

Performance Incentives, Performance Pressure and Executive Turnover

Narayanan Subramanian*, Atreya Chakraborty** & Shahbaz Sheikh*** .

Abstract

We examine the relationship between the optimal incentive contract and the firm's decision to fire a manager for poor performance. We first derive some theoretical results using a simple principal-agent model, and then examine the empirical evidence on the incidence of forced turnover among CEOs with different compensation contracts. We find that CEOs with steeper compensation contracts (i.e., with greater incentives) are more likely to be fired following poor firm performance. Logit estimations indicate that among poorly performing firms, a CEO receiving incentives at the 60th percentile level are roughly 10% more likely to be fired than a CEO with incentives at the 40th percentile. The results are robust to various performance and incentive measures. We also find that the performance pressure was greater in the latter half (1997-99) of the sample than in the first (1993-96). Increased firing pressure might have been one of the factors contributing to the accounting shenanigans of the late 1990's.

Keywords: Incentive Contracts, Executive Compensation, Stock Options, Equity-based compensation, Management Turnover.

JEL Classification Number: G30, J33.

*Brandeis University, ** Brattle Group & Boston College, *** Brandeis University. Corresponding author: Narayanan Subramanian, MS 032, GSIEF, Brandeis University, Waltham, MA 02454, USA. Tel.: 781-736-2261; Fax: (781) 736 2267; E-mail: nsubra@brandeis.edu. We are grateful to Dirk Jenter, Li Jin, Blake LeBaron, Stewart Myers, Ruediger Fahlenbrach, and to participants at the Midwest Finance Association 2003 Conference and the Brandeis University Tuesday seminar for useful remarks and suggestions.

1 Introduction

Do executives who receive greater performance incentives face greater performance pressure, i.e., are they more likely to be fired for poor performance? We first study this question within the principal-agent framework, and derive some results on the relationship between the optimal incentive contract and the likelihood of forced turnover. We then examine the empirical evidence on the incidence of forced turnover among CEOs with different compensation contracts. We find that CEOs with higher incentives are also more likely to be fired for poor performance, and that this firing pressure might have increased over the decade of the 1990s.

A simple analysis of the principal-agent problem suggests two quick answers to the question of whether higher performance incentives imply a greater likelihood of turnover. Firms offer incentives both directly through the compensation contract,¹ and indirectly, through the threat of firing. If firms view these two kinds of incentives as substitutes, then, firms providing higher incentives (for example, with more shares and options), may be less likely to use the firing threat.

Second, executive effort is only one of the factors influencing performance. Ability is another. Faced with poor performance, a firm might attribute it to either low effort or low ability. But while incentives may induce effort, they cannot induce ability. Thus, in light of poor performance, a firm that provides higher incentives to its managers is more likely to infer that the problem is one of ability rather than effort. In this case, firms providing higher incentives may be more likely to fire their managers for poor performance. This

¹Firms offer incentives by linking the compensation of executives to firm performance. They may do this through performance-based bonuses, as well as through stocks and options. Over the last decade, equity-based incentives have largely outweighed performance bonuses as documented by Hall and Liebman (1998), and Core, Guay, and Verrecchia (2000).

suggests that these two kinds of incentives may be complements.

The two conflicting answers suggested above indicate that the issues of performance and turnover must be studied jointly with the issue of incentives, using an optimal contracting framework.² However, prior research (see section 2 below) in this area has tended to deal separately with the two main issues - (i) whether executive compensation incentivizes better firm performance, and (ii) the relationship between firm performance and forced turnover.

In this paper, we recognize that executive incentives and firm performance are both related to executive turnover and analyze them jointly. First, we examine the properties of the optimal incentive contract in a simple multi-period principal-agent setting that explicitly incorporates forced turnover, i.e., firing in the event of poor performance. The slope of the compensation contract measures the level of managerial incentives. We study how the slope of the optimal compensation contract changes between the regime with firing and the regime without firing. Next, using data on CEO compensation, we empirically test whether steeper compensation contracts (i.e., greater incentives) are associated with a greater probability of firing in the event of poor performance.

Our theoretical model examines the optimal incentive contract in the presence of career concerns when the firm can fire the manager for poor performance. In our model, executive

²Firms design executive compensation contracts to provide the right level of incentives for their executives, taking into account many features of the contracting environment such as the ease of monitoring management, the importance of unobservable factors, etc. These same contractual environment variables also endogenously determine whether, and in what circumstances, firms will fire their top executives for poor firm performance. Therefore, any empirical examination of how compensation is related to performance and turnover must control for the incentive effects of compensation. A related point is made by Himmelberg, Hubbard, and Palia (1999), who argue that both managerial ownership and performance are endogenously determined in an optimal contracting framework.

effort and ability jointly determine output. Effort is unverifiable which makes incentive contracts necessary. Executive ability is uncertain, and the firm learns the ability of the manager by observing his performance, i.e., firm output. Bayesian learning implies that a higher level of effort in the first period leads to a lower posterior estimate of ability in the event of a poor outcome (*the learning effect*). If the posterior estimate of the manager's ability is sufficiently low, the firm fires him and switches to an interim CEO until another full time CEO is hired. At hiring, however, the firm is unable to commit to either rehiring or firing the manager for poor performance. This leads to the possibility of two sequential equilibria – the “firing equilibrium,” in which the firm fires the manager for poor performance, and the “rehiring equilibrium,” in which the firm rehires the manager despite poor performance. We assume that the equilibrium that is finally selected is the one that gives higher profits to the firm. In both equilibria, firms offer contracts that link pay to performance. For a given contract, the firing equilibrium is associated with a higher first period effort compared to the rehiring equilibrium. We show that this implies that firm profits are higher in the firing equilibrium than in rehiring. This, in turn, implies that *the optimal contract in the rehiring equilibrium must be flatter than the optimal contract in the firing equilibrium*. (Otherwise, rehiring would lead to lower firm profits and hence not be selected.) This implies that firms which offer greater managerial incentives should be more likely to fire their managers for poor performance.

In the empirical section of this paper, we examine whether CEOs with steeper incentive contracts are more likely to be fired following poor performance than CEOs with flatter contracts. We use data on CEO changes during the period 1993-1999 (in fiscal years) from the ExecuComp database covering 8621 firm-year observations. We measure incentives using both definitions that are commonly used in the literature – (i) the *Dollar Sensitivity* of CEO compensation, defined as the change in the dollar value of the CEO's stock and option holdings for a dollar change in firm equity value; and (ii) the *Return Sensitivity*, defined

as the change in the dollar value of the CEO's stock and option holdings for a one percent change in firm equity value. We calculate these measures using the Core and Guay (1999a) method, which allows us to compute incentives even using the partial details on the CEO's stock option portfolio contained in the annual proxy statements (see Appendix B).

For both measures of incentives, and for seven measures of poor performance,³ we find that, among poorly performing firms, CEOs with steeper incentive contracts are more likely to be fired than those with flatter contracts. Among firms that make a net loss in a given year, a CEO receiving dollar incentives at the 60th percentile level is 14.1% more likely to be fired than a CEO with incentives at the 40th percentile. The corresponding figures are 12.42% for firms whose net income to sales ratio (NIS) is below the industry average level, 10.75% for firms whose ROA is below the industry average level and 11.06% for firms whose stock return is below the market return. We find similar results using return sensitivity as the incentive measure, though the marginal effects are weaker. The results are quite robust.

Our main point point in this paper is that performance incentives and termination-related incentives need not always be substitutes in an optimal contracting framework. We argue that if firms learn sufficiently about the ability of a manager from observing performance, then they may fire managers who perform poorly despite being highly incentivized. This implies that these performance incentives and termination-related incentives may be complements rather than substitutes. Our empirical analysis bears this out. Overall, our results indicate that CEOs with greater incentives also face greater performance pressures.

³One measure is an absolute measure, based on the company's net income before extraordinary items (NIBEX) in the previous fiscal year. The other definitions are relative, based on the firm's net income to sales ratio (NIS), the return on assets (ROA) and the one-year stock return (RET1) relative to the two-digit SIC industry of the firm.

Finally, we split the sample into two sub-periods (1993-96 and 1997-99), and analyze the effect in each. We find that the firing pressure accompanying higher incentives was concentrated in the later half of the 90s. This increased job insecurity might have been a contributing factor to the accounting shenanigans of the late 1990s. CEOs facing greater firing pressure may have resorted to distorting earnings statements, not only to maintain compensation, but also to keep their jobs. However, further research into this area is required before this can be confirmed.

The paper is organized as follows – section 2 discusses prior work in this area, section 3 presents our model of optimal incentive contracts incorporating the firing decision, section 4 describes the data set and our measures of incentives and performance, section 5 describes the estimation and results, and section 6 presents our conclusions. Appendix A has the proofs of results derived in section 3 and appendix B describes the method used in calculating portfolio sensitivities.

2 Prior Research

Previous work in the area of executive compensation, incentives, and management turnover has dealt separately with the two main issues – (i) executive compensation and whether it incentivizes better firm performance, and (ii) the relationship between firm performance and forced management turnover. Coughlan and Schmidt (1985), Murphy (1985, 1986), Abowd (1990), Jensen and Murphy (1990a), and Leonard (1990) study the relationship between executive compensation contracts, incentives and firm performance.⁴ The papers show that firm performance is largely positively related to pay-performance sensitivity, after controlling for the risk, i.e., the variance of performance (Aggarwal and Samwick, 1999). Similarly Weisbach (1988), Warner, Watts, and Wruck (1988), Murphy and Zimmerman

⁴See Murphy, 1999 and Core, Guay, and Larcker, 2001 for extensive surveys on this literature.

(1993), Denis, Denis, and Sarin (1997), Parrino (1997), and Goyal and Park (2002) are among the papers studying how firm performance affects forced executive turnover and the role played by corporate governance factors such as board composition in determining this relationship. These papers indicate forced executive turnover is more likely following poor performance, and that greater insider share ownership and higher insider representation on the board deter forced turnovers.

More closely related to this paper are Holmstrom (1982, 1999) and Gibbons and Murphy (1992). Holmstrom (1982, 1999) shows that contracts may be necessary even in multiperiod settings where career concerns may be expected to play a similar role. Gibbons and Murphy (1992) characterize optimal incentive contracts in the presence of career concerns. They predict and verify that the optimal incentive contracts should be steeper for executives who are closer to retirement. However, in their model, executive tenure is deterministic - the executive is hired for a fixed number of periods and retires at the end of her tenure. In reality, executives are often fired for poor performance and, thus, the executive's tenure length may be uncertain.

Hallman and Hartzell (2001) and Hartzell (2001) study the relationship between incentives from pay for performance contracts and incentives from the threat of termination. However, their theoretical and empirical approaches are quite different from those followed in this paper. Hartzell (2001) derives a comparative static result that contractual incentives and termination-related incentives are substitutes – specifically, as the probability of being fired decreases due to an exogenous increase in the cost of firing, the firm increases the slope of the compensation contract to restore incentives. This is based on the assumption that firms always find it optimal to commit to firing *ex ante*, i.e., when the incentive contracts are written. Thus, it is contextually different from our result which compares contractual incentives and termination related incentives allowing for the possibility that firing

is suboptimal *ex ante*. Further, the empirical verification of the comparative static result in Hartzell (2001) is based on tests that do not condition for performance. Our tests are conditional on poor performance, as is appropriate to our theoretical prediction. Finally, our empirical analysis uses data from 1992-99, while Hartzell (2001) uses data from 1991-95.

In the next section, we develop our theoretical model of optimal incentive contracts with forced turnover and derive its key prediction.

3 Optimal Incentive Contracts with Forced Turnover

Consider a simple model of interaction between an infinitely lived firm and an agent who lives for two periods.⁵ The firm output y_t in any period t is either zero or one with the agent's ability and effort determining the probability that the output is one.⁶ We may refer to the event $y = 1$ as "success" and $y = 0$ as "failure".⁷ There are two types of agents, those of high ability (type H) and those of low ability (type L). If the agent's effort level in a given period is e_t , then,

$$P(\text{Output } y_t = 1) = \begin{cases} e_t & \text{if type} = \text{H} \\ \alpha e_t & \text{if type} = \text{L}, \end{cases} \quad (1)$$

where $\alpha \in [0, 1]$. Thus, α is a measure of the importance of ability over effort in being a successful manager. The closer α is to one, the less important is ability in determining

⁵In this paper, while we derive one main result regarding the relationship between the slopes of the first period contracts in the two cases of firing and rehiring, we do not solve for the exact contract in each case as that does not add much to the intuition required for the empirical analysis to follow. Subramanian, Chakraborty and Sheikh (2002b) contains the full solution to the model.

⁶This formulation is similar to that of Baker, Gibbons, and Murphy (1994).

⁷In the empirical analysis, we use a binary measure of performance in correspondence with the binary nature of output in this model.

managerial success.

Both the firm and the worker are risk-neutral, and have an intertemporal discount rate of δ . The worker has a quadratic disutility of effort $g(e) = 0.5re^2$, where r is a shift parameter. The agent's effort is not verifiable, even if the firm can deduce the equilibrium level of effort. In order to induce effort, the firm offers incentive contracts of the form $\mathbf{w}_t = \mathbf{b}_t \mathbf{y}_t$, where w_t is the wage in period t and \mathbf{b}_t is the slope of the contract.⁸ The firm incurs a fixed cost F in each period in which it operates. If the agent is fired, we assume that the firm has to wait for one period before hiring a new agent. During this period, the firm works with an interim CEO and makes a net profit of zero. Thus, the normal profits of the firm may be interpreted as being measured relative to the potential profits under an interim CEO (such as a retired CEO who is on the board of directors). Equivalently, the fixed cost F may be interpreted as the revenue under an interim CEO. The assumption that the firm waits for one full period before hiring a new CEO simplifies the dynamic optimization framework, without much loss of generality.⁹

At hiring, the firm offers a contract that specifies the first-period slope \mathbf{b}_1 .¹⁰ The firm is unable to commit to a decision regarding termination (if $y_1 = 0$) at the hiring stage. We

⁸In ignoring the fixed portion of managerial compensation, we are assuming that the manager's participation constraint is not binding even at low levels of fixed compensation. We believe that the clarity that this simplification provides in the analysis is worth the loss of generality. Also, the managers we consider here are CEOs of firms, whose compensation largely consists of variable pay in the form of bonuses, shares, and options. In our data, salary constitutes only 16% of the total compensation for the mean CEO.

⁹This assumption implies that in making the decision of the whether or not to fire the agent, the firm has to consider only the profits in the agent's second period and not in any of the future periods, since all agents retire after two periods.

¹⁰Our results are unchanged if the contract also specifies b_{21} and b_{20} , where b_{2j} is the slope of the second period contract when $y_1 = j$, $j \in \{0, 1\}$, with b_{20} being conditional on rehiring. In our simple set-up, the second period slopes do not depend on the first period outcome.

rule out the possibility that the manager could be fired even if $y_1 = 1$, since firing in the good state trivializes the problem.

We seek to derive the optimal contract in a sequential equilibrium. In such an equilibrium, each player (the firm and the manager) follows a strategy that is an optimal response to conjectures regarding the other's strategies. In equilibrium, the conjectures are consistent with the actual strategies played. In our context, the firm's strategy consists of the slopes of the compensation contract and the decision to fire or rehire the manager if $y_1 = 0$. The manager's strategy consists of the effort choices. The manager guesses the firm's firing decision and the firm guesses the manager's conjecture.

We are primarily interested in the properties of the slope b_1 of the equilibrium contract. In the following three subsections, we describe the Bayesian learning process by which the firm and the manager update their beliefs regarding the manager's ability, derive the optimal second period contract and finally, derive the main relationship between the slopes of the optimal first period contracts in the two equilibria of the model.

3.1 Bayesian Learning

As in Gibbons and Murphy (1992) and Holmstrom (1982, 1999), there is symmetric, but imperfect, information about the agent's ability. The firm and the agent alike believe at the beginning of the first period that the agent is of type H with probability $q > 0$. Subsequently, they update their beliefs based on the output observed in the first period. Let q_{2j} denote the posterior probability that the agent is of type H when the first period output is j . Given the prior q , the effort level e_1 , and the technology (1) above, we have

$$q_{20} = \text{P(H} \mid y_1 = 0) = \frac{q(1 - e_1)}{q(1 - e_1) + (1 - q)(1 - \alpha e_1)} = \frac{q(1 - e_1)}{1 - z_1 e_1} \quad (2)$$

$$q_{21} = \text{P(H} \mid y_1 = 1) = \frac{q e_1}{q e_1 + (1 - q) \alpha e_1} = \frac{q}{q + \alpha(1 - q)} \quad (3)$$

where $z_1 = q + (1 - q)\alpha$. It is easy to observe from (2) and (3) that (i) $q_{20} \leq q < q_{21}$, (ii) $\frac{dq_{21}}{de_1} = 0$, and

$$\frac{dq_{20}}{de_1} < 0 \quad (4)$$

(4) implies that higher first period effort has a negative impact on the posterior estimate of the agent's ability in the event of failure. As we see below, this might play an important role in the optimization decision of the agent and the firm. If the effect is sufficiently strong, then the firm might fire the agent after the first period, rather than rehire him.

Next, we derive the optimal contract that the firm would offer any rehired agent in the second period, given the above learning process.

3.2 The Second Period Contract

Let $j \in \{0, 1\}$ denote the first period output. The firm offers a second period incentive contract b_{2j} conditional on the first period output. Let y_{2j} denote the output in the second period when $y_1 = j$. Define z_{2j} as follows:

$$z_{2j} = q_{2j} + (1 - q_{2j})\alpha = q_{2j}(1 - \alpha) + \alpha. \quad (5)$$

The expected utility of the agent in the second period, conditional on first period output, is

$$u_{2j} = -g(e_2) + P(y_{2j} = 1).b_{2j} + P(y_{2j} = 0).0 = -0.5re_2^2 + z_{2j}b_{2j}e_2.$$

The agent's second period effort solves the problem:

$$\max_{e_2} u_{2j} = -0.5re_2^2 + z_{2j}b_{2j}e_2. \quad (6)$$

It follows that the optimal second period effort level $e_{2j}^* = \frac{z_{2j}b_{2j}}{r}$.

The firm's second period profit Π_{2j} conditional on first period output is

$$\Pi_{2j} = -F + P(y_{2j} = 1).(1 - b_{2j}) + P(y_{2j} = 0).0 = -F + z_{2j}e_{2j}^*(1 - b_{2j}).$$

Substituting for e_{2j}^* from above, the firm chooses b_{2j} to solve

$$\max_{b_{2j}} \Pi_{2j} = -F + \frac{z_{2j}^2}{r} (b_{2j} - b_{2j}^2). \quad (7)$$

The following result characterizes the optimal second period contract.

Result 1 *The optimal contract in the second period is independent of first period output and is given by $b_2^* = 0.50$. The optimal second period effort level is $e_{2j}^* = \frac{z_{2j}}{2r}$. The firm's expected second period profit is $\Pi_{2j}^* = \frac{z_{2j}^2}{4r} - F$, and the worker's expected utility is $u_{2j}^* = \frac{z_{2j}^2}{8r}$, where $j \in \{0, 1\}$ is the first period output.*

Result 1 has two implications. First, it implies that the firm would not rehire the agent if the first period output is j and $z_{2j}^2 < 4rF$. In the following analysis, we will assume that:

$$z_{21}^2 > 4rF \quad (8)$$

in order to ensure that a firm rehires the agent if the first period output is one.¹¹

Second, it follows from result 1, (2), (4) and (5) that

$$\frac{du_{20}^*}{de_1} = 0.5 \left(\frac{d\Pi_{20}^*}{de_1} \right) = \left(\frac{z_{20}}{4r} \right) (1 - \alpha) \frac{dq_{20}}{de_1} < 0. \quad (9)$$

We may call this *the learning effect*, as (9) highlights the effect of learning on the conditional expected second period utility and profits. A higher first period effort biases ability downward to a greater extent in the event of poor performance, leading to lower conditional expected utility and profits.¹² A strong enough learning effect will imply that $\Pi_{20} < 0$, so

¹¹Otherwise, the firm would fire the agent even if the first period output was one, which reduces the model to a trivial case of a one-period model. To see this, note that (4) and (5) imply that $z_{20} < z_{21}$.

¹²While the firm does not observe e_1 , it infers e_1 from the equilibrium response of the agent to the contract offered.

that it is optimal for the firm to fire the agent for poor performance.

The learning effect implies that for a given set of parameters δ , r , F , and q , firing and rehiring may each be a part of a separate sequential equilibrium. For example, suppose that the manager conjectures that the firm will fire him if $y_1 = 0$. In consequence, his first period effort is high. The learning effect might then make $\Pi_{20}^* < 0$. Hence it will be optimal for the firm to fire the manager if $y_1 = 0$, justifying the manager's conjecture. Similarly, under a rehiring conjecture, effort may be low enough that the learning effect is weak, resulting in Π_{20}^* being positive.

The possibility of multiple sequential equilibria (hinging on the firing-rehiring decision) necessitates some kind of selection mechanism whereby one equilibrium is picked. However, equilibrium selection is not the focus of this paper. Hence, we make the simplifying assumption that whenever there are multiple equilibria, one involving firing and another involving rehiring, the equilibrium that gives the firm higher expected total profits is selected.

Next we examine whether the optimal contract in the first period includes a firing threat or a commitment not to fire. We derive a general result on the relationship between the contract with firing and the contract without firing, rather than solve for the exact first period contract in each case.

3.3 The First Period Contract

Let Π_1 denote the firm's expected profit in the first period under a first period contract b_1 , and let e_1 be the effort level induced by that contract. The firm's total expected discounted profit is given by

$$\Pi = \Pi_1 + P(y_1 = 1)\delta\Pi_{21}^* + P(y_1 = 0)\delta\Pi_{20}^*$$

$$= z_1 e_1 (1 - b_1) + z_1 e_1 \delta \Pi_{21}^* + (1 - z_1 e_1) \delta \Pi_{20}^*. \quad (10)$$

Keeping the contract fixed, the effect of a change in first period effort on the total profit is given by

$$\frac{d\Pi}{de_1} = \frac{d\Pi_1}{de_1} + \delta z_1 (\Pi_{21}^* - \Pi_{20}^*) + \delta (1 - z_1 e_1) \frac{d\Pi_{20}^*}{de_1}. \quad (11)$$

(11) shows that an increase in e_1 affects total expected discounted profit in three ways. First, it increases the expected first period profit. Second, it increases the expected discounted second period profit, *absent any learning effect*. The third effect, which is a decrease in the expected discounted second period profit, is the learning effect (9). Since Π_{21}^* is independent of e_1 in our model, the learning effect operates only through a reduction in the expected second period profit conditional on failure in the first period (Π_{20}^*).

While the first two terms on the RHS of (11) are positive, the third term is negative. Thus, the net effect of a change in e_1 (given the contract b_1) on the total expected discounted profit depends on the strength of the learning effect relative to the impact of effort on the probability of success. However, it turns out that the learning effect is always weaker than the other two effects. This leads to the following result (proved in appendix A).

Result 2 *Given a first period contract b_1 , the firm's total expected discounted profit increases with the first period effort e_1 .*

Result 2 has a straightforward implication for the relationship between the optimal first period contracts in the firing and rehiring equilibria. Let b_{1F} denote the firm's optimal first period contract in a "firing equilibrium," and b_{1R} , the optimal contract in a "rehiring equilibrium." For each to be sequentially rational, we must have $\Pi_{20}^* \leq 0$ in the firing equilibrium and $\Pi_{20}^* \geq 0$ in the rehiring equilibrium. These conditions, together with the learning effect, imply that the first period effort in a rehiring equilibrium (e_{1R}) cannot be

higher than the first period effort in a firing equilibrium (e_{1F}). This, combined with result 2, implies that if $b_{1F} < b_{1R}$, then the total expected discounted profits of the firm would be higher under firing than under rehiring. Therefore, the rehiring equilibrium would be chosen only if $b_{1R} < b_{1F}$ or if $\Pi_{20}^* > 0$ under the optimal firing contract (which would imply that firing was not a sequential equilibrium strategy). This leads to the following proposition.

Proposition 1 *The optimal first period contract in any sequential equilibrium with firing is at least as steep as the optimal contract in an equilibrium with rehiring, i.e., $b_{1F} \geq b_{1R}$.*

Proposition 1 implies that firms that fire their managers for poor performance must, *ex ante*, have offered steeper incentive contracts relative to similar firms that did not fire their managers. This might seem contradictory to Hartzell's (2001) result that contractual incentives and termination-related incentives are substitutes. However, the two results are derived in different contexts. As mentioned in section 2, Hartzell's (2001) comparative static is based on the assumption that firms always find it optimal to commit to firing *ex ante*, i.e., that they are *in* the firing equilibrium. Hence, as the probability of being fired decreases due to an exogenous increase in the cost of firing, the firm increases the slope of the compensation contract to restore incentives. In contrast, our result compares contractual incentives and termination related incentives across the two equilibria.

Proposition 1 suggests that performance incentives and termination-related incentives need not always be negatively related. Comparing across firms, these two elements of incentives might be complements rather than substitutes. It is easily seen, for example, that if two firms A and B, that are otherwise identical, differ by an arbitrarily small amount in the parameter F, then their slopes in the firing equilibrium will be quite close (i.e., $b_{1F}^A \approx b_{1F}^B$). However, the firm with the lower F, say firm B, might choose rehiring, with the consequent lower slope, while the other firm might choose firing with a higher slope (i.e., $b_{1F}^A \approx b_{1F}^B > b_{1R}^B$). This might happen if $\Pi_{20}^A < 0$ and $\Pi_{20}^B > 0$ in their respective firing

regimes.

However, generalizing this idea and deriving comparative static results on the relationship between the optimal contracts of dissimilar firms is not straightforward. This is because the first order condition in the rehiring case is too complex for a direct interpretation in terms of the underlying parameters. Any comparative static results would therefore have to be derived from numerical solutions. The extra analysis offers little in terms of intuition and is therefore not presented here. Subramanian, Chakraborty and Sheikh (2002b) contains the full solution to the model. Instead, in the following sections, we shift to an empirical analysis of CEO compensation based on the insights gained so far. Our objective is to see whether the complementary relationship between performance incentives and termination-related incentives is observed in the data and, if so, whether it is pervasive.

4 Data

The data on CEO turnover for the period 1993-1999 (in fiscal years) used in this study is collected from *Standard and Poor's ExecuComp* database. We searched the database for instances where the identity of the CEO has changed. We were careful not to include those instances where the identity change was purely short-term and reversed within a year of the change. We also conducted a detailed search of news items on the Lexis-Nexis Academic Universe database in order to verify that such changes were genuine CEO changes. We dropped CEO identity changes in the ExecuComp database which were not corroborated by any corresponding news item in the Lexis-Nexis database. Finally, we omitted firms in the financial sector and regulated firms (SIC codes in the range 4910-4949 and 6000-7000).

4.1 Reasons for CEO Change

For each CEO change, we collected information on the date of the CEO change announcement and the reason specified for the change from the databases of the Lexis-Nexis Academic Universe. Based on this search, we found that CEO changes could be classified by the cited reason for the change into: (i) Retirement and regular succession related; (ii) Resignations and other changes explicitly related to poor performance, including those changes forced by board of directors; (iii) career-related moves to other firms by the CEO; (iv) turnover associated with mergers and acquisitions; (v) health related changes; and (vi) unexplained (in the news) changes. We grouped the changes into three categories, namely *Retirement*, *Forced Turnover*, and *Other Changes*. Table 1 summarizes these changes by year and reason. Our final sample consists of 8621 firm-year observations with 705 instances of CEO change (which is a turnover rate of 8.18%). We are interested mainly in the “Forced Turnover” category, under which are grouped those cases where the news item either explicitly states or speculates that the CEO was forced out or resigned in light of poor performance. There are 92 such instances in our sample.

[TABLE 1 HERE]

For each of these firm-year observations, we collected data on firm characteristics such as revenue, income, assets and performance ratios and CEO characteristics such as the CEO’s age, tenure with the firm, and comprehensive compensation details from the ExecuComp database. Table 2 summarizes these variables. As the table shows, forced CEO changes occur in firms that, on average, have a low profitability as measured by the ratio of net income to sales (NIS), as well as the return on assets (ROA). Such firms also have poor stock performance as indicated by the negative average stock return. Also, the average CEO who is forced out has had a shorter tenure, is several years younger, and owns a smaller percentage of the the firm than the average CEO who continues in office. As documented

in Aggarwal and Samwick (1999) and in other studies, there is a substantial skewness in the data, with the medians being much lower than the means. However, we run robustness checks to make sure that our estimation results are not driven by outliers.

[TABLE 2 HERE]

4.2 Measuring Performance

We define poor firm performance in several different ways and estimate the impact of incentives on turnover using each of them. In addition to the usual market-based measure of performance, namely, stock returns, we also use accounting-based measures. As Murphy (1999) documents, companies use accounting-based measures of performance to a great extent in annual incentive plans. We are therefore interested in examining how incentives based on such measures affect CEO turnover. Our first measure is based on the company's net income before extraordinary items (NIBEX) in the previous fiscal year. While this is an absolute measure, it is appropriate to the extent that a firm is unique within an industry. We believe that such a measure is relevant since running losses or being "in the red" is often a highly visible signal to the markets and shareholders of poor managerial performance. The other six definitions are all relative measures based on the firm's net income to sales ratio (NIS), the return on assets (ROA), and the one-year stock return (RET1) relative to the two-digit SIC industry of the firm.

In our basic analysis, we use the following definitions of poor performance (for firm i in year t).

- $NIBEX_{it} < 0$.
- $NIS_{it} < NISAVG_{it}$, where $NISAVG_{it}$ stands for the average NIS among firms with the same 2 digit SIC code as firm i .

- $ROA_{it} < ROAAVG_{it}$, where $ROAAVG_{it}$ stands for the average ROA among firms with the same 2 digit SIC code as firm i .
- $RET1_{it} < MRET1_t$, where $MRET1_t$ stands for the return on a market index. The market index we use is the NASDAQ Composite index if the company is traded on the NASDAQ market, and the S&P 500 Composite index otherwise.

In addition, we check the robustness of our results to the following definitions of firm performance

- $NIS_{it} < NISQ25_{it}$, where $NISQ25_{it}$ stands for the 25th percentile level of NIS among firms with the same 2 digit SIC code as firm i .
- $ROA_{it} < ROAQ25_{it}$, where $ROAQ25_{it}$ stands for the 25th percentile level of ROA among firms with the same 2 digit SIC code as firm i .
- $RET1_{it} < RET1Q25_{it}$, where $RET1Q25_{it}$ stands for the 25th percentile level of one-year stock returns among firms with the same 2 digit SIC code as firm i .

Table 3 gives summary measures of firm performance around CEO turnovers. As the table shows, the average firm whose CEO is forced out has lower profitability as measured by ratio of net income before extraordinary items to sales, underperforms the industry in terms of return on assets, and vastly underperforms the market in terms of stock returns in the year preceding the CEO change. The distribution of stock returns among the firms in our sample is highly skewed as indicated by the wide difference between the mean and median returns.

[TABLE 3 HERE]

4.3 Incentives - Return Sensitivity and Dollar Sensitivity

We concentrate on equity-based incentives for measuring CEO incentives. Core, Guay, and Verrecchia (2000) show, the bulk of the average CEO's total incentives are equity-based. Similarly, Hall and Liebman (1998) show that fluctuations in the value of stocks and options account for about 98% of CEO pay-performance sensitivity. In our data, OLS regressions similar to regression 1 in Jensen and Murphy (1990a)¹³ indicate that, for a \$1000 change in firm equity value, CEO salary and bonus change 1.28¢ while total CEO compensation including stock and option grants changes 22.11¢, indicating the importance of equity-based incentives. There is an ongoing debate in the literature on how to measure equity-based incentives.¹⁴ Demsetz and Lehn (1985), Jensen and Murphy (1990a), and Yermack (1995) use the dollar change in CEO wealth for a dollar change in firm equity value (the *Dollar Sensitivity*), while Core and Guay (1999b) use the dollar change in CEO wealth for a percentage change in firm equity value (the *Return Sensitivity*). Baker and Hall (1998) argue that the latter measure is the appropriate one to use when CEO actions affect firm percentage returns through control of firm strategy. We estimate our regressions on each of the two measures of incentives and find similar results.

Following Core and Guay (1999b), we calculate incentives in year t as the sum of three components – (i) portfolio incentives from the CEO's holdings of shares, (ii) incentives from the CEO's holdings of unexercised options carried over from past years, and (iii) incentives from options granted during year t . Incentives from options are measured using Black-Scholes option sensitivities to stock price. While the disclosures on each year's grants are

¹³The regressions are of the form $\Delta C_t = a + b\Delta V_t + e_t$, where ΔC_t is the change in CEO compensation and ΔV_t is the change in the market value of the firm over the year t . CEO compensation is measured by the sum of salary and bonus in the first regression, and by the sum of salary, bonus, stock and option grants in the second regression.

¹⁴See Core, Guay, and Larcker (2001) for a discussion on the different approaches.

sufficiently detailed to enable the calculation of the option sensitivities, those on the options carried over from past grants are not. For the latter options, we use the Core and Guay (1999a) method to calculate sensitivities. This method uses estimates of the average exercise price and the average time to maturity, the details of which are summarized in Appendix B.

[TABLE 4 HERE.]

Table 4 gives the summary statistics of the different components of CEO incentives, namely, incentives from stocks held, incentives from options granted in the year of the proxy statement, and incentives from the portfolio of unexercised options carried over from past years. The distribution of our estimates of return sensitivity is roughly similar to those given in table 1 of Core and Guay (1999b) for the period 1992-1996 during which the two samples overlap.¹⁵ The median change in CEO wealth for a 1% change in firm equity value is \$178,070. Equivalently, the median change in CEO wealth is \$16.78 for each \$1000 change in firm equity value.¹⁶

The univariate statistics in table 4 do not allow comparisons between incentive levels of CEOs who are forced out relative to the continuing CEOs, conditioning on age, tenure and performance. We turn to regression analysis for this purpose.

¹⁵For our raw data, including non-CEO observations, the mean, median and standard deviation of return sensitivity are \$599,898, \$120,730 and \$3,799,340, while the corresponding numbers from table 1 of Core and Guay (1999b) are \$557,732, \$117,434 and \$3,680,516 respectively. Differences may be due to the fact that Core and Guay (1999b) use 120 day volatility rather than 60 month volatility.

¹⁶These figures are substantially higher than the estimates in Jensen and Murphy, 1990a, reflecting partly, the huge increase in equity-based compensation since 1986, the end of their study period, and partly, the stock market boom of the 1990s. Indeed, our estimates are closer to those in table VI of Hall and Liebman (1998), who estimate the median return sensitivity to be about \$125,000 for the year 1994, compared to \$121,306 in our sample.

5 Estimation and Results

We wish to examine whether the incidence of forced turnover increases with the incentive level of CEOs, conditioning on poor performance. Therefore, we estimate logit models of the determinants of forced CEO change among firms that perform poorly by our various measures.

$$P(\text{Forced Turnover}) = F(\text{Incentives, CEO Specific and Firm Specific Variables}) \quad (12)$$

We are primarily interested in the coefficient on the incentives variable. The dependent variable in these regressions is an indicator of forced CEO change.¹⁷ It is an anticipatory variable measured at fiscal year end. Thus, if the CEO change variable is one for a certain year, it implies that the company's CEO at the next year end is not the same as the incumbent. We restrict the estimation to CEOs who have held the office for at least 3 years prior to the year of change. Since the model we use is one of a firm learning the CEO's ability by looking at performance, we believe that the CEO must have been in office for at least a few years for the firm to be able to make a judgment on his or her abilities.¹⁸

Denis, Denis, and Sarin (1997) find evidence that higher levels of stock ownership by top management imply lower sensitivities of turnover to performance. Higher stock ownership by the CEO may imply greater levels of entrenchment, making it more difficult for the board to fire the CEO. Our theoretical model does not consider entrenchment effects. Indeed, the issue of whether the CEO is an agent (or one of the principals) is itself muddled in these

¹⁷In these regressions, we include only observations with either no CEO change or a forced change, and drop instances of CEO change that are for retirement and other reasons. The results are even stronger when we group the dropped instances in the "no change" category.

¹⁸In his study of CEO turnover and succession, Parrino (1997) uses the restriction that the CEOs must have held office for at least 3 years. Moreover, we repeated our regressions with a restriction on CEO tenure to 2 years and above and found the results to be mostly similar – the coefficient on incentives is positive and of similar magnitude in all specifications, though its significance is reduced.

cases. Since any such entrenchment effect of stock ownership may confound the incentive effect that we wish to isolate, we eliminate from our sample those instances where the CEO owns greater than 5% of the stock of the firm. Observations with CEO stock ownership greater than 5% constitute about 18% of the data. Regressions including these observations produced inconclusive results. We tried to explicitly account for the entrenchment effect by including the CEO stock ownership variable in the logit regressions. However, this variable is strongly correlated with incentives, particularly the dollar sensitivity measure.¹⁹ To avoid problems of multicollinearity, we included dummy variables for CEO stock ownership in the ranges of 5% to 25% and greater than 25%. (Denis, Denis, and Sarin, 1997 use similar dummies for the management stock ownership.) While the results were strongly supportive of proposition 1, the ownership dummies and the related observations dropped out of the final regressions, leading to potential sample selection problems. Our approach of concentrating on those instances where entrenchment would not be a problem avoids any such hidden biases (within the sample that we consider).

In estimating (12) above, we control for several factors that jointly affect incentives and turnover. These are:

(i) **Firm Size** has been shown in the literature to be linked to pay-performance sensitivities or incentives.²⁰ However, larger firms might also have greater turnover propensity following poor performance since they tend to have more independent outside directors on their boards, as well as a larger talent pool from which to choose a successor (Parrino, 1997). Warner, Watts, and Wruck (1988) also suggest that larger firms have higher turnover rates.

¹⁹See Appendix B for the relationship between stock ownership and dollar sensitivity.

²⁰While Jensen and Murphy (1990a) show that this relationship is negative for their measure of incentives, Core, Guay, and Larcker (2001, pp.14) argue that larger firms might require more talented managers, who are more highly compensated and therefore wealthier. This, combined with decreasing absolute risk aversion leads to higher incentives for CEOs of larger firms.

Thus, we must control for firm size, so as to avoid a spurious correlation between incentives and turnover. We use the natural log of sales as the measure of firm size.

(ii) Firms with higher **growth opportunities** might offer compensation packages with relatively more stock-options in order to induce risk-taking by managers. These opportunities might also be correlated with performance, as well as with the rates of turnover following poor performance.²¹ We use the ratio of book value to market value of assets of the firm as a proxy for the growth opportunities available to the firm.

(iii) The **level of institutional shareholding** and the size of the board of directors of the company are key corporate governance variables that affect the likelihood of CEO turnover, as documented in Denis, Denis, and Sarin (1997) and Weisbach (1988). Since these variables may also be systematically correlated with CEO compensation and incentives, we include them as control variables.²²

(iv) Gibbons and Murphy (1992) show that incentive levels generally increase with the proximity to retirement of a CEO. This implies a positive relationship between the **tenure or age of the CEO** and incentive levels. Since older CEOs are also more likely to retire rather than be forced out, we need to include CEO age and tenure as control variables.

(v) The ease of monitoring a firm's management, and therefore its CEO incentive levels, together with its CEO turnover rate, might depend jointly on industry and year-specific factors. Therefore we use **industry and year dummies** in the regressions.

²¹For example, high growth firms might understand that there is greater risk of failure associated with new ventures, and therefore, may not punish the manager for failure as readily as a low growth firm.

²²The fraction of outsiders on the board of directors is another commonly used proxy for the strength of corporate governance. We repeated our regressions with this variable – it turns out to be insignificant in most specifications, while the other coefficients are largely unchanged. These results are therefore not reported here.

5.1 Baseline Results

Table 5 presents the results of the basic logit regressions. The first panel (columns 1 through 4) of the table gives the results using the dollar sensitivity of CEO pay as the measure of incentives, while the second panel (columns 5 through 8) gives the results using the return sensitivity as the measure of incentives. The four columns of each panel correspond to four different definitions of poor firm performance. Thus column 1 gives the estimates for firms whose net income before extraordinary items was negative over the previous year, column 2 gives the estimates for firms with $NIS_t < NISAVG_t$, column 3 for firms with $ROA < ROAAVG$, and column 4 for firms with $RET1 < MRET1$.

The first panel of the table shows that the dollar sensitivity of CEO pay is positively related to the likelihood of forced turnover. The coefficient on the dollar sensitivity of CEO pay is significant at the 5% level or above for all the measures of performance. The estimates in the second panel similarly indicate that the return sensitivity of CEO pay has a positive impact on forced turnover. The coefficient on incentives is significant at the 5% level for all measures of performance except stock returns.

[TABLE 5 HERE.]

The results may be best understood in terms of the percentage change in probability of firing at different incentive levels in the distribution. Table 6 presents these calculations for the median firm in the sample. As the table shows, among firms that make a net loss in a given year, a CEO receiving dollar incentives at the 60th percentile level is 14.1% more likely to be fired than a CEO with incentives at the 40th percentile. The corresponding figures are 12.42% for firms whose NIS is below the industry average level, 10.75% for firms whose ROA is below the industry average level, and 11.06% for firms whose stock return is below the market return. In terms of elasticities, for a 10% increase in incentives, the probability

of forced turnover increases by 1.71% at a firm whose NIS is below industry average, by 1.37% at a firm whose ROA is below industry average, and by 1.68% at a firm whose stock underperforms the market. Table 6 also presents the corresponding calculations for return sensitivity.

[TABLE 6 HERE.]

The coefficients on the control variables in these regressions are generally of the expected signs. The book to market ratio has a positive effect on the likelihood of forced turnover, which supports the argument that firms with higher growth opportunities (and lower BTM) understand the inherent risks in these opportunities and do not fire CEOs as readily as more stable firms. CEOs with longer tenure are also less likely to be fired for poor performance, which may be an indicator of entrenchment. Institutional stock ownership generally has a positive effect and board size, a negative effect, on the likelihood of being fired for poor performance. However, neither variable is significant. Similarly, firm size and CEO age do not seem to have a significant impact on forced turnover.

5.2 Results for the Worst Performers

In order to further check whether our results are dependent on our definition of poor performance, we examine the impact of incentives on forced turnover among the firms that perform very poorly relative to their industry. These are defined to be firms that are in the lowest quartile of their industry in terms of each of three performance measures, namely, NIS, ROA and stock returns. Table 7 presents these estimates. Columns 1 through 3 of the table present the dollar sensitivity estimates, and columns 4 through 6 present the return sensitivity estimates. The results are largely identical to the earlier estimates – the coefficient on dollar sensitivity is positive and significant at the 5% level or above for all three measures of performance, as is the coefficient on return sensitivity. The return sensitivity

is now significant at the 10% level in the stock returns regression.

[TABLE 7.]

We also repeated the regressions after redefining poor performers to be those that are in the lower 40% of their industry (rather than the lowest quartile) in terms of each of three performance measures, namely, NIS, ROA, and stock returns. The results (not reported here) are positive and mostly significant with both incentive measures.

5.3 Past Performance

One potential problem with the specification of (12) is that it assumes that firms decide on whether or not to fire their CEOs based only on performance in the most recent year. Before addressing this issue more rigorously, we argue at the outset that such misspecification is not likely to be driving the results. Assume first that lagged performance is actually an omitted variable that is driving the results. In order to do so, it must be positively correlated with both incentives and the firing decision. For example, it may be the case that those firms that fire their CEOs for poor performance in a given year do so not because their incentives were high, but because the performance in the previous year was also poor. Then the positive correlation of firing with incentives must be due to a positive correlation between incentives and the likelihood of two consecutive years (or more) of poor performance. Such a systematic positive correlation between incentives and poor performance is an unlikely prospect, in theory as well as reality.

In order to be convinced that lagged performance was not a factor driving the results, we repeated the regressions after including the performance in the previous year in the regressions. Table 8 presents the estimates. The results clearly indicate that lagged performance is not an important determinant of the link between incentives and firing. The

lagged performance variable is not significant in any of the specifications. The positive effect of incentives on the likelihood of forced turnover remains, and is mostly significant.

[TABLE 8 HERE.]

5.4 Volatility

Aggarwal and Samwick (1999) show that the pay-performance sensitivity of executives is closely related to the volatility of stock prices of the firm. Executives at firms with higher stock price volatility face greater risks and, given executive risk aversion, this implies that such firms do not link executive pay to performance as readily as less risky firms. Core and Guay (forthcoming) argue that controlling for firm size reverses the Aggarwal and Samwick (1999) result. They claim that there is an increasing relation between risk and the pay-performance sensitivity after controlling for firm size, which is consistent with Demsetz and Lehn's (1985) prediction. However, Aggarwal and Samwick (2002) presents evidence justifying their earlier results. These papers indicate that the volatility of performance may be an important variable to be included in any estimation of the relationship between incentives, performance, and turnover. Accordingly, we repeated the regressions controlling for the volatility of performance. The control variable we used was the Black-Scholes volatility measure of the stock based on 60 month stock returns, a variable that was readily available in the ExecuComp dataset. Table 9 presents these estimates. The results are similar to the baseline results – the coefficient on the dollar sensitivity of CEO pay is positive and significant at the 5% level or above for all measures of performance, while the coefficient on the return sensitivity is positive and significant at the 5% level or higher for the NIS and ROA measures of performance. Volatility, by itself, is not a significant determinant of forced turnover.

[TABLE 9 HERE.]

5.5 Performance Pressure Over Time

In this section, we examine whether the positive link between performance incentives and performance pressure has changed over the last decade. To do this, the year dummies in the basic regression are replaced with a dummy for the period 1993-96 and its interaction with incentives. The results, presented in table 10, are striking. While the coefficient on the interaction variable is negative, the hypothesis that the sum of the coefficients on incentives and on the interaction variable is different from zero cannot be rejected for any of the specifications. Thus, conditional on poor performance, incentives do not have a significant effect on turnover in the 1993-96 period. However, the incentive variable is positive and significant, indicating that for the period 1997-99, performance incentives were positively linked to firing pressure. The positive association of increased firing pressure with higher performance incentives appears to be a late 1990's phenomenon. This increase in job insecurity over the 1990s for CEOs who receive high incentives might have been a factor contributing to the accounting scandals and distorted earnings reports of late 1990s. If poor performance involved not only lower compensation but also possible job loss, CEOs might have been that much more inclined to embellish profit and earnings figures to avoid the appearance of poor performance. Further research in this direction might shed useful light on the causal factors of the corporate governance failures of the last decade.

[TABLE 10 HERE.]

6 Conclusion

In this paper, we examine the issue of the firing threat and its relationship to the optimal incentive contract in the context of the principal-agent relationship. We first derive some theoretical results on the relationship between the optimal incentive contract and the likelihood of being fired for poor performance. We then examine the empirical evidence on the

incidence of forced turnover among CEOs with different compensation contracts. We find that CEOs with higher incentives are also more likely to be fired for poor performance.

We find that a CEO receiving performance-based incentives (measured by dollar sensitivity) at the 60th percentile level is roughly 10% more likely to be fired following a year of poor performance as compared to a CEO with incentives at the 40th percentile level. While the results are weaker with return sensitivity as the incentive measure, they are nevertheless positive and significant for most measures of firm performance. Even though our results are based on CEOs with stock ownership levels of less than 5%, we believe that this is an appropriate restriction since we are interested in the incentive effect of stock ownership, which is likely to be confounded by the entrenchment effect when ownership is too high.

Our main point point in this paper is that performance incentives and termination-related incentives need not always be substitutes in an optimal contracting framework. We argue that if firms learn sufficiently about the ability of a manager from observing performance, then they may fire managers who perform poorly despite being highly incentivized. This implies that these performance incentives and termination-related incentives may be complements rather than substitutes. Our empirical analysis bears this out. CEOs with greater incentives also face greater performance pressures and have less secure jobs. This insecurity also seems to have increased sharply over the 1990s, which might have been a factor contributing to the accounting scandals and distorted earnings reports of late 1990s. Further research in this direction might shed useful light on the causal factors of the corporate governance failures of the last decade.

Appendix A

Proof of Result 2

The proof follows from a straightforward manipulation of the terms on the RHS of equation 11.

Since $\Pi_1 = z_1 e_1 (1 - b_1)$, it follows that $\frac{d\Pi_1}{de_1} = z_1 (1 - b_1) > 0$. Next,

$$\Pi_{21}^* - \Pi_{20}^* = \frac{(z_{21} - z_{20})(z_{21} + z_{20})}{4r} = \frac{(1 - \alpha)}{4r} (q_{21} - q_{20})(z_{21} + z_{20}), \quad (13)$$

since (5) implies that $z_{21} - z_{20} = (1 - \alpha)(q_{21} - q_{20})$. Further,

$$q_{21} - q_{20} = \frac{q(1 - z_1)}{z_1(1 - z_1 e_1)}, \quad \text{and} \quad (14)$$

$$z_{21} + z_{20} = \frac{[q + \alpha^2(1 - q)](1 - z_1 e_1) + [q(1 - e_1) + \alpha(1 - q)(1 - \alpha e_1)]z_1}{z_1(1 - z_1 e_1)}. \quad (15)$$

Next, from (2), it follows that

$$\frac{dq_{20}}{de_1} = \frac{q(z_1 - 1)}{(1 - z_1 e_1)^2}.$$

Substituting in (9), we get

$$\frac{d\Pi_{20}^*}{de_1} = \frac{(1 - \alpha)}{2r} \left(\frac{q(1 - e_1) + \alpha(1 - q)(1 - \alpha e_1)}{1 - z_1 e_1} \right) \left(\frac{q(z_1 - 1)}{(1 - z_1 e_1)^2} \right). \quad (16)$$

Combining (13), (14), (15) and (16), it may be shown that

$$\delta z_1 (\Pi_{21}^* - \Pi_{20}^*) + \delta (1 - z_1 e_1) \frac{d\Pi_{20}^*}{de_1} > 0. \quad (17)$$

Condition 17, together with the result that $\frac{d\Pi_1}{de_1} > 0$ implies result 2.

Appendix B

Below, we describe briefly the method used to calculate CEO incentive levels (for full details, see Core and Guay, 1999b). CEO wealth consists of a portfolio of stock and options. Return Sensitivity is defined as the dollar change in CEO wealth for a 1% change in firm equity value, while Dollar Sensitivity is defined as the dollar change in CEO wealth for a dollar change in firm equity value. If W denotes CEO wealth in options and stocks held, and V denotes firm equity value, then,

$$\text{Return Sensitivity} = r = 0.01 * dW / \left(\frac{dV}{V} \right), \text{ and}$$

$$\text{Dollar Sensitivity} = \left(\frac{dW}{dV} \right) = \frac{100 * r}{V}.$$

The sensitivity of a stock portfolio to a 1% change in firm equity value is just 1% of the stock portfolio value. As for the option portfolio, we use the Black-Scholes model incorporating dividends to estimate sensitivities (Black and Scholes, 1973; Merton, 1973). This is in line with prior research by Jensen and Murphy (1990), Yermack (1995), Hall and Liebman (1998), and Core and Guay (1999b). The sensitivity of an option's value to a 1% change in the firm equity value is the option *delta* multiplied by $0.01P$, where P is the stock price. Thus, denoting the number of shares and options held by N_s and N_o ,

$$\text{Stock Portfolio Return Sensitivity} = 0.01 * N_s P.$$

$$\text{Option Portfolio Return Sensitivity} = 0.01 * \delta N_o P.$$

To calculate the option delta, we need the stock price, exercise price, time to maturity, expected stock return volatility, expected dividend yield, and the risk-free rate. For each fiscal year, firms are required to disclose the exercise price and time to maturity for options that are granted in that particular year. Therefore, the option delta is readily calculated for these options. However, for options granted in previous years, such details are not available and would have to be collected from past proxy statements. Core and Guay (1999a) present a simplified method for calculating the values of options granted in past years using

information from only the latest proxy statement. This involves: (i) approximating the exercise price with the year-end price minus the current realizable value per option and (ii) setting the time to maturity of unexercisable options to one year less than the time to maturity of the most recent year's grant (or nine years if no new grant was made), and of exercisable options to three years less than the time to maturity of unexercisable options (or six years if no new grant was made). Core and Guay (1999a) show that this method yields estimates of option portfolio sensitivities that are 99% correlated with the measures that would be obtained if the parameters of a CEO's option portfolio were known.

REFERENCES

Abowd, J. (1990), "Does Performance-Based Managerial Compensation Affect Corporate Performance?" *Industrial and Labor Relations Review*, 43(3), S52-73.

Aggarwal, R. and Samwick, A. (1999), "The Other Side of the Tradeoff: The Impact of Risk on Executive Compensation," *Journal of Political Economy*, 107, 65-105.

Aggarwal, R. and Samwick, A. (2002), "The Other Side of the Tradeoff: The Impact of Risk on Executive Compensation – A Reply," *Working Paper No.02-19*, Dartmouth College.

Baker, G. and Hall, B. (1998), "CEO Incentives and Firm Size," *NBER Working paper*, No. 6868.

Baker, G., Gibbons, R. and K. J. Murphy (1994), "Subjective Performance Measures in Optimal Incentive Contracts," *The Quarterly Journal of Economics*, 109, 1125-1156.

Black, F., and Scholes, M. (1973), "The pricing of options and corporate liabilities," *Journal of Political Economy*, 81, 637-654.

Core, J. and Guay, W. (1999a), "Estimating the value of stock option portfolios and their sensitivities to price and volatility," *Working paper*, University of Pennsylvania.

Core, J. and Guay, W. (1999b), "The use of equity grants to manage optimal equity incentive levels," *Journal of Accounting and Economics*, 28, 151-184.

Core, J. and Guay, W. (Forthcoming), "The Other Side of the Trade-Off: The Impact of

Risk on Executive Compensation – A Comment,” *Journal of Political Economy*.

Core, J., Guay W., and Verrecchia, R. (2000), “Are Performance Measures other than Price Important to CEO Incentives?” *Working paper*, University of Pennsylvania.

Coughlan, A. and R. Schmidt (1985), “Executive Compensation, Management Turnover, and Firm Performance: An Empirical Investigation,” *Journal of Accounting and Economics*, 7(1-3), 43-66.

Demsetz, H. and K. Lehn. (1985) “The Structure of Corporate Ownership: Causes and Consequences,” *Journal of Political Economy*, 93, 1155-1177.

Denis, D. J., Denis D. K. and Sarin, A. (1997), “Ownership Structure and Top Executive Turnover,” *Journal of Financial Economics*, 45, 193-221.

Goyal, V. K. and Park, C. W. (2002) “Board leadership structure and CEO turnover,” *Journal of Corporate Finance*, 8, 49-66.

Hall, B. and Liebman, J. (1998), “Are CEOs really paid like bureaucrats?” *The Quarterly Journal of Economics*, 103, 653-691.

Hallman, G. and Hartzell, J. C. (2001), “Optimal Compensation Contracts with Pay for Performance and Termination Incentives,” *Working Paper*, University of Texas at Austin.

Hartzell, J. C. (2001), “The Impact of the Likelihood of Turnover on Executive Compensation,” *Working Paper*, The University of Texas at Austin.

Himmelberg, C., G. Hubbard, and D. Palia (1999), "Understanding the determinants of managerial ownership and the link between ownership and performance," *Journal of Financial Economics*, 53, 353-384.

Holmstrom, B. (1979), "Moral Hazard and Observability," *The Bell Journal of Economics*, 10, 74-91.

Holmstrom, B. (1982), "Managerial Incentive Problems – A Dynamic Perspective," Essays in Economics and Management in Honour of Lars Whalbeck, Swedish School of Economics, Helsinki.

Holmstrom, B. (1999), "Managerial Incentive Problems: A Dynamic Perspective," *Review of Economic Studies*, 66, 169-182.

Jensen, M. and Meckling, W. (1976), "Theory of the Firm: Managerial behavior, agency costs and ownership structure," *Journal of Financial Economics*, 3, 305-360.

Jensen, M. and K. J. Murphy (1990a), "Performance Pay and Top-Management Incentives," *Journal of Political Economy*, 98(2), 225-64.

Jensen, M. and K. J. Murphy (1990b), "CEO Incentives: It's Not How Much, but How," *Harvard Business Review*, (May/June).

Kaplan, S. (1994a), "Top Executive Rewards and Firm Performance: A Comparison of Japan and the United States," *Journal of Political Economy*, 102(3), 510-46.

Kaplan, S. (1994b), "Top Executives, Turnover, and Firm Performance in Germany," *Jour-*

nal of Law, Economics and Organization, 10(1), 142-59.

Merton, R. (1973), "Theory of rational option pricing," *Bell Journal of Economics and Management Science*, 4, 141-183.

Murphy, K. (1999), "Executive Compensation," in eds. O Ashenfelter and D. Card, *Handbook of Labor Economics*, Vol. III, Amsterdam: North-Holland, 2485-2563.

Murphy, K. J. and J. Zimmerman (1993), "Financial Performance Surrounding CEO Turnover," *Journal of Accounting and Economics*, 16(1-2-3), 273-315.

Parrino, R. (1997), "CEO Turnover and Outside Succession: A Cross-Sectional Analysis," *Journal of Financial Economics*, 46, 165-197.

Subramanian, N., A. Chakraborty and S. Sheikh (2002b), "Optimal Incentive Contracts with Forced Turnover." *Manuscript*.

Warner, J., R. Watts and K. Wruck (1988), "Stock Prices and Top Management Changes," *Journal of Financial Economics*, 20, 461-92.

Weisbach, M. (1988), "Outside Directors and CEO Turnover," *Journal of Financial Economics*, 20(1-2), 461-60.

Yermack, D. (1995), "Do Corporations Award CEO Stock Options Effectively?" *Journal of Financial Economics*, 39(2-3), 237-69.

Table 1: CEO Changes, By Reason for the Change

CEO changes between fiscal years 1993-1999 in the ExecuComp database classified by the reason for the change. A CEO change is defined as a change in the identity of the CEO in the ExecuComp database. The reason for the change was identified through a search of the Lexis-Nexis Academic Universe database for news announcements on the change. CEO changes on account of death, illness, corporate control changes and moves to other firms are omitted, as are changes that could not be cross-checked through news reports. Only firms in the non-financial sector and non-regulated industries are included. Data Source: ExecuComp, 1993-1999 & Lexis-Nexis Academic Universe.

Year	No Change	Retirement	Forced	Other	Total
1993	813	35	3	2	853
1994	1076	70	12	14	1172
1995	1137	71	15	20	1243
1996	1176	55	15	30	1276
1997	1190	89	13	20	1312
1998	1247	74	18	23	1362
1999	1277	93	18	15	1403
Total	7916	487	94	124	8621

Table 2: Summary Statistics of Key Variables

Descriptive Statistics of the key variables used in the estimation. Total compensation includes salary, bonus, other annual compensation, restricted stock, and stock options exercised during the year and long-term incentive payouts. Stock options are valued using the Black-Scholes method. Data Source: ExecuComp, 1993-1999.

Variable	Mean	Median	Std. Dev.
<i>No CEO Change</i>			
Sales (\$ mn)	3441.79	891.19	9785.96
Market Value (\$ mn)	4791.73	914.57	16661.99
Book to Market	0.60	0.60	0.27
Return on Assets (%)	4.21	5.51	13.25
Stock Return (%)	32.62	12.09	710.76
Age of CEO (Years)	55.55	56.00	7.79
Tenure of CEO (Years)	7.04	5.00	7.02
Total Compensation (\$ '000)	2981.98	1141.55	12566.87
Ownership (%)	3.71	0.50	7.76
<i>Forced Change</i>			
Sales (\$ mn)	4870.17	1097.55	9062.87
Market Value (\$ mn)	6854.70	850.34	21171.79
Book to Market	0.70	0.68	0.29
Return on Assets (%)	-5.08	1.30	22.76
Stock Return (%)	-12.88	-12.11	35.92
Age of CEO (Years)	53.13	53.50	5.94
Tenure of CEO (Years)	5.12	4.00	4.10
Total Compensation (\$ '000)	2399.70	978.33	3326.24
Ownership (%)	1.02	0.16	2.40
<i>Full Sample</i>			
Sales (\$ mn)	3557.26	923.13	10100.52
Market Value (\$ mn)	4915.48	930.56	17352.74
Book to Market	0.61	0.60	0.27
Return on Assets (%)	4.00	5.42	13.51
Stock Return (%)	31.19	11.08	685.16
Age of CEO (Years)	56.01	56.00	7.84
Tenure of CEO (Years)	7.18	5.00	7.08
Total Compensation (\$ '000)	2995.66	1152.80	12151.13
Ownership (%)	3.61	0.50	7.63

Table 3: Firm Performance Around Turnovers

Measures of firm performance in the previous fiscal year. NIS is the ratio of Net Income (before adjustments for extraordinary items) to Sales, ROA is the return on assets, and $RET1$, the stock return over the previous fiscal year. $NISAVG$ and $ROAAVG$ are the average NIS and ROA of the 2-digit SIC industry to which the firm belongs. $MRET1$ is the return, over the firm's fiscal year, on the NASDAQ Composite Index if the firm is traded on the NASDAQ market, and on the S&P 500 Composite Index otherwise. Data Source: ExecuComp, 1993-1999.

Type of Change	$NIS - NISAVG$		$ROA - ROAAVG$		$RET1 - MRET1$	
	Mean	Median	Mean	Median	Mean	Median
No Change	-0.83	2.29	0.26	1.35	9.31	-7.94
Forced	-4.50	-2.31	-8.95	-2.76	-37.59	-38.61
Full Sample	-0.80	2.18	0.06	1.24	7.86	-9.06

Table 4: Components of CEO Incentives

Dollar sensitivity is the dollar change in CEO wealth for a dollar change in firm value. It is calculated as the sum of the sensitivities of the 3 components of the CEO's portfolio – shares, options granted this year (current options) and the portfolio of unexercised options carried over from past years. The sensitivity of the portfolio of unexercised past options is calculated using the Core and Guay (1999a) method. Return Sensitivity is the change in CEO wealth for a 1% change in firm wealth. The full sample includes CEO changes for retirement and other reasons.

Variable	Mean	Median	Std. Dev.
<i>No CEO Change</i>			
Share Sensitivity (\$ per \$1000)	37.08	5.00	77.56
Curr. Option Sensitivity (\$ per \$1000)	2.36	0.72	5.50
Old Option Sensitivity (\$ per \$1000)	8.13	4.19	12.05
Total Dollar Sensitivity (\$ per \$1000)	47.70	17.31	78.88
Return Sensitivity (\$'000)	1049.37	180.18	9113.02
<i>Forced Turnover</i>			
Share Sensitivity (\$ per \$1000)	10.24	1.61	24.03
Curr. Option Sensitivity (\$ per \$1000)	1.61	0.32	3.25
Old Option Sensitivity (\$ per \$1000)	6.04	3.53	7.07
Total Dollar Sensitivity (\$ per \$1000)	16.44	10.19	19.97
Return Sensitivity (\$'000)	290.81	107.43	717.76
<i>Full Sample</i>			
Share Sensitivity (\$ per \$1000)	36.12	5.00	76.34
Curr. Option Sensitivity (\$ per \$1000)	2.27	0.68	5.33
Old Option Sensitivity (\$ per \$1000)	7.98	4.11	11.84
Total Dollar Sensitivity (\$ per \$1000)	46.48	16.78	77.63
Return Sensitivity (\$'000)	1113.47	178.07	11810.99

Table 5: Incentives and Forced Turnover – I

Logit estimation of the factors affecting the probability of CEO turnover among firms that perform poorly. Dollar Sensitivity is the dollar change in CEO wealth (including stock and options) for a dollar change in firm value, measured at prior fiscal year-end. Return Sensitivity is the dollar change in CEO wealth (including stock and options) for a 1% change in firm value. Columns 1 and 5 present estimates for firms whose net income before extraordinary items was negative over the previous year, columns 2 and 6 for firms whose ratio of net income to sales (NIS) was below the 2-digit SIC industry average over the previous year, columns 3 and 7 for firms whose ROA over the previous year was less than industry average, and columns 4 and 8 for firms whose previous year stock returns (RET1) were below the relevant index returns. The dependent variable is zero if there is no turnover and 1 if the CEO is forced out for performance-related reasons. BTM is the ratio of book to market values of the assets of the firm. Age and tenure pertain to the CEO. Board Size is the number of directors on the company's board. Industry and year dummies are not reported. p -values in parentheses. † indicates significance at 10%, * significant at 5%; ** significance at 1%. Data Source: ExecuComp, 1993-1999.

	Dollar Sensitivity				Return Sensitivity			
	Net Loss	Low NIS	Low ROA	Low RET1	Net Loss	Low NIS	Low ROA	Low RET1
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Sales	0.1177 (0.684)	0.0441 (0.857)	-0.0631 (0.733)	0.0632 (0.683)	-0.3756 (0.288)	-0.1455 (0.565)	-0.2248 (0.245)	-0.0246 (0.874)
BTM	-0.5648 (0.655)	1.5203* (0.030)	0.8794 (0.167)	1.3492* (0.022)	0.4918 (0.707)	1.7480* (0.013)	1.2510* (0.043)	1.3412* (0.029)
Age	0.0704 (0.204)	-0.0011 (0.977)	0.0315 (0.287)	0.0044 (0.858)	0.0827 (0.133)	-0.0034 (0.930)	0.026 (0.400)	-0.0022 (0.934)
Tenure	-0.1813† (0.051)	-0.1644** (0.007)	-0.1703** (0.002)	-0.1350** (0.004)	-0.1932† (0.081)	-0.1711** (0.010)	-0.1743** (0.003)	-0.1217** (0.009)
Instn. Hldg.	0.0341† (0.087)	0.0107 (0.396)	0.016 (0.183)	-0.0012 (0.902)	0.0451* (0.042)	0.014 (0.278)	0.0175 (0.152)	-0.0011 (0.917)
Board Size	-0.0587 (0.733)	0.0606 (0.450)	0.0471 (0.542)	0.016 (0.791)	-0.0566 (0.762)	0.0457 (0.585)	0.0391 (0.621)	-0.004 (0.950)
Incentives	15.0834** (0.005)	12.0784* (0.018)	10.9845* (0.014)	13.0187* (0.012)	1.5941** (0.004)	0.7822* (0.012)	0.5949* (0.035)	0.0957 (0.508)
Constant	-5.6696 (0.162)	-3.0335 (0.200)	-2.301 (0.238)	-2.4713 (0.127)	-4.0267 (0.322)	-1.5296 (0.493)	-3.3098 (0.162)	-1.2248 (0.461)
Obsvns.	236	545	657	1224	236	545	657	1224

Table 6: Marginal Effect of Incentives on Forced Turnover

The table gives the percentage increase in the probability of being fired following poor firm performance, for 10% increase in the incentive level (columns 1 and 3), and for an increase in incentives from the 40th percentile to the 60th percentile level (columns 2 and 4). The estimates are for the median CEO. Dollar sensitivity is the dollar change in CEO wealth for a dollar change in firm value. Return Sensitivity is the change in CEO wealth for a 1% change in firm wealth. NIS is the ratio of net income to sales and RET1 is the return on the firm's stock over its fiscal year.

	Change in Dollar Sensitivity		Change in Return Sensitivity	
	10% increase	40th to 60th Percentile	increase	40th to 60th Percentile
Net Loss	2.82	14.09	1.54	9.40
Low NIS	1.71	12.42	0.85	4.87
Low ROA	1.37	10.75	0.65	3.60
Low RET1	1.68	11.06	0.15	0.93

Table 7: Incentives and Forced Turnover – II

Logit estimation of the factors affecting the probability of CEO turnover among firms that perform poorly. Incentives are measured by the dollar change in CEO wealth (including stock and options) for a dollar change in firm value, measured at prior fiscal year-end. Poor performance is defined as being in the lowest quartile of the industry in terms of ratio of net income to sales (NIS) for the estimations in columns 1 and 2, ROA for columns 3 and 4, and stock returns (RET1) for columns 5 and 6. The dependent variable is zero if there is no turnover and 1 if the CEO is forced out for performance-related reasons. BTM is the ratio of book to market values of the assets of the firm. Age and tenure pertain to the CEO. Board Size is the number of directors on the company's board. Industry and year dummies are not reported. *p*-values in parentheses. † indicates significance at 10%, * significance at 5%; ** significance at 1%. Data Source: ExecuComp, 1993-1999.

	Dollar Sensitivity			Return Sensitivity		
	Low NIS	Low ROA	Low RET1	Low NIS	Low ROA	Low RET1
	(1)	(2)	(3)	(4)	(5)	(6)
Log Sales	-0.1265 (0.542)	-0.0511 (0.788)	-0.0049 (0.982)	-0.3212 (0.164)	-0.219 (0.288)	-0.1305 (0.524)
BTM	0.8864 (0.196)	0.631 (0.377)	0.8133 (0.248)	1.1565† (0.084)	0.8493 (0.231)	0.7378 (0.387)
Age	0.0481 (0.209)	0.051 (0.166)	0.0394 (0.188)	0.0435 (0.248)	0.043 (0.229)	0.0278 (0.445)
Tenure	-0.1586** (0.007)	-0.1529** (0.005)	-0.2353** (0.000)	-0.1692* (0.013)	-0.1606* (0.012)	-0.2139** (0.001)
Instn. Hldg.	0.0192 (0.198)	0.0205 (0.136)	-0.0125 (0.343)	0.024 (0.130)	0.0237 (0.112)	-0.0109 (0.408)
Board Size	0.1167 (0.249)	0.1143 (0.224)	0.068 (0.433)	0.0991 (0.342)	0.0913 (0.346)	0.0193 (0.837)
Incentives	13.1025* (0.011)	13.8630** (0.006)	16.9844** (0.000)	0.7825* (0.024)	0.6725† (0.070)	0.2291† (0.059)
Constant	-2.8903 (0.247)	-5.0741* (0.043)	-4.1312 (0.156)	-1.4604 (0.515)	-3.3296 (0.162)	-2.8216 (0.378)
Obsvns.	384	427	392	384	427	392

Table 8: Results with Lagged Performance

Logit estimation of the factors affecting the probability of CEO turnover among firms that perform poorly. Dollar Sensitivity is the dollar change in CEO wealth (including stock and options) for a dollar change in firm value, and Return Sensitivity is the dollar change in CEO wealth for a 1% change in firm value. Columns 1 and 4 present estimates for firms whose ratio of net income to sales (NIS) was below the 2-digit SIC industry average over the previous year, columns 2 and 5 for firms whose ROA over the previous year was less than industry average, and columns 3 and 6 for firms whose previous year stock returns (RET1) were below the relevant index returns. The dependent variable is zero if there is no turnover and 1 if the CEO is forced out for performance-related reasons. BTM is the ratio of book to market values of the assets of the firm. Age and tenure pertain to the CEO. Board Size is the number of directors on the company's board. Lag Perf is the one year lagged performance of the firm by the relevant measure. Industry and year dummies are not reported. p -values in parentheses. † indicates significance at 10%, * significance at 5%; ** significance at 1%. Data Source: ExecuComp, 1993-1999.

	Dollar Sensitivity			Return Sensitivity		
	Low NIS	Low ROA	Low RET1	Low NIS	Low ROA	Low RET1
	(1)	(2)	(3)	(4)	(5)	(6)
Log Sales	-0.0307 (0.904)	-0.1502 (0.451)	0.0869 (0.589)	-0.2077 (0.429)	-0.2964 (0.146)	-0.0096 (0.952)
BTM	1.2498 (0.101)	0.6388 (0.336)	1.0044 (0.124)	1.4745† (0.054)	0.9868 (0.127)	1.0096 (0.148)
Age	0.0055 (0.892)	0.0364 (0.270)	0.0039 (0.876)	0.0039 (0.923)	0.0331 (0.330)	-0.0034 (0.902)
Tenure	-0.1624** (0.006)	-0.1680** (0.001)	-0.1421** (0.004)	-0.1703** (0.009)	-0.1729** (0.002)	-0.1280** (0.008)
Instn. Hldg.	0.0116 (0.373)	0.0174 (0.146)	-0.0012 (0.904)	0.014 (0.289)	0.019 (0.116)	-0.0009 (0.931)
Board Size	0.0538 (0.512)	0.0459 (0.555)	0.0063 (0.917)	0.0397 (0.644)	0.0395 (0.617)	-0.0149 (0.816)
Incentives	11.0841* (0.028)	9.6283* (0.034)	13.6203** (0.006)	0.7450* (0.015)	0.5561* (0.039)	0.1138 (0.406)
Lagged Perf.	0.1524 (0.152)	0.021 (0.328)	-0.0075 (0.139)	0.1426 (0.128)	0.0219 (0.313)	-0.0067 (0.158)
Constant	-4.0383† (0.084)	-1.713 (0.391)	-6.3111** (0.004)	-3.2778† (0.088)	-1.0197 (0.634)	-2.1015 (0.295)
Obsvns.	481	580	1219	481	580	1219

Table 9: Results with Volatility

Logit estimation of the factors affecting the probability of CEO turnover among firms that perform poorly. Dollar Sensitivity is the dollar change in CEO wealth (including stock and options) for a dollar change in firm value, and Return Sensitivity is the dollar change in CEO wealth for a 1% change in firm value. Columns 1 and 4 present estimates for firms whose ratio of net income to sales (NIS) was below the 2-digit SIC industry average over the previous year, columns 2 and 5 for firms whose ROA over the previous year was less than industry average, and columns 3 and 6 for firms whose previous year stock returns (RET1) were below the relevant index returns. The dependent variable is zero if there is no turnover and 1 if the CEO is forced out for performance-related reasons. BTM is the ratio of book to market values of the assets of the firm. Age and tenure pertain to the CEO. Board Size is the number of directors on the company's board. Volatility is the standard deviation of stock returns measured over 60 months. Industry and year dummies are not reported. p -values in parentheses. † indicates significance at 10%, * significance at 5%; ** significance at 1%. Data Source: ExecuComp, 1993-1999.

	Dollar Sensitivity			Return Sensitivity		
	Low NIS	Low ROA	Low RET1	Low NIS	Low ROA	Low RET1
	(1)	(2)	(3)	(4)	(5)	(6)
Log Sales	0.0429 (0.868)	-0.0484 (0.814)	0.0918 (0.573)	-0.1383 (0.612)	-0.1988 (0.370)	0.0229 (0.889)
BTM	1.5267* (0.032)	0.8891 (0.160)	1.3161* (0.019)	1.7585* (0.014)	1.2612* (0.039)	1.2895* (0.028)
Age	-0.0009 (0.980)	0.0374 (0.236)	0.0095 (0.713)	-0.0025 (0.947)	0.0296 (0.345)	0.0021 (0.937)
Tenure	-0.1627** (0.007)	-0.1733** (0.002)	-0.1351** (0.004)	-0.1696* (0.011)	-0.1756** (0.003)	-0.1209** (0.009)
Instn. Hldg.	0.0106 (0.397)	0.0161 (0.180)	-0.001 (0.914)	0.0138 (0.285)	0.0172 (0.161)	-0.0011 (0.915)
Board Size	0.0583 (0.466)	0.0408 (0.601)	0.0146 (0.810)	0.043 (0.608)	0.0313 (0.698)	-0.0024 (0.971)
Incentives	12.0032* (0.018)	11.9377** (0.009)	13.3699* (0.012)	0.7803* (0.012)	0.5966* (0.035)	0.0897 (0.520)
Volat.	0.0022 (0.999)	0.2063 (0.886)	0.5452 (0.717)	0.1869 (0.908)	0.4593 (0.750)	0.9723 (0.516)
Constant	-1.4795 (0.608)	-4.3422 (0.102)	-3.2196 (0.143)	-0.4047 (0.888)	-3.0857 (0.228)	-2.2842 (0.293)
Obsvns.	538	646	1189	538	646	1189

Table 10: Incentives and Turnover Across Time

Logit estimation of the factors affecting the probability of CEO turnover among firms that perform poorly. Dollar Sensitivity is the dollar change in CEO wealth (including stock and options) for a dollar change in firm value, and Return Sensitivity is the dollar change in CEO wealth for a 1% change in firm value. Columns 1 and 4 present estimates for firms whose ratio of net income to sales (NIS) was below the 2-digit SIC industry average over the previous year, columns 2 and 5 for firms whose ROA over the previous year was less than industry average, and columns 3 and 6 for firms whose previous year stock returns (RET1) were below the relevant index returns. The dependent variable is zero if there is no turnover and 1 if the CEO is forced out for performance-related reasons. BTM is the ratio of book to market values of the assets of the firm. Age and tenure pertain to the CEO. Board Size is the number of directors on the company's board. The 93-96 dummy is one if the relevant year is between 1993 and 1996. Industry dummies are not reported. p -values in parentheses. † indicates significance at 10%, * significance at 5%; ** significance at 1%. Data Source: ExecuComp, 1993-1999.

	Dollar Sensitivity			Return Sensitivity		
	Low NIS	Low ROA	Low RET1	Low NIS	Low ROA	Low RET1
	(1)	(2)	(3)	(4)	(5)	(6)
Log Sales	-0.079 (0.746)	-0.1129 (0.527)	0.0123 (0.937)	-0.1449 (0.524)	-0.2017 (0.244)	0.0221 (0.886)
BTM	1.0275 (0.132)	0.494 (0.426)	0.7528 (0.138)	1.2753† (0.053)	0.7997 (0.171)	0.6172 (0.260)
Age	-0.0004 (0.992)	0.0255 (0.420)	0.0104 (0.679)	-0.0064 (0.857)	0.0188 (0.559)	0.0024 (0.929)
Tenure	-0.1473* (0.011)	-0.1619** (0.005)	-0.1234** (0.007)	-0.1487* (0.012)	-0.1584** (0.005)	-0.1046* (0.016)
Instn. Hldg.	0.0119 (0.349)	0.0125 (0.262)	-0.0016 (0.860)	0.0146 (0.246)	0.0153 (0.173)	-0.0007 (0.938)
Board Size	0.0469 (0.551)	0.0238 (0.734)	0.0035 (0.953)	0.0365 (0.642)	0.0203 (0.774)	-0.0173 (0.784)
93-96 Dummy	0.3223 (0.573)	-0.0477 (0.930)	0.5397 (0.285)	0.218 (0.657)	-0.1901 (0.664)	0.3306 (0.408)
Incen*Dummy	-22.5915 (0.272)	-19.7443 (0.364)	-26.8976 (0.174)	-1.2532 (0.421)	-0.8096 (0.473)	-1.6586 (0.212)
Incentives	12.3169** (0.008)	11.5706** (0.005)	15.0384** (0.001)	0.6185** (0.008)	0.4898* (0.034)	0.0298 (0.797)
Constant	-4.2382† (0.075)	-1.3088 (0.524)	-2.6861 (0.104)	-0.0843 (0.968)	-2.5613 (0.205)	-3.096 (0.105)
Obsvns.	748	913	1448	749	914	1448