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The relationship between incentive compensation and performance related CEO turnover

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\textbf{A B S T R A C T}

We study the relationship between incentive compensation and performance related CEO turnover. Our theoretical model predicts that the slope of the compensation contract and forced turnover may be complements. Our results support this prediction. We find that incentives and turnover are positively related. This relationship however, varies with the equity ownership of CEOs and does not hold for CEOs who own more than 5\% equity. Moreover, this relationship is stronger if the firm under performs its industry. Our results suggest that high-powered incentives may increase the signaling power of performance measures and lead to higher likelihood of turnover.

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\section{1. Introduction}

The structure of CEO compensation has become a controversial issue in corporate finance. Along with skyrocketing levels of compensation there is growing evidence that CEOs in recent years are more likely to be fired for poor performance.\textsuperscript{1} Although firms link managerial compensation to measurable performance targets, they do not usually specify conditions that may trigger termination. This study attempts to investigate the relationship between incentive contracts (the sensitivity of managerial pay to performance) and the subsequent performance related termination of CEOs. Specifically, we ask “do CEOs with high-powered incentives face higher likelihood of termination for poor performance?”

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\textsuperscript{1} “CEO Succession 2002: Deliver or Depart”, Booz Allen Hamilton, 2002.
There are two conflicting explanations of the relationship between incentives and performance related turnover. In a simple analysis of the principal-agent problem firms offer incentives to motivate their CEOs directly through performance-linked compensation, and indirectly via the threat of termination. If these two kinds of incentives are substitutes with different cost structures, then firms providing high-powered incentives are less likely to fire their managers in the event of poor firm performance.

However, CEO performance depends not only on his effort but also on his ability. Whereas high-powered incentives may induce higher effort, these incentives cannot induce higher ability. The board is more likely to attribute poor performance to lower ability than to lower effort if a CEO has high-powered compensation incentives and still performs poorly. In this case, high-powered incentives increase the signaling power of performance measures and lead to higher rates of performance related turnover. According to this learning hypothesis, firms view incentives and forced turnover as complements.

We develop a theoretical model of optimal incentive contracts in a multi-period principal-agent setting that explicitly incorporates performance related firing. In this model we assume that a firm learns the ability of its CEO over time. Our model predicts that higher incentives, i.e. steeper slope of the compensation contract may be associated with higher likelihood of performance related termination. Our empirical results confirm the predictions of our model. We find that CEOs with high-powered incentives (steeper compensation contracts) are more likely to be fired for poor performance. However, this result does not hold for entrenched managers – those who own more than 5% of their company equity. Moreover, we find that the positive relationship between CEO incentives and performance related turnover is even stronger if the firm underperforms its industry as predicted by our theoretical model.

Our empirical results are robust to various specifications, multiple performance measures and alternative definitions of forced turnover. These results are also robust to various measures of lagged incentives and lagged performance measures that we use to mitigate concerns about simultaneity.

This paper contributes to the literature on executive compensation, incentives, and forced turnover in two ways. First, it develops a theoretical model that predicts a positive relationship between incentive compensation and performance related turnover and finds empirical support for this prediction. Second, it analyzes this relationship jointly. In contrast, previous work in this area has largely analyzed the two issues of the relationship between (i) incentives and performance, and (ii) performance and turnover separately.

The remainder of this study is organized as follows: Section 2 discusses prior work in this area; Section 3 outlines the theoretical model, Section 4 describes data and our measures of incentives, performance and other variables, and Section 5 delineates estimation methodology and results. Section 6 presents robustness checks and Section 7 concludes.

2. Related literature

Previous work in the area of executive compensation has dealt separately with the two issues of the relationship between (i) incentives and firm performance, and (ii) firm performance and management turnover. Coughlan and Schmidt (1985), Abowd (1990), Jensen and Murphy (1990) and Aggarwal and Samwick (1999) all study the relationship between executive compensation and firm performance. These articles show that firm performance is largely positively related to pay-performance sensitivity after controlling for risk. Weisbach (1988), Warner, Watts, and Wruck (1988), Murphy and Zimmerman (1993), Parrino (1997), Huson, Parrino, and Starks (2001), and Goyal and Park (2002) are among the authors who investigate how firm performance affects executive turnover and the impact of corporate governance on this relationship. These studies indicate that poor firm performance is the single most important determinant of involuntary turnover.

Denis, Denis, and Sarin (1997) and Hadlock and Lumer (1997) deal with the relationship between incentives and turnover indirectly. Denis et al. (1997) document that the probability of top executive turnover is negatively related to the ownership stake of officers and directors. While their work is mainly concerned with the entrenchment effect of equity ownership of top managers, their results are relevant to our study since equity ownership is a component of performance incentives.
and Power (1998) replicate and extend Denis et al. (1997) results on UK data and report that forced top management turnover is more frequent for executives who own less than 1% of their firms’ equity. We also separate out the effect of entrenchment on the relationship between incentives and forced turnover.

Morse, Nanda, and Seru (2007) assert that powerful CEOs can skim rents at the expense of shareholders by manipulating their incentive contracts. Their empirical evidence rejects the theory that incentives are a substitute for low monitoring at least in firms that have powerful CEOs. Hallman, Hartzell, and Parsons (2008) construct a model that predicts substitution between termination and pay for performance. Their empirical results based on real estate investment trusts (REITs) and real estate limited partnerships (RELPs) data support their model. However, they look at the ex ante incentive effect of the termination threat unlike our empirical estimation that investigates the relationship between incentives and ex post forced turnover for a broader sample of CEOs over a different period of time.

Chakraborty, Sheikh, and Subramanian (2007) find that the expected termination threat affects the relationship between risk taking incentives (vega of the compensation contract) and firm risk. They find a negative relationship between the slope of the compensation contract and turnover conditional on poor performance. This relationship however is not robust and is significant in two out of three specifications. Their estimation of the expected termination conditional on poor performance does not separate out the effect of entrenchment on the relationship between incentives and turnover. Our current findings also indicate that in some instances incentives are negatively related to forced turnover for entrenched CEOs.

Working on the relationship between compensation and CEO turnover, Hasenhuttl and Harrison (2002) conclude that CEO compensation has limited effect on CEO turnover. However, their study is mainly focused on the retention effects of compensation and does not differentiate between involuntary and voluntary turnover. Perry (2000) finds that the incentive compensation of independent directors is positively related to the likelihood of CEO turnover following poor performance. Other related studies include but are not limited to Kaplan and Minton (2006), Brick, Palman, and Wald (2006), Fich and White (2003), Sundaram and Yermack (2007), Bushman, Dai, and Wang (2008) and Jenter and Kanaan (2006).

3. Ability, incentives and performance related turnover – a model

Consider a simple model of interaction between an infinitely lived firm and an agent who lives for two periods.\(^2\) The firm output \(y_t\) in any period \(t\) is either zero or one. We refer to the state \(y = 1\) as “success” and \(y = 0\) as “failure”.\(^3\) An agent’s ability and effort determines the probability of either state. There are two types of agents in this model; 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,

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

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

Both the firm and the agent are risk-neutral, and have an intertemporal discount rate of \(\delta\). The agent 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 \(w_t = b_t y_t\), where \(w_t\) is the wage in period \(t\). The firm incurs a

\(^2\) In 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. Full solution of the model is available in Subramanian, Chakraborty, and Sheikh (2002).

\(^3\) In the empirical analysis of Section 5.2, we use a binary measure of performance (a dummy variable that equals 1 if the firm underperforms its industry and 0 otherwise) in correspondence with the binary nature of output in this model.
3.2. The second period contract

given the above learning process.

As we see below, this might play an important role in the

dynamic optimization framework, without much loss of generality.4

The Contract: At hiring, the firm offers a contract that specifies: (1) slopes \( \{b_1, b_2\} \) where \( b_2 \) is

the slope of the second period contract when \( y_1 = 1 \); and (2) whether the manager will be fired or

rehired if \( y_1 = 0 \). If the manager is rehired, the slope is \( b_{20} \). Note that while the manager could be fired

even if \( y_1 = 1 \), condition (8) below will rule out this possibility. We derive the optimal contract in a

subgame perfect Nash equilibrium. We are interested in the properties of the slope \( b_1 \) of this contract

and how this is related to rehiring of the manager in the next period. We begin with the Bayesian

learning process where a firm updates its belief about manager’s ability.

3.1. Bayesian learning

As in Gibbons and Murphy (1992) and Holmstrom (1982, 1999), there is symmetric, but imperfect,

information about 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 prior \( q \), effort level \( e_1 \), and technology \( 1 \), we have

\[
q_{20} = P(H|y_1 = 0) = \frac{q(1 - e_1)}{q(1 - e_1) + (1-q)(1-\alpha e_1)} = \frac{q(1 - e_1)}{1 - z_1 e_1} \tag{2}
\]

\[
q_{21} = P(H|y_1 = 1) = \frac{q e_1}{q e_1 + (1-q)\alpha e_1} = \frac{q}{1 + \alpha(1-q)} \tag{3}
\]

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

\[
\frac{dq_{20}}{de_1} < 0 \tag{4}
\]

Condition (4) implies that higher first period effort has a negative impact on the posterior estimate

of 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 the firm would offer to the 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:

\[
z_{2j} = q_{2j} + (1-q_{2j})\alpha = q_{2j}(1-\alpha) + \alpha \tag{5}
\]

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

5 In ignoring the fixed portion of managerial compensation, we are assuming that manager’s participation constraint is not
binding even at low levels of fixed compensation. We believe that this simplification brings clarity in the analysis and is worth
the loss of generality. The managers we consider here are CEOs of their firms and their compensation packages largely consist
of variable pay in the form of bonuses, stock and options. In our data, salary constitutes only 16% of the total compensation for
the mean CEO.
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 following problem:
\[ \max_{e_2} u_{2j} = -0.5re_2^2 + z_{2j}b_{2j}e_2 \]  
(6)

It follows that the optimal second period effort level \( e_{2j}^* = (z_{2j}b_{2j})/r \)

The firm’s second period profits \( \prod_{2j} \) conditional on first period output is
\[ \prod_{2j} = -F + P(y_{2j} = 1).0 = -F + z_{2j}e_{2j}^*(1 - b_{2j}) \]

Substituting for \( e_{2j}^* \) from above, the firm chooses \( b_{2j} \) to solve
\[ \max_{b_{2j}} \prod_{2j} = -F + \frac{z_{2j}^2}{r}(b_{2j} - b_{2j}^2) \]  
(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 \( b_{2j}^* = 0.50 \). The optimal second period effort level is \( e_{2j}^* = z_{2j}/2r \). Firm’s expected second period profit is \( \prod_{2j}^* = (z_{2j}^2/4r) - F \), and the agent’s expected utility is \( u_{2j}^* = (z_{2j}^2/8r) \), 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 \( z_{2j}^2 < 4rF \). From Eq. (5) and condition (4), we may see that \( z_{20} \leq z_{21} < z_{21} \). In order to make the model interesting, the following analysis assumes that\(^6\):

\[ z_{21}^2 > 4rF \]  
(8)

This ensures that all firms rehire the agent if the first period output is one. Second, it follows from Result 1, condition (4), and Eqs. (2) and (5) that
\[ \frac{d \prod_{20}^*}{de_1} = 0.5 \left( \frac{d \prod_{20}^*}{de_1} \right) = \left( \frac{z_{20}}{4r} \right)(1 - \alpha) \frac{dq_{20}}{de_1} < 0 \]  
(9)

We call condition (9) the **learning effect**, as it 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 profits.\(^7\) A strong enough learning effect will imply that \( \prod_{20} < 0 \), so that it is optimal for the firm to fire the agent for poor performance.

The learning effect implies that for a given firm (i.e., for a given set of parameters \( \delta, r, F \) and \( q \)), both firing and rehiring may be subgame perfect equilibrium strategies. For example, the firm might induce such high first period effort under firing that the learning effect makes \( \prod_{20}^* < 0 \). The same firm might, under rehiring, induce a low enough effort that the learning effect is weak, resulting in \( \prod_{20}^* \) being positive.

Next we examine the optimal contract in the first period. This depends on whether the contract is accompanied by a firing threat or by a commitment not to fire. Rather than solve for the exact first period contract in each case, we derive a general result on the relationship between the contract with firing and the contract without firing in the next section.

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\(^6\) Otherwise, the firm would fire the agent even when the first period output equals one, which reduces the model to a trivial case of a one period model.

\(^7\) While the firm does not observe \( e_1 \), it infers \( e_1 \) from the agent’s equilibrium response to the contract offered.
3.3. The first period contract

Let \( \prod_1 \) denote the firm’s expected profits in the first period under a first period contract \( (b_1) \) and let \( e_1 \) denote the effort level induced by that contract. The firm’s total expected discounted profits are given by

\[
\Pi = \prod_1 + P(y_1 = 1)\delta \prod_{21} + P(y_1 = 0)\delta \prod_{20} = z_1 e_1(1 - b_1) + z_1 e_1 \delta \prod_{21} + (1 - z_1 e_1) \delta \prod_{20} \quad (10)
\]

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

\[
\frac{d\Pi_1}{de_1} = \frac{d\Pi_1}{de_1} + \delta z_1 (\prod_{21} - \prod_{20}) + \delta (1 - z_1 e_1) \frac{d\prod_{20}}{de_1} \quad (11)
\]

The above equation shows that an increase in \( e_1 \) affects total expected discounted profits in three ways. First, it increases the expected first period profits. Second it increases the expected discounted second period profits, absent any learning effect. Third it highlights the learning effect. Since \( \prod_{21} \) is independent of \( e_1 \) in this model, the learning effect operates only through a reduction in the expected second period profit conditional on failure in the first period (\( \prod_{20} \)).

While the first two terms on the right hand side (RHS) of the above equation are positive, the third term is negative. The net effect of a change in \( e_1 \) (given the contract \( b_1 \)) on the total expected discounted profits thus 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 (proof in Appendix A).

Result 2. Given a first period contract \( b_1 \), the firm’s total expected discounted profits increase with the first period effort \( e_1 \).

Result 2 has a straightforward implication for the relationship between the optimal first period contract in the firing and rehiring regimes. 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 kind of equilibrium to be subgame perfect, we must have \( \prod_{20} \leq 0 \) under firing and \( \prod_{20} \geq 0 \) under rehiring. 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, i.e., firing would dominate rehiring. Therefore, the firm would choose rehiring only if either \( b_{1R} < b_{1F} \) or if \( \prod_{20} > 0 \) under the optimal firing contract (which would imply that firing was not subgame perfect). This leads to the following proposition:

Proposition 1. The optimal first period contract in any subgame perfect equilibrium that specifies firing is at least as steep as the optimal contract in an equilibrium that specifies rehiring, i.e., \( b_{1F} \geq b_{1R} \).

Proposition 1 implies that firms that fire their managers for poor performance must have, ex ante, offered steeper incentive contracts relative to similar firms that did not fire their managers. In order to derive comparative static results on the relationship between the optimal contracts of dissimilar firms, the contracts must first be characterized. While this is easily done for the firing case, the contract in the rehiring case is the solution to a quadratic equation in effort. This does not lend itself easily to a direct interpretation in terms of the underlying parameters and any comparative static results would therefore have to be derived from numerical solutions. Instead, in the following sections, we shift to an empirical analysis of CEO compensation based on the insights gained so far. We test for the primary hypothesis that firms that fire their managers for poor performance do offer steeper incentive contracts relative to similar firms that do not fire their managers. This analysis is presented in the following sections.

4. Data identifying performance related turnover

Our sample is drawn from Standard and Poor’s ExecuComp 1992–2000 dataset. We define turnover as a change in the identity of the CEO from 1 year to the next. We consider changes for the fiscal years
Table 1
CEOs Changes, by year and category.

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of CEOs</th>
<th>CEO changes</th>
<th>Turnover rate (%)</th>
<th>FORCED1</th>
<th>Percent of all changes (%)</th>
<th>FORCED2</th>
<th>Percent of all changes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>988</td>
<td>103</td>
<td>10.43</td>
<td>19</td>
<td>18.45</td>
<td>33</td>
<td>32.04</td>
</tr>
<tr>
<td>1995</td>
<td>1098</td>
<td>114</td>
<td>10.38</td>
<td>21</td>
<td>18.42</td>
<td>30</td>
<td>26.32</td>
</tr>
<tr>
<td>1996</td>
<td>1141</td>
<td>113</td>
<td>9.90</td>
<td>23</td>
<td>20.35</td>
<td>38</td>
<td>33.63</td>
</tr>
<tr>
<td>1997</td>
<td>1200</td>
<td>141</td>
<td>11.7</td>
<td>22</td>
<td>15.60</td>
<td>39</td>
<td>27.66</td>
</tr>
<tr>
<td>1998</td>
<td>1232</td>
<td>126</td>
<td>10.23</td>
<td>26</td>
<td>20.63</td>
<td>44</td>
<td>34.92</td>
</tr>
<tr>
<td>1999</td>
<td>1029</td>
<td>145</td>
<td>14.09</td>
<td>26</td>
<td>17.93</td>
<td>42</td>
<td>28.97</td>
</tr>
<tr>
<td>Total</td>
<td>6688</td>
<td>742</td>
<td>11.09</td>
<td>137</td>
<td>18.46</td>
<td>226</td>
<td>30.46</td>
</tr>
</tbody>
</table>

CEO changes for the fiscal years 1994–1999 from the ExecuComp database. A CEO change is defined if the CEO at the beginning of the year is different from the CEO at the end of last year. FORCED1 is an indicator variable that equals one if (i) news items reports forced or mentions poor performance; (ii) the CEO is under 60 years of age at that time, and does not leave for reasons of poor health or for taking up a comparable position elsewhere, and, the CEO’s career is not described in laudatory terms by independent analysts. FORCED2 is an indicator variable that equals 1 if FORCED1 = 1 and also equals 1 if the CEO is under 60 years of age at that time, and the cited reason for the change is Retired, Personal or Unspecified. Firms in the financial sector and regulated industries (SIC codes 4910–4949 and 6000–6999) are excluded.

1994–1999 as we include only those CEOs in our sample who have at least 3 years of performance data.8 We exclude firms subject to regulation and those in the financial sector (i.e., all firms in SIC codes 4910–4949 and 6000–6999). For each CEO turnover, we search news items on the Lexis–Nexis Academic Universe database to verify that such changes are genuine. Changes not corroborated by news items are not included. Our method of identifying forced turnover is similar to that of Weisbach (1988), Denis and Denis (1995), Huson et al. (2001) and Chakraborty et al. (2007).

Our sample consists of 742 CEO changes during the fiscal year period 1994–1999. For each of these changes, we identify reasons for change through a careful news search. In the first round of search we classify 89 changes as forced if the business news either explicitly report the reason of CEO change as forced or mentions poor performance as the likely reason for CEO departure. We classify the remaining changes as “potential forced turnovers” if the departing CEO is less than 60 years old and the reported reason is retirement, personal, or unspecified. We examine each of these cases closely through further news searches for years preceding and following CEO change and classify a change as voluntary if the CEO change is related to mergers or acquisitions, poor health or moves to comparable positions elsewhere. This process leaves us with 48 more cases of forced turnover.

FORCED1 is based on our thorough news search and includes 137 (89 + 48) changes. We are quite confident that these are indeed performance related or forced changes. We use Core and Guay (2002) methodology for estimating the sensitivity of CEO holdings of stock and options to firm value. A description of this method is given in Appendix B.

4.1. Measuring the incentives

There is strong evidence to suggest that equity-based incentives have significantly increased the sensitivity of CEO compensation to firm performance (Hall & Liebman, 1998). We measure incentives as the dollar change in the CEO’s portfolio of stocks and options for a $1000 change in firm value (dollar sensitivity). We use Core and Guay (2002) methodology for estimating the sensitivity of CEO holdings of stock and options to firm value. A description of this method is given in Appendix B.

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8 Since the ExecuComp dataset reports data on fiscal year basis, the 1992–2000 dataset does not have full year compensation details for the year 2000. We drop the year 2000. The resulting sample covers the period 1994–1999.

9 CEO turnover rates are 8.8% (Weisbach (1988)), 12.2% (Parrino (1997)), 9.3% (Denis et al., 1997), 9.55% (Fee and Hadlock (2004)), and 11.2% (Huson et al., 2001).
Table 2
Components of CEO incentives.

<table>
<thead>
<tr>
<th>Variable</th>
<th>All CEOs</th>
<th>Ownership &lt;5%</th>
<th>Ownership &gt; 5%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Mean</td>
</tr>
<tr>
<td>Current grants</td>
<td>2.00</td>
<td>0.68</td>
<td>2.04</td>
</tr>
<tr>
<td>Past grants</td>
<td>8.37</td>
<td>4.81</td>
<td>8.76</td>
</tr>
<tr>
<td>Shares held</td>
<td>39.67</td>
<td>6.00</td>
<td>8.27</td>
</tr>
<tr>
<td>Total</td>
<td>50.52</td>
<td>19.32</td>
<td>19.31</td>
</tr>
</tbody>
</table>

Incentives are measured by the Dollar sensitivity which is the dollar change in portfolio value of a CEO for a $1000 change in firm value. This is calculated as the sum of the sensitivities of three portfolio components; options granted this year (current options), unexercised options carried over from past years, and shares. The sensitivity of the portfolio of unexercised past options is calculated using the Core and Guay (2002) method. The full sample includes data from ExecuComp for the fiscal years 1994–1999.

4.2. Other determinants of performance related turnover

We include several other control variables in our analysis that may affect the likelihood of performance related CEO turnover. Prior firm performance is an important determinant of forced turnover. Firms that perform poorly – particularly relative to their industry – are more likely to fire their CEOs than firms that perform well. Following Huson et al. (2001), we use three measures of relative performance: return on assets (ROA), change in ROA, and 1-year stock return (RET1). All performance variables are measured net of two-digit SIC industry average performance.

Among other firm specific characteristics, firm size is another important determinant of forced turnover. Larger firms have higher turnover-performance sensitivities because they are more likely to have a larger talent pool from which to choose a successor (Parrino, 1997). We use the natural log of sales as a measure of firm size. Our results do not change when we use log of total assets to measure firm size. We also include leverage (debt-to-equity ratio) to control for effects of any financial stress on CEO turnover.

We include CEO stock ownership and tenure to control for CEO influence on board decisions. Denis et al. (1997) document that the probability of top executive turnover is negatively related to the ownership stake of officers and directors. Similarly, Iqbal and French (2007) find that managers with larger share ownership have lower probability of removal. We include a dummy variable that equals one if the CEO holds more than 5% equity and zero otherwise and interact this variable with incentives to separate out the effect of entrenchment. Similarly, CEOs who have been in their offices for long may build influential relationships with their boards, which they can use to affect turnover decisions (Goyal & Park, 2002). We include CEO tenure to control for this effect.
Table 3
Summary statistics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales ($ mn)</td>
<td>3398.4</td>
<td>822.8</td>
<td>10044.3</td>
</tr>
<tr>
<td>Debt-to-equity</td>
<td>1.01</td>
<td>0.43</td>
<td>9.47</td>
</tr>
<tr>
<td>Tenure (years)</td>
<td>9.10</td>
<td>7.00</td>
<td>6.82</td>
</tr>
<tr>
<td>G-index</td>
<td>9.23</td>
<td>9.00</td>
<td>2.81</td>
</tr>
<tr>
<td>ROA (%)</td>
<td>0.784</td>
<td>1.430</td>
<td>9.715</td>
</tr>
<tr>
<td>Stock return (%)</td>
<td>–3.316</td>
<td>–6.392</td>
<td>54.108</td>
</tr>
<tr>
<td>Dollar sensitivity ($ per $1000)</td>
<td>50.521</td>
<td>19.324</td>
<td>80.863</td>
</tr>
</tbody>
</table>

Sales DTE Tenure G-index ROA Stock Ret Dollar Sen
Sales 1.0000
DTE 0.0107 1.0000
Tenure –0.0343 –0.0095 1.0000
G-index 0.0247 0.1002 –0.0744 1.0000
ROA 0.0217 –0.1097 0.0566 –0.0130 1.0000
Stock Ret 0.0206 –0.0628 0.0016 –0.0296 0.1669 1.0000
Dollar Sen –0.1330 –0.0157 0.2560 –0.2427 0.0509 0.0424 1.0000

Descriptive statistics and correlation matrix of key variables used in estimation. The full sample includes data from ExecuComp for the fiscal years 1994–1999. DTE is debt-to-equity ratio. Tenure is the number of years CEO has been in office. G-index refers to the governance index of Gompers et al. (2003). ROA is the return on assets and stock return is the 1-year buy-and-hold return. Both are industry-adjusted, relative to the 2-digit SIC industry averages. Dollar Sensitivity (Dollar Sen) is the dollar change in CEO’s portfolio of stock and options for a $1000 change in firm value.

We also include a measure of corporate governance, the G-index of Gompers, Ishii, and Metrick (2003) to control for quality of governance. A higher value for this index is associated with a more insulated management and weaker shareholder rights. We expect the coefficient on this index to be negatively correlated with forced turnover. Lastly, we control for year and industry specific effects by including year and industry dummies. Table 3 gives summary statistics for these variables and the pairwise correlation matrix of these variables.

5. Multivariate analysis

We estimate logit models of the determinants of performance related CEO turnover to see how incentives affect performance related turnover and empirically to test the predictions of our theoretical model. The dependent variable FORCED1 is a dummy variable that equals one if the CEO is removed for performance related reasons and zero if there is no change in CEO status. Huson et al. (2001) exclude first 2 years of a CEO’s tenure from their estimations in order to avoid overlap between the incoming and outgoing CEO. We include only those CEOs in our sample who have been in office for at least 3 years in order to be able to correctly attribute firm performance to the departing CEO. We also estimate our regressions without this restriction and find similar results. We estimate the following equation:

\[
P(\text{FORCED}_t) = F(\text{incentives}_{t-1}, \text{performance}_t, \text{CEO and firm characteristics}_t, \text{year and industry dummies})
\]

We lag incentives by 1 year to capture the notion that a firm evaluates its CEO’s performance for a given period based on portfolio incentives provided for that period. It also helps to mitigate concerns about endogeneity that are common in corporate finance. We check the robustness of our results by using more than one lag and find similar results.

\[\text{For the G-index, see Gompers et al. (2003).}\]

Our results do not change when we do not replace the index for the missing values.
Table 4a
Incentives, performance and forced turnover-baseline regressions.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Incentives_{t-1}</td>
<td>0.1103** (0.051)</td>
<td>0.1200** (0.058)</td>
<td>0.1218*** (0.044)</td>
</tr>
<tr>
<td>High ownership</td>
<td>−0.0003 (0.009)</td>
<td>−0.0044 (0.009)</td>
<td>−0.0021 (0.009)</td>
</tr>
<tr>
<td>Incentives_{t-1} × high ownership_{t-1}</td>
<td>−0.1733** (0.071)</td>
<td>−0.1822** (0.084)</td>
<td>−0.1917*** (0.073)</td>
</tr>
<tr>
<td>Performance</td>
<td>−0.0661*** (0.014)</td>
<td>−0.0723*** (0.017)</td>
<td>−0.0143*** (0.003)</td>
</tr>
<tr>
<td>Log (sales)</td>
<td>0.0020** (0.001)</td>
<td>0.0001 (0.001)</td>
<td>0.00005 (0.001)</td>
</tr>
<tr>
<td>Debt-to-equity</td>
<td>0.0008** (0.000)</td>
<td>0.0014*** (0.000)</td>
<td>0.0010** (0.000)</td>
</tr>
<tr>
<td>Tenure of CEO</td>
<td>−0.0009*** (0.000)</td>
<td>−0.0011*** (0.000)</td>
<td>−0.0009*** (0.000)</td>
</tr>
<tr>
<td>G-index</td>
<td>0.0001 (0.001)</td>
<td>0.00001 (0.001)</td>
<td>0.0001 (0.001)</td>
</tr>
<tr>
<td>Technology</td>
<td>0.0139* (0.008)</td>
<td>0.0171* (0.009)</td>
<td>0.01 (0.007)</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.0024 (0.005)</td>
<td>0.0021 (0.005)</td>
<td>0.0003 (0.004)</td>
</tr>
<tr>
<td>Services</td>
<td>0.0121 (0.009)</td>
<td>0.0118 (0.010)</td>
<td>0.006 (0.007)</td>
</tr>
<tr>
<td>Trade</td>
<td>0.01 (0.007)</td>
<td>0.0149 (0.010)</td>
<td>0.0097 (0.007)</td>
</tr>
<tr>
<td>Observations</td>
<td>4225</td>
<td>3975</td>
<td>4224</td>
</tr>
</tbody>
</table>

Marginal effects from logit estimation of the factors affecting the likelihood of performance related CEO turnover. The marginal effects are evaluated at sample means. The dependent variable is FORCED1 that equals 1 if CEO departs for performance related reasons and 0 otherwise. High ownership equals 1 if the CEO owns more than 5% of firm’s stock. Incentives are measured by dollar sensitivity, which is the change in the value of a CEO’s portfolio of stock and options for a $1000 change in firm value. Both incentives and the interaction of incentives are lagged by 1 year. Performance is relative to 2-digit SIC industry average and is measured by return on assets (ROA) in column 1, change in ROA over the previous year in column 2 and 1-year stock return (RET1) in column 3. G-index refers to the governance index of Gompers et al. (2003). Year dummies not reported. Robust standard errors with clustering on firm id are given in parentheses.

* Indicate significance at 10%.
** Indicate significance at 5%.
*** Indicate significance at 1%.

5.1. Baseline results

Table 4a presents marginal effects from estimated logit regressions. Columns 1–3 in this table correspond to three industry-adjusted measures of relative performance (ROA, change in ROA and stock returns).

The marginal effect of incentives measures the effect of incentives on forced turnover for the CEOs who are not entrenched, i.e., those who own less than 5% equity ownership. This effect is positive and significant in all three measures of firm performance. Thus CEOs that have steeper incentives contracts are also more likely to be fired for performance related reasons. This result also provides support to the primary prediction of our theoretical model that the slope of the compensation contract may be positively related to turnover. As discussed above, CEOs with substantial stock ownership may influence the likelihood of forced turnover. In order to see how stock ownership affects the relationship between incentives and turnover, we use an interaction variable by multiplying high ownership with incentives. High ownership is a dummy that equals 1 if the CEO holds more than 5% of his firm’s equity.

The marginal effect of this interaction variable is given in Table 4a. However, interpreting interaction variables in non-linear estimations (in our case logit regressions) is complex (Ai & Norton, 2003; Powers, 2005).11 To correctly estimate the marginal effect of this interaction variable, we use the Norton, Wang, and Ai (2004) methodology. The results are given in Table 4b. It is interesting to see that the interaction effect of incentives and ownership is not only insignificant but also very small in magnitude when we move from Tables 4a and 4b. The correct marginal effect of the interaction variable for ROA measure of firm performance is −0.00019 as given in Table 4b instead of −0.0630 (−0.1733 + 0.1103) in Table 4a. Thus estimating the marginal effect of the interaction variable using the Norton et al. (2004) methodology affects not only the magnitude but also the significance and is the appropriate method to estimate the interaction effects in logit regressions.

11 We thank an anonymous referee for pointing out this issue.
Table 4b
Incentives, performance and forced turnover – the interaction effect of incentives and stock ownership.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>S.D.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>a: ROA</td>
<td>Interaction effect</td>
<td>−0.00019</td>
<td>0.000204</td>
<td>−0.002375</td>
</tr>
<tr>
<td></td>
<td>Standard error</td>
<td>0.000192</td>
<td>0.000252</td>
<td>7.08E−14</td>
</tr>
<tr>
<td></td>
<td>Z-score</td>
<td>−1.09023</td>
<td>0.270366</td>
<td>−1.394839</td>
</tr>
<tr>
<td>b: Change in ROA</td>
<td>Interaction effect</td>
<td>−0.00019</td>
<td>0.000183</td>
<td>−0.002034</td>
</tr>
<tr>
<td></td>
<td>Standard error</td>
<td>0.000177</td>
<td>0.000203</td>
<td>2.86E−14</td>
</tr>
<tr>
<td></td>
<td>Z-score</td>
<td>−1.16053</td>
<td>0.312592</td>
<td>−1.537206</td>
</tr>
<tr>
<td>C: Stock returns</td>
<td>Interaction effect</td>
<td>−0.00016</td>
<td>0.000169</td>
<td>−1.69E−03</td>
</tr>
<tr>
<td></td>
<td>Standard error</td>
<td>0.000181</td>
<td>0.000208</td>
<td>2.85E−11</td>
</tr>
<tr>
<td></td>
<td>Z-score</td>
<td>−0.89951</td>
<td>0.20839</td>
<td>−1.186498</td>
</tr>
</tbody>
</table>

Panels a–c report marginal effects of the interaction of incentives and stock ownership from logit estimation of the likelihood of performance related turnover in Table 4a using three measures of firm performance. The interaction effects have been calculated using the Norton et al. (2004) methodology.

The results in Table 4b show that incentives have no significant effect on performance related turnover if the CEO owns more than 5% of company stock. Thus for the entrenched CEOs control effects of ownership appear to dominate the relationship between incentives and turnover. While for CEOs who own less than 5% of their firms’ equity, incentives and performance related turnover seem to be complements.

The marginal effects of other control variables (Table 4a) also exhibit expected signs. The marginal effect of performance is significantly negative in all three specifications, which is consistent with previous studies. Firm size is not significant in any of the specifications. CEO tenure is negative and significant in all specifications and confirms the assertion that CEOs with longer tenures develop influential relationship with their boards that insulate them from firing pressures. The marginal effect of leverage (debt-to-equity) is positive and significant in all specifications. The G-index on the other hand is not significant in any of the specifications.

5.2. Incentives and turnover – effect of performance

The previous analysis shows that for a given level of performance incentives and performance related turnover are positively related. Our theoretical model predicts that conditional on poor performance, the slope of the optimal compensation contract is positively related to forced turnover. Although the previous analysis supports the prediction of our theoretical model, it does not directly test this prediction. For this purpose, we first define poor performance as a dummy variable that equals one if firm performance (ROA, change in ROA and Stock Returns) is below its two-digit SIC industry average in a given year. This dummy variable relates to our model in the sense that when output equal to 0 (or failure) in our model is equivalent to performance dummy being equal to 1. We then create an interaction variable by multiplying poor performance dummy with incentives. The marginal effect of this interaction variable is interpreted as the impact of incentives on forced turnover when performance is below some industry benchmark.

The results are presented in Table 5a. As mentioned before, interpreting interaction variables in non-linear estimations is complex. We use the Norton et al. (2004) methodology to find the marginal effect of this interaction term on forced turnover. The results are given in Table 5b. The Norton et al. (2004) methodology can only be used with one interaction variable. We, therefore, do not interact incentives and equity ownership in these regressions. We do however, control for equity ownership in all of these estimations. We estimate the interaction effect for those CEOs who own less than 5% equity and find similar results. We also find similar results when we estimate our benchmark regressions for only poorly performing CEOs. However, we lose a significant number of observations due to conditioning on poor performance.
Table 5a

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Incentives_{t-1}</td>
<td>-0.0390 (0.087)</td>
<td>-0.1734** (0.077)</td>
<td>-0.1279 (0.104)</td>
</tr>
<tr>
<td>Poor performance</td>
<td>0.0082 (0.005)</td>
<td>0.0017 (0.002)</td>
<td>0.0038 (0.003)</td>
</tr>
<tr>
<td>Incentives_{t-1} × poor performance</td>
<td>0.1488*** (0.054)</td>
<td>0.2797*** (0.065)</td>
<td>0.2385*** (0.082)</td>
</tr>
<tr>
<td>High ownership</td>
<td>-0.0015** (0.001)</td>
<td>-0.0016*** (0.001)</td>
<td>-0.0018*** (0.001)</td>
</tr>
<tr>
<td>Log (sales)</td>
<td>0.0002 (0.001)</td>
<td>-0.0006 (0.001)</td>
<td>-0.0001 (0.001)</td>
</tr>
<tr>
<td>Debt-to-equity</td>
<td>0.0004 (0.000)</td>
<td>0.0010*** (0.000)</td>
<td>0.0008*** (0.000)</td>
</tr>
<tr>
<td>Tenure of CEO</td>
<td>-0.0005** (0.000)</td>
<td>-0.0005** (0.000)</td>
<td>-0.0005** (0.000)</td>
</tr>
<tr>
<td>G-index</td>
<td>0.0001 (0.000)</td>
<td>0.0001 (0.000)</td>
<td>0.0001 (0.000)</td>
</tr>
<tr>
<td>Technology</td>
<td>0.0107** (0.005)</td>
<td>0.0103** (0.006)</td>
<td>0.0099** (0.006)</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.0013 (0.003)</td>
<td>0.0016 (0.003)</td>
<td>0.0009 (0.003)</td>
</tr>
<tr>
<td>Services</td>
<td>0.0079 (0.006)</td>
<td>0.0079 (0.006)</td>
<td>0.0077 (0.006)</td>
</tr>
<tr>
<td>Trade</td>
<td>0.0007 (0.005)</td>
<td>0.0086 (0.006)</td>
<td>0.0084 (0.006)</td>
</tr>
</tbody>
</table>

Observations 4225 3975 4224

Marginal effects from logit estimation of the factors affecting the likelihood of performance related CEO turnover. The marginal effects are evaluated at sample means. The dependent variable is FORCED1 that equals 1 if CEO departs for performance related reasons and 0 otherwise. High ownership equals 1 if the CEO owns more than 5% of firm’s stock. Incentives are measured by dollar sensitivity, which is the change in the value of a CEO’s portfolio of stock and options for a $1000 change in firm value. Both incentives and the interaction of incentives are lagged by 1 year. Poor Performance equals 1 if the return on assets (ROA) in column 1, change in ROA over the previous year in column 2 or the 1-year stock return (RET1) in column 3 is less than two-digit industry averages. G-Index refers to the governance index of Gompers et al. (2003). Year dummies not reported. Robust standard errors with clustering on firm id are given in parentheses.

- * Indicate significance at 10%.
- ** Indicate significance at 5%.
- *** Indicate significance at 1%.

The marginal effects of other control variables in these regressions are of the expected signs. The marginal effects of high CEO stock ownership (5% or more) and CEO tenure are negative and significant in all specifications. However, firm size and the G-index are again insignificant.

Table 5b

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>S.D.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>a: ROA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction effect</td>
<td>0.6769262</td>
<td>0.452012</td>
<td>3.28E−05</td>
<td>4.150028</td>
</tr>
<tr>
<td>Standard error</td>
<td>0.2681986</td>
<td>0.185603</td>
<td>1.04E−05</td>
<td>2.196464</td>
</tr>
<tr>
<td>Z-score</td>
<td>2.443664**</td>
<td>0.57151</td>
<td>0.316346</td>
<td>3.481063</td>
</tr>
<tr>
<td>b: Change in ROA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction effect</td>
<td>0.787196</td>
<td>0.572029</td>
<td>5.53E−06</td>
<td>9.527724</td>
</tr>
<tr>
<td>Standard error</td>
<td>0.3324796</td>
<td>0.243625</td>
<td>1.78E−05</td>
<td>4.364991</td>
</tr>
<tr>
<td>Z-score</td>
<td>2.288504**</td>
<td>0.630102</td>
<td>0.311431</td>
<td>5.114964</td>
</tr>
<tr>
<td>c: RET1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction effect</td>
<td>0.5623947</td>
<td>0.436745</td>
<td>1.45E−08</td>
<td>5.845033</td>
</tr>
<tr>
<td>Standard error</td>
<td>0.2701461</td>
<td>0.202966</td>
<td>1.55E−07</td>
<td>3.496084</td>
</tr>
<tr>
<td>Z-score</td>
<td>1.990133**</td>
<td>0.561951</td>
<td>0.093647</td>
<td>3.764626</td>
</tr>
</tbody>
</table>

Panels a–c report marginal effects of the interaction of incentives and stock ownership from logit estimation of the likelihood of performance related turnover in Table 5a using three measures of firm performance. The interaction effects have been calculated using the Norton et al. (2004) methodology. *, ** and *** indicate significance at 10%, 5% and 1%, respectively.
Table 6a
Incentives, performance and forced turnover: robustness using alternative definition of forced turnover.

<table>
<thead>
<tr>
<th>Variable</th>
<th>ROA</th>
<th>ΔROA</th>
<th>RET1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[1]</td>
<td>[2]</td>
<td>[3]</td>
</tr>
<tr>
<td>Incentives (_{-1})</td>
<td>0.2058** (0.086)</td>
<td>0.2124** (0.094)</td>
<td>0.2272** (0.089)</td>
</tr>
<tr>
<td>High ownership</td>
<td>0.0046 (0.014)</td>
<td>-0.0003 (0.013)</td>
<td>0.0012 (0.013)</td>
</tr>
<tr>
<td>Incentives (<em>{-1}) × high ownership (</em>{-1})</td>
<td>-0.2728 (0.106)</td>
<td>-0.2705 (0.116)</td>
<td>-0.2936 (0.109)</td>
</tr>
<tr>
<td>Performance</td>
<td>-0.0830** (0.021)</td>
<td>-0.1106** (0.025)</td>
<td>-0.0160** (0.005)</td>
</tr>
<tr>
<td>Log (sales)</td>
<td>0.0015 (0.002)</td>
<td>-0.001 (0.002)</td>
<td>-0.0004 (0.002)</td>
</tr>
<tr>
<td>Debt-to-equity</td>
<td>0.0012 (0.001)</td>
<td>0.0019 (0.001)</td>
<td>0.0015 (0.001)</td>
</tr>
<tr>
<td>Tenure of CEO</td>
<td>-0.0014** (0.000)</td>
<td>-0.0016** (0.000)</td>
<td>-0.0014** (0.000)</td>
</tr>
<tr>
<td>G-index</td>
<td>0.0001 (0.001)</td>
<td>0.0001 (0.001)</td>
<td>0.0001 (0.001)</td>
</tr>
<tr>
<td>Technology</td>
<td>0.0358*** (0.014)</td>
<td>0.0382*** (0.014)</td>
<td>0.0315*** (0.013)</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.0071 (0.008)</td>
<td>0.0066 (0.009)</td>
<td>0.0046 (0.008)</td>
</tr>
<tr>
<td>Services</td>
<td>0.0277 (0.016)</td>
<td>0.0264 (0.016)</td>
<td>0.0209 (0.014)</td>
</tr>
<tr>
<td>Trade</td>
<td>0.0300* (0.015)</td>
<td>0.0365** (0.017)</td>
<td>0.0304* (0.015)</td>
</tr>
</tbody>
</table>

Observations 4286 4036 4285

Marginal effects from logit estimation of the factors affecting the likelihood of performance related CEO turnover. The marginal effects are evaluated at sample means. FORCED2 is an indicator variable that equals 1 if FORCED1 = 1 and also equals 1 if the CEO is under 60 years of age at that time, and the cited reason for the change is Retired, Personal or Unspecified. High ownership equals 1 if the CEO owns more than 5% of firm’s stock. Incentives are measured by dollar sensitivity, which is the change in the value of a CEO’s portfolio of stock and options for a $1000 change in firm value. Both incentives and the interaction of incentives are lagged by 1 year. Poor Performance equals 1 if the return on assets (ROA) in column 1, change in ROA over the previous year in column 2 or the 1-year stock return (RET1) in column 3 is less than two-digit industry averages. G-Index refers to the governance index of Gompers et al. (2003). Year dummies not reported. Robust standard errors with clustering on firm id are given in parentheses.

* Indicate significance at 10%.
** Indicate significance at 5%.
*** Indicate significance at 1%.

6. Robustness alternative definition of performance related turnover

The results reported above use FORCED1, as defined in Section 3. FORCED1 is superior in the sense that it includes only those instances of turnover that we are reasonably certain are forced and performance related as explained in Section 3.1. However, it is also important to examine if our results are sensitive to a change in the definition of forced turnover. In order to check this, we estimate our benchmark regressions using a broader definition of forced turnover, FORCED2. This variable includes FORCED1 and all of the “potential forced turnovers” that we do not include in FORCED1. Tables 6a and 6b present these results.

Table 6b
Incentives, performance and forced turnover: robustness using alternative definition of forced turnover – the interaction effect.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>S.D.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROA Interaction effect</td>
<td>-0.425891</td>
<td>0.3281697</td>
<td>-2.22161</td>
<td>-0.042984</td>
</tr>
<tr>
<td>Standard error</td>
<td>0.2434732</td>
<td>0.2340638</td>
<td>2.78E–02</td>
<td>1.583332</td>
</tr>
<tr>
<td>Z-score</td>
<td>-1.892193*</td>
<td>0.3714007</td>
<td>-9.348217</td>
<td>-0.6900471</td>
</tr>
<tr>
<td>Change in ROA Interaction effect</td>
<td>-0.41363</td>
<td>0.3273819</td>
<td>-2.280921</td>
<td>-0.0248991</td>
</tr>
<tr>
<td>Standard error</td>
<td>0.2456312</td>
<td>0.2381191</td>
<td>1.65E–02</td>
<td>1.627532</td>
</tr>
<tr>
<td>Z-score</td>
<td>-1.81786*</td>
<td>0.3814362</td>
<td>-13.63404</td>
<td>-0.6749768</td>
</tr>
<tr>
<td>RET1 Interaction effect</td>
<td>-0.4851015</td>
<td>0.3973047</td>
<td>-2.33E+00</td>
<td>-4.20E–02</td>
</tr>
<tr>
<td>Standard error</td>
<td>0.263389</td>
<td>0.2675774</td>
<td>2.34E–02</td>
<td>1.838271</td>
</tr>
<tr>
<td>Z-score</td>
<td>-2.025409**</td>
<td>0.8117007</td>
<td>-19.65271</td>
<td>-0.6922267</td>
</tr>
</tbody>
</table>

Panels a–c report marginal effects of the interaction of incentives and stock ownership from logit estimation of the likelihood of performance related turnover in Table 6a using three measures of firm performance. Interaction effects have been calculated using the Norton et al. (2004) methodology. * and ** indicate the coefficients are significant at 10% and 5% respectively.
Even with this broader definition of performance related turnover, the marginal effect of incentives on the likelihood of forced turnover is again positive and significant in all specifications. The marginal effects of the interaction variable are given in Table 6b. One important difference to note is that the interaction effect of high ownership and incentives is negative and significant in all specifications. Thus, for entrenched CEOs – those who hold more than 5% of their company equity, incentives are negatively related to performance related turnover and incentives and forced turnover appear to be substitutes. The entrenchment effect of equity ownership seems to dominate in this broader definition of turnover. All other variables are of the expected sign as in our benchmark regressions.

6.1. Other robustness checks

We perform several other robustness checks on our results. The full results are not presented here in order to conserve space, but are available on request. First, as firms may use past performance as well as the most recent performance in deciding whether to fire the CEO, we re-estimate our benchmark regressions with 1-year-lagged performance as an additional explanatory variable. The results are unchanged. The marginal effect of lagged performance itself is insignificant in almost all specifications. Second, Aggarwal and Samwick (1999) have shown that 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. We estimate our baseline regressions controlling for volatility of stock performance (using the Black–Scholes volatility measure given in ExecuComp) and our results remain qualitatively similar. Volatility, by itself, does not seem to be a significant determinant of forced turnover.

7. Conclusion

We study the relationship between CEO compensation incentives and performance related turnover. We develop a simple theoretical model of optimal incentive contract in a multi-period principal-agent setting that explicitly incorporates performance related firing. Our model predicts that higher incentives, i.e., steeper slope of the compensation contract may be associated with higher likelihood of performance related termination. Our empirical results confirm this prediction. However, our results indicate that this relationship varies with the equity ownership of CEOs. For the CEOs who are not entrenched (i.e., those with shareholdings of less than 5%) the probability of performance related turnover for a given level of firm performance is positively related to the slope of their compensation contract. The positive impact of incentives on forced turnover is stronger and more pronounced when the firm under performs its industry.

We interpret this result as support to the learning explanation of the relationship between incentives and turnover. Given that high-powered incentive schemes induce higher effort; these schemes in the presence of poor performance may signal lower ability of the CEO. Put differently, high-powered incentives may increase the signaling power of performance and lead to higher performance related turnover. Hence, firms providing high-powered incentives may be more likely to terminate their CEOs for a given level of poor firm performance. This relationship however does not hold for entrenched CEOs–those who own more than 5% equity.

Our study is also interesting because it spans most of the bull period of the 1990s. This is particularly interesting because one would expect less performance related turnover in a booming stock market. It is possible that during this bull market when equity-based compensation packages regularly attracted media attention – the boards became less tolerant of poor performance under pressures from institutional shareholders. We recognize that given the possibility that the nature of the market may be correlated with the firing decisions our results may not be generalized.

13 The observed negative and significant impact of entrenchment on the incentive–turnover relationship may explain the lack of unanimity on this issue from earlier findings. For example, Chakraborty et al. (2007) report a negative relationship between incentives and turnover in some of their results. Apart from using different cuts of the Execucomp data, this may in part be due to not controlling for the entrenchment effect.
Acknowledgements

We would like to thank the editors (Kenneth Kopecky, Robert Taggart) and two anonymous referees for several suggestions that have significantly improved the paper.

Appendix A

A.1. Proof of Result 2

The proof follows from a straightforward manipulation of the terms on the RHS of Eq. (11). Since $\prod_1 = z_1 e_1 (1 - b_1)$, it follows that $d\prod_1 / de_1 = z_1 (1 - b_1) > 0$. Next,

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

(13)

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

Further,

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

(14)

and

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

(15)

Next, from (2), it follows that

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

Substituting in (9), we get

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

(16)

Combining (13)–(16), it may be shown that

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

(17)

The above condition, together with the result $d\prod_1 / de_1 > 0$ implies Result 2.

Appendix B

B.1. Measuring incentives

Let $W$ denotes the CEO’s portfolio wealth and $V$ denote the market value of the firm’s equity. Then,

$$
\text{Dollar sensitivity} = \left( \frac{dW}{dV} \right) = \frac{100 \times r}{V}
$$

This is calculated as the sum of the sensitivities of three portfolio components; options granted this year (current options), unexercised options carried over from past years, and shares. The sensitivity of a stock portfolio to a 1% change in firm equity value is just 1% of the portfolio value. As for the option portfolio, we use the Black–Scholes model incorporating dividends to estimate sensitivities (Black & Scholes, 1973; Merton, 1973). 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 $N_O$,

$$
\text{Stock portfolio return sensitivity} = 0.01 \times N_S P
$$

$$
\text{Option portfolio return sensitivity} = 0.01 \times \Delta \times N_O P
$$
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 the current grants all detailed data are available from the proxy statements. 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 (2002) present a simplified method for calculating the values of options granted in past years using information from only the latest proxy statement. We use their method here.

References


