the firm.

The risk averse manager's CARA utility function depends on the manager's income less cost of effort, $U_m(a) = -\exp\left[-\rho_m \left(I - \frac{1}{2}a^2\right)\right]$, where ρ_m is the manager's coefficient of constant absolute risk aversion and $\frac{1}{2}a^2$ is the manager's quadratic cost of effort function.

Risk-neutral owners choose the parameters of the manager's incentive contract so as to maximize the expected value of the firm net of the manager's income:

$$\max_{\alpha_0, \alpha_p} E(\tilde{v} - I). \quad (3)$$

This is maximized subject to the incentive compatibility constraint such that the manager's expected utility is maximized:

$$a = \arg \max_a E \left\{ -\exp \left[-\rho_m \left(I - \frac{1}{2}a^2 \right) \right] \right\}, \quad (4)$$

where the superscripted * indicates the optimal value. In turn, this is equivalent to the manager's certainty equivalent wealth:

$$a = \arg \max_a E(I) - \frac{\rho_m}{2} \text{Var}(I) - \frac{1}{2} a^{*2}, \quad (5)$$

where $\text{Var}(I)$ denotes the variance of managerial income, and subject to the manager's participation constraint:

$$E(I) - \frac{\rho_m}{2} \text{Var}(I) - \frac{1}{2} a^2 \geq \bar{I}. \quad (6)$$

Outside opportunities are reflected in reservation income, \bar{I} .

There are N symmetric risk-neutral blockholders each with holdings of $\frac{\psi}{N}$ shares in the firm and with each submitting a market order, $x_i(\tilde{s})$, after observing a noisy signal of the true (common) value of the firm, v . Uninformed risk-neutral (noise) traders submit market orders \tilde{u} with mean zero and variance, σ_u^2 . We normalize the price and incentive contract to place it on a gross (i.e., pre-management compensation) basis.⁴ The observed price, p , measured net of cash outlays on the manager is related to the gross price, \hat{p} , by $p = \hat{p} - (\alpha_0 + \alpha_p p)$. This normalization procedure results in the definition of the gross (normalized) share price as $\hat{p} = \alpha_0 + (1 + \alpha_p) p$ and normalized manager income as $I = \hat{\alpha}_0 + \hat{\alpha}_y y + \hat{\alpha}_p \hat{p}$, where the superscripted coefficients specify the same income as in equation (2) above. The first-order condition for maximum manager utility, a^* , yields:

$$a^* = \phi_a \left[\hat{\alpha}_p E \left(\frac{d\hat{p}}{dv} \right) + \hat{\alpha}_y \right]. \quad (7)$$

We follow EM and Calcagno and Heider (Appendix A, 2008) for our analysis of trading demands. The normalized market-clearing price, $\hat{p}(\tilde{z})$, is set by the

⁴ In the context of slightly different models, both Holmstrom and Tirole (1993) and Calcagno and Heider (2008) recognize the need to normalize by grossing up. Our specification is more in the spirit of Kyle (2005, 2009) in that noise trader volatility does not affect price volatility and in Appendix A of Calcagno and Heider (2008) but with multiple traders each in receipt of the same partially observed informed signal. In Calcagno and Heider (2008) each partially informed speculator sees part of the puzzle with each one a separate part. Collectively, if all their information was combined, they would face no uncertainty.

competitive market maker who observes only the total order flow, $\tilde{z} = \sum_i \tilde{x}_i + \tilde{u}$, made up of the informed trader demands and normally distributed noise trades, \tilde{u} . As in Kyle (1985, 1989), the i th of N informed trader adopts a linear strategy:

$$x_i = \alpha_i + \gamma_i s_i. \quad (8)$$

The order flow is

$$z = x_i + \sum_{j \neq i} x_j + u = \alpha_i + \gamma_i (\mu + \eta + \varepsilon) + \sum_{j \neq i} x_j + u, \quad (9)$$

with the market maker setting price according to:

$$\hat{p} = E[v|z]. \quad (10)$$

The conditional expectation is

$$\hat{p} = \alpha_0 + (1 + \alpha_p) p = \left(1 - \sum_{i \in N} \lambda \gamma_i\right) \mu^* + \lambda \left(x_i + \sum_{j \neq i} x_j + u - \alpha_i - \sum_{j \neq i} \alpha_j\right), \quad (11)$$

where μ^* represents the equilibrium performance level of the firm. The expected firm value conditional on the signal s is:

$$E[v|s] = \frac{\sigma_\eta^2 s + \sigma_\varepsilon^2 \mu^*}{\sigma_\eta^2 + \sigma_\varepsilon^2}. \quad (12)$$

The i th informed trader's profit is

$$x_i \left(\frac{\sigma_\eta^2 s + \sigma_\varepsilon^2 \mu^*}{\sigma_\eta^2 + \sigma_\varepsilon^2} - (1 - \lambda \gamma) \mu^* - \lambda \sum_{j \neq i} (x_j - \alpha_j) \right) x_i - \lambda (x_i - \alpha_i) x_i, \quad (13)$$

and the first-order condition yields:

$$x_i(s) = \frac{1}{2\lambda} \left(\frac{\sigma_\eta^2 s + \sigma_\varepsilon^2 \mu^*}{\sigma_\eta^2 + \sigma_\varepsilon^2} - (1 - \lambda \gamma) \mu^* - \lambda \sum_{j \neq i} [x_j(s) - \alpha_j] + \lambda \alpha_i \right). \quad (14)$$

Since informed traders are symmetric, we have:

$$x_i(s) = \frac{1}{(N+1)\lambda} \left(\frac{\sigma_\eta^2 s + \sigma_\varepsilon^2 \mu^*}{\sigma_\eta^2 + \sigma_\varepsilon^2} - (1 - \lambda \gamma) \mu^* + \alpha N \lambda \right) \quad (15)$$

The coefficient of s in equation (8) is given by:

$$\gamma = \frac{\sigma_\eta^2}{\sigma_\eta^2 + \sigma_\varepsilon^2} \frac{1}{N+1} \frac{1}{\lambda}. \quad (16)$$

Also,

$$\alpha = -\gamma\mu^*. \quad (17)$$

Since

$$\lambda = \frac{\sqrt{N}}{N+1} \frac{\sigma_\eta^2}{\sigma_u} \frac{1}{\sqrt{(\sigma_\eta^2 + \sigma_\varepsilon^2)}}, \quad (18)$$

we have:

$$\gamma = \frac{1}{\sqrt{N}} \frac{\sigma_u}{\sqrt{\sigma_\eta^2 + \sigma_\varepsilon^2}}, \quad (19)$$

where γ can be interpreted as the trade aggressiveness parameter for an individual informed trader. The collective trading parameter taken over all informed traders is:

$$N\gamma = \sqrt{N} \frac{\sigma_u}{\sqrt{\sigma_\eta^2 + \sigma_\varepsilon^2}}. \quad (20)$$

The summed informed trader profit is $\lambda\sigma_u^2$.

Simplifying equation (11) by substituting for γ and λ in the parameter values yields:

$$\hat{p} = \left(1 - \frac{N}{N+1} \frac{\sigma_\eta^2}{\sigma_\eta^2 + \sigma_\varepsilon^2}\right) \mu^* + \frac{N}{N+1} \frac{\sigma_\eta^2}{\sigma_\eta^2 + \sigma_\varepsilon^2} (\mu + \tilde{\eta}) + \lambda\tilde{u}. \quad (21)$$

EM define a more informative stock price as the proportion of the variance of the asset value that is incorporated in the price:

$$\frac{Var(v) - Var(v|\hat{p})}{Var(v)} = Corr(v, \hat{p})^2 = E\left[\frac{d\hat{p}}{dv}\right] = \frac{N}{N+1} \frac{\sigma_\eta^2}{\sigma_\eta^2 + \sigma_\varepsilon^2} \equiv \beta \quad (22)$$

with $N\gamma\lambda = \frac{\sigma_\eta^2}{\sigma_\eta^2 + \sigma_\varepsilon^2} \frac{N}{N+1} = \beta$ and $Var(\hat{p}) = \sigma_\eta^2\beta$. Hence the normalized stock price

can be expressed simply as

$$\hat{p} = (1 - \beta)\mu^* + \beta(\mu + \tilde{\eta}) + \lambda\tilde{u}, \quad (23)$$

and the aggregate informed order flow:

$$Nx = N\gamma(\eta + \varepsilon). \quad (24)$$

Informativeness captures the degree to which the future, that is, the fundamental, value is incorporated in the contemporaneous stock price. This is increasing in the

number of informed traders at the rate, $\frac{dE\left[\frac{d\hat{p}}{dv}\right]}{dN} = \frac{d\beta}{dN} = \beta \frac{1}{N(N+1)} > 0$. Calcagno

and Heider (2008) adopt a different measure of price informativeness that reflects the inverse of the volatility in future value conditional on the observed price. This is

given by $Var[v|\hat{p}]^{-1} = \frac{1}{\sigma_\eta^2(1-\beta)}$. Under both definitions, informativeness is

increasing in the number of informed traders and in the precision of their observation of the informed signal (i.e., lower σ_ε^2) but for Calcagno and Heider (2008) it is also diminishing in the informational advantage of informed traders, σ_η^2 . Note that due to our generalized Kyle structure, the volatility of noise trading does not enter into either definition, or into the volatility of price itself. In the Kyle framework, informed trading adjusts to the rate of noise trading, hence removing noise trading as a source of price volatility.

The transformed components of the incentive contract in gross form can be expressed in terms of the net or observable elements as $\hat{\alpha}_0 = (1 - \alpha_y) \frac{1}{1 + \alpha_p} \alpha_0$,

$\hat{\alpha}_y = \alpha_y$, and $\hat{\alpha}_{\hat{p}} = (1 - \alpha_y) \frac{\alpha_p}{1 + \alpha_p}$, with optimal effort, $a^* = \phi_a(\beta \hat{\alpha}_{\hat{p}} + \hat{\alpha}_y)$, on

substituting the relevant values into equation (7). Optimal effort is thus dependent on the normalized equity share allocated to the firm manager and the bonus proportion. It is also increasing in price informativeness for a given managerial share allocation, as was noted by EM.

The firm's (inside shareholder's) problem is to maximize expected cash flows net of payments and share transfers to management, and subject to the manager's participation constraint given by equation (6), by the appropriate choice of the share allocation, $\hat{\alpha}_p$, and bonus proportion, $\hat{\alpha}_y$:

$$\begin{aligned} & \max_{\hat{\alpha}_p, \hat{\alpha}_y} E(\tilde{v} - I) \\ & \text{s.t. } E(I) = \frac{1}{2} [\phi_a (\beta \hat{\alpha}_p + \hat{\alpha}_y)]^2 + \frac{\rho_m}{2} \text{Var}(I) + \bar{I} \end{aligned} \quad (25)$$

On simplifying by eliminating $E(I)$ using the participation constraint, the objective becomes:

$$\max_{\hat{\alpha}_p, \hat{\alpha}_y} \left\{ \begin{aligned} & (\phi_a)^2 (\beta \hat{\alpha}_p + \hat{\alpha}_y) + \phi_b \log \sum_i b_i - \frac{1}{2} [\phi_a (\beta \hat{\alpha}_p + \hat{\alpha}_y)]^2 \\ & - \frac{\rho_m}{2} [(\hat{\alpha}_p)^2 \beta \sigma_\eta^2 + (\hat{\alpha}_y)^2 (\sigma_\eta^2 + \sigma_\theta^2)] - \bar{I} \end{aligned} \right\} \quad (26)$$

since $E(\tilde{v}) = (\phi_a)^2 \beta \hat{\alpha}_p + \phi_b \log \sum_i b_i$. Hence we have:

Proposition 1: *The manager's optimal incentive share allocation is diminishing in his degree of risk aversion, ρ_m , and also in the degree of price informativeness, β , since a larger number of informed traders raises stock price volatility. The share allocation is also diminishing in the variance of the informative signal, σ_η^2 , as higher stock price volatility due to information increases the manager's risk burden.*

The optimal solution to the inside shareholder's allocational problem with respect to the manager's share allocation is:

$$\hat{\alpha}_p^* = \left[\frac{\beta}{(1 - \hat{\alpha}_y)} + \frac{\sigma_\eta^2 \rho_m}{(\phi_a)^2 (1 - \hat{\alpha}_y)} \right]^{-1}. \quad (27)$$

Note that $(1 - \hat{\alpha}_y) > 0$ since $0 \leq \hat{\alpha}_y \leq 1$.

Proposition 2: *The manager's optimal incentive bonus proportion is increasing in the degree of price informativeness, β . It is also diminishing in the manager's degree of risk aversion, ρ_m , the variance of the informative signal, σ_η^2 , the accounting-based performance measurement errors, σ_θ^2 .*

The optimal solution to the inside shareholder's allocational problem with respect to the manager's bonus proportion is:

$$\hat{\alpha}_y^* = \frac{(\phi_a)^2(1 - \beta\hat{\alpha}_p)}{(\phi_a)^2 + \rho_m(\sigma_\eta^2 + \sigma_\theta^2)}. \quad (28)$$

Note that the product of $\beta\hat{\alpha}_p$ is negative as shown in equation (27). Hence the higher degree of price informativeness, the higher the bonus allocation.

Based on Proposition 1 and 2, in this paper we test the following two hypotheses:

H1: The higher the trade aggressiveness induced by informed traders (“threat of exit”) due to increasing number of informed traders, the *lower* the manager's equity-based compensation (by *Proposition 1*);

H2: The higher the trade aggressiveness induced by informed traders (“threat of exit”) due to increasing number of informed traders, the *higher* the manager's bonus pay awarded by the firm (by *Proposition 2*);

3. Data and descriptive statistics

We merge CRSP/Compustat database with Standard & Poor's (S&P) ExecComp database (from 1992 to 2007) to calculate CEO incentives. The institutional trading and shareholdings data are sourced from Thomson's institutional ownership database. All the firm-level accounting and stock price data are from Compustat and CRSP respectively.

3.1 CEO incentives data

The ExecComp database covers the 1500 firms in the S&P 1500, which consists of the 500 S&P 500, the 400 S&P MidCap, and the 600 S&P SmallCap index firms. The database also keeps the information of the firms that were removed from the index but are still trading; hence the total number of firms included in the database can be above 1500 in each year. ExecComp contains valuable compensation-related information for the top five (sometimes more) executives of each firm including total amounts of salary, bonus, long-term incentive plan, restricted stock grants and stock option grants. In our paper we focus only on the CEO because we expect CEO alone to have the greatest power in a firm's decision-making process and also to be the focus of institutional investors.

We calculate the pay-for-performance sensitivity of CEO option grants (*PPS_Cum_Option*) as per Yermack (1995). *PPS_Cum_Option* is used to measure the dollar change in value of CEO options for every \$1000 change in the value of the firm (shareholders value). PPS is computed by dividing the share equivalent of CEO option holdings by the total number of shares outstanding at the beginning of the fiscal year, whereas the share equivalent of CEO option holdings is the product of the delta (i.e. the hedge ratio, based on the Black-Scholes formula adjusted for dividends) and the number of option granted. When there is more than one option grant during the year we take the weighted average of delta. The dilution effects of option grants on share outstanding are also dealt with. In our analysis we multiply PPS of CEO option grants by 1000 to reflect the dollar change in CEO option grants for every \$1000 change in the firm value.

We measure the sensitivity of CEO shareholdings to the firm value (*PPS_CEO_Shares*) by using CEO common shareholdings (including restricted stock) scaled by the total number shares outstanding at the beginning of each fiscal year. We multiply this measure by 1000 to reflect the dollar change in CEO shareholdings for every \$1000 change in the firm value. We then combine *PPS_Cum_Option* and *PPS_CEO_Shares* to obtain an aggregate PPS measure: *PPS_Total*.

We also include CEO total compensation and other pay components (salary and bonus) in our sample. Total compensation is the total direct compensation data derived from ExecComp, defined as the sum of salary, bonus, total value of restricted stock granted, total (Black-Scholes) value of stock options granted, and long-term payouts.

3.2 Institutional trading and ownership measures

To identify the trading patterns of each institution and construct the institutional trading and ownership measures we rely on SEC 13-f filings compiled by Thomson/CDA Spectrum. Institutions with more than \$100 million of securities under management are required to report to the SEC. The reports contain the aggregate shareholdings for each institution on the quarterly basis.⁵ To make sure that all shares in the 13-f reports are adjusted for splits and special distributions we merge the 13-f reports with CRSP monthly stock file dataset and use FDATE (file date in Thomson

⁵ All positions greater than 10,000 shares or \$200,000 must be disclosed.

13-f dataset) and CRSP cumulative adjustment factors to make the adjustment. We also make the same adjustment for total shares outstanding sourced from CRSP. We make similar adjustment for price by using CRSP cumulative adjustment factors for price on the corresponding FDATE of Thomson dataset. As a final step to clean up the data we remove the stocks with total institutional investors' holdings greater than total shares outstanding. We then carry out all the following calculation based on RDATE (quarterly report date in the 13-f dataset).

3.2.1 Institutional ownership measures

For each stock we aggregate shares held across all institutions and divide it by total number of shares outstanding at the end of each quarter to construct the institutional ownership measure (*IO*). We also construct the *Top5_Shroul* measure by summing up the holdings of the five largest institutional investors for each firm and scale it by total number of shares outstanding at the end of each quarter.

3.2.2 Institutional trading pattern and turnover

We analyze all institutional trades in a year (four quarters). All yearly trades are split up into mutually exclusive trading patterns based on the sign of change in the quarterly holdings of a particular stock. A trading pattern hence represents how an institution investor has been trading a particular stock within a year. Since the report date of Thomson data for a year is fixed at every March, June, September and December, we take every December of the previous year as the starting point and calculate the quarterly change of shareholdings of an institutional investor for a particular stock for the next four quarters. We identify the following eight mutually exclusive trading patterns: (1) Buy-Sell-Buy (BSB), (2) Sell-Buy-Sell (SBS), (3) Sell-Buy (SB), (4) Buy-Sell (BS),⁶ (5) Hold-Hold-Hold (HHH), (6) Buy-Buy-Buy (BBB), (7) Sell-Sell-Sell (SSS), and finally (8) Others (one occurrence of either Sell or Buy in the sequence). We require an institutional investor to hold the stock for four consecutive quarters for her trade sequence to be valid.

As a stock can experience different trade sequences across institutional investors in any given year, for each stock we calculate a turnover ratio by each trading pattern identified in a year. The detail goes as follows: for each stock we firstly compute the

⁶ Pattern (3) also includes both Sell-Buy-Hold and Hold-Sell-Buy; pattern (4) also includes Buy-Sell-Hold and Hold-Buy-Sell.

annual trading volume of an institution investor by summing the absolute value of the quarterly change in holding within a year (i.e. four quarters). Then we aggregate the trading volume across all institutional investors engaging in a particular trading pattern, scaling it by total number of shares outstanding at the end of each September (Because we start with each December of the previous year, the ending quarter is September of each year). We repeat the same process for all the trading patterns and finally arrive at a dataset containing the turnover rate of each of the seven⁷ trading pattern for each stock, totalling 24,679 firm-years (covering 16 years from 1992 to 2007). We also construct a measure called *InstTrade* that represents the total institutional turnover by aggregating all the trading volume annually (regardless of the trading patterns) across all institutions, scaling it by its total number of shares outstanding.

3.2.3 Other control variables

We carefully conduct our analyses by controlling for variables pervasively used in the literature. *Ln_MktCap* is the natural log of market value of equity, measured as the product of the number of shares outstanding and share price, both of which are sourced from CRSP. The difference of MktCap between year t and year $t-1$, ΔMktCap , and the lagged value of ΔMktCap are included as per Hartzell and Starks (2003) to control for change in shareholder value. We also include *Debt_Ratio*, computed as the ratio of Total Liabilities to Total Assets, for debt has been widely viewed as an alternative monitoring mechanism in Principal-Agent theory and therefore is likely to have impact on CEO incentives. *Tobin_Q*, defined as the ratio of the market value of assets⁸ to the book value of total assets, is included as a popular proxy for the firm's growth opportunities in the literature. The above two firm-level controls are computed based upon Compustat dataset. We also include both the yearly buy-and-hold cumulative returns (*CumRet*) and standard deviation of market capitalization (*Dol_Volat*) because the former deals with the potential association between the firm's performance and CEO pay whereas the latter is highly related to the talent of CEO as per Sung and Swan (2009). Both of them are computed from CRSP. All the price level-related variables are CPI deflated (2006-07=100).

⁷ The trading pattern of "HHH" is excluded because there is no change in holdings, hence no turnover rate.

⁸ See Sung and Swan (2009) for more details on the calculation of market value of asset

In all of our analyses we also control for year and industry effects. Year dummy variables are used to allow both PPS and other CEO pay component to vary year by year. They also serve the purpose of controlling for exogenous factors that may influence PPS and other CEO pay component, such as the overall market condition. Industry dummy variables can be treated as fixed effects at the industry level.

As a final step to generate a unified dataset that merge CEO incentives-related data with institutional trading/ownership data and firm-level control variables, we avoid the potential overlapping issue due to the fact that ExceComp is fiscal-year-based annual dataset (same as Compustat) and Thomson 13-f reports are calendar-year-based quarterly dataset by selecting firms with fiscal year-end month in September, October, November, and December only.⁹ Our final unified dataset covers more than 77% of the firms in ExecComp from 1992 to 2007, totalling 17,946 firm-years. All the continuous variables are winsorized at the 1% and 99% levels to mitigate the effect of extreme observations.

In Table 2 we report descriptive statistics on all the variables of interest. In Panel A we can see that on average, PPS of CEO total equity-based compensation is about \$35 per \$1000 change in shareholder value. Around 67% of PPS of CEO total equity-based compensation can be attributed to CEO shareholdings (including restricted shares), and the remaining part to CEO option grants. The average CEO's total compensation is \$5.06 million (CPI deflated, 2006=100). Of this amount, salary averages \$760,000 and bonus \$784,000. All the CEO pay measures are right-skewed.

Panel B of Table 2 shows the average institutional ownership of the 13-f institutions is about 60% in the 1992-2007 year range, which is 7 percentage point higher than a decade ago reported in Hartzel and Starks (2003), using 1992-1997 data. The concentration of the top 5 institutions averages 24%, which is only slightly higher than a decade ago. The mean of total institutional turnover is about 23.5% with a standard deviation of 13% and the mean turnover of all the trading patterns is 3.5%, varying from 0.17% (the "Sell-Buy" pattern) to 11.7% (the "Others" pattern).

As can be seen from Panel C of Table 2, the average annual stock return (buy-and-hold) is 17.7% with a standard deviation of nearly 49%. The standard deviation of market capitalization averages \$2210 million. The debt ratio of all the firms in our

⁹ See Appendix I for further details.

sample is about one quarter and Tobin's Q is 1.8 on average. Finally, the mean (median) firm size is about \$7.4 billion (\$1.8 billion).

<<Insert Table 2>>

4. Threat of exist—“BSB” and “SBS” as churning trades

We follow GGS to identify institutional investors aiming to make trading profits rather than to extract private benefits from acquiring control of the firm or to gain from better governance of the firm. Of all the eight trading patterns, the sequence of a “Buy”, followed by a “Sell”, then a “Buy” (“BSB” sequence) or a “Sell”, followed by a “Buy”, then a “Sell” (“SBS” sequence) in a stock fits the characteristics of an institutional investor's “threat of exist” best. The justification given by GGS is briefly summarized here: the sequence of three consecutive “Buys” (“Sells”) may indicate strongly-held beliefs about the future prospect of the firm and thus the subsequent long-term outperformance (underperformance) but shows no “threat of exit”. The sequence of three consecutive “Holds” (“HHH”) in a year shows either there is no private information at all that may induce institutional investors to trade or the investors are simply holding the stock with long-term horizon. A “Buy-Sell” (including both “Hold-Buy-Sell” and “Buy-Sell-Hold”) sequence may indicate bad news. Similarly, a “Sell-Buy” (including both “Hold-Sell-Buy” and “Sell-Buy-Hold”) sequence may suggest good news. None of the above trading patterns poses an explicit and unambiguous “threat of exit” to the CEO.

By contrast, the sequence of “BSB” or “SBS” best captures the notion of “threat of exit” in the EM model because it involves large swings (defined as the distance from the peak to trough in the holdings) without indicating a pure favorable or unfavorable view of an institutional investor about the firm's future performance as in “BBB” or “SSS”. We call the trade sequence of BSB or SBS “churning”, as per GGS. Note that the major difference between our methodology and that of GGS is the latter is able to identify churning trade within a three-month time period using daily data in Australia; ours relies on the quarterly change in holdings to identify trade sequences within a year. Although it is true that the trade sequences we identify do not capture the short-term institutional trading between quarters, the argument provided above is still valid. For example, longing (shorting) a stock for three consecutive quarters can still

reasonably be viewed as a strong signal that the institutional investors believes the price of the firm will go up (down). Likewise, the churning sequence does encapsulate the potential “threatening” nature of some institutional investors among all the eight mutually exclusive trading patterns. Also importantly and from the firm’s perspective, the CEO may be more concerned about medium-long term impact of share price movement on her compensation package, rather than the extremely volatile daily effect.

Panel A of Table 3 shows that on average BSB-type (SBS-type) churning accounts for nearly 9% (8.5%) of total institutional trading volume per firm. Also in Panel B of Table 3, we find on average, about 7% of total institutional investors engaging in BSB and SBS trading pattern each per firm. Though their trades may offset as one trader (e.g. BSB) may very likely take the other side of trade against the other (e.g. SBS), a one-sided trade of 9% of the market (in terms of trading volume) should be considered substantial compared with other trading patterns (e.g. “Sell-Buy” only accounts for 1% of total institutional trading volume). The largest amount (about 50%) comes from “Others”, which registers actually no pattern at all. Similar observation can be made from the perspective of number of institutional investors as shown in Panel B.

<<Insert Table 3>>

5. Empirical results

5.1 Pay-for-performance sensitivity of CEO total equity-based compensation

In this section we test our first hypothesis:

H1: *The higher the trade aggressiveness induced by informed traders (“threat of exit”) due to increasing number of informed traders, the lower the manager’s equity-based compensation.*

As explained in Section 4, we believe the institutional investors engaging in BSB- (or SBS-) type trading patterns are likely to be the informed traders in model. Their trade aggressiveness are measured by “churning”, or the turnover rate of their trades within a year. The manager’s equity-based allocation is measured by sensitivity of CEO total equity-based compensation to the firm value (*PPS_Total*), which consists of two parts: PPS of CEO shareholdings and PPS of CEO option grants. In our

theoretical framework we do not distinguish one from the other, therefore in our first hypothesis we are interested in the relationship between informed investors' churning and *PPS_Total*.

To test H1 we estimate the following equation:

$$\begin{aligned}
 (PPS_Total)_{it} = & \beta_0 + \beta_1(Churning)_{it-1} + \beta_2(Top5_Shrout)_{it-1} \\
 & + \beta_3(CumRet)_{it-1} + \beta_4(Dol_Volat)_{it-1} + \beta_5 \ln(MktCap)_{it-1} \\
 & + \beta_6(\Delta MktCap)_{it} + \beta_7(\Delta MktCap)_{it-1} + \beta_8(Debt_Ratio)_{it-1} \\
 & + \beta_9(Tobin_Q)_{it-1} \\
 & + \varepsilon_{it},
 \end{aligned} \tag{29}$$

Since *PPS_Total* is censored from below (left-censored at 0), we employ Tobit analysis instead of OLS regression. Column (1) of Table 4 shows that *PPS_Total* is negatively associated with the turnover by institutional investors engaging in the BSB-type trading pattern at the 1% level even when we control for the ownership concentration of the five largest institutions, firm performance of past year, volatility of the market capitalization, size, change in size, debt ratio, Tobin's Q, and the industry and year dummy variables. This result implies that a one-standard-deviation increase in BSB-type churning is associated with a decrease in CEO total equity-based pay of \$1.42 per \$1000 change in firm value. This is a 4% (10.6%) drop for a CEO with *PPS_Total* equal to the sample mean of \$35.3 (\$13.4) per \$1000 change in firm value. Column (1) also reports the result of regressing *PPS_Total* on SBS-type churning along with other control variables. The increase in SBS-type churning also leads to lower *PPS_Total* although the impact is not as big as with BSB-type churning.¹⁰ We hence confirm our first hypothesis (H1) that the more intense the trade aggressiveness the lower the manager's equity-based compensation.

The concentration of the top five institutions can be viewed as a proxy for "voice". If "voice" exerts monitoring, we should expect to see a positive relationship between *Top5_Shrout* and *PPS_Total*. Our result shows it is not the case. Increasing concentration of the largest five institutions actually reduce sensitivity of CEO's total equity-based pay to shareholder value. Churning, however, reduces the sensitivity as CEO's degree of risk aversion rises. We therefore conclude that "threat of exit" indeed constitutes a monitoring mechanism.

¹⁰ We also examine the impact of other trading patterns and total institutional turnover on *PPS_Total*. Though most of the trading patterns are significantly negatively associated with *PPS_Total*, none of them exert as big impact as BSB-type churning.

<<Insert Table 4>>

To further examine which component of CEO equity-based pay is most affected by institutional investors' churning, we re-run the analysis but substitute PPS_Total in equation (30) with PPS of CEO shareholdings (PPS_CEO_Shares) and PPS of CEO option grants (PPS_Cum_Option). Column (2) of Table 4 shows a significant negative relationship between PPS_CEO_Shares and BSB-type churning. However, Column (3) shows the relationship between PPS_Cum_Option and BSB-type churning turns positive. As the impact of BSB-type churning on sensitivity of CEO's shareholdings is much greater than that on sensitivity of CEO's cumulative option grants in absolute terms, we conclude that the negative relationship between PPS_Total and BSB-type churning is mainly driven by the CEO's shareholdings. This is possible because the CEO's option holdings suffer no downside when the volatility of stock price soars due to intense trade aggressiveness, but the value of her share ownership will take a hit. Hence PPS_CEO_Shares is more adversely affected by CEO's heightened risk aversion as a result of increasing volatility in stock price than PPS_Cum_Option . The same result also applies when BSB-type churning is replaced by SBS-type churning, though the impact of the former, again, is bigger than that of the latter.

"Voice", as proxied by $Top5_Shrout$, increases sensitivity of CEO option grants now. But overall, when we examine the impact of "voice" on PPS of CEO total equity-pay, this channel of monitoring is not at work.

In our model we show aggregate trade aggressiveness is increasing in the number of N informed investors. Since PPS of CEO total equity-based pay (PPS_Total) decreases in aggregate trade aggressiveness, we expect that PPS_Total also decrease in the number of N informed investors. To test this conjecture, we estimate the following equation:

$$\begin{aligned}
 (PPS_Total)_{it} = & \beta_0 + \beta_1(\ln(\text{num_mgr}))_{it-1} + \beta_2(Top5_Shrout)_{it-1} \\
 & + \beta_3(CumRet)_{it-1} + \beta_4(Dol_Volat)_{it-1} + \beta_5\ln(MktCap)_{it-1} \\
 & + \beta_6(\Delta MktCap)_{it} + \beta_7(\Delta MktCap)_{it-1} + \beta_8(Debt_Ratio)_{it-1} \\
 & + \beta_9(Tobin_Q)_{it-1} \\
 & + \varepsilon_{it},
 \end{aligned} \tag{30}$$

The only difference between equation (29) and (30) is we replace churning with the natural log of the number of institutional investors engaging in either BSB- or SBS-type churning. Table 5 reports the Tobit regression result. In Column (1) of Table 5 we find higher number of institutional investors engaging in BSB-type churning indeed leads to lower *PPS_Total*. Similar result is also found when we examine those who engage in SBS-type churning.

For completeness, we also use *PPS_CEO_Shares* and *PPS_Cum_Option* as dependent variables and the results, as shown in Column (2) and (3) of Table 5, are similar to those found in Table 4. Namely, higher number of institutional investors engaging in churning leads to lower *PPS_CEO_Shares* but higher *PPS_Cum_Option*. Therefore, we conclude that the overall CEO share allocation is indeed decreasing in the number of institutional investors engaging in churning, and the consequent aggregate trade aggressiveness. The result on “voice” is the same as shown in Table 4.

<<Insert Table 5>>

5.2 Trading Aggressiveness and CEO’s Total Compensation Components

The second hypothesis we test involves the bonus pay component of CEO’s total compensation:

H2: *The higher the trade aggressiveness induced by informed traders (“threat of exit”) due to increasing number of informed traders, the higher the manager’s bonus pay awarded by the firm.*

The equation that we examine is:

$$\begin{aligned}
 (\text{Bonus})_{it} = & \beta_0 + \beta_1(\text{Churning})_{it-1} + \beta_2(\text{Top5_Shrout})_{it-1} + \beta_3(\text{CumRet})_{it-1} \\
 & + \beta_4(\text{Dol_Volat})_{it-1} + \beta_5 \ln(\text{MktCap})_{it-1} + \beta_6 (\Delta \text{MktCap})_{it} \\
 & + \beta_7 (\Delta \text{MktCap})_{it-1} + \beta_8 (\text{Debt_Ratio})_{it-1} + \beta_9 (\text{Tobin_Q})_{it-1} \\
 & + \varepsilon_{it},
 \end{aligned} \tag{31}$$

where the dependent variable now is CEO’s *Bonus*, rather than the *PPS_Total* as in equation (29). Column (3) of Table 6 presents the results. We find more intense the BSB-type churning leads to significantly higher CEO bonus pay in our sample. A one-standard-deviation increase in BSB-type churning is associated with an increase in *Bonus* of \$23.8, which is about a 3% (6%) rise for a CEO with the mean (median) bonus pay of \$783.9 (\$386.8). Note that the figures of bonus pay are in thousands and

at 2006 price level. We do not find, however, a significant positive relationship between *Bonus* and SBS-type churning. Hence we again confirm our second hypothesis that CEO's bonus pay is increasing in the aggregate trade aggressiveness of informed traders (BSB-type churning in our empirical test).

<<Insert Table 6>>

In addition to CEO's bonus pay, we are also interested in other components of CEO's total pay and naturally, the total pay itself. In Column (2) and (4) of Table 6 we report the results of using CEO's salary and CEO's incentive pay (defined as subtracting the bonus and salary components from the CEO's total compensation) in equation (31) respectively. We find neither of our churning measures has any significant impact on *Salary*, but both churning measures exert significant impact on CEO's incentive pay. The positive relationship between churning and *IncentivePay* is not surprising as the latter comprises mainly CEO's option grants, restricted shares, and other long-term incentive payout, the result is generally consistent with the regression of *PPS_cum_option* on churning in Column (3) of Table 4.

To complete the analysis of this section, we regress CEO total compensation on our churning measures. As can be seen from Column (1) of Table 6 CEO's total pay increases in the trade aggressiveness (for both BSB- and SBS-type churning). A one-standard-deviation increase in BSB-type churning is associated with an increase in CEO's total pay of \$303.5, or a 6% (11%) rise for a CEO with the average (median) total pay of \$5055.8 (\$2671) per year. Note that the figures are in thousands and at 2006 price level. The result implies that despite the outcome of lower equity-based incentives for the CEO, the informed traders' trading aggressiveness, serving as a monitoring mechanism of "threat of exit", would induce higher level of the CEO efforts since now the CEO will be rewarded for her efforts by higher total pay. The price becomes a better signal to the firm owner because more information is impounded in the price as a result of informed traders' aggressive trading. The implication is in line with EM model and also our setting in equation (7). We also find the more concentrated the top 5 institutional are, the higher level the total pay and its components become. Although "voice" reduces sensitivity of CEO's equity-pay, it is found to be critical in determining the level of CEO's pay package.

5.3 Robustness check

5.3.1 First-difference approach

We implement the first-difference method by assuming the existence of some time-invariant firm-specific variables for each firm (e.g. some CEOs are exceptionally talented and their talent are persistent). Since the firm-specific characteristic is generally unobserved, by first differencing the equation for a specific firm across the sample period we also remove the time-invariant variables from the model. In other words, first-difference model enables us to consider the all the (time-invariant) individual variables across the firms without having to estimate them. The equation we estimate is hence:

$$\begin{aligned} (\Delta PPS_Total)_{it} &= \delta_t + \beta_1(\Delta Turnover)_{it} + \beta_2(\Delta Top5_Shrout)_{it} + \beta_3(\Delta CumRet)_{it} \\ &+ \beta_4(\Delta Dol_Volat)_{it} + \beta_6(\Delta MktCap)_{it} + \beta_7(\Delta MktCap)_{it-1} \\ &+ \beta_8(\Delta Debt_Ratio)_{it} + \beta_9(\Delta Tobin_Q)_{it} \\ &+ \Delta \varepsilon_{it}, \end{aligned} \tag{32}$$

where δ_t is the time dummy. Because we also take first difference of time dummy variables and we still keep the constant term in the model, we use $t-2$ time dummy variables.

In order to show that the significance of either the BSB-type or SBS-type churning is not accidental, we also consider all the other five trading patterns we identify in Section 3, specified as *Turnover*, along with the total institutional turnover, specified as *InstTrade*, in our regression model (32). Table 7 to Table 9 present the results of first-difference regression using different *PPS* measures as our dependent variables.

Table 7 confirms our conclusion from Section 5.1 that the more aggressive the BSB-type churning gets, the less sensitive the CEO total equity-based pay becomes. Although the size of impact is reduced compared with the result in Column (1) of Table 4 since we are now adopting a stricter estimation approach, the coefficient is nonetheless significant at 1%. As can be seen from Column (2) to Column (7) of Table 7, all the other trading patterns, including SBS-type churning, have no impact on *PPS_Total*, except the “Others” trading pattern. Column (8) shows that total institutional turnover also exerts negative impact on *PPS_Total*. However, the impact of both the Others-type trading pattern and institutional turnover is smaller in size

compared with that of BSB-type churning. It is also worth noting that *Top5_Shroul* has no impact in this more strenuous regression result.

<<Insert Table 7>>

The result of Table 8 and Table 9 further confirms out hypothesis that aggressive trading leads to lower sensitivity of CEO equity-based compensation by examining the related pay components. Column (1) of Table 8 shows again the negative relationship between *PPS_CEO_Shares* and BSB-type churning as in Column (2) of Table 4. Such relationship is not observed for other trading patterns except the Others-type. Total institutional turnover is negatively significant as shown in Column (8) of Table 8. Similar to the result in Table 7, neither the Others-type turnover nor institutional turnover exerts impact on PPS of CEO shareholdings as big as BSB-type churning.

<<Insert Table 8>>

When the dependent variable is PPS of CEO option grants as shown in Table 9, none of the trading pattern has any impact this time except BSB-type churning. This suggests this particular “Buy-Sell-Buy” trading sequence indeed poses an explicit “threat of exit” to the CEO. Interestingly, our first-difference approach reverses the sign of relationship between *PPS_Cum_Option* and BSB-type churning as reported in Column (3) of Table 4. That is, the greater the “threat of exit” is, the lower the sensitivity of CEO option grants this time. The risk aversion of CEO now overwhelms the upside benefit the option grants may reap from higher volatility of price due to aggressive trading by informed investors (or those engage in Buy-Sell-Buy trading pattern).

<<Insert Table 9>>

5.3.2 The “swing” measures

So far we have been employing the aggregate turnover rate of institutional investors engaging in the BSB or SBS trade sequence as our churning or “threat of exit” proxy. To further examine the robustness of our results that BSB-type institutional investors are the most likely the informed traders, we develop an alternative proxy for “threat of

exit”. We calculate a “swing” measure as per GGS by computing the difference between the peak and trough in stock holdings induced by an institutional investor trading in the BSB or SBS sequence. We then aggregate this swing measure across all BSB- or SBS-type traders, scaling it by total number of shares outstanding. We re-estimate equation (32) by using first-difference approach but replace *Turnover* with our swing measures. The result is shown in Table 10.

Column (1) to Column (3) of Table 10 use different measures of PPS of CEO equity-based compensation as the dependant variables. The result is consistent with what we find from Table 7 to Table 9: the greater the BSB-type swing, the lower the sensitivity of CEO total equity-based compensation and its component. Most importantly, this result suggests institutional investors engaging in this Buy-Sell-Buy trading pattern are most likely the ones who know something about the firm other investors do not know. Their self-interested trading poses a “threat of exit” to the manager, serving as an alternative monitoring mechanism other than direct intervention (“voice”).

<<Insert Table 10>>

6. Conclusion

In this paper we provide a theoretical framework with multiple blockholders trading out of their own interests but serendipitously constituting a monitoring mechanism in disciplining CEO’s behavior. The higher the number of these informed investors is, the more information is impounded in the price. But this results in two impacts. First, higher volatility of stock price due to informed trading will increase the manager’s degree of risk aversion, reducing sensitivity of her equity-based pay to the firm’s value. Second, with higher stock informativeness, the manager is willing to put in more efforts as she will be optimally rewarded with higher pay.

Our empirical tests confirm the prediction from our model. Our model also suggests this alternative form of monitoring—“threat of exit”—can be a force for good in improving a firm’s operating performance, as documented by Gallagher, Gardner and Swan (2009), or even a firm’s governance. These related topics are on the authors’ research agenda.

APPENDIX

We calculate institutional turnover rate for each stock in a year (or four quarters) by using December of the previous year as the starting point and September as the ending point. Since only quarterly holdings data available in Thomson 13-f reports, an institution's holdings in December actually represent the holdings from October to December of the previous year. In other words, the turnover is computed based on all the information from October in year $t-1$ to September in year t . To ensure consistency, we calculate all CRSP-derived variables (e.g. the buy-and-hold cumulative returns) using the same time period.

The primary concern is 13-f reports and CRSP datasets are calendar-year based, while ExecComp and Compustat datasets are fiscal-year based. As variables generated from both type of databases are on the annual basis, if we naively merge variables generated from the former datasets with those from the latter by *YEAR* without considering different fiscal year-end months (*FYR* in *ExecComp* and *Compustat*) across firms, our ExecComp (or Compustat) variables will capture only a fraction of the contemporaneous effect in that year. The issue is more egregious when we estimate a regression model with a lead-lag relationship between the dependent and independent variables.¹¹

In order to minimize this problem without leaving out value information, we keep firms with year-end month (*FYR*) equal to September (i.e. fiscal year covering Oct/ $t-1$ to Sep/ t), October (i.e. fiscal year covering Nov/ $t-1$ to Oct/ t), November (i.e. fiscal year covering Dec/ $t-1$ to Nov/ t), and December (i.e. fiscal year covering Jan/ t to Dec/ t). Any analysis that involves the combined datasets of fiscal-year-based data and calendar-year-based data should beware the issue of overlapping time periods among testing variables.

¹¹ For example, if we select firms with *FYR*=June, 2007 (which covers July, 2006 to June, 2007 as per calendar year), the subsequent period would be *FYR*=June, 2008 (which covers July, 2007 to June, 2008 as calendar year). Variables in this subsequent period are not "clean" in the sense that there is 3-month overlap between those variables and *Turnover*, which is computed from October, 2006 to September, 2007. For more information on *FYR* please refer to Compustat or ExecComp manuals.

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Table 1: Proportion of Firms with N Blockholders in the S&P ExecComp Database Universe from 1992 to 2007

This table reports the proportion (in percentage terms) of U.S. firms in the universe of S&P ExecComp database with *N* number of blockholders. A blockholder is defined as a institution who holds at least 5% of the firm. The institutional ownership data is sourced from Thomson 13-f reports.

Number of Blockholder	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0	35%	31%	29%	27%	27%	25%	24%	21%	18%	19%	17%	15%	13%	12%	10%	8%
1	32%	35%	30%	30%	28%	30%	28%	26%	28%	26%	26%	27%	24%	24%	21%	19%
2	20%	20%	22%	23%	24%	22%	24%	26%	25%	26%	25%	25%	25%	25%	27%	25%
3	9%	9%	12%	13%	14%	14%	15%	16%	17%	18%	20%	18%	21%	21%	23%	20%
4	3%	4%	5%	6%	6%	7%	6%	7%	8%	8%	9%	11%	11%	12%	11%	17%
>=5	1%	1%	1%	2%	2%	2%	3%	3%	4%	4%	4%	5%	6%	7%	8%	12%

Figure 1: Trend of Proportion of Firms with N Blockholders

This chart plots the time-series proportion of firms specified in Table 1 with N number of blockholders from 1992 to 2007. We ignore the firms with 2 or 3 blockholders in the chart to better reflect the upward/downward trend.

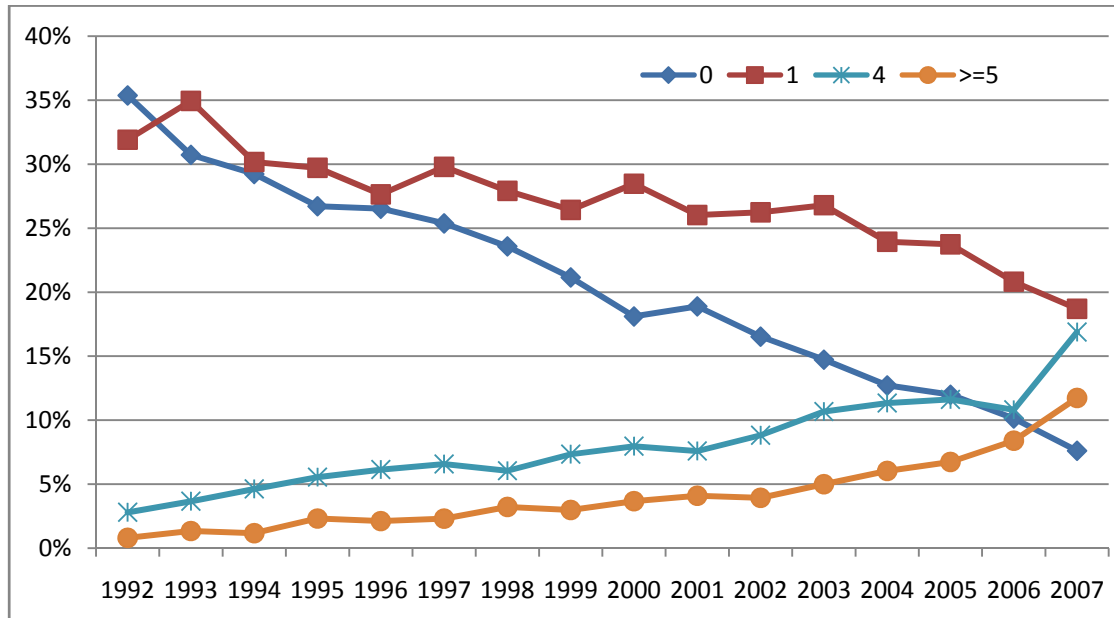


Table 2: Descriptive Statistics (1992-2007)

We merge ExecComp database with Thomson 13-f reports and the combined dataset includes 17,946 firm-year observations (2,324 unique firms) from 1992 to 2007. *PPS_cum_option* is the dollar value change in the CEO cumulative option grants per \$1000 change in shareholder value, computed based on Black-Scholes formula. *PPS_CEOshares* is the dollar value change in the CEO shareholdings (inclusive of restricted stock) per \$1000 change in shareholder value. *PPS_Total* is the sum of the above two measures. *Total_Comp* includes salary, bonus, total value of restricted stock granted, total (Black-Scholes) value of stock options granted, and long-term payouts. *Salary* and *Bonus* are simply the cash value of the CEO's annual salary and bonus, respectively. *IO (Institutional Ownership)* is calculated as the shares held by the 13-f institutional investors divided by the total number of shares outstanding. *Top5_shourt* is the five largest institutional investors' ownership of the firm. *InstTrade* is calculated as the annual sum of the absolute value of quarterly change in institutional holdings, aggregated across all institutions trading shares in the firm, scaled by total number of shares outstanding. *Turnover (Trading Pattern)* is computed as *InstTrade* but applied to the trading pattern specified in the brackets. *CumRet* is the annual buy-and-hold cumulative return for the firm. *Dol_Volat* is the dollar volatility of the firm's stock, computed as the product of the standard deviation of returns and the market capitalization at the beginning of the year. *Tobin_Q* is measured as the ratio of market value of assets to the book value of assets. *Debt_Ratio* is computed as the ratio of total liabilities to total assets. *MktCap* is defined as the product of the number of shares outstanding and the price at the beginning of the year. All prices are CPI deflated (2006=100).

Variables	Obs.	Mean	Std Dev	Min	25%ile	Median	75%ile	Max
Panel A: CEO Incentives Variables								
PPS_cum_option	17946	11.066	14.093	0.000	2.073	6.038	14.247	78.912
PPS_CEOshares	17946	23.746	56.714	0.000	0.871	3.242	13.708	337.575
PPS_total	17946	35.310	60.309	0.150	5.143	13.403	34.344	346.000
Total_Comp (real, \$000)	17820	5055.835	6730.363	235.621	1321.638	2671.052	5807.964	41196.130
Salary (real, \$000)	17946	759.972	368.331	3.176	490.478	707.547	984.571	2118.518
Bonus (real, \$000)	17946	783.992	1245.546	0.000	0.502	386.824	954.965	8011.799
Panel B: Institutional Trading and Concentration Variables								
IO	17946	60.37%	20.33%	10.68%	46.24%	62.29%	76.02%	97.10%
Top5_shrout	17946	24.39%	9.35%	6.05%	17.48%	23.76%	30.37%	51.12%
InstTrade	17946	23.486%	13.151%	1.399%	13.434%	21.877%	31.729%	60.704%
Turnover(Buy-Sell-Buy)	16675	2.133%	2.218%	0.019%	0.585%	1.427%	2.893%	11.411%
Turnover(Sell-Buy-Sell)	15837	2.084%	2.239%	0.011%	0.515%	1.355%	2.828%	11.527%
Turnover(Sell-Buy)	12725	0.169%	0.355%	0.000%	0.011%	0.045%	0.148%	2.306%
Turnover(Buy-Sell)	14619	0.304%	0.589%	0.000%	0.023%	0.087%	0.283%	3.596%
Turnover(Buy-Buy-Buy)	17449	4.396%	3.524%	0.047%	1.723%	3.573%	6.134%	16.501%
Turnover(Sell-Sell-Sell)	16976	3.445%	3.017%	0.024%	1.167%	2.608%	4.896%	14.109%
Turnover(Other pattern)	17926	11.676%	7.682%	0.475%	5.902%	10.160%	15.921%	36.104%
Panel C: Control Variables								
CumRet	17946	17.680%	48.882%	-76.126%	-9.914%	11.877%	35.260%	244.796%
Dol_Volat (\$M)	17943	2210.438	5098.753	36.523	238.982	587.735	1666.786	35311.700
Tobin_Q	17942	1.830	1.270	0.759	1.092	1.383	2.014	8.296
Debt_Ratio	17886	0.241	0.181	0.000	0.090	0.230	0.356	0.830
MktCap (real, \$M)	17946	7437.179	17070.980	52.157	663.403	1849.385	5796.308	117141.200

Table 3: Summary of Institutional Investor Trading Pattern (1992-2007)

This table presents the average trading volume of a firm across all institutional investors engaging in a particular trading pattern within a year and the average number of institutional investors engaging in such a trading pattern. Panel A reports the information on trading volume with each trading pattern breakdown. The average trading volume per firm is computed by firstly summing all annual trading volume across all institutional investors engaging in the particular trading pattern in a particular stock, and then summing the result over all firms experiencing such trading pattern, and finally dividing it by the total number of such firms. Panel B reports the information on the number of institutional investors with each trading pattern breakdown. The average number of institutional investors per firm is computed by first summing the number of institutional investors engaging in the particular trading pattern across all the firms experiencing such trading pattern, and then averaging the result by the total number of such firms. The percentage is computed using the average total institutional trading volume (or the average total number of institutional investors) across all trading patterns as the base. We require an institutional investor to hold the stock for four consecutive quarters for her trade sequence to be valid. Note that for the trading pattern of “HHH” there is no trading volume due to no change in quarterly holdings.

Panel A: Trading volume			
Trading pattern	Number of firm	Average trading volume per firm	Average % of total trading volume
SBS	22168	5126034.32	8.5%
BSB	22629	4993632.44	8.9%
SB	16873	262238.64	1.1%
BS	19566	453924.91	1.8%
HHH	23334	NA	NA
BBB	23851	9415112.65	19.0%
SSS	23063	7952260.59	14.8%
Others	24649	25100637.38	49.9%
Total	24679	51323373.45	100%

Panel B: Number of institutional investors engaging in a particular trading pattern			
Trading pattern	Number of firm	Average number of institution investors per firm	Average % of total institutional investors
SBS	22168	9.0	7.2%
BSB	22629	9.0	7.6%
SB	16873	2.6	2.5%
BS	19566	3.4	3.4%
HHH	23334	8.8	9.6%
BBB	23851	14.9	13.1%
SSS	23063	14.6	10.5%
Others	24649	56.2	50.6%
Total	24679	113.3	100%

Table 4: The Impact of Institutional Investor’s Trading Aggressiveness on Pay-for-Performance Sensitivity of CEO equity-based incentives

This table reports the results of our regression model of pay-for-performance sensitivity of CEO option grants on the churning measures (“Buy-Sell-Buy”-type or “Sell-Buy-Sell”-type), along with control variables. A churning measure for a firm is defined as the sum of trading volume across all institutional investors engaging in either “Buy-Sell-Buy” or “Sell-Buy-Sell” trading pattern when trading the firm’s stock for a year, scaled by the total number of shares outstanding. In Column (1) the dependent variable is PPS of the sum of CEO’s both option grants (transformed into shares equivalents) and shareholdings. Column (2) uses PPS of CEO shareholdings as the dependent variables. Column (3) uses PPS of CEO option grants (including historical grants) as the dependent variable. *Top5_shrout* is the five largest institutional investors’ ownership of the firm. *CumRet* is the annual buy-and-hold cumulative return for the firm. *Dol_Volat* is the dollar volatility of the firm’s stock. *Lag_Ln(MktCap)* is the natural log of firm’s size. $\Delta MktCap$ is the first difference of the firm’s market capitalization between year t and year $t-1$. *DebtRatio* is the debt ratio of the firm. *TobinQ* is the firm’s Tobin’s Q measure. The lagged values of independent variables are used in the model, except $\Delta MktCap$. We report t-statistics robust to heteroscedasticity for each estimate. Since the dependent variables are censored from below at 0, we use Tobit regression. The asterisks indicate statistical significance at the 1% (***) , 5%(**), and 10%(*) levels.

	(1)		(2)		(3)	
	PPS_Total		PPS_CEO_Shares		PPS_Cum_Option	
Intercept	115.1596*** (24.42)	122.9117*** (24.80)	78.15322 (16.67)	82.82902*** (17.04)	30.72504*** (28.02)	33.72002*** (28.83)
Lag_Churning (BSB)	-64.00637*** (-3.02)		-109.851*** (-5.28)		42.2711*** (7.50)	
Lag_Churning (SBS)		-57.1225*** (-2.8)		-91.69993*** (-4.58)		33.41861*** (5.91)
Lag_Top5_shrout	-46.69865*** (-7.32)	-45.12017*** (-7.10)	-53.15172*** (-8.37)	-51.37229*** (-8.10)	8.142397*** (5.83)	7.744827*** (5.44)
Lag_CumRet	5.377146*** (4.48)	4.616116*** (3.78)	3.412748*** (2.87)	2.769799** (2.27)	2.17192*** (7.31)	2.046079*** (6.85)
Lag_Dol_Volat	.0002421** (2.14)	.0002756** (2.44)	.0001222 (1.15)	.0001502 (1.41)	.000091*** (3.89)	.0000904*** (3.85)
Lag_Ln(MktCap)	-9.539013*** (-21.11)	-9.384701*** (-19.90)	-6.086668*** (-13.81)	-5.895119*** (-12.78)	-3.047706*** (-28.74)	-3.045179*** (-27.44)
$\Delta MktCap$	0.0000825** (2.23)	0.0000841** (2.34)	0.000082** (2.18)	0.0000803** (2.18)	0.0000249*** (2.74)	0.0000257*** (2.83)
Lag_ $\Delta MktCap$	-0.0000347 (-0.85)	-0.0000178 (-0.44)	-0.0000279 (-0.75)	-0.0000196 (-0.54)	-2.82E-06 (-0.34)	2.69E-06 (0.32)
Lag_DebtRatio	-16.22091*** (-4.39)	-18.54648*** (-4.87)	-14.25488*** (-3.84)	-17.38539*** (-4.51)	-1.161171 (-0.15)	.3230255 (0.38)
Lag_TobinQ	4.294714*** (7.56)	3.557893*** (6.04)	3.289354*** (5.65)	2.544992*** (4.23)	.8729358*** (7.10)	.9528667*** (7.48)
Year effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry effect	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.1675	0.0169	0.012	0.0121	0.0331	0.034
Observations	14451	13693	14451	13693	14451	13693

Table 5: The Impact of Number of Informed (Churning) Traders on Pay-for-Performance Sensitivity of CEO equity-based incentives

This table reports the results of our regression model of pay-for-performance sensitivity of CEO option grants on the number of institutional investors engaging in the churning trades (“Buy-Sell-Buy”-type or “Sell-Buy-Sell”-type), along with control variables. In Column (1) the dependent variable is PPS of the sum of CEO’s both option grants (transformed into shares equivalents) and shareholdings. Column (2) uses PPS of CEO shareholdings as the dependent variables. Column (3) uses PPS of CEO option grants (including historical grants) as the dependent variable. *Top5_shrout* is the five largest institutional investors’ ownership of the firm. *CumRet* is the annual buy-and-hold cumulative return for the firm. *Dol_Volat* is the dollar volatility of the firm’s stock. *Lag_Ln(MktCap)* is the natural log of firm’s size. $\Delta MktCap$ is the first difference of the firm’s market capitalization between year t and year $t-1$. *DebtRatio* is the debt ratio of the firm. *TobinQ* is the firm’s Tobin’s Q measure. The lagged values of independent variables are used in the model, except $\Delta MktCap$. We report t-statistics robust to heteroscedasticity for each estimate. Since the dependent variables are censored from below at 0, we use Tobit regression. The asterisks indicate statistical significance at the 1% (***) , 5%(**), and 10%(*) levels.

	(1)		(2)		(3)	
	PPS_Total		PPS_CEO_Shares		PPS_Cum_Option	
Intercept	102.0835*** (21.01)	105.6487*** (20.37)	64.14637*** (13.26)	66.08535*** (12.93)	31.29363*** (27.14)	34.48214*** (26.57)
Lag_Ln(NumMgr) (BSB)	-9.850448*** (-8.79)		-10.3951*** (-9.34)		.5546225** (2.54)	
Lag_Ln(NumMgr) (SBS)		-7.155486*** (-6.95)		-7.044748*** (-6.88)		.4071155** (1.99)
Lag_Top5_shrout	-47.82861*** (-7.58)	-47.16697*** (-7.40)	-55.51463*** (-8.81)	-54.0795*** (-8.50)	9.321475*** (6.69)	8.474543*** (5.96)
Lag_CumRet	3.403081*** (2.82)	3.019614** (2.44)	1.289407 (1.08)	1.229135 (0.99)	2.317361*** (7.69)	2.103597*** (6.94)
Lag_Dol_Volat	.0003523*** (3.15)	.000331*** (2.94)	.0002503** (2.38)	.0002148** (2.02)	.0000741*** (3.15)	.0000789*** (3.35)
Lag_Ln(MktCap)	-5.057059*** (-7.06)	-5.86538*** (-7.97)	-1.457203** (-2.06)	-2.51866*** (-3.47)	-3.20805*** (-21.35)	-3.169885*** (-20.17)
$\Delta MktCap$	0.0000926** (2.59)	0.0000917*** (2.60)	0.0000942** (2.56)	0.000088** (2.40)	0.000023** (2.51)	0.0000242*** (2.66)
Lag_ $\Delta MktCap$	-0.0000195 (-0.49)	-0.000011 (-0.28)	-8.41E-06 (-0.23)	-9.91E-06 (-0.28)	-6.95E-06 (-0.82)	-1.27E-07 (-0.01)
Lag_DebtRatio	-16.45422*** (-4.49)	-18.81547*** (-4.95)	-14.5273*** (-3.93)	-17.71993*** (-4.61)	-.05039 (-0.06)	.399814 (0.47)
Lag_TobinQ	3.846265*** (6.74)	3.260839*** (5.5)	2.772461*** (4.74)	2.220573*** (3.67)	.9383659*** (7.57)	.9978221*** (7.8)
Year effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry effect	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.0176	0.0174	0.0129	0.0125	0.0325	0.0336
Observations	14451	13693	14451	13693	14451	13693

Table 6: The Impact of Institutional Investors’ Trading Aggressiveness on CEO Total Compensation and Key Components

This table reports the results of our regression model of CEO total pay components on institutional investors’ “churning” measures (“Buy-Sell-Buy”-type or “Sell-Buy-Sell”-type), along with control variables. Column (1) uses *Total_Comp* as the dependent variable. In Column (2) the dependent variable is *Salary*. In Column (3) the dependent variable is *Bonus*. In Column (4) we use *IncentivPay* as dependant variable, computed by subtracting *Salary* and *Bonus* from *Total_Comp*. A churning measure for a firm is defined as the sum of trading volume across all institutional investors engaging in either “Buy-Sell-Buy” or “Sell-Buy-Sell” trading pattern when trading the firm’s stock for a year, scaled by the total number of shares outstanding. *Top5_shrout* is the five largest institutional investors’ ownership of the firm. *CumRet* is the annual buy-and-hold cumulative return for the firm. *Dol_Volat* is the dollar volatility of the firm’s stock. *Lag_Ln(MktCap)* is the natural log of firm’s size. Δ *MktCap* is the first difference of the firm’s market capitalization between year *t* and year *t-1*. *DebtRatio* is the debt ratio of the firm. *TobinQ* is the firm’s Tobin’s Q measure. The lagged values of independent variables are used in the model, except Δ *MktCap*. We report t-statistics robust to heteroscedasticity for each estimate. The asterisks indicate statistical significance at the 1% (***) , 5%(**), and 10%(*) levels.

	(1)		(2)		(3)		(4)	
	Total_Comp		Salary		Bonus		IncentivPay	
Intercept	-10018.1*** (-24.81)	-8496.763*** (-18.49)	-333.7065*** (-15.88)	-350.1085*** (-15.57)	-1158.258*** (-15.79)	-1013.484*** (-12.36)	-8426.692*** (-23.67)	-7060.135*** (-17.32)
Lag_Churning (BSB)	13685.76*** (5.28)		-11.98894 (-0.11)		1076.885** (2.39)		12224.4*** (5.36)	
Lag_Churning (SBS)		10081.84*** (4.15)		30.98088 (0.28)		618.3687 (1.41)		9378.326*** (4.4)
Lag_Top5_shrout	2847.45*** (5.46)	2930.012*** (5.53)	114.9315*** (3.98)	112.3977*** (3.78)	221.3452** (2.15)	202.982* (1.91)	2455.96*** (5.38)	2531.425*** (5.48)
Lag_CumRet	818.6663*** (6.44)	860.8927*** (6.62)	-12.18647** (-2.30)	-7.309626 (-1.34)	137.37*** (6.51)	156.5002*** (7.22)	627.1079*** (5.66)	648.5751*** (5.72)
Lag_Dol_Volat	.3374645*** (15.97)	.3306955*** (15.64)	.0031716** (3.68)	.0030203*** (3.47)	.0484282*** (11.40)	.0474852*** (11.10)	.2764077*** (14.94)	.2703187*** (14.59)
Lag_Ln(MktCap)	1710.34*** (35.87)	1728.364*** (35.67)	158.0838*** (70.42)	158.5035*** (68.28)	247.8939*** (27.72)	250.6668*** (27.00)	1289.939*** (30.84)	1305.535*** (30.72)
Δ MktCap	0.0357646*** (2.82)	0.0304648*** (2.40)	0.0009647** (2.01)	0.0011237** (2.24)	0.0201153*** (6.93)	0.0204112*** (6.76)	0.0178552* (1.66)	0.013038 (1.21)
Lag_ΔMktCap	0.0705901*** (5.35)	0.068771*** (5.21)	0.0012632** (2.54)	0.0012305** (2.45)	0.0143267*** (5.71)	0.0139658*** (5.55)	0.0545094*** (4.76)	0.0533137*** (4.65)
Lag_DebtRatio	1600.304*** (5.01)	1564.312*** (4.72)	210.5669*** (12.28)	210.4246*** (11.93)	364.8715*** (5.61)	387.6798*** (5.58)	1066.586*** (3.84)	992.2221*** (3.47)
Lag_TobinQ	-292.4387*** (-5.14)	-266.0816*** (-4.21)	-66.24482*** (-25.99)	-65.8215*** (-24.65)	-132.4815*** (-15.23)	-133.7299*** (-14.29)	-106.1821** (-2.12)	-80.13374 (-1.44)
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.4119	0.4153	0.5062	0.5059	0.3724	0.3729	0.3620	0.3655
Observations	14366	13613	14451	13693	14451	13693	14366	13613

Table 7: The Impact of Institutional Investor’s Trading Aggressiveness on Pay-for-Performance Sensitivity of CEO Total Equity-based Compensation, using First-Difference Estimation

This table reports the results of First-Difference regression model of pay-for-performance sensitivity of CEO total equity-based compensation on the turnover of institutional investors displaying a specific trading pattern, along with control variables. The turnover for a firm is defined as the sum of trading volume across all institutional investors displaying a particular trading pattern when trading the firm’s stock for a year, scaled by the total number of shares outstanding. Column (1) to Column (7) reports the regression results using turnover of a specific trading pattern as the explanatory variables in the following order: (1) Buy-Sell-Buy, (2) Sell-Buy-Sell, (3) Sell first then Buy, (4) Buy first then Sell, (5) Buy-Buy-Buy, (6) Sell-Sell-Sell, and finally (7) Others, which includes one occurrence of either Sell or Buy in the sequence. Column (8) uses the turnover of all trading patterns, which is the total institutional turnover rate, as the explanatory variable. Both the trading patterns of “Buy-Sell-Buy” and “Sell-Buy-Sell” are termed “Churning” in our analysis. *Top5_shrout* is the five largest institutional investors’ ownership of the firm. *CumRet* is the annual buy-and-hold cumulative return for the firm. *Dol Volat* is the dollar volatility of the firm’s stock. $\Delta MktCap$ is the first difference of the firm’s market capitalization between year t and year $t-1$. $Lag_ \Delta MktCap$ is the lagged value of $\Delta MktCap$. *DebtRatio* is the debt ratio of the firm. *TobinQ* is the firm’s Tobin’s Q measure. We report t-statistics robust to heteroscedasticity for each estimate. The asterisks indicate statistical significance at the 1% (***) , 5%(**), and 10%(*) levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	-4.798897 (-0.64)	-6.027951 (-0.89)	-4.446427 (-0.77)	-1.636426 (-0.25)	-6.334879 (-0.88)	-7.224229 (-1.09)	-4.676124 (-0.63)	-5.02718 (-0.67)
Δ Churning (BSB)	-24.62267*** (-2.86)							
Δ Churning (SBS)		1.618075 (0.23)						
Δ Turnover(Sell-Buy)			67.30281 (0.9)					
Δ Turnover(Buy-Sell)				-29.19164 (-1.05)				
Δ Turnover(BBB)					-2.918269 (-0.58)			
Δ Turnover(SSS)						1.667847 (0.29)		
Δ Turnover(others)							-7.273183** (-2.08)	
Δ InstTrade								-7.272452*** (-2.74)
Δ Top5_shrout	-6.848161 (-1.53)	-10.67877** (-2.18)	-6.646888 (-0.15)	-5.701654 (-1.14)	-7.037246 (-1.64)	-7.558173* (-1.71)	-8.425313* (-1.94)	-7.779767* (-1.82)
Δ CumRet	-1.1472725 (-0.29)	.0589853 (0.12)	-4.32105 (-0.65)	-2.646604 (-0.45)	.2519968 (0.51)	.2186184 (0.46)	.2215559 (0.46)	.2037429 (0.43)
Δ DoI_Volat	-0.0002463** (-2.14)	-0.0002346* (-1.90)	-0.0001771* (-1.70)	-0.0002716** (-2.15)	-0.0002571** (-2.23)	-0.0002628** (-2.25)	-0.0003696** (-2.18)	-0.0003582** (-2.12)
Δ MktCap	5.26E-06 (0.41)	0.00000105 (0.08)	-0.0000199 (-1.39)	1.83E-06 (0.14)	0.0000115 (0.91)	8.19e-06 (0.65)	0.00000977 (0.78)	9.00E-06 (0.72)
Lag_ Δ MktCap	0.0000266*** (2.62)	0.0000154 (1.60)	0.0000149* (1.70)	0.0000224** (2.46)	0.0000263*** (2.63)	.0000229** (2.34)	0.0000296*** (2.75)	0.0000291*** (2.71)
Δ DebtRatio	10.92256*** (3.11)	9.16435** (2.39)	7.717145 (1.62)	6.070797* (1.72)	8.269856*** (2.66)	8.323223** (2.39)	12.40236*** (3.60)	12.38999*** (3.60)
Δ TobinQ	1.662852*** (2.72)	1.679288** (2.53)	2.362097*** (2.62)	1.635807** (2.13)	1.069321* (1.88)	1.044014* (-1.69)	1.172271** (2.25)	1.182339** (2.27)
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effect	No	No	No	No	No	No	No	No
R-squared	0.0058	0.0053	0.0083	0.0048	0.0042	0.0039	0.0054	0.0058
Observations	13813	12689	8808	10977	14824	14264	11510	15546

Table 8: The Impact of Institutional Investor’s Trading Aggressiveness on Pay-for-Performance Sensitivity of CEO Shareholdings, using First-Difference Estimation

This table reports the results of First-Difference regression model of pay-for-performance sensitivity of CEO shareholdings on the turnover of institutional investors displaying a specific trading pattern, along with control variables. The turnover for a firm is defined as the sum of trading volume across all institutional investors displaying a particular trading pattern when trading the firm’s stock for a year, scaled by the total number of shares outstanding. Column (1) to Column (7) reports the regression results using turnover of a specific trading pattern as the explanatory variables in the following order: (1) Buy-Sell-Buy, (2) Sell-Buy-Sell, (3) Sell first then Buy, (4) Buy first then Sell, (5) Buy-Buy-Buy, (6) Sell-Sell-Sell, and finally (7) Others, which includes one occurrence of either Sell or Buy in the sequence. Column (8) uses the turnover of all trading patterns, which is the total institutional turnover rate, as the explanatory variable. Both the trading patterns of “Buy-Sell-Buy” and “Sell-Buy-Sell” are termed “Churning” in our analysis. *Top5_shrout* is the five largest institutional investors’ ownership of the firm. *CumRet* is the annual buy-and-hold cumulative return for the firm. *Dol_Volat* is the dollar volatility of the firm’s stock. $\Delta MktCap$ is the first difference of the firm’s market capitalization between year t and year $t-1$. $Lag_ \Delta MktCap$ is the lagged value of $\Delta MktCap$. *DebtRatio* is the debt ratio of the firm. *TobinQ* is the firm’s Tobin’s Q measure. We report t-statistics robust to heteroscedasticity for each estimate. The asterisks indicate statistical significance at the 1% (***) , 5%(**), and 10%(*) levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	-0.9399514 (-1.28)	-1.093997* (-1.66)	-0.84039 (-1.48)	-0.5963546 (-0.94)	-1.017821 (-1.46)	-1.166636* (-1.81)	-0.867596 (-1.20)	-0.8955972 (-1.24)
Δ Churning (BSB)	-17.46477** (-2.18)							
Δ Churning (SBS)		-1.5945 (-0.24)						
Δ Turnover(Sell-Buy)			70.49794 (0.98)					
Δ Turnover(Buy-Sell)				-22.22146 (-0.84)				
Δ Turnover(BBB)					0.7451514 (0.16)			
Δ Turnover(SSS)						-0.0127992 (0)		
Δ Turnover(others)							-6.748053** (-2.03)	
Δ InstTrade								-6.075602** (-2.39)
Δ Top5_shrout	-9.97334** (-2.33)	-11.80466** (-2.54)	-4.460708 (-1.07)	-7.166394 (-1.50)	-9.033101** (-2.22)	-8.326468** (-1.96)	-8.838928** (-2.24)	-8.180767** (-2.10)
Δ CumRet	-0.3207854 (-0.66)	-0.1653064 (-0.35)	-0.6675958 (-1.05)	-0.5235246 (-0.93)	-0.0101507 (-0.02)	-0.0965949 (-0.21)	0.0900402 (0.20)	0.061583 (0.14)
Δ Dol_Volat	-0.0002382* (-2.04)	-0.0002194* (-1.82)	-0.0001254 (-1.21)	-0.0002545** (-1.98)	-0.0002439** (-2.10)	-0.0002358** (-1.99)	-0.0002158* (-1.88)	-0.0002085* (-1.82)
Δ MktCap	0.0000108 (0.88)	0.00000944 (0.81)	-0.000015 (-1.11)	5.41E-06 (0.43)	0.0000159 (1.32)	0.0000142 (1.17)	0.0000151 (1.27)	0.0000146 (1.24)
Lag_ Δ MktCap	0.0000232** (2.25)	0.0000092 (1.02)	5.59E-06 (0.70)	0.000018* (1.93)	0.0000232** (2.26)	0.0000186* (1.84)	0.0000225** (2.19)	0.0000222** (2.17)
Δ DebtRatio	11.66566*** (3.27)	8.576912** (2.34)	6.589448 (1.24)	6.06082* (1.78)	8.664461*** (2.99)	8.079082** (2.27)	10.87774*** (3.30)	10.77773*** (3.28)
Δ TobinQ	0.8919303 (1.51)	0.5945063 (0.95)	1.611939* (1.88)	0.9045312 (1.22)	0.4298344 (0.79)	0.3693584 (0.62)	0.41832 (0.84)	0.4315466 (0.87)
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effect	No	No	No	No	No	No	No	No
R-squared	0.0042	0.1464	0.0056	0.0025	0.0026	0.002	0.003	0.0031
Observations	13813	12706	8808	10977	14824	14264	11510	15546

Table 9: The Impact of Institutional Investor’s Trading Aggressiveness on Pay-for-Performance Sensitivity of CEO Option Grants, using First-Difference Estimation

This table reports the results of First-Difference regression model of pay-for-performance sensitivity of CEO option grants on the turnover of institutional investors displaying a specific trading pattern, along with control variables. The turnover for a firm is defined as the sum of trading volume across all institutional investors displaying a particular trading pattern when trading the firm’s stock for a year, scaled by the total number of shares outstanding. Column (1) to Column (7) reports the regression results using turnover of a specific trading pattern as the explanatory variables in the following order: (1) Buy-Sell-Buy, (2) Sell-Buy-Sell, (3) Sell first then Buy, (4) Buy first then Sell, (5) Buy-Buy-Buy, (6) Sell-Sell-Sell, and finally (7) Others, which includes one occurrence of either Sell or Buy in the sequence. Column (8) uses the turnover of all trading patterns, which is the total institutional turnover rate, as the explanatory variable. Both the trading patterns of “Buy-Sell-Buy” and “Sell-Buy-Sell” are termed “Churning” in our analysis. *Top5_shrout* is the five largest institutional investors’ ownership of the firm. *CumRet* is the annual buy-and-hold cumulative return for the firm. *Dol_Volat* is the dollar volatility of the firm’s stock. $\Delta MktCap$ is the first difference of the firm’s market capitalization between year t and year $t-1$. $Lag_ \Delta MktCap$ is the lagged value of $\Delta MktCap$. *DebtRatio* is the debt ratio of the firm. *TobinQ* is the firm’s Tobin’s Q measure. We report t-statistics robust to heteroscedasticity for each estimate. The asterisks indicate statistical significance at the 1% (***), 5%(**), and 10%(*) levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	.5000349*** (7.40)	.5524964*** (8.06)	.4166471*** (5.36)	.4871132*** (6.29)	.4765839*** (4.7)	.5217896*** (7.69)	.4966212*** (4.84)	.4853149*** (4.75)
Δ Churning (BSB)	-6.722544*** (-3.05)							
Δ Churning (SBS)		2.452359 (1.16)						
Δ Turnover(Sell-Buy)			-20.9154 (-1.27)					
Δ Turnover(Buy-Sell)				-6.772961 (-0.92)				
Δ Turnover(BBB)					-1.064816 (-0.76)			
Δ Turnover(SSS)						.559464 (0.37)		
Δ Turnover(others)							1.164824 (1.46)	
Δ InstTrade								-1.167499 (-0.2)
Δ Top5_shrout	2.427347** (2.16)	.9514097 (0.82)	3.123532** (2.23)	1.144288 (0.96)	1.586445 (1.47)	.2801516 (0.25)	1.378188 (1.16)	1.225058 (1.04)
Δ CumRet	.1941564* (1.72)	.2986276** (2.29)	.2330635* (1.67)	.3234496** (2.44)	.2778877** (2.40)	.3418245*** (2.92)	.2454894** (2.11)	.2400231** (2.06)
Δ Dol_Volat	-0.000164 (-0.59)	-0.000105 (-0.35)	-0.000434*** (-2.77)	-0.000304 (-1.12)	-0.000249 (-0.89)	-0.000334 (-1.18)	-0.000679 (-1.59)	-0.000651 (-1.52)
Δ MktCap	-5.52E-06 (-1.49)	-0.0000082** (-2.07)	-4.18E-06 (-1.19)	-4.81E-06 (-1.29)	-5.49E-06 (-1.46)	-0.00000821** (-2.15)	-0.00000555 (-1.45)	-5.67E-06 (-1.48)
Lag_ Δ MktCap	0.00000659* (1.94)	0.00000721** (2.03)	0.0000103*** (3.26)	0.00000736** (2.19)	0.00000684** (2.01)	0.00000789** (2.29)	0.00000845** (2.34)	0.00000817** (2.27)
Δ DebtRatio	.5692393 (0.49)	1.362951 (0.84)	2.103456** (2.04)	.4715181 (0.50)	.4304678 (0.40)	1.629761* (1.83)	1.706102 (1.33)	1.728562 (1.35)
Δ TobinQ	.6971358*** (5.57)	.9039619*** (5.61)	.6382815*** (4.12)	.7036896*** (4.65)	.6113217*** (4.72)	.7017897*** (5.21)	.6602325*** (5.19)	.6571002*** (5.19)
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effect	No	No	No	No	No	No	No	No
R-squared	0.0331	0.0377	0.0358	0.0355	0.0321	0.0351	0.0308	0.031
Observations	13813	12689	8808	10977	14824	14264	11510	15546

Table 10: The Impact of Institutional Investor’s Swing on Pay-for-Performance Sensitivity of CEO Total Equity-based Compensation, using First-Difference Estimation

This table reports the results of our regression model of in pay-for-performance sensitivity of CEO total equity-based compensation on the swing measures of institutional investors engaging in “BSB” or “SBS” trading patterns, along with control variables. Column (1) uses PPS_Total as the dependent variable. Column (2) uses PPS_CEOShares as the dependent variable. Column (3) uses PPS_cum_option as the dependent variable. *Swing (BSB or SBS)* is defined as the absolute value of the change in shareholdings from peak to trough in a year, summed across all institutional investors and scaled by the firm’s total shares outstanding. *Top5_shrout* is the five largest institutional investors’ ownership of the firm. *CumRet* is the annual buy-and-hold cumulative return for the firm. *Dol Volat* is the dollar volatility of the firm’s stock. *ΔMktCap* is the first difference of the firm’s market capitalization between year *t* and year *t-1*. *Lag_ΔMktCap* is the lagged value of *ΔMktCap*. *DebtRatio* is the debt ratio of the firm. *TobinQ* is the firm’s Tobin’s Q measure. We report t-statistics robust to heteroscedasticity for each estimate. The asterisks indicate statistical significance at the 1% (***) , 5%(**), and 10%(*) levels.

	(1)		(2)		(3)	
	ΔPPS_Total		ΔPPS_CEO_Shares		ΔPPS_Cum_Option	
Intercept	-0.4692228 (-0.62)	-0.6043162 (-0.90)	-0.932802 (-1.27)	-1.0939* (-1.66)	.502578*** (7.44)	.5514675*** (8.05)
ΔSwing (BSB)	-59.12806*** (-2.7)		-43.67285** (-2.13)		-17.67951*** (-3.2)	
ΔSwing (SBS)		-12.90752 (-0.77)		-10.757 (-0.69)		1.818354 (0.38)
ΔTop5_shrout	-7.225643 (-1.61)	-10.71367** (-2.19)	-10.23311** (-2.39)	-11.80619** (-2.54)	2.331358** (2.08)	.9312296 (0.80)
ΔCumRet	-0.1656615 (-0.33)	.0441506 (0.09)	-0.3343588 (-0.68)	-0.1693306 (-0.36)	.1886661* (1.67)	.2931229** (2.25)
ΔDol_Volat	-0.0002514** (-2.18)	-0.0002308* (-1.87)	-0.0002415** (-2.07)	-0.0002179* (-1.81)	-0.0000176 (-0.63)	-9.53e-06 (-0.32)
ΔMktCap	5.07E-06 (0.40)	1.27E-06 (0.10)	0.0000107 (0.87)	9.61E-06 (0.83)	-5.58E-06 (-1.52)	-0.00000821** (-2.07)
Lag_ΔMktCap	0.0000273*** (2.69)	0.000015 (1.57)	0.0000237** (2.29)	9.03E-06 (1.00)	0.00000677** (1.99)	0.00000713** (2.02)
ΔDebtRatio	10.88901*** (3.10)	9.183876** (2.40)	11.64131*** (3.26)	8.585374** (2.34)	.5595935 (0.48)	1.367314 (0.84)
ΔTobinQ	1.657381*** (2.71)	1.685858** (2.54)	.888549 (1.5)	.5972372 (0.96)	.6960848*** (5.57)	.9055359*** (5.61)
Year effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry effect	No	No	No	No	No	No
Pseudo R-squared	0.0057	0.0053	0.0042	0.0033	0.0332	0.0375
Observations	13813	12689	13813	12689	13813	12689