Relevance of Past Performance Measures in Chief Executive Compensation

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Abstract

Prior research has examined the relationship between executive compensation and measures of contemporaneous performance. In contrast, we focus on measures of past performance as signals on the agent's ability in optimal compensation contracts. We present a simple analytical model emphasizing the principal's adverse selection problem to derive empirically testable hypotheses and support them with an analysis of compensation and performance data on 8,476 existing CEO-year observations and 155 new CEO-year observations during the period 1993-2006. We find that salary, the fixed component of CEO compensation, is positively related to past performance for both existing CEOs and newly hired CEOs. Consistent with a theoretical prediction when an empirical researcher cannot observe some information available for contracting, we also find that salary is correlated with subsequent performance. In a moral hazard setting, measures of past performance are useful as benchmarks to filter out the noise when incentive pay is based on contemporaneous performance. Consistent with this prediction, we find that bonus, the contingent part of total compensation, is negatively related to past performance when performance measures are serially correlated. Our results indicate that it is necessary to consider both contemporaneous performance and past performance and to investigate fixed pay separately from contingent pay in order to understand pay-for-performance sensitivity.

Keywords: *Executive compensation, past performance, salary, bonus, contingent pay*

Data Availability: *Data are available from public sources indicated in the text.*

I. INTRODUCTION

Empirical work on executive compensation has examined the role of contemporaneous performance measures in determining compensation. Under a moral hazard setting, compensation is paid contingent on contemporaneous performance measures that depend on the agent's unobservable effort and are revealed after the agent has acted. To induce higher levels of effort from the agent, optimal compensation level increases with contemporaneous performance (Lambert and Larcker 1987; Sloan 1993; Antle and Smith 1986; Janakiraman, Lambert and Larcker 1992). However, prior research has not investigated the relevance of past performance measures for which the realized values are already known to the principal before setting the contract. In this paper we posit that past performance is also relevant in optimal contracting to the extent that it provides signals about the agent's ability, and present theoretical analysis and empirical evidence in support.

Prior studies of pay-for-performance sensitivity of contemporaneous performance measures, do not differentiate between salary, the fixed component of compensation, and bonus, the component contingent on contemporaneous performance measures whose distributions are affected by the agent's action. To the extent that an agent's ability persists over time, his past performance is likely to be an informative signal on how his ability will affect future performance. Consequently, firms are willing to pay a higher level of salary to attract an agent who has performed well in the past. Therefore, we expect salary to be positively related to past performance; the higher the signal on the agent's ability, the higher the level of salary. To the extent that salary is also based on an agent's other characteristics that signal his ability to the principal, but are not observable to empirical researchers, future performance will also correlate with salary because this signal is omitted from empirical examination (Hayes and Schaefer 2000). [1]

Bonus, on the other hand, is designed to motivate higher effort from the agent and is positively related to contemporaneous performance. It is negatively correlated with past performance to filter out noise when performance is serially correlated. Consequently, we expect the association between bonus and past performance to be different from the association between salary and past performance. The exact relationship between bonus and past performance depends on the time series properties of performance measures. Thus, if the performance measure is persistent over time, such as return on equity (ROE), bonus is negatively related to past performance. However, if the performance measure is uncorrelated over time, such as stock return (RET), bonus is not correlated with past performance.

We present a simple principal-agent model to motivate how salary and bonus are related to past and contemporaneous performance. Our analytical results indicate that both salary and bonus compensation are positively associated with contemporaneous performance. However, while salary is positively associated with past performance, bonus is negatively associated with past performance. Consequently, considering total cash compensation as a whole, the positive weight on past performance for the salary component may offset the negative weight on past performance for the bonus component and no significant relation may be found between total cash compensation and past performance.

[1] Prior studies suggest that compensation contracts may be based on performance measures that are observable only to the contracting parties but not to the public (Azariadis 1975; Holmstrom 1983; Bull 1987; Baker, Gibbons, and Murphy 1994; Levin 2003).

We test these hypotheses empirically by examining the extent to which past performance measures influence the salary and bonus components of chief executive officer (CEO) compensation. In our sample of 8,476 CEO-years over the period 1993-2006, salary comprises a significant part of CEO's cash compensation, average salary (mean = $551,000, median = $515,000) is comparable to average bonus (mean = $633,000, median = $333,000). Consistent with our analytical results, we find that both past change in ROE and past level of RET are positive determinants of change in salary. While past change in ROE is negatively related to bonus, the weight on past RET in bonus compensation is not significantly different from zero. Total cash compensation is positively related to contemporaneous change in ROE and RET and also past RET, but is not significantly related to past change in ROE because the positive weight in salary compensation and the negative weight in bonus compensation offset each other.

We test our hypotheses also for newly appointed CEOs. We identify 155 newly appointed CEO-year observations from the ExecuComp database whose past performance is available in Compustat and CRSP. We verify these CEOs' job history using Marquis Who's Who Survey and S&P Register. We find that the new CEO's salary is positively related to the past performance of his previous company, but unrelated to the past performance of his hiring company.

Our analysis and results thus emphasize the importance of considering both contemporaneous performance and past performance in examining efficient contracting. While contemporaneous performance measures help mitigate the moral hazard problem, past performance measures contribute to a reduction of the information asymmetry in an adverse selection context. This study also emphasizes the need to separately consider the relationship of past performance with the salary and bonus components of compensation as they serve different purposes in selecting the agent for the firm or in motivating the desired level of effort from the agent. Aggregating the fixed pay and contingent pay together may fail to uncover these relationships. Also, we document that if compensation contracts are based on some signals on agent's ability that are not observable by empirical researchers, such omitted variables can result in fixed salary appearing to be positively correlated with subsequent performance.

The remainder of this paper is structured as follows. Section 2 develops our analytical agency model and derives our main theoretical results. Section 3 describes the empirical hypotheses, research design and sample selection. Section 4 presents the empirical results. Finally, section 5 concludes the paper with a discussion of implications for future research.

II. ANALYTICAL MODEL

Prior research on pay-for-performance sensitivity has examined the association between compensation and contemporaneous performance measures. In a moral hazard model, measures of contemporaneous performance are useful because they provide information about the agent's unobservable effort (Holmstrom 1979; Banker and Datar 1989; Kim and Suh 1991; Bushman and Indjejikian 1993; Feltham and Xie 1994; Datar Kulp, and Lambert 2001). Consistent with these theoretical predictions, prior empirical research in accounting has shown that both accounting and market measures of contemporaneous performance receive positive weight in compensation and the weight is determined by sensitivity and noise of the performance (e.g., Lambert and Larcker 1987;

Sloan 1993; Natarajan 1996; Baber, Kang, Kumar 1998; Core, Guay and Verrecchia 2003; Evans, Kim, and Nagarajan 2006). A stream of literature in economics has examined the role of asymmetric information about the manager's ability in an adverse selection setting (e.g., Rose and Shepard 1997; Abowd, Kramarz, and Margolis 1999). When agents possess different levels of ability that are unobservable to principal, compensation schemes can be designed to screen out agents with inferior ability or induce agents to self-select contracts that reveal their ability. A separating equilibrium occurs when the higher ability agents choose steeper contracts as they expect higher contemporaneous performance, and the lower ability agents select flatter contracts (Darrough and Melumad 1995). Prior studies on executive compensation, however, have focused on compensation contracts contingent on contemporaneous performance, but not explicitly investigated the relevance of past performance.

An essential role of executive compensation contracts is to select and retain competent agents by compensating them commensurate with their ability. Since the agent's ability tends to persist over time, measures of past performance convey useful information on his ability and its effect on subsequent performance. Outside opportunities are better for agents with higher performance in the past, requiring firms to pay a higher salary to attract such agents. Very little research, however, informs us on the determinants of base salary level and the effect of past performance on salary (Chen and Leng, 2004).

Performance Measures, Ability and Effort

To analyze the role of past performance in incentive compensation, we develop a simple analytical model to capture some features of traditional adverse selection models (e.g. Maskin and Riley, 1984), moral hazard models (e.g. Grossman and Hart, 1983), and signaling models (e.g. Spence, 1973). A risk-neutral principal hires a risk-neutral agent to operate her firm. To operate the firm, the agent exerts effort $e > 0$, which may in general represent any action undertaken by the agent on behalf of the principal for which the agent bears a personal cost. The agent has an unobservable ability $a \in [\underline{a}, \overline{a}]$, $\underline{a} > 0$, drawn from the uniform distribution $F(a) = (a - \underline{a})/(\overline{a} - \underline{a})$, creating an adverse selection problem for the principal. Let $\mu(a) \equiv [1 - F(a)]/f(a) = \overline{a} - a$ denote the inverse of the hazard rate of *F*. Prior to the initiation of the agency relationship, two signals, y_0 and y_1, on the agent's past performance are available. The signal y_1 is an accounting measure observable by the empirical researcher but the signal y_0 represents the agent's personal characteristics that, while known to potential employers, is not observable by researchers for empirical analysis.

An agent with ability *a* that exerts effort *e* incurs the cost $c(e, a) = ce/a$, where $c > 0$ is a cost parameter that is common knowledge. Thus, greater effort is more costly to the agent, $c_e = c/a > 0$, higher ability agents incur a smaller cost of exerting effort, $c_a = -ce/a^2 < 0$, and the "single-crossing" Spence-Mirrlees condition is satisfied, $c_{ea} = -c/a^2 < 0$, ensuring that separation (or screening) across different types of agents can occur. The marginal cost of exerting effort is decreasing in ability; thus, higher ability agents find it less costly to exert higher effort.

An agent with ability a that exerts effort e generates the contemporaneous accounting measure of (expected) cash flows $y_2(e,a;y_0,y_1)=\bar{v}+v_0y_0+v_1y_1+v_aa+v_ee^{\alpha}$ that accrue to the principal, where $\alpha\in(0,1)$ and $\bar{v}$, v_0, v_1, v_a, $v_e>0$ are parameters representing the relationship of y_2 with other signals, effort and ability.[2] Thus, expected contemporaneous performance increases with greater effort by the agent, $v_e>0$, and with more able agents, $v_a>0$. Even after controlling for ability, performance is positively correlated with signals on both personal characteristics and past performance, perhaps due to serial correlation, $v_0,v_1>0$. To ensure the optimal mechanism yields an interior solution, we assume $v_0,v_1<1$.

The principal compensates the agent according to the compensation function $w(a;y_0,y_1)$. The outside opportunity of the agent is $r(y_0,y_1)=\bar{r}+r_0y_0+r_1y_1$, where $\bar{r}$ and r_0, $r_1>0$ are parameters. This expression represents the agent's reservation utility and as such may be interpreted as the income the agent would earn in the next best available employment opportunity. The reservation utility is increasing in both signals on the agent's ability because an agent with a more successful track record earns more in an alternative occupation.[3]

The Structure and Timing of the Game

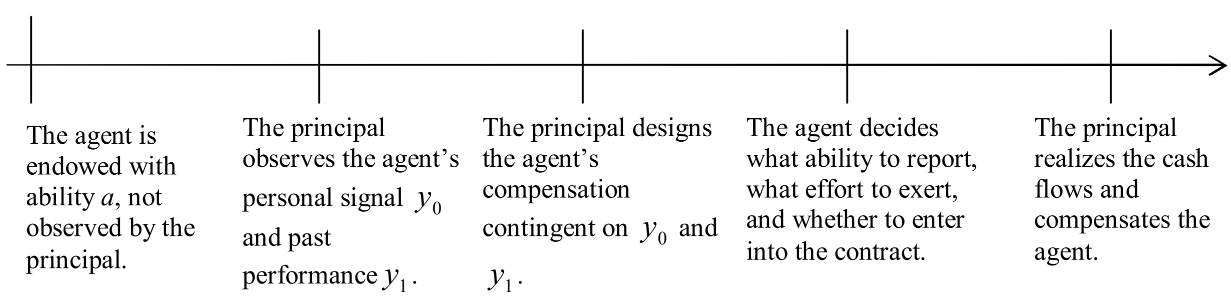
[2] The stochastic properties of the shock affecting the signal y_2 of contemporaneous performance do not affect the mechanism design problem of the principal since both the agent and principal are assumed to be risk-neutral. As such, the compensation mechanism of the agent is independent of those stochastic properties, so they are left unspecified.

[3] Dutta (2008) studies an adverse selection problem in which the outside option of the agent depends on his ability in a linear fashion. The framework also has linear shocks, constant absolute risk aversion (CARA) preferences, and linear contracts, but yet sacrifices considerable mathematical tractability of the simpler model we describe.

The principal designs an employment contract that motivates the agent to voluntarily sign the employment contract (individual rationality), exert the desired level of effort, and truthfully reveal his ability (incentive compatibility). Due to the revelation principle (Myerson 1979), the principal may restrict her attention to truthful mechanisms in which the message space is restricted to be the private information possessed by the agent, namely his ability level.

The timing of the game is as follows. At the beginning of the period, the principal observes signals on the agent's personal characteristics, y_0, and his past performance, y_1. The principal designs the effort policy $e(a; y_0, y_1)$ to be implemented by the agent and the compensation $w(a; y_0, y_1)$ paid to the agent that satisfy incentive compatibility and individual rationality. Based on the properties of the mechanism $(e(a; y_0, y_1), w(a; y_0, y_1))$, the agent decides what ability to announce to the principal, what level of effort to exert, and whether to enter into the employment contract. At the end of the period, the principal earns $y_2(e, a; y_0, y_1)$ and pays $w(a; y_0, y_1)$ to the agent. The following figure illustrates the timing of the game:

Figure 1: Timing of the Game



The Mechanism Design Problem

The utility of the agent (conditional on the message on ability being *a*, i.e. truthful) is

(1) $U^A(e(a;y_0,y_1),w(a;y_0,y_1);a)=w(a;y_0,y_1)-c(e(a;y_0,y_1),a)$,

and the utility of the principal (conditional on the agent's message being truthful) is

(2) $U^P(e(a;y_0,y_1),w(a;y_0,y_1);a)=y_2(e(a;y_0,y_1),a;y_0,y_1)-w(a;y_0,y_1)$.

The principal's mechanism design problem is to maximize her (expected) net profit

(3) $\max\limits_{e(a;y_0,y_1),w(a;y_0,y_1)}\int_{\underline{a}}^{\bar{a}}[y_2(e(a;y_0,y_1),a;y_0,y_1)-w(a;y_0,y_1)]dF(a)$,

subject to the individual rationality constraint of the agent

(4) $w(a;y_0,y_1)-c(e(a;y_0,y_1),a)\geq r(y_0,y_1)$ for all $a\in[\underline{a},\bar{a}]$;

and the incentive compatibility constraint of the agent

(5) $w(a;y_0,y_1)-c(e(a;y_0,y_1),a)\geq w(\tilde{a};y_0,y_1)-c(e(\tilde{a};y_0,y_1),a)$ for all $a,\tilde{a}\in[\underline{a},\bar{a}]$.

The truth-telling constraint in (5) requires that, an agent with ability *a* is at least as well off by announcing *a* rather than any other ability level $\tilde{a}$.

Let $U^A(a,\tilde{a};y_0,y_1)=w(\tilde{a};y_0,y_1)-c(e(\tilde{a};y_0,y_1),a)$ denote the expected utility of an agent with ability level *a* who announces his ability as $\tilde{a}$, conditional on the two signals. The agent announces the ability $\tilde{a}$ that maximizes his expected utility $U^A(a,\tilde{a};y_0,y_1)$. For the mechanism $(e(a;y_0,y_1),w(a;y_0,y_1))$ to be incentive compatible (such that condition (5) holds), it must satisfy the first-order condition (FOC) of the agent's messaging problem ($\partial U^A(a,a;y_0,y_1)/\partial\tilde{a}=0$):

(6) $w_a(a;y_0,y_1) - c_e(e(a;y_0,y_1),a)e_a(a;y_0,y_1) = 0$;

and the second-order condition (SOC) of the agent's problem ($\partial^2 U^A(a,a;y_0,y_1)/\partial\tilde{a}^2 \leq 0$):

(7) $w_{aa}(a;y_0,y_1) - c_{ee}(e(a;y_0,y_1),a)e_a(a;y_0,y_1)^2 - c_e(e(a;y_0,y_1),a)e_{aa}(a;y_0,y_1) \leq 0$.

The FOC and SOC are evaluated at the true ability level since the mechanism is truthful at the optimum.

LEMMA 1:

In the optimal compensation mechanism,

a. The optimal effort policy is

$$(8)\quad e = \left(\frac{\alpha v_e a^2}{c\bar{a}}\right)^{1/(1-\alpha)}.$$

b. The expected optimal compensation is

$$(9)\quad w = \left(\frac{1}{1+\alpha}\right)\left(\frac{\alpha v_e a^{1+\alpha}}{c^\alpha \bar{a}}\right)^{1/(1-\alpha)} - \left(\frac{1-\alpha}{1+\alpha}\right)\left(\frac{\alpha v_e \underline{a}^{1+\alpha}}{c^\alpha \bar{a}}\right)^{1/(1-\alpha)} + \bar{r} + r_0 y_0 + r_1 y_1.$$

Proof: Please see Appendix.

The agent's compensation may be analyzed into two components that we label as bonus and salary as follows. The first term on the right-hand side of (9) is derived from the agent's optimal effort in (8), so it represents the (expected) bonus b paid to the agent:

$$(10)\quad b = \left(\frac{1}{1+\alpha}\right)\left(\frac{\alpha v_e a^{1+\alpha}}{c^\alpha \bar{a}}\right)^{1/(1-\alpha)}.$$

The agent is offered a bonus to elicit the desired level of effort. The (expected) bonus is increasing in ability reflecting the fact that higher ability agents incur a smaller marginal cost from exerting effort ($c_{ea} < 0$). The salary s of the agent equals his reservation utility r minus an adjustment that takes into account the cost of exerting effort incurred by the lowest ability agent:

(11) $s = \Omega_s + r_0 y_0 + r_1 y_1$,

where $\Omega_s \equiv \overline{r} - \left(\frac{1-\alpha}{1+\alpha}\right)\left(\frac{\alpha v_e \underline{a}^{1+\alpha}}{c^{\alpha}\overline{a}}\right)^{1/(1-\alpha)}$ reflects the fact that the lowest ability agent receives the reservation utility.

The bonus may be expressed as a linear combination of the three signals as follows. From the optimal effort policy in (8), we have $v_e e^{\alpha} = \left(\frac{\alpha v_e^{1/\alpha} a^2}{c\overline{a}}\right)^{\alpha/(1-\alpha)}$. From the definition of the contemporaneous performance y_2, we have that $v_e e^{\alpha} = y_2 - \overline{v} - v_0 y_0 - v_1 y_1 - v_a a$. We infer from (10) that the realized bonus is of the form

(12) $b = \Omega_b - \left(\frac{\alpha a v_0}{\overline{a}(1+\alpha)}\right) y_0 - \left(\frac{\alpha a v_1}{\overline{a}(1+\alpha)}\right) y_1 + \left(\frac{\alpha a}{\overline{a}(1+\alpha)}\right) y_2$,

where $\Omega_b \equiv -\left(\frac{\alpha a(\overline{v} + v_a a)}{\overline{a}(1+\alpha)}\right)$.

LEMMA 2:

In the optimal compensation mechanism, the sensitivity of the bonus b to contemporaneous performance y_2 is increasing in the agent's ability a.

Proof: Follows directly from (12).

Across the entire population of agents, higher ability agents earn a bonus that is more sensitive to contemporaneous performance since they incur a smaller marginal cost from exerting effort ($c_{ea} < 0$). Indeed, it is the Spence-Mirrlees condition that ensures the screening of agents with heterogeneous ability can occur, such that the principal is able to alleviate the adverse selection problem.

Finally, expressed as a function of the three signals, the total compensation $w = b + s$ of the agent is the sum of (11) and (12):

(13) $$w = \Omega_w + \left(r_0 - \frac{\alpha a v_0}{\overline{a}(1+\alpha)} \right) y_0 + \left(r_1 - \frac{\alpha a v_1}{\overline{a}(1+\alpha)} \right) y_1 + \left(\frac{\alpha a}{\overline{a}(1+\alpha)} \right) y_2 ,$$

where $\Omega_w \equiv \overline{r} - \left(\frac{1-\alpha}{1+\alpha} \right) \left(\frac{\alpha v_e \underline{a}^{1+\alpha}}{c^{\alpha} \overline{a}} \right)^{1/(1-\alpha)} - \left(\frac{\alpha a(\overline{v} + v_a a)}{\overline{a}(1+\alpha)} \right)$.

We have thus characterized the agent's optimal compensation as a function of the three signals y_0, y_1, and y_2. To provide empirical content to this result we have the following proposition that describes the ways in which the optimal compensation mechanism depends on the signals of past and contemporaneous performance in an empirical model that omits the signal on the agent's personal characteristics:

PROPOSITION:

When the signal y_0 is omitted from the empirical model,

(a) The realized bonus of the agent is positively correlated with the signal of contemporaneous performance y_2.

(b) The realized bonus of the agent is negatively correlated with the signal of past performance y_1 due to the positive serial correlation between y_1 and y_2.

(c) The salary of the agent is positively correlated with both y_1 and y_2.

(d) The sum of salary and bonus is positively correlated with y_2, but has an ambiguous relationship with y_1.

Proof: Please see Appendix.

The bonus *b* is increasing in the signal of contemporaneous performance y_2 to ensure incentive compatibility: the agent must be rewarded when exerting higher effort. The bonus is decreasing in the signal of past performance y_1 because the effort exerted by the agent is decreasing in the same due to the positive correlation between past and contemporaneous performance ($v_1 > 0$).

The salary *s* inherits the properties of the reservation utility *r*. It is increasing in the signal of past performance y_1 because an agent with a superior track record is compensated more generously in the labor market. Moreover, the reservation utility and hence the salary is increasing in the signal y_0 of personal characteristics. Since y_0 is positively correlated with future performance y_2, the salary is positively correlated with y_2. Were it not for the signal y_0 omitted from the researcher's empirical estimation model, the salary would be independent of contemporaneous performance.

The sum of salary and bonus is increasing in contemporaneous performance y_2 since both components have that property. An increase in the signal of past performance y_1 has offsetting impacts. On the one hand, it increases the salary via its effect on the reservation utility. On the other hand, it decreases the bonus via its effect on the level of effort exerted by the agent due to its serial correlation with y_2. The net impact of y_1 on total compensation is thus ambiguous.

III. RESEARCH DESIGN AND SAMPLE SELECTION

Empirical Hypotheses

We rely on the relative performance evaluation literature to construct performance measures for our empirical analysis. Holmstrom's informativeness principle implies that the agent's performance should be evaluated relative to that of his peers to eliminate noise when common uncertainty exists (Holmstrom 1979; Holmstrom 1982). Empirical studies have provided support for relative performance evaluation (RPE), showing that agents are compensated for their contemporaneous performance after removing the peer-group component (Antle and Smith 1986; Gibbons and Murphy 1990; Janakiraman, Lambert and Larcker 1992, Hannan, Krishnan and Newman 2008). Much of this literature on executive compensation employs an accounting-based performance measure such as change in return on equity (ROE), and a market-based performance measure such as stock return (RET). Accordingly, we use these industry-adjusted measures of performance in our study, and state our empirical hypotheses as follows:

Hypothesis 1: *Salary compensation is positively associated with both contemporaneous and past industry-adjusted change in return on equity and industry-adjusted stock returns.*

The association between bonus and past performance is different from the association between salary and past performance. When the performance is correlated over time, past performance is used as a benchmark in the bonus contract against which contemporaneous performance is evaluated. In this case, past performance is filtered out from contemporaneous performance to obtain information about agent effort and to evaluate the agent contribution to firm value. Since accounting-based performance measures exhibit high persistence, bonus is expected to be negatively related to such past measures. On the other hand, since market-based performance measures are uncorrelated over time, bonus will be based on contemporaneous market performance, but not rely on past measures. We state the hypothesis as follows:

Hypothesis 2(a): Bonus compensation is positively associated with contemporaneous industry-adjusted change in return on equity and contemporaneous industry-adjusted stock returns.

Hypothesis 2(a): Bonus compensation is negatively associated with past industry-adjusted change in return on equity but not correlated with past industry-adjusted stock returns.

Since our theoretical results support directional hypotheses for only salary and bonus, we focus attention only on these two components of cash compensation. Other components of the CEO's compensation, such as stock-based pay, pensions and deferred compensation, combine aspects of both fixed and contingent pay. Therefore, their relationship with past performance measures is likely to have features of both salary and bonus that are document in this paper.

Estimation Models and Sample Data

For our primary analysis, we obtain data from the Compustat annual 2006, CRSP monthly 2006 and ExecuComp 2006 databases and focus on salary and bonus paid to the CEO. We impose the following restrictions on the sample: (1) no CEO turnover during the year; (2) CEO has served in the same company for at least two consecutive years; (3) ROE data are not missing for at least three consecutive years and RET data are not missing for at least two consecutive years; and (4) book value of equity is positive. We also eliminate all firms in an industry from our sample if there are fewer than 11 firms in the industry. The final sample contains 1,099 firms with 8,476 CEO-year observations from 1993 to 2006. The number of CEO-year observations varies from 128 in 1993 to 891 in 2006.

We specify the following model to examine the pay-for-performance sensitivity of past performance measures in CEO cash compensation:

$$\Delta \ln(SALARY_{i,t}) = \beta_0 + \beta_1 \Delta AdjROE_{i,t} + \beta_2 \Delta AdjROE_{i,t-1} + \gamma_1 AdjRET_{i,t} + \gamma_2 AdjRET_{i,t-1} + \varepsilon_{i,t}$$

$$\Delta \ln(BONUS_{i,t}) = \beta_0 + \beta_1 \Delta AdjROE_{i,t} + \beta_2 \Delta AdjROE_{i,t-1} + \gamma_1 AdjRET_{i,t} + \gamma_2 AdjRET_{i,t-1} + \varepsilon_{i,t}$$

$$\Delta \ln(CASHPAY_{i,t}) = \beta_0 + \beta_1 \Delta AdjROE_{i,t} + \beta_2 \Delta AdjROE_{i,t-1} + \gamma_1 AdjRET_{i,t} + \gamma_2 AdjRET_{i,t-1} + \varepsilon_{i,t}$$

where the subscript t refers to the year and the subscript i refers to the CEO. *CASHPAY* is the CEO's total cash compensation for the fiscal year, comprising SALARY and BONUS. Salary is determined at the beginning of the year, while bonus is determined at the end of the year based on realized values of contemporaneous performance measures. Our hypothesis 1 predicts that β_1, γ_1, β_2 and γ_2 are positive for salary compensation. Hypothesis 2a predicts that β_1 and γ_1 are positive for bonus compensation, while hypothesis 2b predicts that β_2 is negative and γ_2 is insignificant for bonus compensation.

Since the residual factors driving salary, bonus, and total cash compensation are likely to be correlated, these three equations together form a Seemingly Unrelated Regression (SUR) model. For a SUR model, the ordinary least squares (OLS) estimates are generally consistent but not efficient. The efficient estimator is generalized least squares (GLS) (Zellner 1962). However, if the equations have identical explanatory variables, as is the case in our 3-equation analysis, then OLS and GLS estimates are identical (Dwivedi and Srivastava 1978). Therefore we use OLS to estimate the coefficients. To extend our analysis to consider other components of CEO compensation simply requires the OLS estimation of equations for those components unless a theoretical model is developed to focus on the economic determinants of optimal allocation between cash and non-cash components of pay.

We convert measures of compensation and performance to 1992 dollars using the Consumer Price Index for each year. Following the prior literature, we measure ROE as earnings before extraordinary items and discontinued operations (Compustat annual #18) divided by the average common equity (Compustat annual #60). We measure RET as the sum of the firm's price appreciation and dividends divided by the stock price at the beginning of the year. Industry-adjusted ROE (AdjROE) is defined as the difference between ROE and industry ROE where industry ROE is measured as the value-weighted (based on the average book value of common equity) ROE for all other firms within the same two-digit SIC code in the 2006 annual industrial, full coverage and research Compustat file. Similarly, industry adjusted RET (AdjRET) is defined as the difference between RET and industry RET where industry RET is measured as the value-weighted (based on the market value of common stock at the beginning of the fiscal year as in Janakiraman, Lambert and Larcker 1992) RET for all other firms with the same two-digit SIC code in the monthly CRSP file.

We follow prior research (Jensen and Murphy 1990; Gibbons and Murphy 1990; Sloan 1993) and use the first difference in the logarithm of CEO compensation as the dependent variable to account for possible multiperiod nature of compensation contracts and to mitigate correlated omitted variables problem (Lambert 1983; Lambert and Lacker

1987). [4] We adjust performance measures for industry performance to eliminate the common factors other than manager's effort that may affect performance of all firms in the industry. We use the change in ROE over time to capture the incremental information content of ROE in a period t (or t-1) since ROE is positively autocorrelated over time. We use the level of RET to capture the incremental information content in RET since efficient capital market implies that RET is uncorrelated over time.

To evaluate the robustness of our results for existing CEOs, we also estimate an empirical model adding past lags of both accounting-based and market-based performance. Model specification tests based on AIC and SBC indicate that a model with three lags yields the best fit. Therefore we include past three lags to account for long-term effect of past compensation on current compensation. We estimate the coefficients using feasible generalized least squares with Park-Mitchell adjustment to account for serial correlation.

Since the adverse selection problem is especially salient when a firm chooses a new CEO, we examine the association between salary and bonus and past performance when a firm appoints a new CEO. We identify newly appointed CEOs using the executive ID number in ExecuComp. We use Compustat and CRSP to obtain accounting-based and market-based performance measures, respectively. We link company IDs in ExecuComp with company IDs in Compustat and CRSP to trace two types of past performance that may be relevant for the newly appointed CEO: past performance of the firm that the new CEO previously worked for, and past performance of the firm that the new CEO currently works for. We identified 155 newly appointed

[4] The results are robust when we use alternative transformations employing estimated serial correlation coefficients which may be less than one.

CEO-year observations with available compensation and past performance data from 1992 to 2006. We compare these 155 new CEO-year observations with the executive profiles in Marquis Who's Who and S&P register to validate the accuracy of the job history data in our sample. We estimate the equations for this sample including past performance measures for both the previous and the current firm of the CEO. Our hypothesis that salary is based on signals on agent's ability suggests that only the past performance of the previous firm will be relevant in determining new CEO salary.

IV. EMPIRICAL RESULTS

Table 1 shows the descriptive statistics that characterize our sample of firms. To alleviate potential outlier problem, we delete those observations for which the value of any variable lies in the top or bottom 1% of its empirical distribution. Results reported here are robust to the exclusion of additional observations identified as being influential using variance inflator and Belsley-Kuh-Welch criteria. Logarithmic transformation helps reduce the skewness in total cash compensation and its two components. After transforming and taking the first difference, the mean of each compensation variable is approximately equal to the median. The mean change in log salary is 0.031 (median=0.022) while the mean change in log bonus is 0.043 (median = 0.057). The mean change in log total cash compensation is 0.075 (median = 0.083). We also present descriptive statistics of contemporaneous and past performance measures used in our empirical models. The mean ΔROE_t is 0.001 (median = 0.001) and the standard deviation is 0.089, very similar to those reported in prior studies. The mean RET_t is 0.159 (median = 0.133) and the standard deviation is 0.349.

Consistent with the RPE literature, firm-specific RET and industry RET are positively correlated (Janakiraman, Lambert and Larcker 1992). The Pearson and Spearman correlation coefficients are as high as 0.46 and 0.48 respectively. The positive correlation between firm-specific ΔROE_t and industry ΔROE_t is much lower (Pearson coefficient = 0.14, Spearman coefficient = 0.18). This may reflect more idiosyncratic factors affecting accounting-based performance measures compared to market-based performance measures (Sloan 1993). The correlation between contemporaneous RET and past RET is low (both Spearman and Pearson correlation coefficients are –0.07), supporting the notion that stock returns are generally uncorrelated over time. However, the correlation between industry RET_t and industry RET_{t-1} is higher (Spearman coefficient = 0.17, Pearson coefficient = 0.09), indicating that industry average stock returns are slightly more persistent than firm-specific stock returns. The correlation between contemporaneous ΔROE and past ΔROE is negative (Pearson coefficient = –0.23, Spearman coefficient = –0.19), consistent with prior findings that earnings exhibit mean-reverting properties.

Table 2 presents empirical results to evaluate hypotheses 1 based on a pooled regression of equations.[5] Consistent with hypothesis 1, we find that the coefficient on past change in industry-adjusted ROE and past level of industry-adjusted RET are both significantly positive. Column 1 shows that the coefficient on past change in industry-adjusted ROE is 0.017 (t-statistic = 2.29).[6] The coefficient on past industry-adjusted RET

[5] We include both industry and year fixed effects in the pooled regression specification. We remove observations with Cook's D greater than one or Studendized residual greater than three.

[6] The t-statistics are based on the Huber-White robust standard error. It is a generalization of the White (1980) standard error that is robust to both serial correlation and heteroscedasticity (Rogers 1993).

is 0.026 (t-statistic = 11.37). This supports the notion that past performance measures provide information about agent's ability and higher ability is associated with higher salary. Consistent with hypothesis 1, we also find that the coefficient on contemporaneous change in industry-adjusted ROE and contemporaneous level of industry-adjusted RET are both significantly positive. The coefficient on $\Delta AdjROE_t$ is 0.017 (t-statistic = 2.29) and the coefficient on $AdjRET_t$ is 0.011 (t-statistic = 4.59). This suggests that there may be unobservable past performance measures that are informative about the agent's ability but not captured in our empirical model. These unobservable measures associated with agent's innate ability are likely to be correlated with higher contemporaneous performance. Since the agent may be rewarded based on past signals on his ability not observable by us, it can result in the apparently surprising result that the salary fixed at the beginning of the period is positively correlated with subsequent performance.

Column 2 of table 2 shows the estimation results for the bonus compensation regression. Consistent with hypothesis 2a, the coefficient on the contemporaneous change in industry-adjusted ROE and the contemporaneous level of industry-adjusted RET are both positive and significant (coefficient = 0.675, t-statistic = 7.22 for $\Delta AdjROE_t$; coefficient = 0.389, t-statistic = 16.30 for $AdjRET_t$). Consistent with hypothesis 2b, we find that the pay-for-performance sensitivity of change in past industry-adjusted ROE is significantly negative (coefficient = –0.317, t-statistic = –4.85). But the pay-for-performance sensitivity of past industry-adjusted RET is not significantly different from zero (coefficient = 0.005, t-statistic = 0.25).

Results for total cash compensation are shown in column 3 of table 2. Our empirical results indicate that the coefficient on past change in industry-adjusted ROE is -0.062 (t-statistic = –0.82), while the coefficient on past level of industry-adjusted RET is 0.062 (t-statistic = 2.79). The coefficient on contemporaneous change in industry-adjusted ROE (0.371) is indeed significantly positive (t-statistic = 4.73) and the coefficient on the contemporaneous level of industry-adjusted RET (0.277) is also significantly positive (t-statistic = 10.90). Thus a focus on only total cash compensation may suppress the relation between its components and past performance either to reward higher ability or benchmark to filter out noise. These results emphasize the importance of separating the components of compensation when examining pay-for-performance sensitivity. If we focus only on total cash compensation instead of analyzing salary and bonus pay individually, we may not find any significant role for past performance. [7]

We repeat the analysis in table 2 using year-by-year regressions from 1993 to 2006 and report the mean coefficients and Fama-MacBeth (1973) t-statistics in table 3. In support of hypothesis 1, we find that change in salary is positively related to both past change in industry-adjusted ROE (coefficient = 0.021, t-statistic = 2.43) and past level of industry-adjusted RET (coefficient = 0.025, t-statistic = 7.30). As in table 2, we find contemporaneous performance measures are positively associated with change in salary. The coefficient on contemporaneous change in industry-adjusted ROE is 0.023 (t-statistic = 1.61) and on contemporaneous level of industry-adjusted RET is 0.008 (t-statistic = 2.20).

[7] While we focus only on the salary and bonus components of CEO compensation for whom directional hypotheses are supported by our theoretical results, we also estimated similar equations for other components of CEO compensation. As expected, the results for the non-cash components reveal features of both fixed and contingent pay.

In support of hypothesis 2a, we again find that change in bonus is positively associated with both contemporaneous performance measures. The coefficient of change in industry adjusted ROE is 0.764 (t-statistic = 7.34) and of industry adjusted RET is 0.415 (t-statistic = 10.64). Consistent with hypothesis 2b, we find that change in bonus is negatively related to past change in industry-adjusted ROE (coefficient = –0.289, t-statistic = –3.58) and unrelated to past level of industry-adjusted RET (coefficient = –0.029, t-statistic = –1.06). Finally, we find that total cash compensation is not associated with past accounting performance, perhaps because the positive effect in the salary regression and the negative effect in the bonus regression offset each other. However, as before, total cash compensation is positively and significantly associated with both contemporaneous performance measures.

We also repeat the analysis to allow for different coefficients across industries. Table 4 presents industry-by-industry results based on two-digit SIC code. We report both the mean coefficients and aggregate Z-statistics for the regression for each component of cash compensation. We compute aggregate Z-statistics from t-statistics in the industry regressions, assuming cross-sectional independence among industries so that $Z = \frac{1}{\sqrt{N}} \sum_{j=1}^{N} t_j \sqrt{(k_j - 2)/k_j}$, where t_j is the t-statistic for industry j, k_j is the degree of freedom in the regression for industry j, and N is the number of industries in the sample (Patell 1976; Dechow, Huson and Sloan 1994). The Z-statistic is distributed asymptotically as standard normal. Consistent with hypothesis 1, we find that the mean coefficients on past change in industry-adjusted ROE and past level of industry-adjusted RET are both positive and significant in the salary regression (aggregate Z-statistic = 2.08 and 3.29, respectively). Consistent with hypothesis 2a, we find that the mean coefficients on the contemporaneous change in industry-adjusted ROE and the contemporaneous level of industry-adjusted RET are significantly positive in the bonus regression (aggregate Z-statistic = 5.19 and 4.98, respectively). Consistent with hypothesis 2b, we find that the mean coefficient on the past change in industry-adjusted ROE is significantly negative and the mean coefficient on the past level of industry-adjusted RET is insignificant in the bonus regression (aggregate Z-statistic = –2.37 and –1.08, respectively). We also find that total cash compensation is not significantly associated with either accounting or market measure of past performance but is positively associated with both contemporaneous performance measures.

To further assess the robustness of our results, we relax the constraint on the coefficient of past compensation implicit in the first difference transformation and allow it to be freely estimated (Boschen et al. 2003). We also empirically model the time-series properties of different compensation components and specify current compensation component as the dependent variable explained in part by past compensation component as one of the independent variables. We estimate the coefficients using feasible generalized least squares with Park-Mitchell adjustment to account for serial correlation. We include past compensation and past performance measures for up to 3 years. Table 5 presents the estimation results for 8,956 CEO-year observations where CEOs have been with company for at least 4 years (current year and past 3 years). The results in column 1 show that current salary is positively associated with past salary. The coefficient on the one-year-lagged salary is the largest in magnitude with the highest t-statistic (coefficient = 0.869, t-statistic = 84.19). The coefficients on the two-year-lagged salary (coefficient = 0.089, t-statistic = 7.33) and three-year-lagged salary (coefficient = 0.024, t-statistic =

1.12) are both positive, but the coefficients and the t-statistics decay for longer lags. We obtain similar results for bonus as shown in column 2 of table 5.

Our empirical finding that salary is positively related to past performance is robust when we allow the coefficients on past salary to be freely estimated. We find that coefficient on past accounting-based performance is significant for the first lag (coefficient = 0.015, t-statistic = 2.29), but not significant for the second (coefficient = -0.000, t-statistic = -0.11) and third lags (coefficient = -0.000, t-statistic = -0.07). This finding suggests that firms rely mainly on recent past performance to set the salary for CEOs. We also find that the coefficient on past market-based performance is significant for both the first (coefficient = 0.022, t-statistic = 9.10) and the second lags (coefficient = 0.009, t-statistic = 4.23), but not for the third lag (coefficient = -0.001, t-statistic = -0.69).

We report the results for the new CEO sample in table 6. The salary of the new CEO is positively associated with the CEO's past performance at his previous company ($ROE_{t-1\_previsou\ firm}$ and $RET_{t-1\_previous\ firm}$). The coefficient on $ROE_{t-1\_previous\ firm}$ is 0.493 (t-statistic = 2.70) and on $RET_{t-1\_previous\ firm}$ is 0.219 (t-statistic = 2.09). These results suggest that salary is set higher to attract high ability managers who have delivered high performance at their previous company. As expected, the new CEO's salary is *not* associated with the past performance of the hiring firm. The coefficient on past ROE of the hiring firm ($ROE_{t-1\_hiring\ firm}$) is –0.060 (t-statistic = –0.40) and the past RET of the hiring firm ($RET_{t-1\_hiring\ firm}$) is –0.161 (t-statistic = –1.62). These results are consistent with our theoretical model, indicating that a new CEO's salary depends on his or her own past performance in the previous company rather than the past performance of the hiring company. In addition, we find that the new CEO's salary does not depend on the CEO's subsequent performance in the hiring firm. The coefficient on ROE_t is –0.041 (t-statistic = –0.60) and on RET_t is 0.007 (t-statistic = 0.09). The results indicate that salary, the fixed component of new CEO pay, is not contingent on subsequent performance affected by the CEO's effort and that on average there is no significant omitted variable signaling the new CEO's ability, such as impressions based on interactions at work, that may be correlated with subsequent performance.

Since an underlying assumption in our analysis is that there may be signals on the agent's ability available to the principal but not observable by an empirical researcher, we directly examine this assumption for our primary sample. If there are such omitted variables then salary and bonus will be lead indicators of subsequent performance in the following model:

$$\begin{aligned}\Delta AdjROE_{i,t} = {} & \alpha_0 + \alpha_1 \Delta \ln(SALARY_{i,t}) + \alpha_2 \Delta \ln(BONUS_{i,t-1}) + \alpha_3 \Delta AdjROE_{i,t-1} \\ & + \alpha_4 AdjRET_{i,t-1} + \varepsilon_{i,t}\end{aligned}$$

$$\begin{aligned}AdjRET_{i,t} = {} & \alpha_0 + \alpha_1 \Delta \ln(SALARY_{i,t}) + \alpha_2 \Delta \ln(BONUS_{i,t-1}) + \alpha_3 \Delta AdjROE_{i,t-1} \\ & + \alpha_4 AdjRET_{i,t-1} + \varepsilon_{i,t}\end{aligned}$$

If salary is based on various past signals, some observable and some unobservable to empirical researchers, the variation in salary that is not explained by observable past performance can be attributed to the variation in signals unobservable by empirical researchers. Since the underlying ability drives both the unobservable past signals and observable contemporaneous performance, we expect a positive correlation between unobservable past signals and observable contemporaneous performance. Consequently the variation in salary that is not explained by observable past performance is a predictor of variation in contemporaneous performance (Hayes and Schaeffer 2000). The same idea applies to bonus compensation to the extent that past bonus compensation is based on both observable and unobservable signals. Therefore, we expect α_1 and α_2 to be positive when using both industry-adjusted ROE (equation) and industry-adjusted RET (equation) to measure subsequent performance.

The results in table 7 support the conjecture that cash compensation is based in part on past signals unobserved and omitted in our empirical analysis. The coefficients on current salary compensation and past bonus compensation are positive and significant for both industry adjusted ΔROE and industry adjusted RET regressions. In the first column showing results of using industry adjusted ΔROE as a measure of subsequent performance, the coefficient on current salary is positive and significant (coefficient = 0.050, t-statistic = 2.26), and past bonus is also positive and significant (coefficient = 0.012, t-statistic = 4.95). The negative coefficient on past industry adjusted ΔROE is consistent with the mean reverting property of accounting performance measures (Abarbanell and Bushee 1997). We find similar results when using industry adjusted RET as the measure of subsequent performance.

V. CONCLUSION

In this paper, we focus on the use of past performance measures in executive compensation, an issue that has not yet been investigated in detail in prior research. Since past performance may signal the agent's ability, we expect to see salary, the fixed component of total compensation, to be positively related to past performance. This helps the principal reduce information asymmetry in an adverse selection setting and offer salary commensurate with the reservation wage of the agent. Since past performance may be used as a benchmark to filter out noise in contemporaneous performance when determining bonus, the contingent part of incentive pay, it will be negatively related to bonus if performance measures are positively correlated over time to help the principal alleviate the moral hazard problem.

We also present an analytical agency model to formalize the above intuition and derive testable hypotheses. Our model in section 2 may be extended along several paths. First, the ability of the agent may be multidimensional (McAfee, McMillan, and Whinston 1989; Dutta 2008). For example, ability may have two components: general human capital (applicable across all potential employers) and specific human capital (applicable only to the firm of the principal under consideration). Second, the principal-agent problem may be embedded in a general equilibrium labor market, perhaps as in entrepreneurial theories of occupational choice (Lazear 2005). In this case, the reservation wage of the agent would become endogenous. Third, the principal may face repeated adverse selection, such that the asymmetric information problem is dynamic. Depending on whether full commitment, long-term commitment with renegotiation, or limited (or short-term) commitment is enforceable between the principal and agent, significantly different contracts would be optimal (Salanie 2005, Ch. 6). Of related interest would be the examination of career concerns of the agent (Holmstrom 1982). Fourth, the action undertaken by the agent may be private information, such that the principal designs a mechanism that resolves both the moral hazard and adverse selection problems (Lewis and Sappington 2000). Because the agent and principal are risk-neutral in our model, doing so would not change the qualitative results as long as the "first-order approach" commonly used to solve moral hazard problems can be applied (Bolton and

Dewatripont 2005, Ch. 6). Since our objective in this paper is to provide a relatively simple and intuitive model to motivate our empirical hypotheses, we leave these additional complexities for future research.

We provide empirical evidence indicating that past performance measures play different roles in determining salary and bonus. Specifically, the past change in industry-adjusted ROE and the past level of industry-adjusted RET are both positively and significantly associated with change in salary. This suggests that the principal determines salary commensurate with her expectation about the agent's ability based on his past performance and pays a higher salary to a higher ability agent because higher ability is associated with higher outcome in the future. We also find that the change in bonus is negatively associated with the past change in industry-adjusted ROE. This indicates that in order to motivate the agent to exert a higher level of effort, past performance is filtered out from contemporaneous performance if the performance measure exhibits persistence over time. Furthermore, change in bonus is unrelated to past level of industry-adjusted RET. This shows that when performance measures are uncorrelated over time, there is no benchmark required to filter out unobservable common factors. When the two components of compensation are aggregated together, we find that total cash compensation is unrelated to past performance, possibly because the positive effect in the salary equation and the negative effect in the bonus equation offset each other. This may explain why prior studies that did not separate components of total compensation may not have detected any significant role for past performance measures.

We show that it is necessary to separate various components of compensation and investigate them individually. Since salary is the fixed component and bonus is the contingent component, different information plays different roles in optimal contracting for each component. Without the disaggregated analysis, as we demonstrated in this paper, the net effect for total cash compensation may cancel out, leading to insignificant results. We also emphasize the need to consider unobservable (to empirical researchers) signals on the agent's ability that may be employed in the implicit contract with the principal. We show that because salary may be based on such private signals correlated with public measures of subsequent performance, the researcher is likely to estimate a positive coefficient on subsequent performance measures in salary compensation. Our empirical findings support this conjecture and indicate new avenues to investigate the relation between compensation and performance. Further empirical research can employ our framework to explore finer details of the structure of executive contracts in light of the fundamental relation of the salary component with past performance measures that signal the ability of the executive.

Appendix

Proof of Lemma 1:

Differentiating the agent's FOC in (6) with respect to his ability *a*, we obtain

$$\text{(A1)}\quad \begin{aligned} &w_{aa}(a;y_0,y_1) - c_{ee}(e(a;y_0,y_1),a)e_a(a;y_0,y_1)^2 \\ &- c_e(e(a;y_0,y_1),a)e_{aa}(a;y_0,y_1) - c_{ea}(e(a;y_0,y_1),a)e_a(a;y_0,y_1) = 0 \end{aligned}.$$

Applying (A1) to the agent's SOC in (7), we have

$$\text{(A2)}\quad c_{ea}(e(a;y_0,y_1),a)e_a(a;y_0,y_1) \le 0\,.$$

Since the Spence-Mirrlees condition is satisfied ($c_{ea} < 0$), $e(a;y_0,y_1)$ belongs to a direct truthful mechanism $(e(a;y_0,y_1), w(a;y_0,y_1))$ if and only if the effort policy $e(a;y_0,y_1)$ is increasing in ability ($e_a(a;y_0,y_1) \ge 0$), as in Salanie (2005, p. 31). Therefore, the agent's SOC in (A2) requires that $e(a;y_0,y_1)$ be increasing in ability and the agent's FOC in (6) yields the optimal compensation $w(a;y_0,y_1)$ for the agent.

We follow the procedure in Myerson (1981) and Salanie (Ch. 2) to solve the principal's mechanism design problem. Let $u^A(a;y_0,y_1)$ denote the utility an agent with ability *a* gets at the optimum of his program. As the optimal mechanism is truthful, we have

$$\text{(A3)}\quad u^A(a;y_0,y_1) = U^A(a,a;y_0,y_1) = w(a;y_0,y_1) - c(e(a;y_0,y_1),a)\,.$$

Differentiating (A3) with respect to ability and applying the envelope theorem, the FOC in (6) implies that

$$\text{(A4)}\quad u_a^A(a;y_0,y_1) = -c_a(e(a;y_0,y_1),a)\,.$$

Integrating (A4), we obtain the utility of the agent at the optimum:

(A5) $u^A(a; y_0, y_1) = -\int_{\underline{a}}^{a} c_a(e(x; y_0, y_1), x)dx + r(y_0, y_1)$.

The boundary condition for the integration is given by the individual rationality constraint (4), which binds for the lowest ability agent as in a traditional adverse selection model; thus, the lowest ability agent earns the reservation utility *r*. Combining (A3) and (A5), we infer the optimal compensation as a function of the effort policy:

(A6) $w(a; y_0, y_1) = c(e(a; y_0, y_1), a) - \int_{\underline{a}}^{a} c_a(e(x; y_0, y_1), x)dx + r(y_0, y_1)$.

The objective of the principal is to maximize $\int_{\underline{a}}^{\bar{a}} [y_2(e(a; y_0, y_1), a; y_0, y_1) - w(a; y_0, y_1)]dF(a)$. Substituting for optimal compensation expression in (A6), the objective becomes

(A7)

$$\int_{\underline{a}}^{\bar{a}} [y_2(e(a; y_0, y_1), a; y_0, y_1) - c(e(a; y_0, y_1), a) + \int_{\underline{a}}^{a} c_a(e(x; y_0, y_1), x)dx]dF(a) - r(y_0, y_1).$$

Integrating (A7) by parts, it becomes

(A8)

$$\int_{\underline{a}}^{\bar{a}} [y_2(e(a; y_0, y_1), a; y_0, y_1) - c(e(a; y_0, y_1), a) + \mu(a; y_0, y_1)c_a(e(a; y_0, y_1), a)]dF(a) - r(y_0, y_1)$$

.

It follows that the principal's problem involves the point-wise maximization of the integrand, referred to as the "virtual surplus" following Myerson:

(A9) $\max_{e(a; y_0, y_1)} y_2(e(a; y_0, y_1), a; y_0, y_1) - c(e(a; y_0, y_1), a) + \mu(a)c_a(e(a; y_0, y_1), a)$.

The term $\mu(a)c_a(e(a;y_0,y_1),a)$ in the virtual surplus expression quantifies the impact of the adverse selection problem since it measures the extent to which the principal's objective deviates from the social surplus of the relationship $y_2(e(a;y_0,y_1),a;y_0,y_1) - c(e(a;y_0,y_1),a)$, which is the principal's objective in the absence of the adverse selection problem. Therefore, the larger is $\mu(a)$, the inverse of the hazard rate, the greater is the distortion caused by asymmetric information between the principal and agent. Furthermore, by virtue of the single-crossing property $c_{ea} < 0$, the term $\mu(a)c_a(e(a;y_0,y_1),a)$ is decreasing in effort *e*, so it augments the cost to the principal of implementing a higher level of effort.

Substituting the expressions for the expected contemporaneous performance $y_2(e,a;y_0,y_1) = \bar{v} + v_0 y_0 + v_1 y_1 + v_a a + v_e e^{\alpha}$, the inverse of the hazard rate $\mu(a) = \bar{a} - a$, and effort cost function $c(e,a) = ce/a$, the FOC with respect to effort *e* of the principal's problem yields the optimal policy

(A10) $$e(a;y_0,y_1) = \left(\frac{\alpha v_e a^2}{c\bar{a}}\right)^{1/(1-\alpha)}.$$

It is straightforward to show the SOC of the principal's problem is satisfied since $\alpha \in (0,1)$. The effort policy is increasing in ability, as is required for the mechanism to be optimal, such that the SOC in (A2) of the agent's problem holds.[8]

[8] Applying the envelope theorem to the FOC of the agent's problem, the result of which is given by (11), we have that $u_a^A(a;y_0,y_1) = -c_a(e(a;y_0,y_1),a)$. Because higher ability agents incur a smaller cost of exerting effort (i.e. $c_a < 0$), we infer that $u_a^A(a;y_0,y_1) > 0$: higher ability agents earn greater utility. The utility of the agent at the optimum $u^A(a;y_0,y_1)$ represents his "informational rent," which we showed is an increasing function of his ability. The more able is an agent, the more he benefits from his private information. Suppose an agent with ability *a* announces the ability $\tilde{a} < a$, to receive the utility

The agent's compensation is given by the expression in (A6):

$$w(a;y_0,y_1)=c(e(a;y_0,y_1),a)-\int_{\underline{a}}^{a}c_a(e(x;y_0,y_1),x)dx+r(y_0,y_1).$$

Using the expressions for the optimal effort policy in (A10), the effort cost function $c(e,a)=ce/a$, and the reservation utility $r(y_0,y_1)=\bar{r}+r_0y_0+r_1y_1$, the agent's compensation becomes

(A11) $$w=\left(\frac{1}{1+\alpha}\right)\left(\frac{\alpha v_e a^{1+\alpha}}{c^\alpha\bar{a}}\right)^{1/(1-\alpha)}-\left(\frac{1-\alpha}{1+\alpha}\right)\left(\frac{\alpha v_e \underline{a}^{1+\alpha}}{c^\alpha\bar{a}}\right)^{1/(1-\alpha)}+\bar{r}+r_0y_0+r_1y_1,$$

Proof of Proposition:

We calculate the omitted variable bias (OVB) induced by not observing the agent's personal characteristics y_0. Suppose there are *n* observations. Let Y_i denote the $n\times1$ vector of the signal y_i for $i=0,1,2$, wherein Y_0 is unobservable by the empirical researcher. Let Y_{C12} denote the $n\times3$ matrix whose first column is a vector of ones, second column is Y_1, and third column is Y_2. Similarly, let Y_{C1} denote the $n\times2$ matrix whose first column is a vector of ones and second column is Y_1. Let *S* denote the $n\times1$ vector of the salary *s*, *B* of the bonus *b*, and *W* of total compensation *w*.

$$U^A(a,\tilde{a};y_0,y_1)=w(\tilde{a};y_0,y_1)-c(e(\tilde{a};y_0,y_1),a)=$$
$$u^A(\tilde{a};y_0,y_1)+c(e(\tilde{a};y_0,y_1),\tilde{a})-c(e(\tilde{a};y_0,y_1),a).$$

This is greater than the utility earned by a truthful agent with ability $\tilde{a}$, given by $u^A(\tilde{a};y_0,y_1)$, since $c_a<0$. The capability of high ability agents to "hide behind" low ability agents provides them informational rent. This rent is the price the principal must pay for high ability agents to reveal their information, which is consistent with Salanie (p. 34).

From (12), the bonus b is related to the trio of signals according to the following regression equation:

(A12) $B = Y_{C12}\beta_{C12}^{b} + Y_0\beta_0^{b} + \varepsilon^{b}$,

where ε^{b} is an $n\times1$ vector of disturbances. β_{C12}^{b} is the 3×1 vector of coefficients derived from (12): the first row is the constant $\Omega_b \equiv -\left(\frac{\alpha a(\bar{v}+v_a a)}{\bar{a}(1+\alpha)}\right)$, the second row is the coefficient of y_1 given by $-\left(\frac{\alpha a v_1}{\bar{a}(1+\alpha)}\right)$, and the third row is the coefficient of y_2 given by $\left(\frac{\alpha a}{\bar{a}(1+\alpha)}\right)$. Also from (10), it follows that the coefficient of y_0 is given by $\beta_0^{b} = -\left(\frac{\alpha a v_0}{\bar{a}(1+\alpha)}\right)$. Performing a regression of B on Y_{C12}, we obtain the 3×1 vector of estimators $\hat{\beta}_{C12}^{b} = (Y_{C12}'Y_{C12})^{-1}Y_{C12}'B$. Applying (A13) and taking the expectation (conditional on the observations), we obtain

(A14) $E[\hat{\beta}_{C12}^{b}] = \beta_{C12}^{b} + (Y_{C12}'Y_{C12})^{-1}Y_{C12}'Y_0\beta_0^{b}$,

having imposed the standard regression assumptions on ε^{b}. The second term represents the OVB that arises from not observing the signal Y_0.

Since the coefficient of y_1 in the vector β_{C12}^{b} is given by $-\left(\frac{\alpha a v_1}{\bar{a}(1+\alpha)}\right)$ and $\beta_0^{b} = -\left(\frac{\alpha a v_0}{\bar{a}(1+\alpha)}\right)$, we infer that the coefficient of y_1 in the vector $E[\hat{\beta}_{C12}^{b}]$ is negative. Since the coefficient of y_2 in the vector β_{C12}^{b} is given by $\left(\frac{\alpha a}{\bar{a}(1+\alpha)}\right)$, $\beta_0^{b} = -\left(\frac{\alpha a v_0}{\bar{a}(1+\alpha)}\right)$, and $v_0 < 1$, we infer that the coefficient of y_2 in the vector $E[\hat{\beta}^b_{C12}]$ is positive. Thus, the realized bonus of the agent is negatively correlated with the signal of past performance y_1 and positively correlated with the signal of contemporaneous performance y_2 when the signal y_0 is omitted from the estimation model.

According to (11), the salary s is related to the signals as follows:

(A15) $S = Y_{C1}\beta^s_{C1} + Y_0\beta^s_0 + \varepsilon^s$,

where ε^s is an $n\times1$ vector of disturbances. β^s_{C1} is the 2×1 vector of coefficients derived from (11): the first row is the constant $\Omega_s \equiv \bar{r} - \left(\frac{1-\alpha}{1+\alpha}\right)\left(\frac{\alpha v_e \underline{a}^{1+\alpha}}{c^\alpha \bar{a}}\right)^{1/(1-\alpha)}$ and the second row is the coefficient of y_1 given by r_1. Also from (11), we have that the coefficient of y_0 is given by $\beta^s_0 = r_0$. Performing a regression of S on Y_{C12}, we obtain the 3×1 vector of estimators $\hat{\beta}^s_{C12} = (Y'_{C12}Y_{C12})^{-1}Y'_{C12}S$. Applying (A15) and taking the expectation, we obtain

(A16) $E[\hat{\beta}^s_{C12}] = (Y'_{C12}Y_{C12})^{-1}Y'_{C12}(Y_{C1}\beta^s_{C1} + Y_0\beta^s_0)$.

Following Greene (2003, p. 151), we may decompose this expression as follows:

(A17) $E[\hat{\beta}^s_{C12}] = \begin{bmatrix}\beta^s_{C1}\\ 0\end{bmatrix} + (Y'_{C12}Y_{C12})^{-1}Y'_{C12}Y_0\beta^s_0$.

The estimator associated with the signal of past performance y_1 is biased due to the omitted variable y_0. Were it not for the private signal, the estimator associated with contemporaneous performance y_2 would be zero.

Since the coefficient of y_1 in the vector β^s_{C1} is given by $r_1 > 0$ and $\beta^s_0 = r_0 > 0$, we infer that the coefficient of y_1 in the vector $E[\hat{\beta}^s_{C12}]$ is positive. Since the first term of (A17) makes no contribution to y_2 and $\beta^s_0 = r_0 > 0$, we infer that the coefficient of y_2 in the vector $E[\hat{\beta}^s_{C12}]$ is positive. Thus, the salary of the agent is positively correlated with the signals of past performance y_1 and contemporaneous performance y_2.

According to (13), total compensation w is related to the trio of signals as follows:

(A18) $W = Y_{C12}\beta^w_{C12} + Y_0\beta^w_0 + \varepsilon^b$,

where ε^w is an $n \times 1$ vector of disturbances. β^w_{C12} is the 3×1 vector of coefficients derived from (13): the first row is the constant $\Omega_w \equiv \bar{r} - \left(\frac{1-\alpha}{1+\alpha}\right)\left(\frac{\alpha v_e \underline{a}^{1+\alpha}}{c^\alpha \bar{a}}\right)^{1/(1-\alpha)} - \left(\frac{\alpha a(\bar{v} + v_a a)}{\bar{a}(1+\alpha)}\right)$, the second row is the coefficient of y_1 given by $\left(r_1 - \frac{\alpha a v_1}{\bar{a}(1+\alpha)}\right)$, and the third row is the coefficient of y_2 given by $\left(\frac{\alpha a}{\bar{a}(1+\alpha)}\right)$. Also from (13), we have that the coefficient of y_0 is given by $\beta^w_0 = \left(r_0 - \frac{\alpha a v_0}{\bar{a}(1+\alpha)}\right)$. Performing a regression of W on Y_{C12}, we obtain the 3×1 vector of estimators $\hat{\beta}^w_{C12} = (Y'_{C12}Y_{C12})^{-1}Y'_{C12}W$. Taking the expectation, we obtain

(A19) $E[\hat{\beta}^w_{C12}] = \beta^w_{C12} + (Y'_{C12}Y_{C12})^{-1}Y'_{C12}Y_0\beta^w_0$,

where the second term represents the OVB.

Since the coefficient of y_1 in the vector β_{C12}^{w} is given by $\left(r_1 - \frac{\alpha a v_1}{\bar{a}(1+\alpha)} \right)$ and $\beta_0^{w} = \left(r_0 - \frac{\alpha a v_0}{\bar{a}(1+\alpha)} \right)$, both of which have ambiguous signs, we infer that the coefficient of y_1 in the vector $E[\hat{\beta}_{C12}^{w}]$ has an ambiguous sign. Since the coefficient of y_2 in the vector β_{C12}^{w} is given by $\left(\frac{\alpha a}{\bar{a}(1+\alpha)} \right)$, $\beta_0^{w} = \left(r_0 - \frac{\alpha a v_0}{\bar{a}(1+\alpha)} \right)$, and $v_0 < 1$, we infer that the coefficient of y_2 in the vector $E[\hat{\beta}_{C12}^{w}]$ is positive. Thus, the total compensation of the agent has an ambiguous relationship with the signal of past performance y_1 and it is positively correlated with the signal of contemporaneous performance y_2.

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TABLE 1
Descriptive statistics on cash compensation components, firm and industry performance measures

Variable	Mean	STD	Q1	Median	Q3
Salary ($000)	551	263	365	515	699
Bonus ($000)	633	1,228	65	333	753
Δln(Salary)	0.031	0.077	-0.016	0.022	0.066
Δln(Bonus)	0.043	0.725	-0.215	0.057	0.330
Δln(Cash pay)	0.075	0.750	-0.145	0.083	0.358
ΔROE_t	0.001	0.089	-0.026	0.001	0.025
$\Delta industry\_ROE_t$	-0.004	0.094	-0.026	0.000	0.025
RET_t	0.159	0.349	-0.069	0.133	0.341
$Industry\_RET_t$	0.117	0.241	-0.042	0.101	0.263

Notes:
The above table shows sample characteristics of 8,476 CEO-year observations from 1993 to 2006. CASH PAY is the CEO's total cash compensation for the fiscal year, including salary and bonus. ROE is earnings before extraordinary items and discontinued operations (Compustat annual #18) divided by the average common equity (Compustat annual #60). RET is the sum of the firm's capital gains and dividends divided by the stock price at the beginning of the year. Industry ROE is measured as the value-weighted ROE for all other firms within the same two-digit SIC code in the 2006 annual industrial, full coverage and research Compustat file. The weights are determined as the average book value of common equity for each firm. Industry RET is measured as the value-weighted RET for all other firms with the same two-digit SIC code in the monthly CRSP file. The weights are determined by the market value of common stock at the beginning of the fiscal year. Δ denotes the first difference between two consecutive years.

TABLE 2
OLS regression of change in cash compensation components on change in past industry-adjusted performance and change in contemporaneous industry-adjusted performance
(Pooled regression from 1993 to 2006)

	$\Delta\ln(\text{Salary})_t$	$\Delta\ln(\text{Bonus})_t$	$\Delta\ln(\text{Cash Pay})_t$
Independent Variables	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)
$\Delta AdjROE_t$	0.017 (2.29)	0.675 (7.22)	0.371 (4.73)
$\Delta AdjROE_{t-1}$	0.017 (2.29)	-0.317 (-4.85)	-0.062 (-0.82)
$AdjRET_t$	0.011 (4.59)	0.389 (16.30)	0.277 (10.90)
$AdjRET_{t-1}$	0.026 (11.37)	0.005 (0.25)	0.062 (2.79)
Adjusted R^2	3.8%	10.7%	4.8%
N	8,476	6,069	7,867

Notes:

AdjROE is defined as the difference between ROE and industry ROE. AdjRET is defined as the difference between RET and industry RET. $\Delta AdjROE_t$ is the first difference between $AdjROE_t$ and $AdjROE_{t-1,}$ $\Delta AdjROE_{t-1}$ is the first difference between $AdjROE_{t-1}$ and $AdjROE_{t-2,}$ Coefficients on industry and year dummies are not shown. All other variables are defined as in table 1. To mitigate outlier problem, we delete those observations for which any variable lies in the top or bottom 1% of its empirical distribution of each regression. We also remove observations with Cook's D greater than one or Studendized residual greater than three based on regression diagnostics. The t-statistics are based on the Huber-White robust standard error, robust to both serial correlation and heteroscedasticity (Rogers 1993).

TABLE 3
OLS regression of change in cash compensation components on change in past industry-adjusted performance and change in contemporaneous industry-adjusted performance (Year-by-year regressions from 1993 to 2006)

	$\Delta\ln(\text{Salary})_t$	$\Delta\ln(\text{Bonus})_t$	$\Delta\ln(\text{Cash Pay})_t$
Independent Variables	Mean Coefficient (Fama-MacBeth t-statistic)	Mean Coefficient (Fama-MacBeth t-statistic)	Mean Coefficient (Fama-MacBeth t-statistic)
ΔAdjROE_t	0.023 (1.61)	0.764 (7.34)	0.329 (3.10)
$\Delta \text{AdjROE}_{t-1}$	0.021 (2.43)	-0.289 (-3.58)	-0.022 (-0.36)
AdjRET_t	0.008 (2.20)	0.415 (10.64)	0.268 (6.26)
AdjRET_{t-1}	0.025 (7.30)	-0.029 (-1.06)	0.060 (1.93)
Adjusted R^2	3.3%	10.6%	4.8%
N	8,547	6,107	8,172

Notes:
AdjROE is defined as the difference between ROE and industry ROE. AdjRET is defined as the difference between RET and industry RET. ΔAdjROE_t is the first difference between AdjROE_t and AdjROE_{t-1}, $\Delta \text{AdjROE}_{t-1}$ is the first difference between AdjROE_{t-1} and AdjROE_{t-2}. Coefficients on industry dummies are not shown. All other variables are defined as in table 1. To mitigate outlier problem, we delete those observations for which the any variable lies in the top or bottom 1% of its empirical distribution of each regression. We also remove observations with Cook's D greater than one or Studendized residual greater than three based on regression diagnostics. The coefficients are based on the mean of the 14 yearly coefficients from 1993 to 2006. The t-statistics are the Fama-MacBeth (1973) t-statistics based on 14 yearly coefficients from 1993 to 2006.

TABLE 4
OLS regression of change in cash compensation components on change in past industry-adjusted performance and change in contemporaneous industry-adjusted performance
(Industry-by-industry regressions from 1993 to 2006)

	Δln(Salary)$_t$	Δln(Bonus)$_t$	Δln(Cash Pay)$_t$
Independent Variables	Mean Coefficient (z-statistic)	Mean Coefficient (z-statistic)	Mean Coefficient (z-statistic)
ΔAdjROE$_t$	0.019 (1.27)	1.630 (5.19)	0.654 (4.09)
ΔAdjROE$_{t-1}$	0.037 (2.08)	-0.719 (-2.37)	-0.014 (-0.17)
AdjRET$_t$	0.015 (1.83)	0.355 (4.98)	0.302 (7.76)
AdjRET$_{t-1}$	0.019 (3.29)	-0.120 (-1.08)	0.006 (0.18)
Mean Adjusted R^2	3.1%	23.3%	12.8%
N	8,616	6,215	8,633

Notes:
AdjROE is defined as the difference between ROE and industry ROE. AdjRET is defined as the difference between RET and industry RET. ΔAdjROE$_t$ is the first difference between AdjROE$_t$ and AdjROE$_{t-1,}$ Δ AdjROE$_{t-1}$ is the first difference between AdjROE$_{t-1}$ and AdjROE$_{t-2,}$ Coefficients on year dummies are not shown. All other variables are defined as in table 1. To mitigate outlier problem, we delete those observations for which any variable lies in the top or bottom 1% of its empirical distribution of each regression. We also remove observations with Cook's D greater than one or Studendized residual greater than three based on regression diagnostics. The coefficients are the mean coefficients from the 42 industry regressions based on two-digit SIC code. The aggregate Z-statistics are computed from t-statistics in the 42 industry regressions, assuming cross-sectional independence among industries. $Z = \frac{1}{\sqrt{N}} \sum_{j=1}^{N} t_j \sqrt{(k_j - 2) / k_j}$,

where t_j is the t-statistic for industry j, k_j is the degree of freedom in regression for industry j, and N is the number of industries in the sample. The Z-statistic is distributed asymptotically as standard normal.

TABLE 5
Feasible generalized least square regression of salary on past and contemporaneous performance for existing CEOs
(FGLS with Park-Mitchell adjustment from 1995 to 2006)

	$\ln(\text{Salary})_t$		$\ln(\text{Bonus})_t$		$\ln(\text{Cash Pay})_t$	
Independent Variables	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
$\ln(\text{Salary})_{t-1}$	0.869	84.19				
$\ln(\text{Salary})_{t-2}$	0.089	7.33				
$\ln(\text{Salary})_{t-3}$	0.024	1.12				
$\ln(\text{Bonus})_{t-1}$			0.534	38.58		
$\ln(\text{Bonus})_{t-2}$			0.148	9.81		
$\ln(\text{Bonus})_{t-3}$			0.138	10.85		
$\ln(\text{Cash Pay})_{t-1}$					0.306	31.98
$\ln(\text{Cash Pay})_{t-2}$					0.254	26.73
$\ln(\text{Cash Pay})_{t-3}$					0.168	18.62
ROE_t	0.015	2.04	1.046	11.75	0.292	6.43
ROE_{t-1}	0.015	2.29	-0.484	-7.19	-0.027	-0.77
ROE_{t-2}	-0.000	-0.11	-0.152	-2.47	-0.059	-1.94
ROE_{t-3}	-0.000	-0.07	-0.006	-0.92	0.012	1.94
RET_t	0.015	4.97	0.503	22.06	0.304	19.14
RET_{t-1}	0.022	9.10	0.073	4.08	0.237	18.68
RET_{t-2}	0.009	4.23	-0.039	-2.40	0.071	6.58
RET_{t-3}	-0.001	-0.69	-0.019	-1.31	0.010	1.13
SIZE	0.016	12.07	0.089	12.07	0.143	21.95
Adjusted R^2	96.2%		74.6%		71.0%	
N	8,956		6,253		8,971	

Notes:
Coefficients on industry and yearly dummies are not shown. Size is defined as logarithm of total assets. All other variables are defined as in table 1.

TABLE 6
OLS estimation of salary on past and contemporaneous performance measures for newly-hired CEOs
(Pooled regression from 1993 to 2006)

	$\ln(\text{Salary})_t$	$\ln(\text{Bonus})_t$	$\ln(\text{Cash Pay})_t$
Independent Variables	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)
Intercept	4.615 (12.36)	2.630 (3.97)	5.194 (5.81)
ROE_t	-0.041 (-0.60)	0.615 (2.94)	0.137 (0.67)
$ROE_{t-1\_ \text{previous firm}}$	0.493 (2.70)	-0.194 (-1.26)	-0.380 (-1.19)
$ROE_{t-1\_\text{hiring firm}}$	-0.060 (-0.40)	-0.537 (-2.98)	-0.684 (-2.08)
RET_t	0.007 (0.09)	0.332 (1.65)	0.019 (0.10)
$RET_{t-1\_\text{previous firm}}$	0.219 (2.09)	0.006 (0.04)	0.339 (1.39)
$RET_{t-1\_\text{hiring firm}}$	-0.161 (-1.62)	-0.164 (-0.84)	-0.047 (-0.33)
SIZE	0.207 (7.09)	0.389 (6.50)	0.352 (5.12)
Adjusted R^2	44.1%	53.6%	24.2%
N	155	155	155

Notes:
The above table is based on a sample of 155 newly-hired CEOs whose past accounting and market performance can be tracked through COMPUSTAT and CRSP. $ROE_{t-1\_ \text{previous firm}}$ is the past ROE of the previous firm. $ROE_{t-1\_\text{hiring firm}}$\\is the past ROE of the hiring firm. $RET_{t-1\_ \text{previous firm}}$ is the past RET of the previous firm. $RET_{t-1\_\text{hiring firm}}$\\is the past RET of the hiring firm. Coefficients on industry and yearly dummies are not shown. Size is defined as logarithm of total assets. All other variables are defined as in table 1. The t-statistics are based on the Huber-White robust standard error, robust to both serial correlation and heteroscedasticity (Rogers 1993).

TABLE 7
OLS Regression of contemporaneous performance on past performance and cash compensation components
(Pooled regression from 1993 to 2006)

	Dependent Variable			
	$\Delta AdjROE_t$	$AdjRET_t$	$\Delta AdjROE_t$	$AdjRET_t$
Independent Variables	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)
$\Delta\log(Salary)_t$	0.050 (2.26)	0.237 (3.54)		
$\Delta\log(Bonus)_{t-1}$	0.012 (4.95)	0.034 (3.93)		
$\Delta\log$ (Cash Pay)$_t$			0.034 (3.80)	0.199 (12.55)
$\Delta AdjROE_{t-1}$	-0.189 (-8.33)	-0.043 (-0.97)	-0.145 (-8.61)	-0.040 (-0.99)
$AdjRET_{t-1}$	0.021 (4.30)	-0.067 (-3.43)	0.016 (4.74)	-0.064 (-4.66)
Adj. R^2	11.7%	12.5%	9.7%	10.6%

Notes:
The above table shows pooled regression for 5,537 CEO-year observations from 1993 to 2006. T-statistics are calculated based on standard errors that are robust to cross-sectional dependence. Coefficients on industry and yearly dummies are not shown. The t-statistics are based on the Huber-White robust standard error, robust to both serial correlation and heteroscedasticity (Rogers 1993).