

**THE GOOD, THE BAD AND THE LUCKY:  
CEO PAY AND SKILL\***

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**Abstract**

CEO compensation varies widely, even within industries. In this paper, we investigate whether differences in skill explain these differences in CEO pay. Using the idea that skilled CEOs should be more likely to continue prior good performance and more likely to reverse prior poor performance, we develop a new methodology to detect whether skill is related to pay. We find that highly paid CEOs are more skilled than their less well paid peers when pay is performance-based and when there is a large shareholder. This detected link between pay and skill is strong even when we examine industry-wide declines: highly paid CEOs are more likely to reverse the firm's fortunes. We also examine CEO turnovers and show that the firm's post-turnover performance is related to differences between the two CEO's pay levels. These results highlight conditions where pay and skill are linked, and hence identify firms where high pay appears to have no justification.

One of the great, as-yet-unsolved problems in the country today is executive compensation and how it is determined.  
Securities and Exchange Commission chairman, William H. Donaldson<sup>1</sup>

Is it a problem of bad apples, or is it the barrel?  
Harvard Business School Dean, Kim Clark<sup>2</sup>

## **PART I. INTRODUCTION**

Very few business topics are as hotly contested as the salaries of CEOs of public firms. The amount that CEOs are paid and the structure of their pay is frequently debated in the popular press, television programs, proposed legislation, political campaigns, magazine cover stories and academic research. Outrage over CEO pay has forced important changes at major firms; Jack Welch of GE was forced to give back part of his pay when investors complained it was excessive and Richard Grasso of the NYSE was forced to resign altogether when the details of his pay were revealed.

One obvious reason for the interest in CEO pay is its striking increase. In 1992, the average CEO of an S&P 500 firm earned \$2.7 million. By its peak in 2000, average pay for these CEOs had increased to over \$14 million – an increase of more than 400%. The increase in CEO pay is more striking in relative terms. Twelve years ago, CEOs at major U.S. corporations were paid 82 times the average earnings of a blue collar worker; last year they were paid more than 400 times the average blue collar worker. This huge increase in executive compensation has been especially controversial because CEOs are sometimes paid large sums even as the firm's results

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<sup>1</sup> National Press Club speech, August 2003

<sup>2</sup> National Press Club speech, February 2003

deteriorate; CEOs at WorldCom, Tyco, and Enron, collected over \$100 million on average in the year prior to the scandals at or collapse of their firms.

These facts and spectacular governance failures at important firms have caused many to conclude that the process for setting CEO pay and, more generally, the governance of public firms is badly broken. Critics such as Bebchuk and Fried (2004) conclude that CEOs are overpaid because they have too much influence over the board that should be monitoring them. Thus, CEOs are effectively able to set their own pay and the CEO's compensation contract is badly distorted. In this view, CEO pay is the product of badly functioning corporate governance. Such arguments also suggest that cases of excessive CEO pay reflect a systematic social problem of "fat-cat" CEOs skimming money at shareholders' expense and therefore a systematic breakdown of governance, thus demonstrating the need for widespread governance reform.

Others are more sanguine, arguing that the process for determining CEO pay is not systematically broken. Holmstrom and Kaplan (2003) argue that US corporate governance works relatively well and that any problems with CEO pay have not erased the comparative advantages of the U.S. system.<sup>3</sup> Murphy (2002) argues that CEO pay levels and practices are generally consistent with good governance and that distortions from optimal contracting reflect the perceived impact of accounting and tax rules. In this view, compensation problems reflect breakdowns in particular firms, but do not indicate a general problem in compensation or in the governance of public firms generally.

Previous research seeking to distinguish between these competing views of CEO pay typically examines whether a CEO's pay changes with contemporaneous changes in firm

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<sup>3</sup>Reasons other than governance failures may explain the increase in pay unrelated to performance. For example, Murphy and Zbojnik (2004), Oyer (2004), and Himmelberg and Hubbard (2000) argue that CEO pay reflects changes in labor market for CEOs. Bolton, Scheinkman and Xiong. (2003) argue that it may even be in shareholders' interest to avoid incentive pay if capital markets are speculative.

performance. Agency theory suggests that the CEO pay should be linked to changes in firm value in order to align managers' interests with shareholders.<sup>4</sup> To the degree pay doesn't change with performance, deviations are taken as evidence of CEO skimming excessive compensation.

Surprisingly, however, there is little evidence on the basic question: is CEO pay related to CEO skill? Are highly paid CEOs better than their more poorly paid peers? Given the potential agency problems that affect CEO pay, it is difficult to know how well the market for CEO pay functions. However, an indirect indicator of a well functioning CEO labor market would be that the ranking of CEOs based on their pay levels should reflect their skill levels.

The question of whether CEO pay and skill are related is not only important in evaluating the appropriateness of CEO pay levels but also in evaluating the governance of public firms. If pay and skill are related, high salaries will not necessarily be evidence that "fat cat" CEOs capture the board. Just as sports teams may decide to pay high salaries to attract or retain valuable players, boards may also pay more for especially talented managers. If, on the other hand, pay and skill are unrelated, the process for setting CEO pay is likely to be badly broken and highly paid CEOs may be over-paid, regardless of which model describes the process of setting executive compensation. The question of CEO pay and skill is thus indirect evidence of the quality of governance in public firms.

To examine whether pay and skill are linked, we introduce a new methodology. The intuition behind our methodology is straightforward: firms run by good CEOs should consistently do better than firms run by bad CEOs, taking industry factors into account. If a firm has recently performed poorly relative to its peers, a skilled CEO will be more likely to reverse the firm's

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<sup>4</sup> There are several papers that investigate factors, such as risk, that affect the optimal amount of incentive pay. See Murphy (1999) and Core, Guay and Larcker (2001) for a survey of this literature.

fortunes, while a less skilled CEO will be more likely to continue the poor performance.<sup>5</sup> If, on the other hand, a firm has performed well relative to its peers, a skilled CEO will consistently be more likely to continue the good performance, while a less skilled CEO will increase the chance of a bad outcome. Thus, good CEOs will reverse poor performance and continue positive performance. “Bad” CEOs continue poor performance and reverse positive performance. “Lucky” CEOs are highly paid, but perform no differently from their lower-paid (and “unlucky”) peers.

Our measure for skill – the persistence of positive performance and the reversal of poor performance -- is a modification of the performance persistence measure used to evaluate skill among mutual fund managers (Brown and Goetzmann, 1995), hedge fund managers (Brown, Goetzmann and Ibbotson, 1999) and investment analysts (Mikhail, Walther and Willis, 2004) and has several advantages for studying industrial firms and CEOs. First, by conditioning on past performance, we try to ensure that we are comparing CEOs to other CEOs in a similar position. A firm’s opportunities may be a function of its past performance, so by controlling for past performance, we avoid comparing CEOs with whatever different prospects the firms might have as a result of their prior performance.

Second, this method allows us to avoid some of the econometric problems that have affected prior research. One reason that prior research has not previously examined the relationship between CEO pay and CEO skill is that it is difficult to separate CEO effects from firm effects. Bertrand and Schoar (2003) deal with this by examining CEOs who move from one firm to another. This methodology helps them to distinguish the styles of particular CEOs, but for much of the analysis restricts the sample to roughly 117 CEOs (out of around 500 top executives)

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<sup>5</sup> We give a formal definition in Part II.

that switched firms. However, CEOs who switch firms may be different from CEOs who do not change firms. The potential difference between CEOs who move and those who do not move might be important in that the design of CEO pay is said to be a wide-spread problem and to be particularly bad in firms when the CEO is entrenched and thus hasn't moved. While our methodology does not explicitly separate the effects of individual CEOs, it does reduce such concerns (as discussed in Part II, any identified skill will likely be related to the CEO) and can be used to shed light on how firms respond to industry shocks. Moreover, our method allows us to consider a large sample of public firms, which is useful given the widespread nature of the potential problem of executive compensation. We can also distinguish between "good," "bad" and "lucky" CEOs rather than simply examining whether there is persistence in general.

Our empirical strategy is straightforward. If pay and skill are related, current compensation will be related to future performance; if CEO pay levels are unrelated to CEO skill, current compensation will be unrelated to future performance. High skill would yield high current pay, and the following year, the executive's skill would lead to good firm performance. Thus, if skill and pay are related, one should find that highly paid CEOs are more likely to continue good performance and to reverse poor performance. If pay and skill are unrelated, one should find no such relation.<sup>6</sup>

Using industry-adjusted returns on assets as our measure of firm performance, we find evidence that highly paid CEOs are more skilled when the CEO receives performance-based pay. In the presence of performance-based pay, higher paid CEOs are more likely to continue good performance and to reverse poor-performance than their more poorly paid peers. Further, this link between skill and pay exists only when there is an external blockholder to monitor management,

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<sup>6</sup> This relationship should hold in a functioning labor market where a CEO's reservation wages and pay level are increasing with a CEO's outside opportunities, skill or marginal product.

consistent with the idea that performance-based pay works best when blockholders monitor (Mulinaithan and Bertrand, 2001). While our focus is on return on assets as a measure of firm performance, we also investigate positive persistence and reversals in equity returns. Using annual abnormal returns, likely to be associated with market surprises, we find some consistent evidence that highly paid CEOs with high performance-based pay are more likely to be skilled.<sup>7</sup>

We also examine firm responses to a common industry shock and find evidence that highly paid CEOs show superior skill in responding to industry downturns when pay is highly performance-based, but only mixed evidence that pay and skill are connected when pay is not performance-based. We also find that a new CEO who gets a higher pay than the departing CEO is more likely to reverse prior poor performance, relative to CEOs who are paid similarly or lower than the departing CEO, if the pay package is performance-based. Strikingly, if the highly paid new CEO's pay is not performance-based, the CEO is more likely to continue prior poor performance. Finally, we also document that the link between pay and skill appears to be stronger in industries where pay variation is higher.

Our results indicate that a class of highly paid CEOs exhibits superior skill (those with high performance-based pay and an external blockholder) and another class (CEOs without an external blockholder or high performance-based pay) shows no such evidence of superior skill. Thus there appears no justification for the relatively high pay of CEOs without an external blockholder and low performance-based pay. While the results suggests that such CEOs may be overpaid, we are unable to take a stand on whether the pay associated with the skilled CEOs is 'excessive'. Although, the relative pay levels appear reasonable in such cases – that is, that the

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<sup>7</sup> Why these abnormal returns should persist is not clear given that CEO pay is public. A possible reason might be the relatively short time period used, during which the market does not sufficiently update its estimate of CEO skill.



highly paid appear to be better than the poorly paid -- it might still be the case that all CEOs are overpaid.

Part II describes our methodology and the data. Part III describes our findings on the connection between pay and skill, the importance of performance-based pay and the role of blockholders. Part IV investigates the role of firm size and uses equity returns as a performance measure. Part V examines the impact of an individual CEO by examining the effect of CEO turnover and industry-wide trends. Part VI examines the association between pay and skill as a function of pay dispersion within an industry. Part VII concludes.

## **PART II. METHODOLOGY AND DATA**

### **A. CEO SKILL**

A class of models of the impact of the CEO on firm performance underlies our estimations. Basically, we consider models in which firm performance  $x$  depends on the state of nature  $\theta$  and CEO skill  $\eta$ :  $x = f(\theta, \eta)$ . For purposes of illustration, we suppress the state of nature and treat firm performance as a random variable that has a density  $g(x; \eta)$  (and cumulative distribution function  $G(x; \eta)$ ). A minimal conception of CEO skill implies that a skilled CEO improves firm performance stochastically. Specifically, we require that,

**Definition 1:** If two CEOs  $A$  and  $A'$  have skills  $\eta$  and  $\eta'$  respectively such that  $\eta > \eta'$ , then  $A$  is more skilled than  $A'$  if and only if the distribution  $G(x; \eta)$  of firm returns generated by  $A$  first order stochastically dominates the distribution  $G(x; \eta')$  of firm returns generated by  $A'$ .

Notice that, in our formalization of skill, a skilled CEO must do more than merely improve the mean performance of the firm over a less skilled CEO. First-order stochastic dominance not only implies that the mean of  $G(x;\eta)$  is greater than the mean of  $G(x;\eta')$ ; it also implies that the distribution of returns generated by the skilled CEO is shifted to the right of the distribution of returns generated by the less skilled CEO: if  $\eta > \eta'$ , then, for all  $x$ ,  $G(x;\eta') \geq G(x;\eta)$ .

More generally, we might condition the distribution of firm returns on more than CEO skill. For example, firm returns in period  $t$  might, for example, depend not only on CEO skill  $\eta_t$  in period  $t$  but also on firm performance  $x_{t-1}$  in period  $t-1$ . Now we simply require that if  $\eta > \eta'$  as before  $G(x_t; x_{t-1}, \eta)$  first order stochastically dominates  $G(x_t; x_{t-1}, \eta')$ . For any fixed level of performance in  $t-1$ , the probability that the more skilled CEO will produce returns greater than  $x_t$  (for any  $x_t$ ) is greater than the probability that the less skilled CEO will produce returns greater than  $x_t$ .

Specifically, then, our definition of a skilled CEO has two implications that we will take as jointly necessary for the empirical manifestation of skill. First, a skilled CEO is more likely to continue good performance than a less skilled CEO. Second, a skilled CEO is more likely to reverse bad performance than a less skilled CEO.

We note that skill itself is a function of CEO effort and CEO talent. Neither effort nor talent is directly observable but economic theory predicts that CEO effort will depend on the structure of CEO pay. In this article, we seek to determine whether CEO skill and CEO pay are related. Given our definition of skill, our approach to this question follows immediately: if pay and skill are related, current compensation will be related to future performance. If CEO pay

levels are unrelated to CEO skill, then current compensation will be unrelated to future performance.

It is worth noting at the outset that our approach differs from the vast majority of research on CEO pay. Most prior research examines the structure and design of CEO pay or, in other words, the relationship between pay and contemporaneous performance.<sup>8</sup> By contrast, we examine pay and its relation to *future* firm performance. Thus, while the prior literature typically uses firm performance as the independent variable and the CEO's pay as the dependent variable, we use prior CEO pay as an independent variable and future firm performance as the dependent variable.

## B. EMPIRICAL METHODOLOGY

Since we are interested in detecting if pay levels are related to CEO skill, we estimate the following regression for two categories of CEO Pay (high pay and low pay):

$$\text{Perf}_{i,t} = a + a_1 I_{\text{BAD}} + b (\text{Perf}_{i,t-1} * I_{\text{GOOD}}) + c (\text{Perf}_{i,t-1} * I_{\text{BAD}}).$$

where  $\text{Perf}_{i,t}$  is the measure of the firm's performance, and  $I_{\text{BAD}}$  ( $I_{\text{GOOD}}$ ) is an indicator variable equal to one if the firm's performance was worse (better) than the industry median. We are specifically interested in whether the coefficients for performance persistence (b) and reversals (c) differ with different CEO pay levels.

Alternatively, we estimate both regressions jointly as follows

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<sup>8</sup> An important exception, discussed in Part V, is Hayes and Schaefer (2000). If boards observe and reward a CEO's contribution before the market does, then regressing current pay on future performance will not capture CEO skill: current high pay and future good performance might both just reflect good current firm performance and good current performance may not be related to CEO skill, but luck.

$$\text{Perf}_{i,t} = a + b \text{HighPay} + c I_{\text{BAD}} + d (I_{\text{BAD}} * \text{HighPay}_{i,t-1}) + e (\text{Perf}_{i,t-1} * I_{\text{GOOD}}) + f (\text{Perf}_{i,t-1} * I_{\text{BAD}}) + \\ \mathbf{P} * \text{HighPay}_{i,t-1} * (\text{Perf}_{i,t-1} * I_{\text{GOOD}}) + \mathbf{R} * \text{HighPay}_{i,t-1} * (\text{Perf}_{i,t-1} * I_{\text{BAD}}) + \varepsilon$$

where  $\text{HighPay}_{t-1}$  is a dummy variable set equal to 1 if the CEO pay was in the top 40% of the industry the prior year, equal to 0 if the CEO pay was in the bottom 40% of the industry, and otherwise set to missing.<sup>9</sup> The highly paid CEO is more likely to continue prior good performance if  $\mathbf{P}$  is positive.<sup>10</sup> If highly paid CEOs are also highly skilled, in addition to  $\mathbf{P}$ , the estimated coefficient  $\mathbf{R}$  will be significant as well. However  $\mathbf{R}$  will be negative (rather than positive) because we adjust firm performance for the industry median and hence firm performance is actually negative in bad years.<sup>11</sup> Because a skilled CEO is more likely to turn the firm around and produce positive results, a skilled CEO should have a negative coefficient on the prior (negative) bad performance.<sup>12</sup>

Since two firms that have performed differently in the past might have very different possibilities in the future, we condition on prior performance being above industry median or below industry median levels. This ensures that we compare CEOs managing firms with similar prior results. Conditioning on prior performance has another advantage. There may be firm specific factors that increase both pay and persistence in prior performance. For instance, it might

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<sup>9</sup> We are interested in whether CEO pay and skill are connected. Therefore, we examine the CEO's total compensation and do not adjust our calculations for other factors that might explain excess CEO compensation such as firm size, characteristics or CEO education. See, e.g., Core, Holthausen and Larker (1999). Such other factors may affect the CEO's skill, but we are agnostic as to the source of CEO skill and are interested in whether skill and pay are related. We thus do not examine excess compensation. If factors such as age and education are directly related to skill, controlling for all these factors would remove any variation in CEO pay and prevent us from examining whether overall pay and skill are related.

<sup>10</sup>  $\mathbf{P}$  represents the performance of highly-paid CEOs relative to poorly paid CEOs following years the firm had good performance and  $\mathbf{R}$  represents the performance of highly-paid CEOs relative to poorly paid CEOs following years the firm had bad performance.

<sup>11</sup> To adjust for industry performance, we subtract the industry median from each firm's performance.

<sup>12</sup> Results are consistent when we estimate the regression with two-year lags, rather than one year lags.

be the case that large firms have both a higher pay and, due to inertia, have greater overall performance persistence. We mitigate – but do not completely remove - such concerns by defining skill as the persistence of superior performance *and* the reversal of poor performance (or turnarounds).<sup>13</sup> If we find only one or the other, we do not conclude that pay and skill are related. In terms of the regression, we therefore look for both a significant positive coefficient for highly paid CEOs given prior good performance (*P*) and a significant negative coefficient for highly paid CEOs given prior bad performance (*R*). This pattern would indicate that, compared with poorly paid CEOs, highly paid CEOs are both more likely to continue good performance and more likely to reverse prior bad performance. We would interpret that as evidence that skill and pay are linked. The alternative interpretation would be that some firm factor (unrelated to the CEO's actions and skill) is correlated with high pay, reversals of bad performance *and* persistence of good performance. We are unable to think of plausible candidate for such a factor unrelated to CEO skill.<sup>14</sup>

## **B. DATA**

We first compute CEO pay, defined as the sum of the cash, bonus payments, option grants and stock grants. We then compute industry adjusted pay-levels for all CEOs by subtracting the median CEO pay in the same industry, using the 48 industry classification provided by Fama-French (1997). We then sort the CEOs in pay-quintiles based on industry adjusted overall pay and

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<sup>13</sup> Momentum in stock prices will not explain any observed skill. It is true that stock price momentum might lead to performance persistence for CEOs whose compensation were related to the firm's stock price, however we define skill as performance persistence when the firm's prior performance was good, and reversals (rather than momentum) if the prior performance was bad. This pattern of reversals will be inconsistent with explanations based on momentum. Also note that any survivorship bias will only explain observed skill if the most highly paid CEOs are more likely to fail and thus disappear from the sample, thus exaggerating the good performance the next year. This seems unlikely.

<sup>14</sup> One potential objection is that, by conditioning on prior poor performance, we might identify someone as skilled when they have only done well relative to poor performers, which is too low a standard for calling someone skilled. However, because we condition both on good and bad performance, highly paid CEOs will need to do well consistently (following good years and following bad years) to be identified as skilled.

classify CEOs as highly paid if they are in the top 2 pay quintiles for their industry (the top 40%).<sup>15</sup>

We use a firm's industry-adjusted return on assets as our primary measure of firm performance.<sup>16</sup> As a secondary measure, we use annual stock returns. To the degree stock market participants accurately estimate the CEO's skill, we would not expect skilled CEOs to be able to regularly produce positive abnormal returns. Nevertheless, for robustness purposes, we also present some results using the firm's stock price performance allowing for the possibility that a skilled CEO 'surprises' the market. Thus, we include in our sample all firms for which we can find stock return data on CRSP, accounting data on Compustat, and compensation data on Execucomp for the years 1992-2001. This produces a sample of 12,569 firm years, in which there are 2,373 unique firms and 3,579 unique CEOs.

In regressions reported below, we exclude firms if there is a turnover either that year or in the previous year. This ensures that we do not use the performance of one CEO to estimate the performance of another. The resulting sample thus avoids years involving (or following) CEO turnovers and has 2,284 firms and 2,880 CEOs (10,043 firm years). The sample of firm-years involving CEO turnovers, as used in section V, contains 980 firms. Finally, we also obtained data, from Thomson's CDA Spectrum database, to identify firms with external blockholders, defined as institutional investors who hold at least 5% of the firm's stock.<sup>17</sup>

Table 1 below provides summary data for our sample. Panel A lists descriptive statistics. Mean CEO pay in our sample is 4.39 million, of which 46% is characterized as performance-

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<sup>15</sup> Results are robust to defining high pay as those CEOs in the top 20% and are not presented here.

<sup>16</sup> See discussion in Part V on why biases associated with accounting data are less likely to generate the results we document.

<sup>17</sup> See Bertrand and Mullainathan (2001) for the role of blockholders in the design of CEO pay and Cremers and Nair (2005) for the impact of blockholders on firm valuation and equity returns.

based.<sup>18</sup> The top five spots are occupied by Charles Wang of Computer Associates (\$1.3 billion in 1998), Steve Jobs of Apple (\$600 million in 2000), Gregory Reyes of Brocade (\$370 million in 2001) and Thomas Siebel of Siebel (\$293 million in 2000, and \$244 million in 2001). On the other end of the scale were 18 CEOs who received no pay.

Variation in CEO pay is large, with a standard deviation in our sample of roughly \$18 million. Figure 1a provides detailed information by industry. The difference between CEOs paid at the 90th percentile and those paid at the 10<sup>th</sup> percentile ranges from \$1.66 million in Fabricated Products and Machinery and \$2.62 million in Textiles (on the low side) to \$24.2 million in Finance and nearly \$25 million in Telecom (on the high side). As evident in Figure 1b, the standard deviation in CEO pay is closely connected to the industry average pay. Note that there is very little between industry variation in the fraction of CEO pay that is performance-based. Even as average pay increases, the incentive fraction remains relatively flat at between 35% to 50% of total CEO pay.

Panel B of Table 1 reports correlation coefficients between the main variables of interest. CEO pay is positively correlated with firm size and with the fraction that is performance-based, as expected. Our proxy for shareholder monitoring of CEO performance, the existence of a 5% blockholder, is negatively correlated with total CEO pay and positively correlated with the fraction that is performance-based. As an initial matter, we also find in unreported regressions that high pay and the firm's future ROA are positively related. The effect is statistically significant at the 1% level and large. A highly paid CEO is associated with an increase in industry adjusted ROA of 1.04%.

[Insert Table 1 and Figure 1 about here]

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<sup>18</sup> For a measure of incentive pay, we use  $((\text{total pay} - \text{salary} - \text{bonus}) / \text{total pay})$ .

### **PART III THE LINK BETWEEN CEO PAY AND SKILL**

We first estimate a pooled cross-sectional regression estimating performance persistence and reversals for all firms in our sample. The estimated regression coefficients are reported in Table 2.<sup>19</sup> We find that, when compared to their poorly paid peers, highly paid CEOs are significantly more likely to exhibit consistently good performance. The estimated coefficient is 0.09 and significant at the 5% level. However, we find no evidence that highly paid CEOs are more likely to reverse poor performance (estimated coefficient is -0.01, but not statistically significant). Since we define CEO skill as production of greater positive persistence and the increased likelihood of reversing poor performance, we cannot say whether CEO pay and skill are generally linked. Not surprisingly, we also find performance persistence generally.

#### **A. PERFORMANCE-BASED PAY**

As discussed in Part II, CEO skill can be viewed as a combination of the executive's innate ability (or talent) and the CEO's effort. Two CEOs with different talent endowments but who exert no effort are more likely to perform similarly than are CEOs who exert different amounts of effort. Since higher performance-based pay should induce higher effort, we would expect to find a stronger link between pay and skill when the CEO has greater incentives to exert effort.<sup>20</sup> Thus, we would observe a greater link between pay and skill when pay is tied to performance. We

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<sup>19</sup> The statistical significance of the results presented in the paper is robust to clustering of standard errors by firm.

<sup>20</sup> By investigating the link between pay and skill in categories based on level of performance-based pay, we, however, compare high paid CEOs with high performance-based pay to low paid CEOs with high performance-based pay. We thus emphasize on the impact of talent when effort incentives are high.



therefore examine the link between pay and skill when performance-based pay (stock and option-based compensation) constitutes an important part of the CEO's total pay package.

We first divide the sample into firms lead by CEOs with high (or low) performance-based pay, depending on whether the CEO's fraction of stock and option based compensation is above (below) the median level in the same industry. We then separately run the same regression for both groups<sup>21</sup>

Consistent with the prediction that pay and skill are more closely linked in the presence of high-powered incentives, we find greater evidence of skill for highly paid CEOs where pay is performance-based. As reported in Table 2, panel B below, when CEO pay is performance-based, highly paid CEOs were more likely to continue superior performance and also more likely to reverse inferior performance than their less richly compensated peers. Conditional on good prior performance, the estimated coefficient for highly paid CEOs was 0.41 and significant at the 1% level. Conditional on poor prior performance, the estimated coefficient was -0.39 and also significant at the 1% level. Since the persistence and reversal coefficients for low paid CEOs is 0.30 and 0.75 respectively, high paid CEOs are more than twice more likely to continue prior good performance and reverse prior poor performance. By contrast, absent performance-based pay, we find no evidence of differential skill for highly paid CEOs; there is no significant difference in the likelihood of a reversal of poor performance. See Table 2, panel C.

This effect is economically meaningful. The impact of a highly paid CEO on firm performance can be roughly estimated using these data. The difference between the likelihood of persistence between the high paid and the low paid CEOs is 0.41 following good performance (see

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<sup>21</sup> Analyzing performance pay also sheds light on a potential interpretation that all agents have same reservation wages but different contracts are offered. More skilled agents choose pay structures with greater incentive pay and hence also get a higher pay level. We think this is unlikely to be the complete story, since there are many CEOs with high pay but not high incentive pay. Moreover, even within an industry, where firms are similar, there are differences in incentive pay and pay levels.

Table 2, Panel B). For an average firm in this category (median firm size = 12.9 bn), the average ROA conditional on good performance is 4.36%. Thus the increase in earnings associated with a highly paid CEO is \$211 million ( $.41 \times 4.36\% \times 12.9 \text{ bn}$ ). A similar calculation for the marginal impact of a highly paid CEOs following years the firm has performed poorly yields an estimate of \$112 million in additional earnings.

Thus, we find that highly paid CEOs with performance-based pay are significantly more likely to reverse bad performance and to continue good performance than their more poorly paid peers. By contrast, for CEOs with low powered incentives, there is no such evidence that high CEO pay is associated with superior results. These results are consistent with the idea that CEOs have differing abilities and that pay and skill are indeed linked when the pay is performance-based.

[Insert Table 2 and 3 about here]

## **B. MONITORING SHAREHOLDERS AND PERFORMANCE-BASED PAY**

We next examine a refinement of these results on performance-based pay. Bertrand and Mullainathan (2001) have shown that stock and option based pay are not likely to be related to CEO effort in the absence of monitoring shareholders. Absent such monitoring shareholders, high performance-based pay seems to compensate CEOs for luck rather than effort. Thus performance-based pay should perhaps instead be characterized as a combination of high stock and option based pay and an external blockholder. We therefore redo our results on performance-based pay for firms with and without a blockholder, where blockholder is defined as a non-managerial investor holding at least 5% of the stock.

Generally consistent with Bertrand and Mullainathan (2001), the results suggest that incentives work better in the presence of a blockholder. As reported in Panel Table 3, highly paid CEOs with a blockholder and high stock and option-based pay are both more likely to continue good performance (estimated coefficient 0.18, significant at 10%) and to reverse poor performance (estimated coefficient is -0.77, significant at 1%) than are their less well-paid counterparts. However, absent a blockholder, highly paid CEOs are no more likely to continue positive performance than their more poorly paid peers, regardless of the pay for performance intensity of the CEO's pay. CEOs in firms with high incentives but without a blockholder do appear to reverse prior bad performance (estimated coefficient -0.37, significant at 1%)

The effect of a highly paid CEO in these firms is also economically meaningful. The difference between the likelihood of reversals between the high paid and the low paid CEOs is -0.77 following poor performance (see Table 3). For an average firm in this category (median firm size=10.52 bn), the average ROA conditional on poor performance is -1.6%. Thus, the increase in earnings associated with a highly paid CEO is \$129 million ( $-0.77 \times -1.6\% \times 10.52$ ). A similar calculation for the impact of a highly paid CEOs when the firm has performed well yields \$77 million.

This evidence is thus consistent with the idea that CEOs pay and skill are related in firms with both performance-based pay and with monitoring shareholders. There is some mixed evidence that pay and skill are related when the firm has either a monitoring shareholder or performance-based pay, but not both. Absent both a monitoring shareholder and performance-based pay, there is no evidence that CEO pay and skill are related. A caveat is that there is a relatively few number of firms without institutional blockholders and the lack of statistical significance for firms without blockholders may be related to the lower number of observations.

## **Part IV. EXTENSIONS**

### **A. HOW SIGNIFICANT ARE THE REVERSALS?**

We earlier reported that firms were significantly more likely to turn around poor performance when managed by a highly-paid CEO, so long as the pay was performance-based pay. But how much did things improve? A negative estimated coefficient ( $\beta$ ) could indicate that following the bad year, either: (a) firm performance improved, but that it was still below industry median (relative improvement); or (b) the firm had improved sufficiently that it was now performing better than the median firm (absolute improvement).

We investigate this question by estimating the probability that a firm will do badly, again conditional on whether the firm's prior performance was poor. We estimate a logistic regression for the form:

$$\text{Poor}_t = C + \text{Poor}_{t-1} + \text{Highpay}_{t-1} + \text{Highpay} \times \text{Poor}_{t-1}$$

where HighPay reflects highly paid CEOs as defined earlier (top 40% of industry) and poor is a dummy variable that takes the value of 1 if firm performance was below industry median.

As evidenced in Table 4, we find that firms managed by highly paid CEOs are less likely to underperform their industry the following year. Additionally, supportive of our earlier results, we find that this negative relation between CEO pay levels and future poor performance is stronger when pay is performance based. When pay is performance based the coefficient on the Highpay dummy is -0.39 and is significant at the 1% level. However, when performance based component in pay is low, the coefficient on Highpay is -0.26 and is significant at only the 10% level.

[Insert Tables 4 and 5 here]

## **B. IMPORTANCE OF FIRM SIZE**

In our basic regression testing the overall link between pay and skill, we found a link between pay levels and positive persistence, but no evidence that pay and skill were linked generally. One reason for that may be that there are firm factors associated with both high pay and persistence. One such firm characteristic could be firm size. Large firms might have both more inertia in performance and higher CEO pay; large firms, like large ships, may take time to turn around, making it difficult to find evidence of turnaround skill in large firms. We therefore examine the link between pay and skill for large and small firms. Note that this hypothesized inertia would not explain why highly paid CEOs are more likely to reverse poor performance, though it may explain why we do not find reversals in some instances. Firms are classified as large if their asset size is greater than the median asset size in their industry. We now investigate if pay and skill are related in large and small firms. In these regressions, we use both one year and two year lags between performance measures to allow for the possibility that large firms take longer to turn around.

Using one-year lags, we find that the earlier documented positive persistence is much stronger in small firms (0.16 compared to 0.09 for the entire sample). The estimated coefficient for reversals for highly paid CEOs of small firms is negative, but only marginally significant (p value of 0.13). Thus, the inertia of relatively large firms does not cause the overall positive persistence we observe in the sample. It is also perhaps tempting to conclude that the link between pay and skill is looser in large firms. On the other hand it might be the case that large firms, on an average, take longer to turn around. Consequently, we redo our regressions using two year lags

between performance measures. We now observe a strikingly higher likelihood of reversals in large firms run by high paid CEOs and although the estimated relationship between prior good performance and subsequent performance is positive, the significance is weak. Thus, taking a conservative view, the link between pay and skill appears to exist for both small and large firms but appears stronger in small firms.

### C. USING EQUITY RETURNS AS A MEASURE OF PERFORMANCE

We also examine the relationship between high-CEO pay and abnormal returns. As noted earlier, stock returns are another potential measure of firm performance, however they are more problematic in that to the degree that the market anticipates the CEO's skill, risk-adjusted stock returns will not vary for firms run by CEOs of differing skills. Nevertheless, we allow for the possibility that a skilled CEO can surprise the market and examine the relationship between CEO pay and subsequent realized stock returns.

We compute the yearly abnormal return for each firm in the sample. The abnormal return is computed relative to the Fama-French four factor model that includes the market factor, size factor, book to market factor and the momentum factor. Both of these measures of performance are computed relative to the firm's industry, where industry adjustments are done using the 48 industries classified by Fama and French.<sup>22</sup> To reduce the noise in these yearly abnormal returns we (1) use daily returns and (2) form quintiles based on a firm's measure of abnormal returns, making it less likely that our results are driven solely by noise in measures of return.<sup>23</sup> We now

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<sup>22</sup> The abnormal return to a value weighted industry portfolio is subtracted from the abnormal return of each individual firm in the same industry to adjust for industry returns.

<sup>23</sup> Our results are qualitatively similar, but statistically weaker, when we use the abnormal returns directly instead of quintiles and are omitted here. In results below, we find similar results when we use an ordered logistic regression rather than an ordinary least squares regression.

perform persistence and reversal regressions using the industry-adjusted abnormal return as a measure of performance.

The estimated regression coefficients are reported in Table 6. Results using abnormal returns as a measure of performance are similar to those using return on assets, with one notable difference. Compared to their poorly paid peers, highly paid CEOs have a significant positive persistence coefficient. The estimated persistence coefficient is 0.11 and significant at the 5% level. However, in contrast to the return on assets results, the dummy on high CEO pay in this case is negative and significant (-0.15, significant at the 1% level). Thus, the difference in the likelihood of persistence associated with high paid CEOs is  $-0.15 + 0.11 \times \text{prior good performance}$ . Consequently, the greater likelihood of positive persistence outweighs the negative effect on high pay only for extreme cases of good performance.<sup>24</sup> Thus there seems to be some evidence that high paid CEOs show some skill if firm performance is very good (> 80<sup>th</sup> percentile) and not otherwise. These results, on the one hand, suggest that pay and skill are related precisely when firm performance is furthest away from the industry median and hence is less likely to be due to small changes around industry median and, on the other hand, suggest that the link between pay and skill using abnormal returns is weaker than with accounting measures and depends on existing firm performance.

We also investigate if the link between pay and skill varies with performance-based pay. As with return on assets, we find that highly paid CEOs are more likely to continue prior poor performance if the pay consists of a high performance-based component. Interestingly, in such cases, we also find a weakly significant negative coefficient on reversals (p-value of 0.10). When high pay has a low performance-based component, we find no such effects. While confirming our

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<sup>24</sup> Prior good performance takes the value of 1 or 2, since we look at industry-adjusted quintile measures.

results on the importance of performance-based pay and thus providing a robustness check, it is also worth noting that both these effects only hold in cases of extreme prior good and bad performances.

[Insert Table 6 and 7 about here]

## **PART V CEO SKILL, INDUSTRY DOWNTURNS AND CEO TURNOVER**

We have seen that pay and skill are correlated when CEO-pay is performance-based and when there is a large shareholder to monitor management. In this section, we examine two additional tests that shed light on the question of whether this effect is attributable to something specific about the CEO's skills.

### **A. CEO SKILL IN INDUSTRY-WIDE DOWNTURNS**

We have argued that skilled CEOs are more likely to continue prior good performance and more likely to reverse prior poor performance. However, the reversal of poor performance implies that the firm recently did poorly. In order to reconcile this variable performance with a more stable notion of CEO skill, we posit that this poor performance could be due to industry level shocks. However, it might then be natural to ask how better skilled CEOs react to such industry level changes. We consequently investigate how highly paid CEOs respond to performance deteriorating changes in the industry.



If highly-paid CEOs respond better to industry-wide downturns, this would bolster our finding that the CEO skill played some role in reversing a widespread trend. Since it is difficult to completely identify exogenous shocks for a large number of industries, we instead identify those instances where the average industry performance declined from one year to the next. If we continued to observe a link between pay and skill following industry-wide secular declines, this would be support for the argument that highly-paid CEOs are more likely to withstand adverse industry trends and thus more skilled, even if they sometimes have poor outcomes. Our test to identify performance persistence and reversals is the same as before, but is done only for those industry-years where the average industry ROA has declined. It is useful to note that the average industry performance does not affect the firm performance measures since these firm performance measures are industry adjusted.

As shown in Table 7, given performance-based pay, firms run by highly paid CEOs are significantly more likely to perform well, both when the firm had previously performed well relative to its peers (good performance) and when it had performed poorly relative to its peers (bad performance). Here the persistence coefficient is particularly interesting suggesting that better performing CEOs remain better performing CEOs even in conditions when the entire industry has performed poorly. Further, both the persistence and reversal coefficients are significant at the 1% level and again economically meaningful (estimated coefficients were 0.65 for the persistence of positive performance and -0.39 for the reversal following a bad year). By contrast, when we examine firms where CEO pay is below the median level of performance-based pay, highly paid CEOs do not show consistent evidence of skill. Highly paid CEOs are then more likely to reverse negative performance (estimated coefficient of -0.18, significant at 1%) but are no more likely to continue prior positive performance.

Thus, we find evidence consistent with the earlier results that CEO pay and skill are linked when performance-based pay is high, even when we limit the sample to firms experiencing an industry wide decline in performance.

## **B. CEO SKILL AND CEO TURNOVER**

We next test if skill and pay are related by examining a firm's performance persistence in a sample associated with CEO turnover. Changes in CEOs could be associated with changes in CEO skill. If pay is indeed related to skill, pay levels should be different when skill varies. Consequently, we would expect that a new CEO who is paid differently from the old CEO would perform differently as well.

We begin by testing whether changes in CEO pay are associated with changes in performance persistence, without conditioning on prior performance. If CEO pay and skill are connected, CEOs with similar wages should be similarly skilled and perform similarly. Greater differences in pay suggest greater differences in skill and therefore less correlation between the firm's performance under the old CEO and its performance under the new CEO. In each year  $t$ , we select firms that witnessed a turnover the previous year ( $t-1$ ). We then relate the firm's performance in year prior to the old CEO's departure ( $t-2$ ) to the firm's performance after the new CEO has had a year on the job ( $t$ ).

As before, each CEO's pay is categorized into 5 categories, ranging from 1 to 5, based on quintiles formed using industry pay levels. The difference between the two CEO's pay is the measured simply as the difference between their quintiles. We compute the absolute value of

these changes, so the change in compensation varies from 0 to 4.<sup>25</sup> All observations with compensation change greater than 2 are lumped together to form three categories of compensation change of 0, 1, and >2. We then estimate the firm's performance persistence for each of these three categories.

As reported in Table 8 below, we find that firm's post-turnover performance is less similar to its pre-turnover performance if the new CEO's pay is not similar to the former CEO's pay. This is consistent with the idea that changes in pay are connected to changes in skill, but is only suggestive. Ideally we would examine this sub sample in greater detail to see whether pay increases are associated with performance improvements, and how performance-based pay affect pay and skill.<sup>26</sup> However, we have only around 200 observations with pay increases and a similar number for pay reductions. Further partitions, based on firm characteristics, reduce our chances of finding statistical significance. There is also a potential bias with the CEO turnover sample that makes it difficult to detect positive persistence. CEO turnovers are often associated with poor performance and there are fewer instances of CEO turnover following good performance. Thus it is difficult to observe any statistically significant positive persistence following good performance, but we have a better chance in detecting patterns among reversals of poor performance.

Nevertheless, we perform these regressions based on persistence and reversals and unsurprisingly find that most of our estimated coefficients are statistically insignificant. See Table 9 below. However, we find that an increase in CEO pay is associated with a greater likelihood of reversing poor performance only when pay is highly dependent on firm performance. These

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<sup>25</sup> The new CEO's compensation information is from year t-1 and the old CEOs compensation information is from date t-3.

<sup>26</sup> Note that by considering positive persistence and reversals we are already partitioning the sample into two categories based on prior performance. Any further partitioning (e.g., on incentive pay) generates atleast four categories.

findings confirm our earlier findings on the importance of performance-based pay in the link between pay and skill.

[Insert Table 8 and 9 about here]

These findings are also of interest because they address an alternative interpretation of our earlier results using the sample without CEO turnovers. Hayes and Schaeffer (2000) show that the portion of CEO pay that is unexplained by current performance might reflect the fact that boards observe performance that public markets will only observe in the future. That is, boards might pay CEOs today for their good performance that will yield improved results tomorrow. If higher unexplained variation in pay is also related to higher CEO pay levels, then it might be the case that high pay is correlated with future good performance because boards observe and pay for CEO effort not yet reflected in public measures of performance.<sup>27</sup> However, in a sample where there is a CEO change, there is no history for the new CEO and therefore any link between pay and skill is unlikely to be driven by realized good performance that is not yet reflected in public measures of performance. The fact that the performance change across CEOs depends on the difference in CEO pay is not likely to be driven by the fact that boards may pay CEOs for performance that is not yet reflected in public measures of performance.<sup>28</sup>

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<sup>27</sup> Note that higher unexplained variation is not always related to higher pay. For example, a CEO who gets a high pay concurrently with high firm performance has little unexplained variation in CEO pay but a CEO who gets a high pay when firm performance is poor has a high unexplained variation. Thus, the interpretation that pay reflects realized performance not yet reflected in public performance measures is more applicable for reversals, where both pay is high and unexplained variation is high too. Encouragingly, it is exactly here too that the turnover results suggest that pay and skill are related.

<sup>28</sup> It is also useful to address a concern that Hayes and Schaefer (2000) acknowledge in the interpretation of their results. They discuss the possibility that the link between higher unexplained compensation and high future performance might be due to earnings manipulation by the CEO. If managers indeed smooth earnings between time periods and are paid for the ‘true’ current earnings, it should be difficult to detect reversals because managers would “borrow” from future good times to boost current bad times. Thus, smoothing would mask rather than explain any reversals.

Nevertheless, if boards do pay CEOs in advance of firm performance, this might produce a pattern of high pay and subsequently better performance even if firm performance varies randomly from year to year. To rule out the possibility that CEO skill is simply an artifact of this sort of process, we first examine the frequency of pay changes. If CEO skill is not constant over time, as this interpretation suggests, then CEO pay will vary a lot over time as well. We examine compensation changes from year to year (in terms of industry adjusted quintile) and find that in fact more than 90% of the time there is either no change in CEO pay or a change of 1 quintile. Thus, it appears that pay is relatively stable over time and does not change a lot from year to year as this alternative would suggest. We also re-ran our regressions using only CEOs that were consistently identified as highly-paid in consecutive years, with largely similar results.

#### **PART VI. PAY DISPERSION AND CEO SKILL**

We began the paper by noting the widely varying degree of pay dispersion within industries - as shown in Table 2, the intra-industry difference between CEOs paid at the 90th percentile and those paid at the 10<sup>th</sup> percentile ranges from \$1.66 million in Fabricated Products and Machinery to nearly \$25 million in Telecom. Are these differing levels of pay dispersion due to differing importance of CEO skill?

To answer this, we examine the association between CEO pay and skill at different levels of this pay dispersion. When CEO pay differences are relatively compressed, it may mean that CEO skill is relatively less important in determining firm performance in that industry. Then, the link between pay and skill would be weaker in such industries. We therefore calculate the difference between the 90<sup>th</sup> percentile CEO pay and the 10<sup>th</sup> percentile CEO pay in each industry and divide the sample into above and below median pay-dispersion. For each category, we then estimate the regressions that test whether pay and skill are related. Results are in Table 10.

In industries with below-median pay dispersion, there is no evidence that highly paid CEOs are more likely to turnaround negative performance or to continue positive performance. Even the signs on the estimated persistence and reversal coefficients are of contrary to what one would expect if pay and skill were indeed linked. However, in industries with dispersion above the median, there is some evidence. Highly paid CEOs in these industries are more likely to continue positive performance. Although they are not more likely to turnaround negative performance, the reversal coefficient is negative as well. This again is suggestive of a difference between highly paid and less well paid CEOs in industries where pay dispersion is large. This finding is then consistent with the view that CEO skill is important in these industries and hence differences in CEO skill are associated with differences in pay.

## **PART VII. CONCLUSION**

Our analysis has two important conclusions, one methodological and one substantive. We have introduced a new measure of CEO skill that allows us to assess the relation of CEO skill and pay. We assess skill in terms of the CEO's role in perpetuating good firm performance and in reversing or turning around poor firm performance. Substantively, we provide evidence that highly paid CEOs are likely to be associated with superior subsequent firm performance, particularly when the CEO receives performance-based pay and when a large shareholder monitors CEO performance. These effects are both statistically significant and economically important, suggesting that highly paid CEOs are in fact "good" where pay is performance-based and in the presence of a blockholder. By contrast, where pay is not performance-based, we find no evidence that highly paid CEOs are in fact more skilled at improving the firm's profitability, suggesting that highly paid CEOs in these environments may just be "lucky." We observe a connection between pay and skill even in firms experiencing an industry-wide secular decline.

These findings shed light on a highly debated question - ‘are CEOs overpaid?’ On the one hand, we find a set of firms in which highly paid CEOs perform better (i.e. firms where the CEO receives performance-based pay or where a large shareholder monitors CEO performance). In these firms, highly paid CEOs are actually on average “good” – they consistently do better than their peers. We conclude that compensation problems in such firms are likely outliers (“a few bad apples”) rather than signs of a systematic problem. We find no evidence that pay and skill are connected in firms where CEO pay is relatively insensitive to firm performance or when there is no shareholder blockholder to monitor management – we refer to these highly paid CEOs as “lucky” given that there is no evidence of superior performance to justify the higher pay.

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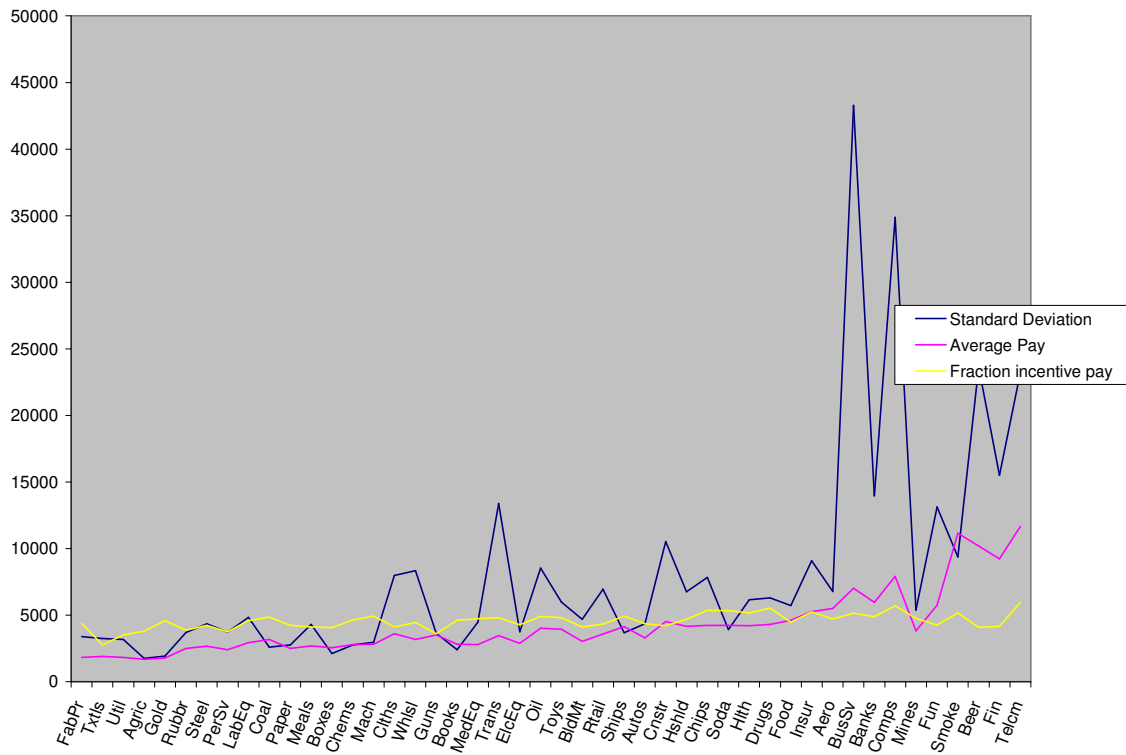
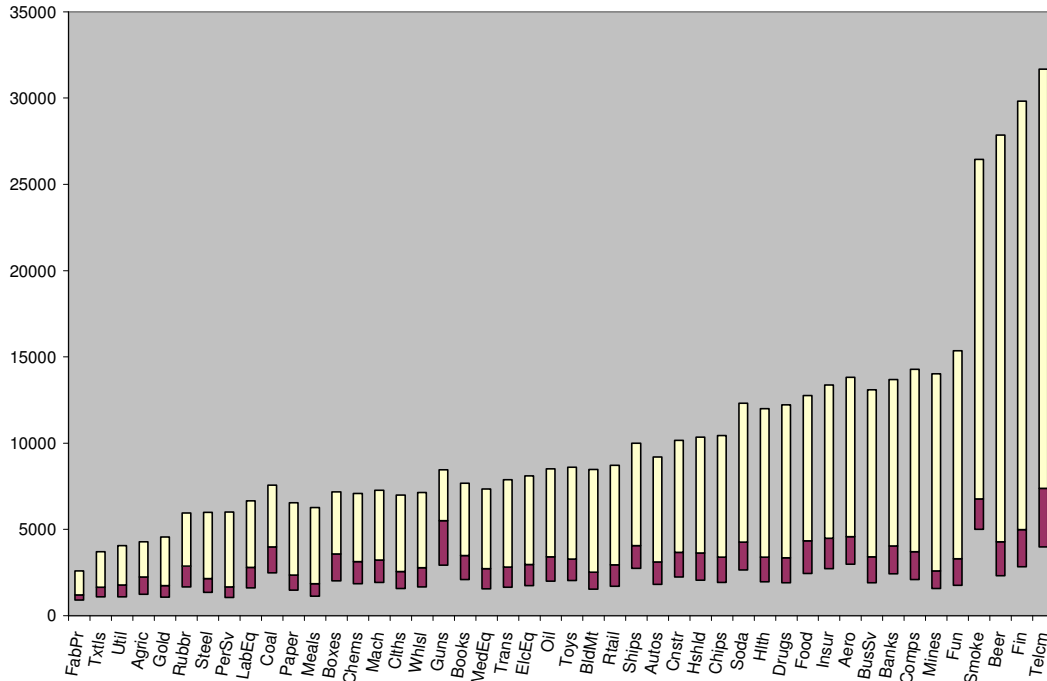
**TABLE 1**  
**DESCRIPTIVE STATISTICS**

This table reports descriptive statistics of a sample of 2,412 firms (12,725 firm years) between 1992-2001. Blockholder is a dummy variable indicating whether there is a shareholder holding at least 5% of the firm's stock. The sample includes all firms for which executive compensation, accounting and stock price data is available on Execucomp, Compustat and CRSP. Panel A gives summary statistics and Panel B lists correlation coefficients, significant at 5% (\*\*) and 1% (\*\*\*) levels.

<b><i>Panel A</i></b>	<u>PAY</u> (1,000)	PERFORMANCE- <u>BASED PAY</u>	<u>ASSETS</u> (1,000,000)	<u>BLOCK</u>	<u>ADJ.ROA</u>	<u>ADJ.EQ.RETURN</u>
Mean	4,439	0.46	8,738	0.75	1.96	-0.03
Stand. Dev.	16,731	0.29	36,998	0.42	11.55	0.22
N	12,666	12,640	12,692	10,147	11319	12725
 <b><i>Panel B</i></b>						
Performance-based pay	0.23***					
Assets	0.02***	0.11***				
Block	-0.02**	0.04**	- 0.11***			
Adj.roa	0.03***	0.02***	-0.02***	-0.02***		
Adj.eq.return	-0.00	0.00	0.00	-0.02*	0.10***	

**FIGURE 1**

**CEO pay by industry**  
10th percentile, median and 90th percentile



**Table 2**  
**CEO PAY AND SKILL**

This table reports regression estimates of the performance of public firms between 1993 and 2001. The dependent variable is the firm's industry-adjusted return on assets. Independent variables include a dummy variable for whether the firm was managed by a highly paid CEOs (defined as those CEOs whose pay is in the top 40% of industry adjusted pay in the prior year). This dummy variable estimates the effect of highly paid CEOs relative to poorly paid CEOs (those CEOs whose industry adjusted pay is in the lower 40% in the prior year). The regression also includes a control for the prior year's ROA. These variables are all interacted with dummy variable indicating whether the performance was above the industry median (good prior performance) or below the industry median (poor prior performance). To ease exposition, we report the estimated coefficients in two columns. The sample includes all firms for which executive compensation, accounting and stock price data is available on Execucomp, Compustat and CRSP. Standard errors are in parentheses and are adjusted for clustering. Estimated coefficients are significant at 1(\*\*\*), 5(\*\*), and 10 (\*) percent.

	<i>A</i>		<i>B</i>		<i>C</i>	
	All firms		Above Median Performance-Based Pay		Below Median Performance-Based Pay	
	Good prior performance	Bad prior performance	Good prior performance	Bad prior performance	Good prior performance	Bad prior performance
Prior performance for highly paid CEOs	0.09** (0.04)	-0.01 (0.02)	0.41*** 0.07	-0.39*** 0.09	0.19*** 0.07	0.04 0.04
Prior performance	0.66** (0.03)	0.35*** (0.02)	0.30*** 0.06	0.65*** 0.09	0.73*** 0.03	0.33*** 0.02
Highly paid CEO dummy	-0.23 (0.36)	0.05 (0.57)	-0.68 0.65	-0.86 1.05	-0.77 0.66	0.06 1.11
Intercept	0.75*** (0.27)	-1.43*** (0.42)	1.38** 0.60	-0.22* 0.96	0.50 0.32	-1.47*** 0.49
R-squared		0.31		0.31		0.33
N		5,808		2,987		2,809

**TABLE 3**  
**MANAGERIAL SKILL BY PREFORMANCED BASED PAY AND BLOCKHOLDER**

We report association between a highly paid CEO and firm performance. Firms are first partitioned into high performance-based pay (defined as those where the fraction of CEO pay tied to stock price is above the industry median) or low performance-based pay (below the industry median). We then further partition firms by the existence of an institutional shareholder that owns at least 5% of the firm's shares. The table reports results from a regression estimating the firm's industry-adjusted accounting performance. We report only the estimated coefficients for firms lead by highly paid CEOs conditional on positive prior performance (above industry median) and prior bad (below industry median) performance (or "reversals"), that estimates the effect of highly paid CEOs relative to poorly paid CEOs. The regression model includes other unreported independent variables, including a constant, a dummy for highly paid CEOs, and controls for prior year performance, and interaction terms. The sample includes all firms for which executive compensation, accounting and stock price data is available on Execucomp, Compustat and CRSP. Estimated coefficients are significant at 1(\*\*\*), 5(\*\*), and 10 (\*) percent.

	<u>Above median</u> performance - based pay		<u>Below median</u> performance - based pay	
	Good prior performance	Bad prior performance	Good prior performance	Bad prior performance
<b>Blockholder</b>	<b>0.18*</b> (0.11) n=1,872	<b>- 0.77***</b> (0.10)	<b>0.18**</b> (0.09) n=1,705	- 0.04 (0.06)
<b>No Blockholder</b>	0.04 (0.12) n=593	<b>- 0.37***</b> (0.12)	0.15 (0.13) n=519	- 0.62 (1.12)

**TABLE 4**  
**MANAGERIAL SKILL AND THE LIKELIHOOD OF BAD PERFORMANCE**

This table reports the results of logit regressions estimating the performance of public firms between 1993 and 2001. The dependent variable is an indicator variable set equal to 1 if the firm's industry-adjusted return on assets is negative (i.e. below industry median). Independent variables include a dummy variable for whether the firm was managed by a highly paid CEOs (defined as those CEOs whose pay is in the top 40% of industry adjusted pay in the prior year). This dummy variable estimates the effect of highly paid CEOs relative to poorly paid CEOs (those CEOs whose industry adjusted pay is in the lower 40% in the prior year). Other variables include an indicator variable for whether the firm performed poorly (i.e. below industry median) in the prior year, and an interaction term. The sample includes all firms for which executive compensation, accounting and stock price data is available on Execucomp, Compustat and CRSP. Standard errors are in parentheses and are adjusted for clustering. Estimated coefficients are significant at 1(\*\*\*), 5(\*\*), and 10 (\*) percent.

	<u>Below Median</u> <u>Performance-Based Pay</u>	<u>Above median</u> <u>Performance-Based Pay</u>
Highly paid CEO dummy	<b>- 0.26 *</b> <b>(0.15)</b>	<b>- 0.39***</b> <b>(0.15)</b>
Prior poor performance	2.79*** (0.09)	2.05*** (0.20)
Highly paid CEO dummy * Prior poor performance	0.01 (0.23)	0.31 (0.22)
Intercept	- 1.54*** (0.07)	- 1.07*** (0.14)

**Table 5**  
**THE EFFECT OF FIRM SIZE**

This table reports regression estimates of the performance of public firms between 1993 and 2001 based on firm size (assets). Firms with assets greater than the industry median level are classified as large firms. The dependent variable is the firm's industry-adjusted return on assets. Independent variables include a dummy variable for whether the firm was managed by a highly paid CEO (defined as those CEOs whose pay is in the top 40% of industry adjusted pay in the prior year). This dummy variable estimates the effect of highly paid CEOs relative to poorly paid CEOs (those CEOs whose industry adjusted pay is in the lower 40% in the prior year). The regression also includes a control for the prior year's ROA. These variables are all interacted with dummy variable indicating whether the performance was above the industry median (good prior performance) or below the industry median (poor prior performance). To ease exposition, we report the estimated coefficients in two columns. The sample includes all firms for which executive compensation, accounting and stock price data is available on Execucomp, Compustat and CRSP. Standard errors are in parentheses and are adjusted for clustering. Estimated coefficients are significant at 1(\*\*\*), 5(\*\*), and 10 (\*) percent.

	<u>Above Industry Median Size</u>	<u>Below Industry Median Size</u>		
<b>PANEL A: USING 1 YEAR LAG BETWEEN PERFORMANCE MEASURES</b>				
	Good prior performance	Bad prior performance	Good prior performance	Bad prior performance
Prior performance for highly paid CEOs	-0.07 0.06	0.08 0.09	0.16** 0.08	-0.10 0.07
Prior performance	0.82***	0.27***	0.59***	0.35***
	0.06	0.08	0.03	0.02
Highly paid CEO dummy	0.28 0.56	-0.47 0.79	-1.10 0.72	-0.08 0.88
Intercept	0.43 0.51	-0.32 0.89	0.90*** 0.33	-1.90*** 0.53
R-squared		0.34		0.27
N		3,271		2,537
<b>PANEL B: USING 2 YEAR LAGS BETWEEN PERFORMANCE MEASURES</b>				
	Good prior performance	Bad prior performance	Good prior performance	Bad prior performance
Prior performance for highly paid CEOs	0.11 0.08	-0.38** 0.17	0.28*** 0.11	-0.05 0.08
Prior performance	0.58***	0.42**	0.48***	0.21***
	0.08	0.17	0.05	0.04
Highly paid CEO dummy	-0.62 0.68	-0.58 1.01	-1.51* 0.78	-0.87 1.17
Intercept	1.68*** 0.64	-0.32 0.97	1.17*** 0.38	-1.14** 0.55
R-squared		0.25		0.19
N		2,973		1,549

**Table 6**  
**CEO PAY AND SKILL: USING ANNUAL ABNORMAL EQUITY RETURNS**

This table reports regression estimates of the performance of public firms between 1990 and 2001. The dependent variable is the firm's equity return corrected for risk and/or style effects using the four factor Fama-French model (see details in text) and adjusted for average industry return. Independent variables include a dummy variable for whether the firm was managed by a highly paid CEO (defined as those CEOs whose pay is in the top 40% of industry adjusted pay in the prior year). This dummy variable estimates the effect of highly paid CEOs relative to poorly paid CEOs (those CEOs whose industry adjusted pay is in the lower 40% in the prior year). The regression also includes a control for the prior year's equity return. These variables are all interacted with dummy variable indicating whether the performance was above the industry median (good prior performance) or below the industry median (poor prior performance). To ease exposition, we report the estimated coefficients in two columns. The sample includes all firms for which executive compensation, accounting and stock price data is available on Execucomp, Compustat and CRSP. Standard errors are in parentheses and are adjusted for clustering. Estimated coefficients are significant at 1(\*\*\*), 5(\*\*), and 10 (\*) percent.

	All firms		Above Median Performance-Based Pay		Below Median Performance-Based Pay	
	Good prior performance	Bad prior performance	Good prior performance	Bad prior performance	Good prior performance	Bad prior performance
Prior performance for highly paid CEOs	0.11** (0.05)	0.00 (0.09)	0.22** 0.10	-0.25* 0.15	0.13 0.10	-0.13 0.19
Prior performance	-0.06* (0.04)	0.09 (0.07)	-0.17* 0.09	0.37** 0.15	-0.05 0.04	0.01 0.08
Highly paid CEO dummy	-0.15*** (0.05)	-0.12** (0.06)	-0.31*** 0.11	-0.41*** 0.18	-0.14 0.09	-0.21 0.17
Intercept	-0.08* (0.04)	0.00 (0.10)	0.08 0.09	0.33 0.24	-0.10** 0.05	-0.08 0.06
R-squared		0.002		0.006		0.001
N		6,375		3,248		3,112



**TABLE 7**  
**INDUSTRY DECLINES AND CEO SKILL**

We report the marginal impact of a highly paid CEO on firm performance when the industry experiences an overall decline in profitability (defined as a decline in the median firm ROA). We first select firms operating in industries where median ROA has declined from the prior year. We next partition firms by the fraction of CEO pay that is performance-based pay, dividing the sample into two subgroups, above median performance-based pay and below median firms. The table reports results from a regression estimating the firm's industry-adjusted accounting performance. Independent variables include a dummy variable for whether the firm was managed by a highly paid CEOs (defined as those CEOs whose pay is in the top 40% of industry adjusted pay in the prior year). This dummy variable estimates the effect of highly paid CEOs relative to poorly paid CEOs (those CEOs whose industry adjusted pay is in the lower 40% in the prior year). The regression also includes a control for the prior year's ROA. These variables are all interacted with dummy variable indicating whether the performance was above the industry median (good prior performance) or below the industry median (poor prior performance). To ease exposition, we report the estimated coefficients in two columns.. The sample includes all firms for which executive compensation, accounting and stock price data is available on Execucomp, Compustat and CRSP. Estimated coefficients are significant at 1(\*\*\*), 5(\*\*), and 10 (\*) percent.

	<u>Above median</u>		<u>Below Median</u>	
	<u>Performance-Based Pay</u>		<u>Performance-Based Pay</u>	
	Good prior performance	Bad prior performance	Good prior performance	Bad prior performance
Prior performance for highly paid CEOs	0.65*** 0.08	-0.39*** 0.09	-0.02 0.09	-0.18*** 0.06
Prior performance	0.32*** 0.08	0.85*** 0.12	0.98*** 0.04	0.65*** 0.04
Highly paid CEO dummy	0.13 0.67	1.86** 0.76	0.80 1.16	0.77 0.61
Intercept	-0.92 0.62	1.66** 0.71	-1.38 0.30	3.43*** 0.27
R-squared				
N				

**TABLE 8**  
**CEO PAY, SKILL AND TURNOVER**

This table examines firm performance (ROA) in a two year window surrounding CEO turnover and reports the correlation between performance under one CEO and the performance under the successor. Panel A reports the overall performance persistence, conditional on the change in pay between the old CEO and the new CEO, for firm ROA and abnormal return quintiles. Panel B breaks these numbers down to reflect performance persistence for those changes associated with pay increases and those associated with pay decreases. The sample includes all firms for which executive compensation, accounting and stock price data is available on Execucomp, Compustat and CRSP. T-statistics are in parentheses.

	<u>No pay change</u>	<u>1 quintile pay change</u>		<u>2 quintile pay change</u>	
<i>Panel A</i>	0.55 (12.21)	0.61 (13.89)		0.00 (0.58)	
		Pay decrease	Pay increase	Pay decrease	Pay increase
<i>Panel B</i>	0.55 (12.21)	0.61 (11.25)	0.60 (9.16)	0.21 (2.37)	0.00 (0.47)
N	287	135	150	56	108

**TABLE 9**  
**CEO PAY, SKILL AND TURNOVER**

This table examines regressions estimating firm performance (defined as industry adjusted return on assets) in a two year window surrounding CEO turnover and reports the correlation between performance under one CEO and the performance under the successor. Firms are first partitioned into above median performance-based pay (those where the fraction of CEO pay tied to stock price is above the industry median) or below the industry median performance-based pay. Independent variables include a dummy variable for whether the firm was managed by a highly paid CEO (defined as a CEOs whose pay is in the top 40% of industry adjusted pay in the prior year). This dummy variable estimates the effect of highly paid CEOs relative to poorly paid CEOs (those CEOs whose industry adjusted pay is in the lower 40% in the prior year). The regression also includes a control for the prior year's ROA. These variables are all interacted with dummy variable indicating whether the performance was above the industry median (good prior performance) or below the industry median (poor prior performance). To ease exposition, we report the estimated coefficients in two columns. The sample includes all firms for which executive compensation, accounting and stock price data is available on Execucomp, Compustat and CRSP. Standard errors are in parentheses and are adjusted for clustering. Estimated coefficients are significant at 1(\*\*\*), 5(\*\*), and 10 (\*) percent.

	Above Median Performance-Based Pay		Below Median Performance-Based Pay	
	Good prior performance	Bad prior performance	Good prior performance	Bad prior performance
Prior performance * dummy for increase in pay	0.12 (0.17)	-0.46*** (0.07)	0.10 (0.16)	-0.03 (0.32)
Prior performance	0.85*** (0.09)	0.46*** (0.07)	0.85*** (0.08)	0.05 (0.05)
Dummy for increase in pay	-0.19 (1.43)	-3.20 (1.93)	-0.02 (1.72)	0.63 (3.11)
Intercept	0.39 (0.95)	0.83 (1.33)	0.07 (0.76)	1.33 (1.06)
R-squared		0.35		0.42
N		459		275

**TABLE 10**  
**MANAGERIAL SKILL AND PAY DISPERSION**

We report association between a highly paid CEO and firm performance. Firms are first partitioned into above and below median pay dispersion, where pay dispersion is defined as the difference between the 90<sup>th</sup> percentile and the 10<sup>th</sup> percentile industry total CEO pay. The table reports results from a regression estimating the firm's industry-adjusted accounting performance. We report only the estimated coefficients for firms lead by highly paid CEOs conditional on positive prior performance (above industry median) and prior bad (below industry median) performance (or "reversals"), that estimates the effect of highly paid CEOs relative to poorly paid CEOs. The regression model includes other unreported independent variables, including a constant, a dummy for highly paid CEOs, and controls for prior year performance, and interaction terms. The sample includes all firms for which executive compensation, accounting and stock price data is available on Execucomp, Compustat and CRSP. Estimated coefficients are significant at 1(\*\*\*), 5(\*\*), and 10 (\*) percent.

	Below Median Pay Dispersion		Above Median Pay Dispersion	
	Good prior performance	Bad prior performance	Good prior performance	Bad prior performance
Prior performance for highly paid CEOs	-0.06 (0.06)	0.05 (0.08)	0.13** (0.06)	- 0.03 (0.03)
Prior performance	1.00*** (0.12)	0.67** (0.35)	0.82*** (0.04)	0.27*** (0.4)
Highly paid CEO dummy	0.08 (0.40)	0.43 (0.63)	- 0.33 (0.64)	0.55 (1.04)
Intercept	- 0.29 (0.27)	- 1.09*** (0.4)	1.60*** (0.48)	- 2.11*** (0.77)
R-squared	.34		.29	
N	2,412		2,980	