To Each According to His Ability? The Returns to CEO Talent

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Abstract

This paper addresses the key empirical challenge of measuring CEO talent. Using multiple proxies for CEO talent, a hand-collected sample of 2,195 CEO successions between 1993 and 2005, and within-firm estimators to achieve identification, we offer direct estimates of the return to talent for CEOs and shareholders. Consistent with competitive CEO labor market models, we document that: 1) there is a sizable talent premium in CEO pay; 2) there is a significant return premium to CEO talent for shareholders; and 3) the CEO job is riskier at the top of the talent distribution. Our estimates imply that CEOs who are one decile higher in the distribution of talent earn 3 percent more and deliver 0.3 percent higher returns for shareholders. These findings suggest that sorting considerations in the CEO labor market are an important determinant of CEO pay.

1 Introduction

Public corporations invest considerable resources in the search for top executive talent. In recent theoretical work, Gabaix and Landier (2008), Tervio (2008), and Murphy and Zábojník (2007) argue that the external labor market for CEOs is the central nexus between CEO talent, pay, and firm performance. Yet, although there is growing evidence that CEO attributes matter for pay and performance (Bertrand (2009) presents a recent survey), we know relatively little about the way the market for CEO talent actually works.[1] Bertrand (2009) suggests that "[b]uilding some more systematic quantitative, large sample, analysis on the CEO search process, how boards measure, identify and evaluate 'talent', and on the role played by third parties such as the media ... would greatly foster our understanding of who runs corporations and why." We seek to fill this gap by developing a comprehensive empirical analysis of the role of CEO talent in firm decisions to hire, fire, and pay the CEO, as well as of the consequences of these decisions for shareholder value. Our empirical strategy relies on multiple proxies for CEO talent, a large hand-collected sample of CEO successions, and within-firm estimators to achieve identification. To the best of our knowledge, we are the first to provide direct estimates of the returns to talent for CEOs and shareholders.

While recent studies and anecdotal accounts point to an increased importance of the external market for CEOs over the last two decades, the issue of pay for talent remains the subject of substantial controversy. In particular, Murphy and Zábojník (2007) show that, while little more than one CEO out of ten used to be appointed from outside the firm in the 1970s, that number has risen to about four over the last decade. The trend toward external hires has also been accompanied by an upward trend in pay. Kaplan and Rauh (2010) study the determinants of the level of CEO pay as compared to other superstar labor markets. Gabaix and Landier (2008) emphasize that the relation between the level of CEO pay and firm size is consistent with the talent view, whereas some have argued that the pay-size relation is tenuous prior to the 1970s (Frydman and Saks (2010)). And while this relationship is consistent with a talent story, it is also consistent with a rent-extraction story since it is possible that such issues are more severe at larger firms. Overall, the existing evidence is mostly indirect and we altogether lack direct large

[1] See see Bertrand and Schoar (2003), Graham, Harvey and Puri (2009), Graham, Li and Qiu (2009), and Bennedsen, Nielsen, Perez-Gonzalez and Wolfenzon (forthcoming).

sample evidence on the market for CEO talent.

In order to guide our empirical analysis, we start with a simple competitive assignment model of the market for CEO talent as in Gabaix and Landier (2008), Tervio (2008), and Murphy and Zábojník (2007). The model illustrates the intuition underlying the key testable predictions on the role of CEO talent in firm decisions to hire, fire, and pay the CEO, as well as how these decisions affect shareholder value. The testable hypotheses that arise from the model are as follows. First, a CEO's total compensation in increasing and convex in CEO talent. The intuition behind this result is that if CEO talent and firm assets are complements, it is efficient for more talented CEOs to be matched to larger firms where they are more valuable. This complementarity ultimately leads to proportionally larger rewards for more talented CEOs. In addition, it leads to rewards for CEO talent that are increasing in firm size. Second, the appointment of a more talented CEO should result in greater firm performance, since talented CEOs are matched to firms where they can best contribute to output. Lastly, more talented CEOs face a greater likelihood of being fired for subpar performance. Again, the reason for this is that since talent and effort are complements, tying the threat of dismissal more closely to performance is more effective for talented CEOs. The first two predictions are standard in the literature and are unique to a broad class of competitive models of the CEO labor market. The third prediction is new and can be used to further distinguish our analysis from an entrenchment story (Bebchuk, Fried, and Walker (2002) and Bebchuk and Fried (2003)) which would view superstar CEOs as powerful and thus, more likely to face a captive board of directors that insulates them from performance-related dismissals.[2]

We explore the empirical importance of talent in the market for CEOs using a large hand-collected sample of 2,195 CEO successions between 1993 and 2005.[3] We start from the entire ExecuComp dataset (20,981 firm-year observations) and use standard criteria in the literature to identify succession events (see Parrino (1997) and Jenter and Kanaan (2006)). We collect data on three different empirical proxies for CEO talent, which is naturally difficult to observe directly. Our proxies are based on the three key characteristics that boards of directors and

[2] A standard career concerns model (Gibbons and Murphy (1992), Chevalier and Ellison (1999)) would make the same prediction since it would identify superstar CEOs as those whose performance is less uncertain and thereby less likely to be informative.

[3] The empirical component of our work contributes to the literature that includes Murphy and Zábojník (2003), Jensen, Murphy, and Wruck (2004), and Frydman (2007).

search consultants are likely to be looking at using information contained in resumes or that which is publicly available through the business press: reputation, career record, and educational background. Our first proxy aims at capturing CEO reputation and is based on the number of articles containing the CEO's name that appear in the major U.S. and global business newspapers as identified through Factiva searches (see Milbourn (2003) and Rajgopal, Shevlin, and Zamora (2006) for other papers using a similar proxy). The basic idea behind this proxy is that more talented CEOs are more likely to be recognized by the business press. To ensure that the number of articles is not merely a reflection of CEO infamy as opposed to talent, we screen for the tone of each article so as to insure that only nonnegative press coverage is included in our count. We count the number of articles containing the CEO's name in the major U.S. and global business newspapers and net out any articles containing words with a negative connotation. We also rely on two additional, yet easily observable proxies for CEO talent in our empirical tests. We construct a new proxy called *Fast-Track Career* that is the age of the executive when he/she took her first CEO job. Intuitively, the younger an executive is when appointed CEO of a firm, the more talented he/she is. In robustness analysis, we also use a third proxy which is based on the undergraduate college attended by the CEO. We measure the selectivity of each college and argue that the more selective the college, the more talented is the executive.

We have three sets of empirical results. First, we document empirically that there is a reliably positive relation between our observable proxies for talent and the level of CEO pay. In our sample of successions, we estimate an empirical elasticity of first-year CEO pay to talent of about 0.5, which implies that CEOs who are one decile higher in the distribution of talent earn 5 percent higher total pay. In the entire ExecuComp sample, we estimate a long-run elasticity of CEO pay to talent of about 0.29. We verify that our estimates are robust to using either of our two main talent proxies and to controlling for a vast array of internal and external governance characteristics (which include the GIM index for external governance (Gompers, Ishii, and Metrick (2003)), board size and independence).

Our analysis of CEO pay addresses directly the issues of measurement error and imperfect proxies by using factor analysis (see Harman (1976) for details) and a GMM estimation approach. Factor analysis aggregates our multiple proxies for CEO talent into a single CEO Talent Factor, which is a linear combination of the underlying proxies with more weight given to proxies that more accurately reflect latent CEO Talent. To implement the model, we first derive the CEO Talent Factor using our main talent proxies, Press and Fast-Track Career, and our additional proxy, Selective College. We add Selective College to the factor analysis in order to derive an estimated factor that is less likely to contain measurement error. After obtaining the factor loadings using data for the entire ExecuComp sample, we show that the CEO talent factor delivers estimates of the talent premium in pay which are in line with our OLS estimates, suggesting that measurement error is unlikely to be driving our results. We also show robustness of our results to using an instrumental variable approach to address measurement error (see Wooldridge (2002, p.105)), which is the so-called "multiple indicator solution". This approach uses one CEO talent proxy, namely Press, in the "structural equation" and the remaining two as instruments. As in the factor analysis, the intuition is that we can exploit the correlation among our multiple proxies which is likely to arise from their common dependence on latent CEO talent. Our estimated elasticities are robust to using optimally-weighted GMM to estimate this system. Overall, to the best of our knowledge, these results represent the first estimates of the talent premium in CEO pay.

Our pay-talent elasticity estimates are also robust to addressing selection concerns. In fact, CEO successions involve both observable and unobservable differences in firm characteristics which might be time-varying. Thus, making a direct comparison between pay levels of talented vis-à-vis less talented CEOs potentially problematic. Ideally, we would like to compare pay decisions of a firm that appoints a talented CEO to the same firm's pay had the firm appointed a less talented CEO. Since the counterfactual is not observed, we must find an empirical proxy for the hypothetical pay without talent change. As our main identification strategy to address selection issues, we construct a nearest-neighbor matching estimator, following Abadie and Imbens (2007). We estimate a logit regression to identify observable firm characteristics that predict successions involving talented CEOs. We then match each succession involving talented CEOs to the succession that, at the time of the succession, had the closest predicted probability of involving a less talented CEO. CEO successions are a natural application for matching since the succession decisions are made by corporate boards who, like the econometrician, have to rely mostly on public information to assess CEO quality. Our results for pay-talent elasticities relative to the matched control sample confirm our baseline results. Our estimated pay-talent elasticities lend empirical support to the parametric value of $\frac{1}{3}$, which is commonly used to calibrate empirical Pareto distributions of CEO talent (e.g., Gabaix and Landier (2008)).

In comparison to the average effect of CEO talent on pay, the economic significance of the convexity we uncover is certainly more striking. We estimate the sensitivity of CEO total pay to our primary proxy for talent (*Press*) to be ten times larger for a CEO moving from the median talent level to the top 5% of the distribution of talent. In addition, we estimate significantly larger pay-talent sensitivity for larger firms. We also present evidence supporting a talent interpretation of Gabaix and Landier's (2008) size effect in CEO pay. In particular, we run a first stage regression of firm size on our CEO talent proxies and use the estimated residual from this first stage to decompose firm size into a component that is systematically related to CEO talent and one orthogonal to it. We then use these two components as explanatory variables in a standard CEO pay regression. What we find is that *only* the component of firm size that is systematically related to CEO talent generates a size effect in pay, and its estimated value is in line with those of Gabaix and Landier.

Finally, we address an important debate spurred by Bertrand and Schoar (2003) and Graham, Li and Qiu (2009) that executive fixed effects explain a large fraction of the total variation of CEO pay. An important question is whether and to what extent managerial styles reflect CEO talent. To make progress on this question, we run executive fixed effect regressions on total pay (achieving R^2 of about 75%). We then estimate the implied CEO fixed effects, and show that we can explain up to 30% of the variation in CEO pay fixed effects (i.e., the average variation in pay across CEOs) using our CEO talent proxies. This result is important, considering that standard biographical CEO characteristics used in the previous literature, such as CEO age and MBA education, have relatively limited explanatory power. These two controls offer incremental R^2 improvements of only 0.3%.

In our second set of results, we derive quantitative estimates of the performance impact of CEO talent. In particular, we document that there is a significant positive shareholder wealth effect to appointing a talented CEO, which is consistent with our competitive assignment model and validates the talent interpretation of our results on pay. The positive announcement returns to the appointment of a talented CEO are economically significant and range from 1 percent in the overall sample to 5.5 percent for the sub-sample of outside appointments. In addition, long-term stock market returns and several measures of operating performance suggest that the positive impact of CEO talent on firm performance is not simply driven by favorable investor perception. Using within-firm estimators based on long-term changes in operating performance around CEO successions, we estimate an elasticity of shareholder returns to CEO talent which ranges between 3% and 4.5%. This implies that CEOs who are one decile higher in the distribution of talent deliver between 0.3 and 0.45 percent higher returns for shareholders. These estimates are in line with the estimated impact of 1.7% of CEO deaths in Bennedsen, Perez-Gonazalez, and Wolfenzon (2008). Moreover, the fact that the estimated elasticity of shareholder returns to talent is an order of magnitude smaller than the one of CEO pay is consistent with competitive assignment models such as ours and Gabaix and Landier (2008). To the best of our knowledge, our results on firm performance also represent the first estimates of the return premium to CEO talent for shareholders.

We verify that our performance results are robust to running the same battery of robustness checks as above, including controlling for firm governance and addressing measurement error and selection issues. In addition, we offer evidence that the performance premium may be related to turnaround skills. In particular, we show that CEO talent has explanatory power for changes in firm policies around CEO successions. Using a set of investment, financial, and organization firm policies as in Bertrand and Schoar (2003), we document that talented CEOs are more likely to cut both capital and M&A expenditures, and shed excess-capacity (existing divisions) with respect to their less talented peers. Moreover, they are more likely to cut leverage and increase internal financing (cash). However, and perhaps not surprisingly, the stronger association is between CEO talent and firm operating decisions, as talented CEOs generate higher cash flows and pursue more aggressive (sales) growth strategies. These results paint a picture that fits remarkably well with anecdotal accounts of talented CEOs as aggressive turnaround specialists. In addition, these results suggest that CEO talent may contribute to the evidence in Bertrand and Schoar that there are significant CEO fixed effects in firm policies.

Finally, consistent with the model's third prediction, we document a strong positive link between the propensity of firms to fire CEOs based on performance and our proxies for CEO talent. Our evidence that the sensitivity of forced CEO turnover to performance is increasing in the level of CEO talent holds for an array of performance measures, including firm returns, industry-adjusted firm returns, and industry returns. This result is robust to controlling for CEO characteristics such as age and tenure, firm characteristics, and corporate governance mechanisms. Thus, more talented CEOs face higher performance pressure, which suggests that they are actually less likely to face a lenient board of directors.

In summary, our study makes three main contributions to the literature. First, we document the first direct evidence consistent with competitive sorting models of CEO pay (Gabaix and Landier (2008), Tervio (2008), and Murphy and Zábojník (2007)). In particular, we identify several novel and readily observable proxies for CEO quality that are important empirical determinants of CEO pay, turnover, and firm performance. Ours is the first paper to show how prior CEO career outcomes, as well as reputational considerations of incumbent CEOs earned while serving at *other* firms can play a key role in CEO pay.[4] Thus, our results augment the prevailing understanding of the determinants of CEO pay. Our evidence strongly suggests that the growth in the high CEO talent market is an important factor behind recent trends in CEO pay, consistent with Murphy and Zábojník. In addition, we contribute to the literature on CEO turnover which has traditionally focused on internal monitoring mechanisms (e.g. Warner, Watts, and Wruck (1988), Parrino (1997), and Huson, Parrino, and Starks (2001)). Our results are complementary to recent work by Eisfeldt and Kuhnen (2010) who also study CEO turnover in a competitive assignment setting, focusing on the role of industry-wide shocks. Given both the broad set of new variables we examine and the large cross-section of firms we include in our hand-collected dataset, our investigation represents the first large-sample study of the impact of sorting consideration in the external labor market on CEO pay and turnover.

Second, our results contribute to the small but growing literature that attempts to identify the effect of managerial characteristics on CEO pay and firm performance. Bertrand and Schoar (2003), Bennedsen, Perez-Gonzalez, and Wolfenzon (2006), Bennedsen, Nielsen, Perez-Gonzalez, and Wolfenzon (2007), Bloom and Van Reenen (2007), and Graham, Li and Qiu (2009) present evidence that CEOs matter for pay and firm performance. Garvey and Milbourn (2003, 2006), Milbourn (2003), and Rajgopal, Shevlin, and Zamora (2006) link CEO pay, pay-performance sensitivities, and the lack of relative performance evaluation to executive characteristics such as

[4] While the role of labor market forces has received increasing attention in the literature on CEO pay (Himmelberg and Hubbard (2000), Oyer (2004), and Rajgopal, Shevlin, and Zamora (2006) study the lack of relative performance evaluation in pay; Gabaix and Landier (2008) and Kaplan and Rauh (2010) study the increase in the level of pay), the link between CEO talent and the level of pay has been surprisingly overlooked.

age, wealth, and media cites. Our study highlights the link between CEO characteristics and CEO turnover, which has been surprisingly overlooked in the literature. As for pay and firm performance, an advantage of our approach is that using empirical variables that can be plausibly interpreted *a priori* as talent proxies, we can show that CEO talent helps to explain managerial style effects, thus making progress on the issue of how to interpret these effects. At the same time, by linking managerial fixed-effects to our talent proxies, we can offer direct evidence of the specific channels and decisions through which CEO talent impacts pay and performance.

Finally, our results have important implications for the recent debate on CEO pay and whether they are overpaid. Our evidence suggests that the relation between pay, performance, and turnover – arguably the most important outcomes in the market for CEOs – is consistent with optimal contracting. In contrast to the standard criticism of board of directors for not prudently rewarding and monitoring CEOs (see, e.g., Bebchuk and Fried (2003)), our evidence suggests that the compensation decisions of boards are in line with ex-ante measures of managerial ability. In addition, our evidence indicates that the CEO post is most precarious at the top of the talent pool, exactly among those CEOs that have been enjoying the highest increases in pay. Our new cross-sectional evidence corroborates the time-series argument in Kaplan and Minton (2008) that the period in which CEO pay increased substantially coincides with a period in which CEO tenure decreased substantially, partially offsetting some of the pay gains.

The remainder of the paper is organized as follows. Section 2 outlines our competitive assignment model of the market for CEO talent and develops its testable implications. Section 3 describes our new CEO succession dataset and our empirical proxies for CEO talent. Section 4 outlines our empirical strategy and presents the results. Section 5 concludes.

2 Model and Empirical Predictions

In this section, we develop a simple model of the CEO labor market. Our model is based on recent work by Gabaix and Landier (2008) and Tervio (2008)[5] and illustrates how equilibrium factors in the CEO labor market affect shareholders' optimal CEO pay and turnover decisions. CEOs

[5]See Sattinger (1979, 1993) for an earlier treatment of optimal assignment models of the labor maket and Himmelberg and Hubbard (2000) and Oyer (2004) for other models emphasizing the role of the CEO labor market.

have observable managerial talent and are matched to firms competitively. The marginal impact of a CEO's talent is assumed to increase with the value of the assets under his control. The best CEOs go to the bigger firms, which maximizes their impact. We start with a simple benchmark case where incentive considerations do not matter and later introduce effort. The work of both Gabaix and Landier and Tervio jointly provide the framework for our model's testable predictions on the link between CEO pay and firm size. However, we extend this framework and develop the model's testable predictions for the link between CEO talent and pay and turnover decisions.

2.1 Setup

There is a continuum of firms and potential CEOs. Firms differ in their size, k, while CEOs differ in their talent or ability, a. Let $S(k)$ and $T(a)$ denote the density functions of firms with respect to size and CEOs with respect to talent, respectively. Thus, $\int_{k_1}^{k_2} S(x)\,dx$ will be the number of firms with size between k_1 and k_2. For simplicity, we assume that both density functions take the Pareto (exponential) form, i.e. $T(a) = a^{-\alpha}, S(k) = k^{-\beta}$, with $\alpha \geq 1$ and $\beta \geq 1$. There is evidence that a Pareto distribution with coefficient $\beta \simeq 1$ fits the empirical firm size distribution well in the U.S. (see Gabaix and Landier (2008)). Both Gabaix and Landier and Tervio (2008) show that the key insights of our analysis generalize to a broader class of density functions for the distribution of CEO talent.

The profits of a firm of size k that hires a CEO of ability a are given by revenues net of CEO pay: $\pi(a,k) = ak - w(a)$, where w is CEO pay. Shareholders, typically via the board of directors, decide which CEO to hire by maximizing profits net of CEO pay. We next derive the optimal allocation of CEO talent across firms and the equilibrium level of CEO pay, $w^*(a)$, as implied by the assumptions of a competitive labor market for CEO talent and profit-maximizing behavior.

2.2 Optimal Matching, Pay Decisions, and Shareholder Returns

A competitive equilibrium in the CEO labor market consists of a compensation function, $w(a)$, which specifies the market pay of a CEO of talent a, and a matching function, $k(a)$, which specifies the size of a firm run by a CEO of talent a, such that shareholders of each firm maximize profits and the CEO labor market clears, giving each firm a CEO.

2.2.1 Optimal Matching

In equilibrium, more talented CEOs will work for larger firms. Technically, this competitive equilibrium is referred to as positive assortative matching. A sufficient condition for positive assortative matching is that CEO talent and firm assets are complements in the sense that a talented CEO has a larger impact on her firm's profits when she has more assets under her control. This condition is satisfied in our model since the mixed partial derivative of firm revenues with respect to assets and CEO talent, $\frac{\partial^2 \pi}{\partial a \partial k} = 1$, is positive. Intuitively, if there are two firms with size $k_1 > k_2$ and two CEOs with talent $a_1 > a_2$, the net surplus is higher by putting CEO 1 at the helm of firm 1, and CEO 2 at the helm of firm 2. Formally, this is expressed in the following inequality: $a_1 k_1 + a_2 k_2 > a_2 k_1 + a_1 k_2$, which always holds given that $(k_1 - k_2)(a_1 - a_2) > 0$.

Since positive assortative matching is efficient in our model, CEO labor market clearing delivers the optimal assignment function of CEO and firms via $k(a)$. In fact, the market clearing condition requires that if k is the size of a firm run in equilibrium by a CEO with ability a, then the number of firms of size greater than k has to be equal to the number of CEOs with ability greater than a. Thus, competition in the CEO labor market implies that

$$\int_k^\infty x^{-\beta} dx = \int_a^\infty x^{-\alpha} dx$$

Using this equation, we can derive the equilibrium matching function, $k(a) = \phi a^{\frac{1-\alpha}{1-\beta}}$, where $\phi = \left(\frac{\beta-1}{a-1}\right)^{\frac{1}{1-\beta}}$. It is immediately clear that in equilibrium, firm size is a strictly increasing function of CEO talent since $\frac{\partial k(a)}{\partial a} > 0$.

2.2.2 Equilibrium CEO Pay

Profit maximization by shareholders implies that optimal CEO pay has to satisfy the following first-order condition:

$$\frac{\partial w(a)}{\partial a} = k.$$

Thus, profit-maximizing shareholders trade off the marginal cost (higher pay) and the marginal benefit (higher revenues) of hiring a more talented CEO. Combining this equation with the equilibrium matching function, $k(a)$, allows us to derive an implicit equation for equilibrium CEO pay,

$\frac{\partial w(a)}{\partial a} = \phi a^{\frac{1-\alpha}{1-\beta}}$. Integrating this with respect to CEO talent, we obtain the following equilibrium CEO pay rate (up to a constant of integration equal to the pay of the least productive CEO) of:

$$w(a) = \theta a^{\frac{1-\alpha}{1-\beta}+1}, \tag{1}$$

with $\theta = \phi \frac{1-\beta}{2-\alpha-\beta}$.

Clearly, equilibrium CEO pay is a strictly increasing function of CEO talent, i.e., $\frac{\partial w(a)}{\partial a} > 0$. But, is equilibrium CEO pay a convex function of CEO talent, reminiscent of the so-called superstar effect (Rosen (1981))? The answer to this question is yes. To see this, consider that given equation (1), a sufficient condition for $\frac{\partial^2 w(a)}{\partial a^2} > 0$ is that $\frac{\partial k(a)}{\partial a} > 0$, which is exactly what the efficient allocation of CEO talent (assortative matching) implies. Thus, efficient sorting in the CEO labor market implies that more talented CEOs are matched to larger firms where they are more valuable, leading to convex rewards for CEO talent. This complementarity between CEO talent and firm size also leads to rewards for CEO talent that are larger for larger firms, i.e, $\frac{\partial^2 w(a)}{\partial a \partial k} > 0$. In summary, our model makes the following testable prediction for the joint variation of CEO talent and CEO pay:

Prediction T1 (CEO Pay): CEOs with higher levels of talent receive higher total compensation and this relation between total CEO pay and talent is convex. In addition, the positive relation between total CEO pay and talent is increasing in firm size.

2.2.3 Shareholder Returns

How large is the impact of CEO talent on shareholder value? As in Gabaix and Landier (2008) and Tervio (2007), we study the following counterfactual. We consider a firm that at no additional cost can replace its current CEO with ability a_0 with a more talented CEO of ability $a_1 > a_0$. We abstract from the additional wage cost of hiring a more talented CEO, and first focus on gross profits in order to derive an upper bound on the impact of CEO talent differences. Appointment returns to shareholder, AR, are given by

$$AR(a_1, a_0) = \frac{\pi(a_1, k) - \pi(a_0, k)}{\pi(a_0, k)} = \frac{a_1}{a_0}.$$

Some interesting features of this expression immediately obtain. First, shareholder returns are increasing in the talent of the incoming CEOs given the fact that $AR' > 0$. However, given that $AR'' = 0$, we see that although it is optimal for shareholders to set convex pay, shareholder returns need not be a convex function of CEO talent. In other words, although superstar pay is consistent with shareholder maximization, shareholder returns are less sensitive to CEO talent than they are to pay. That said, our model makes the following testable prediction for the joint variation of CEO talent and firm performance:

Prediction T2 (Firm Performance): Appointments of CEOs with higher levels of talent are more likely to benefit shareholders – that is, the impact of CEO appointments on shareholder value is more likely to be positive for relatively more talented incoming CEOs.

2.3 Equilibrium CEO Effort

We now introduce effort into our benchmark model. We do so by building on standard multitask moral hazard models (Holmstrom and Milgrom (1992)). We assume that CEOs differ not only with respect to their talent, a, but also with respect to their effort, e. Effort is distributed independently from talent and $E(e)$ denotes the density functions of CEOs with respect to effort, which for simplicity we assume to take the Pareto (exponential) form of $E(e) = e^{-\varepsilon}$. The profits of a firm of size k that hires a CEO of ability a willing to put in effort e are given by revenues net of CEO pay: $\pi(a, e, k) = aek - w(a, e)$, where other than for effort the notation is unchanged. This section shows that incentive devices aimed at increasing effort are more valuable to firms that hire more talented CEOs. Thus, we offer a sorting-rationale for incentive provision.

In equilibrium, it is efficient for firms that hire more talented CEOs to make them work harder. Technically, this is again positive assortative matching. A sufficient condition for such is that CEO talent and effort are complements in the sense that a talented CEO has a larger impact on firm profits when she works harder and is satisfied in our model since the mixed partial derivative of firm revenues with respect to CEO talent and effort, $\frac{\partial^2 \pi}{\partial a \partial e} = k$, is positive. Intuitively, for any given firm, if there are two CEOs with talent $a_1 > a_2$ and two possible contracts that induce effort $e_1 > e_2$, the net surplus is higher by offering to CEO 1 the contract that induces effort 1, and to CEO 2 the contract that induces effort 2. Formally, this is expressed as $a_1ke_1 + a_2ke_2 > a_2ke_1 + a_1ke_2$, which again obtains in our model since $(e_1 - e_2)(a_1 - a_2) > 0$.

Since positive assortative matching is efficient in our model, the assumption of CEO labor market clearing delivers the optimal assignment function of CEO talent and effort, $e(a)$. In fact, the CEO labor market clearing condition requires that, if e is effort in equilibrium by a CEO with ability a, then the number of CEOs with effort greater than e has to be equal to the number of CEOs with ability greater than a. Thus, competition in the CEO labor market implies that

$$\int_e^\infty x^{-\varepsilon} dx = \int_a^\infty x^{-\alpha} dx$$

Using this equation, we can derive the equilibrium matching function, $e(a) = \eta a^{\frac{1-\alpha}{1-\varepsilon}}$, where $\eta = \left(\frac{\varepsilon-1}{a-1}\right)^{\frac{1}{1-\varepsilon}}$. Clearly, equilibrium effort is a strictly increasing function of CEO talent, i.e., $\frac{\partial e(a)}{\partial a} > 0$. In this sense, it is efficient to offer to more talented CEOs contracts that induce higher effort. This is the case since shareholders that hire more talented CEOs also derive the most value from their effort. Thus, they benefit the most from an incentive provision such as performance-based dismissals (see Milbourn (2003) and Rajgopal, Shevlin, Zamora (2006) for a related argument. With this, our model makes the following testable prediction for the joint variation of CEO talent and CEO turnover:

Prediction T3 (CEO Turnover): CEOs with higher levels of talent are more likely to be fired based on performance – that is, the sensitivity of CEO turnover to performance is higher for relatively more talented CEOs.

3 Data

To implement empirical tests of our predicted impact of CEO talent on pay and firm performance, we construct a database of the CEO labor market that contains detailed information on CEO successions, as well as multiple empirical proxies for CEO talent at the time the terms of the contract are set. This section details how we construct the dataset and the collection process for each of our variables. Additional details on variable definitions are in Appendix C.

3.1 Sample selection

We hand-collect our CEO succession data for the universe of all firms in the S&P ExecuComp database for the 1993 to 2005 period. ExecuComp contains information on the top executives of all firms in the S&P 1500. We recognize a CEO turnover for each year in which the CEO identified in ExecuComp changes (earlier studies, such as Parrino (1997), Huson, Parrino, and Stark (2001), and Huson, Malatesta, and Parrino (2004), use Forbes surveys; Jenter and Kanaan (2006) also use ExecuComp but only study departing CEOs for the 1993-2001 period). This gives us a first sample of 2,357 candidate CEO succession events. We then search the Factiva news database in order to collect information about the circumstances around each succession. We exclude 67 successions that are directly related to a takeover and 95 successions involving interim CEOs. The final sample contains 2,195 CEO succession events for a total of 20,904 firm-year observations.

We classify each CEO turnover according to whether it was forced or voluntary and whether the incoming CEO is an insider or an outsider to the firm Here we follow standard criteria in the literature that have began with Parrino (1997). Departures for which the press reports state that the CEO has been fired, forced out, or retired/resigned due to policy differences or pressure are classified as *forced*. All other departures for CEOs above and including age 60 are classified as *not forced*. All departures for CEOs below age 60 are reviewed further and classified as forced if either the article does not report the reason as death, poor health, or the acceptance of another position (including the chairmanship of the board), or the article reports that the CEO is retiring, but does not announce the retirement at least six months before the succession.[6] This careful classification scheme is necessary since CEOs are rarely openly fired from their positions.

We classify as outsiders those successor CEOs who had been with their firms for one year or less at the time of their appointments. All other new CEOs are classified as insiders. Finally, for each succession we determine exact announcement dates, which are the earliest dates of the news about incumbent CEO departure and successor CEO appointment.

Table 1 presents an overview of our CEO succession data set with descriptive statistics on total and forced CEO turnover. Panel A summarizes successor type for each year, and Panel B contains the three sub-periods covered by our sample, which are the first and second half of the

[6] The cases classified as forced can be reclassified as voluntary if the press reports convincingly explain the departure as due to previously undisclosed personal or business reasons that are unrelated to the firm's activities.

1990's and first half of the 2000's. We are able to give a more comprehensive picture of the CEO labor market than previous studies since our sample includes a more detailed collection and larger cross-section of firms (S&P 1500) than S&P500 and S&P MidCap 400 sub-samples, which have been the standard focus of the literature.[7] These statistics suggest that the nature of the CEO labor market has changed significantly with respect to the 1970s and 1980s. The likelihood that a turnover is forced and that the new CEO comes from outside the firm both increase over time and are higher than in previous decades.

These two trends are particularly evident when viewed across the sub-periods in Panel B, which first shows that the frequency of forced turnover is higher in the later part of our sample. Forced turnovers represent about 22 percent of all turnovers in the 1993 to 1995 sub-period and about 27 percent in the following sub-periods, an increase of almost 25%. Irrespective of the sub-samples, forced turnovers are higher than in previous decades. For example, Huson, Parrino, and Starks (2001) report that forced turnovers represented only about 10 percent of all turnovers in the 1970's, and about 17% in the 1980's. Panel A shows that there is significant time-variation in both forced and voluntary turnover. Forced turnover (percentage of firms with forced CEO turnovers) is as low as 1.9% in 1993 and as high as 4.1% in 2002. These trends and the overall frequency of forced (2.8%) and voluntary (10.4%) CEO turnovers in our sample are in line with recent studies (e.g., see Huson, Parrino, and Starks (2001) who report 23.4% of forced to total turnovers for the 1989-1994 period).

Panel B shows a second important trend in the CEO labor market: the percentage of outside successions increases monotonically across the three sub-periods. The increasing prevalence of filling CEO openings through external hires rather than through internal promotions suggests that there has been a material change in the CEO selection process in the 1990s. About 30% of the departing CEOs in the 1993 to 1995 sub-period are replaced by executives who have been employed at the firm for one year or less. In contrast, the frequency of outside appointments is about 40% percent in the 2000 to 2005 sub-period. Moreover, as shown in Panel A, while there

[7] Studies covering earlier periods use Forbes Compensation Surveys, which roughly include S&P 500 and S&P MidCap 400 firms. Denis and Denis (1995) cover a sample of 908 CEO successions between 1985 and 1988. Huson, Parrino, and Starks (2001) and Huson, Malatesta, and Parrino (2004) have 1,316 and 1,344 CEO successions, respectively, between 1971 and 1994. Murphy and Zabojnik (2007) have 2,783 appointments between 1970 and 2005, which is a larger, but significantly less detailed dataset than ours.

is some time-variation (a peak of 41.8% in 2005 and a dip of 34.3% in 2003), the frequency of outside hires has been consistently around 40% since 1998. These figures are even more striking if contrasted against earlier decades. Murphy and Zabojnik (2007) and Huson, Parrino, and Starks (2001) report that during the 1970s and 1980s, outside hires accounted for only 15% to 17% of all CEO replacements, less than half as large as our figures since 1998.

It is tempting to attribute this outsider trend to the higher incidence of forced turnovers. However, this is not the case since the trend holds for both voluntary and forced successions. While not reported in Table 1, we find that the percentage of voluntary (forced) successions in which an outsider is appointed increased from about 30 (33) percent in the first sub-period to about 38 (44) percent in the last subperiod. Finally, notice that the percentage of outside hires for the 2001 to 2005 sub-period in our data is higher than the 32.7% figure reported by Murphy and Zabojnik (2007). This difference is due to the fact that their sample only includes S&P 500 and S&P MidCap 400 firms, which tend to rely more on inside hires (32.8% in our sample).

3.2 Variable construction

3.2.1 CEO Talent Proxies

Our key explanatory variable from our theory is CEO talent. We construct two main empirical proxies for CEO talent, and supplement these with a third measure. The first proxy is based on the number of articles containing the CEO's name and company affiliation that appear in the major US and global business newspapers in a calendar year. The second is based on the speed with which an executive becomes CEO. The third relies on the selectivity of the CEO's undergraduate college and whether or not the CEO completed an MBA. We detail these measures next.

Our first proxy for CEO talent, *Press*, is intended to capture whether external parties view the CEO as talented. We construct Press by counting the number of articles containing the CEO's name and company affiliation that appear in the major U.S. and global business newspapers in a calendar year. The newspapers considered and the search criteria are analogous to previous studies in the literature (see Milbourn (2003), Francis, Huang, Rajgopal and Zang (2004), and Rajgopal, Shevlin, and Zamora (2006)). Appendix A contains the detailed list of newspapers used in our Factiva search. Our text search uses both the CEO's last name and company name (e.g., Akers and International Business Machines or IBM). We include an article only once, irrespective of how many times the CEO's name appears in the article. As standard in the existing literature, we classify CEOs with larger values of press coverage as more talented than CEOs with smaller coverage values. Finally, for each newly appointed CEO, we use the press count in the year prior to the transition in order to mitigate simultaneity concerns, as well as the concern that the press count might be capturing characteristics of the current firm employing the CEO, rather than CEO-specific characteristics.[8]

With respect to the previous literature, we construct our reputation measure for a significantly larger cross-section of firms (entire ExecuComp) and longer time-series (fourteen-year period). In fact, Milbourn (2003) considers all ExecuComp firms as we do, but only covers a six-year period (1993-1998). Rajgopal, Shevlin, and Zamora (2006)) consider a nine-year time period close to ours (1993-2001), but focus only on S&P 500 firms.[9] Moreover, we develop a novel approach to overcome the obvious potential concern that not all press is necessarily reflecting something positive about talent. That is, not all press is necessarily good press, and thus we screen articles to only include nonnegative press coverage in our count. To screen for each article's tone, we check whether it includes words with a negative connotation. Appendix A contains a list of the precise words we use. The list was compiled by randomly sampling 50 CEOs and reading articles about them. We then count the number of articles containing the CEO's name, company affiliation, and any of the words with a negative connotation that appear in the major U.S. and global business newspapers in a calendar year. This gives us a proxy for *Bad Press*, which we can use to construct *Good Press = Press – Bad Press.*

Our Good Press proxy is novel to the literature. The standard approach (see, for example, Milbourn (2003) and Rajgopal, Shevlin, and Zamora (2006)) is to verify whether the Press variable is highly correlated with Good Press only for a small, randomly-selected sample of CEOs. Our strategy allows us to construct Good Press for the entire sample so as to test directly its role in the CEO labor market. There are two advantages of doing this. First, we can offer a large sample

[8] We verified that our results are robust to using contemporaneous press count, as well as an average of the annual press count in the three years prior to the transition.

[9] Likely due to these differences, in our sample the median CEO gets about 7 mentions in the press in a year. This is in line with previous studies, but somewhat lower than Milbourn (2003) and Rajgopal, Shevlin, and Zamora (2006). However, when we consider only the S&P 500 subsample, we are close to Rajgopal, Shevlin, and Zamora's median number of articles (13 in our sample vs. 11 in theirs).

validation of simple count measures (e.g., Press) typically used in the literature. The good news for the previous literature is that in our large sample, Good Press is highly correlated (0.9) with Press since few negative articles apparently appear in print. However, the second advantage of our approach is found in the interesting cross-sectional differences: the correlation is higher at the high end of the distribution of Press (0.92 for above median CEOs), and relatively lower at the low end of the distribution of Press (0.7 for below median CEOs). Therefore, we argue that it is important to address directly the question of whether the effect of Press is driven by Good Press in the full cross-section of CEOs.

Our second proxy for CEO talent, *Fast-Track Career*, is also novel to the literature and is intended to capture the market signal about CEO talent. We conjecture that CEOs who have a faster career path to the top are relatively more talented. The intuition for this proxy is that if the selection process of corporate elites is meritocratic, age as of the first CEO appointment should capture an important dimension of CEO talent. The intuition is that more talented executives will need to spend less time on the corporate ladder and will be able to clear the hurdle for the CEO job sooner. A related spin would be that the hurdle for appointing a young CEO is higher since younger executives have less experience. The underlying motivation for this measure comes from the evidence by sociologists that indeed the selection process of corporate elites in the US has been relatively meritocratic over the last decades (see Friedman and Tedlow (2003) for a comprehensive review of the literature, and Capelli and Hamori (2005) for evidence).

To construct our second talent measure, we collect detailed information about the complete career histories of CEOs from the following sources: (1) Dun & Bradstreet Reference Book of Corporate Managements (various years); (2) Standard & Poor's Register of Corporations, Directors and Executives; (3) Marquis Who's Who in Finance and Industry; (4) Biography Resource Center by Thomson Gale; (5) Lexis-Nexis, Factiva, and (6) various web searches. Given the evidence of higher job mobility over the last decades, an important concern with this *Fast-Track Career* proxy is that it captures simply a cohort-effect, with younger cohorts of executives being able to get their first CEO job sooner. To address this concern, we use a cohort-adjusted version of our measure, where we divide our sample of CEOs into three age cohorts and define Fast-Track Career as the difference between age of the first CEO job and median first CEO job age in the age cohort. Ultimately, our second talent proxy classifies as more talented executives that got their first CEO job sooner than other executives in their age cohort.

To partially address identification issues, we complement our two main talent proxies with a third proxy based on CEO educational background and the selectivity of the undergraduate institution attended. Using the same five sources employed to collect information on career histories, we compile information on CEO academic histories and, in particular, college attendance and graduate education. In particular, we use Barron's (1980) rankings to sort CEOs into two groups: selective college if the CEO has attended a "very competitive" or more selective undergraduate institution (top 189 institutions), and less selective college otherwise.[10] This proxy has been used previously in the literature (see, for example, Perez-Gonzalez (2008), Palia (2000), and Chevalier and Ellison (1999b)). However, our study is, to the best of our knowledge, the first to employ it for a large cross-section of CEOs. Finally, we control for graduate education using a dummy for whether or not CEOs have an MBA. There is evidence that MBA education is both related to pay (see Murphy and Zábojník (2007) and Frydman (2005) who emphaisize that CEOs with MBAs are generalists) and firm performance (Bertrand and Schoar (2003)).

In summary, we use three CEO talent variables, based on CEO reputation, career background, and educational background. An advantage of having multiple talent proxies is that we can validate them by checking their pairwise correlations. Panel A of Table 2 displays pairwise correlations among our talent variables for different sub-samples of our dataset and for the entire ExecuComp sample. The correlations are positive and all statistically significant, suggesting that indeed the variables capture some aspect of CEO talent. However, the correlations are far from one, which suggests that they capture different aspects of CEO talent, but do so noisily. The difference between each of our proxy variables and latent CEO talent is measurement error. In the next section, we develop a simple empirical strategy that addresses directly the classic problem of noisy proxies and measurement error (see Wooldridge (2002) for a textbook treatment).

[10] The top three classifications in Barron's (1980) are "Most Competitive," "Highly Competitive," and "Very Competitive," which include 33, 52 and 104 undergraduate institutions, respectively. We were able to find information on the college attended in 95 percent of the cases. As in Perez-Gonzalez (2008), we classified CEOs with missing college information as less selective college CEOs, since CEOs are arguably more likely to disclose their alma mater when they attended prominent colleges. Since there are no available comprehensive rankings of foreign undergraduate institutions, we also classified CEOs who attended foreign colleges as less selective college CEOs.

3.2.2 Firm Performance and Firm-Level Controls

We supplement our data with several measures of firm stock market and operating performance, as well as a variety of firm-level controls whose importance in the CEO labor market has been documented in the literature. All measures are at calendar year-end, and details on variables definitions are in Appendix C. Our stock market-based measure of performance is based on stock returns from CRSP. We also use two measures of firm operating performance from Compustat: (1) operating return on assets (OROA); (2) return on assets (ROA). For each of these measures, we use their industry-and industry and performance-adjusted counterparts. The control groups are created following standard methodology (see Barber and Lyon (1996) for details).

Our main set of controls includes firm size, CEO age and tenure. The role of firm size in the CEO labor market is an important implication of competitive models such as ours (see Gabaix and Landier (2008) and Tervio (2008)). Previous research suggests that CEO pay and turnover rates are a function of CEO age and tenure (see, for example, Milbourn (2003) and Chevalier and Ellison (1999a)'s study of the sensitivity of mutual funds manager turnover to performance). While we include age and tenure as controls, we do not emphasize any particular interpretation of their sign since there are likely many considerations in place. For example, on the one hand, tenure and age are related to talent, since longer tenures and older ages are likely associated with greater experience. However, age and tenure could also reflect countervailing rent extraction effects that are hard to disentangle empirically.

Finally, we verify that our results are robust to controlling for several measures of external and internal governance. In particular, we control for the GIM index (Gompers, Ishii, and Metrick (2003)), which counts the number of firm anti-takeover provisions and has been found to be related to CEO pay levels (Gabaix and Landier (2008)). We also control for the size and independence of the board of directors (see Weisbach (1988) and Kaplan and Minton (2006)).

Panel B of Table 2 contains summary statistics for both the outgoing CEO and his successor, as well as standard firm characteristics. These are additionally sorted by whether the departing CEO is forced out, and whether the incoming CEO is an insider or outsider. The age and tenure characteristics of outgoing CEOs are consistent with the previous literature. As Panel B.1 shows, the median outgoing CEO is 61 years old and has held that position for about 8 years. As shown in Panel B.2, the median successor CEO is younger (54 years old, compared to 53 in Huson, Malatesta, and Parrino (2004) and 48 in the sample of family succession of Perez-Gonzalez (2006)) and is more likely to have an MBA. Moreover, particularly for outside hires and forced successions, outgoing CEOs tend to rank lower than successor CEOs in terms of our main talent proxies. For example, the median outgoing CEO has 7 press articles (5 good articles) versus 9 articles (7 good articles) of the median outside successor. For forced successions, the median outgoing CEO got his first CEO job at age 46, while the median successor CEO got his first CEO job at age 45. Moreover, among successor CEOs, outside hires have higher press coverage (9 vs. 7 articles) and were younger when they got their first CEO job (48 years old vs. 50) compared to inside hires. These differences are even larger when considering incoming CEOs after forced successions.[11]

Finally, Panel B.3 shows that average stock returns in the 12 months before a forced CEO turnover are about negative 28%. The average equal-weighted (2-SIC) industry return before forced turnovers is also lower than before voluntary turnovers. This is consistent with the results in Kaplan and Minton (2008) and Jenter and Kanaan (2006) that CEO dismissals are more common in underperforming firms and industries. Panel B.3 also shows that our sample firms are relatively large, and tend to have outsider-dominated boards (65% of the directors on the median board are outsiders). However, firm size and governance characteristics are not statistically significantly different from the median firm in ExecuComp.

4 Empirical Strategy and Findings

Our research setting allows us to implement direct tests of the relation between CEO talent and a variety of labor market outcomes, such as CEO pay and turnover, and corporate performance. This section outlines our empirical strategy and reports the results.

4.1 Empirical Strategy

Our baseline empirical specification is as follows:

$$y_{ijt} = \alpha + \beta * CEO\ Talent_{it} + \gamma * Controls_{ijt} + \delta_t + \varepsilon_{ijt} \quad (2)$$

[11] These results are also consistent with Prediction T3.

where the executive i works at firm j in year t, the dependent variable, y_{ijt}, is a labor market outcome (CEO pay and several measures of changes in firm performance), and the key explanatory variable is $CEO\ Talent$ as proxied intially by *Press* and *Fast-Track Career*. In each test, we include a number of controls for firm and CEO characteristics, such as firm size and CEO age and tenure, that have been found to be important covariates of outcomes in previous studies (see Huson, Malatesta, and Parrino (2004) and Perez-Gonzalez (2006) for recent papers on firm performance changes around CEO successions). Our choice of controls is aimed at including observables that are likely to be selection variables, such as prior performance. Controlling for potential selection variables is particularly important in our analysis of the impact of CEO talent on firm performance and thus we devote special care to it. Finally, all our specifications include year-effects and (2-SIC) industry fixed-effects. The null hypothesis is that β is equal to zero.

In our baseline tests, we estimate equation (2) using ordinary least squares (OLS), as is standard. However, we also address directly the potential issues of measurement error and imperfect proxies that arise from the fact that we are employing noisy empirical proxies of CEO talent. In fact, it is well known that in the presence of classical measurement error, OLS estimates will be attenuated (see Wooldridge (2002, p.73)). Moreover, under a more general measurement error (see Black and Smith (2006)), OLS estimates may actually be biased upward despite attenuation.

In order to address the fundamental identification problem that arises when using proxy variables, we pursue two alternative strategies, both aimed at combining our different proxies of CEO talent to obtain more reliable estimates. In particular, we estimate the following more general model:

$$y_{ijt} = \alpha + \beta * CEO\ Talent^{*}_{it} + \gamma * Controls_{ijt} + \delta_t + \varepsilon_{ijt} \tag{3}$$

where the executive i works at firm j in year t, and all variables are the same as in (2) except for $CEO\ Talent^{*}_{it}$, which we now treat as a latent CEO talent variable. Since we do not measure CEO talent directly, we specify the following classic measurement error equation:

$$CEO\ Talent_{kit} = CEO\ Talent^{*}_{it} + u_{kjt}$$

where u_{kjt} is measurement error that we assume is uncorrelated with both $Talent^{*}_{jt}$ and $Controls_{ijt}$. Note that a well-recognized related issue is that by including a rich set of controls we are likely to exacerbate the attenuation bias because the controls explain a portion of $CEO\ Talent^{*}_{it}$ but none of the error term (see, for example, Griliches and Hasuman (1986)).

Our first solution is to use factor analysis.[12] Intuitively, factor analysis allows us to aggregate our multiple measures of CEO talent into a single CEO Talent or T-Factor, which is a linear combination of the underlying measures with weights chosen in such a way that leans more heavily on proxies that more accurately reflect latent CEO Talent. To implement the model, we first derive the CEO Talent Factor using our main talent proxies, Press and Fast-Track Career, and Selective College. We add Selective College to the factor analysis in order to reduce the variance of the resulting estimate of the latent CEO Talent variable and thereby derive an estimated factor that is less likely to contain measurement error. After obtaining the factor loadings using data for the entire ExecuComp sample,[13] we estimate equation (2) using OLS with the CEO Talent factor included as the talent measure.

The factor analysis approach has several advantages: it is intuitive, easy to implement, and generates a simple one-dimensional variable that ranks CEOs based on their talent. However, our factor analysis estimates remain potentially attenuated relative to the true value because the use of multiple signals lowers, but does not eliminate measurement error. Thus, we offer a second more standard solution to the measurement error issue based on instrumental variables. It has long been recognized that instrumental variables estimation may eliminate biases associated with measurement error (see Griliches and Hausman (1986) for a review of the early literature, and Wooldridge (2002, p.105) for a detailed discussion). Our second approach relies on the "multiple indicator solution", where we use one CEO talent proxy, namely Press, in the "structural equation" and the remaining two, namely Fast-Track Career and Selective College as instruments. As in the factor analysis, the intuition is that we can exploit the correlation among our multiple proxies which is likely to arise from their common dependence on latent CEO talent. We use optimally-weighted GMM rather than 2SLS to estimate the system since in the presence of heteroskedasticity GMM estimates should be relatively more efficient.

[12] See Harman (1976) for details on factor analysis; Joreskog and Goldberger (1975) is an early study and Heckman, Stixrud, and Urzua (2006) and Black and Smith (2006) are recent papers using factor analysis to address measurement error. We offer details on why this approach is effective in Appendix B.

[13] The values of the factor loading are as follows: 0.705 for Fast-Track Career, 0.667 for Press, and 0.297 for Selective College.

Selection A final important concern with our estimation of (2) is that even though we control for several covariates of pay and performance, these variables can differentially affect pay and firm performance around CEO successions through sorting since talented CEOs are hired by different firms than are less talented ones. Thus, part of our estimated impact of CEO talent might be attributed to firm characteristics that determine the differential sorting of CEOs rather than CEO talent itself. For example, since large firms are more likely to hire talented CEOs based on our competitive assignment model, it might be that part of the pay premium is simply due to talented CEOs being chosen to run bigger firms.

In the ideal empirical experiment, we would compare the pay and performance of a talented CEO appointment firm to the same firm's pay and performance had the firm appointed a less talented CEO. Since the counterfactual is not observed, we must find an empirical proxy for the hypothetical pay and performance without the talented CEO appointment. A seemingly obvious (but problematic) strategy is to compare average changes in ex post performance of firms that appoint talented CEOs to those of firms that appoint less talented CEOs. This difference-in-differences approach would provide a valid estimate of the treatment effect of the treated *if* assignment to the treatment group were random. However, our model and previous evidence on CEO successions suggest that this assumption is not likely to hold in the data. In fact, when we test differences in pre-succession firm characteristics across the two groups of firms that hire more talented versus less talented CEOs (based on top and bottom quartile of our talent measures), we find significant differences in firm size, with appointments of top talent CEOs associated with larger firms. Economically, these differences reflect the endogeneity of CEO succession decisions.

In order to isolate the real effects of CEO succession type on pay and corporate performance from selection effects, our strategy is to construct a nearest-neighbor matching estimator, following Rosenbaum and Rubin (1983) and Abadie and Imbens (2007). While we do not observe the criteria used to select talented versus less talented CEOs, the matching procedure reconstructs this information using observable characteristics. We construct the control sample in two steps. First, we run a logit regression to predict the probability that a firm appoints a talented CEO (top quartile of the distribution of our proxies) based on firm characteristics. We set the binary dependent variable to 1 if the firm appoints a talented CEO. Based on our model and on the results in the literature, we include firm size, performance, and a dummy for forced prior turnover.

We also include dummies for years. In unreported results (available upon request), we do not find a statistically significant relation between pre-transition firm performance and the likelihood of appointing a talented CEO. However, consistent with our competitive assignment model, we find that larger firms are significantly more likely to appoint talented CEOs. Next, we use the predicted values from the logit regression (propensity scores) to construct a nearest-neighbor matched sample for appointments of talented CEOs. In each year, we choose, with replacement, the appointments of talented CEOs with propensity scores closest to those of less talented ones. We use the propensity score as the match variable to reduce the dimensionality of the matching problem.

4.2 Analysis of CEO Pay

In this section, we derive empirical estimates of the skill premium in CEO pay by estimating empirical pay-talent sensitivities. Based on our model (Prediction T1), we expect talented CEOs to earn a positive premium resulting in higher total pay. Our research setting allows us to *quantify* the returns to CEO talent. Before describing our regression results, we offer univariate evidence in Figure 1. This figure plots the relationship between (the logarithm of) appointment-year total CEO pay and CEO talent for newly appointed CEOs based on the distribution of *Press* (*Fast-Track Career* delivers qualitatively similar results). What emerges is a pattern that is strikingly consistent with Prediction T1: the relation between CEO pay and talent is increasing and convex.

To implement formal tests of Prediction T1, we extend the standard econometric framework that estimates the determinants of total CEO pay (see Murphy (1999) for a careful description of this approach by allowing total CEO pay to vary with our measures of CEO talent. Accordingly, we estimate equation (2), where the dependent variable, w_{ijt}, is log total compensation (tdc1), and the key explanatory variable, $CEO\ Talent$, is measured by Press and Fast-Track Career. To facilitate intuitive interpretation of the economic significance of the results, we follow Aggarwal and Samwick (1999) and Milbourn (2003) and construct the cumulative distribution functions (CDFs) of our talent proxies. We include several controls (including firm size, prior firm performance, the new CEO's age, and her insider status) that have been shown in the literature to be important determinants of CEO pay. Finally, we include year-effects and, in unreported results available upon request, consider two alternative specifications with firm fixed effects.

Panel A of Table 3 summarizes the results, with Panel A.1 reporting results of OLS regressions and Panel A.2 reporting results of the propensity-score matched sample analysis. Robust to our two primary talent proxies, we find a positive and highly significant coefficient on CEO talent. In the entire sample, we estimate a first-year elasticity of CEO pay to talent of about 0.5. That is, moving from the least to the most talented CEO is associated with a 50 percent increase in total pay. The positive relation between total pay and talent is much stronger for external hires. Among this group of outside appointments, going from the least to the most talented CEO leads to almost twice the total pay package. Finally, the positive relation is robust to addressing selection issues using a propensity-score matched sample.

We view these first-year elasticities as important and to the best of our knowledge, first evidence of a significant skill premium in CEO pay. Moreover, an advantage of these estimates is that first-year pay is a close proxy for contractual pay and is a natural empirical counterpart for our model of competitive assignment. However, these elasticities are likely best interpreted as short-term elasticities and a legitimate concern is whether they hold up in the long-run. To test whether there is a long-term relation between CEO pay and talent, we estimate long-term elasticities using regression (2) for the entire ExecuComp sample.[14] To minimize the risk that our estimates capture spurious cross-sectional correlation, we include firm fixed-effects. Panel B of Table 3 reports the results. In the entire sample, we estimate a long-run elasticity of CEO pay to talent of about 0.29, implying that a move from the least to the most talented CEO is associated with a nearly 30% increase in total pay. The positive relation between total pay and talent is again much stronger for external hires. The fact that long-run elasticities are smaller than short-run ones is consistent with depreciation over time in the quality of the CEO-firm match. The magnitude of our estimated elasticity lends empirical support to using values of approximately 1/3 to parametrize the empirical distribution of CEO talent, as done based on theoretical arguments in Gabaix and Landier (2008)'s calibration. In unreported results, we use an approach analogous to theirs and fit an empirical Pareto distribution to our talent proxies. We derive estimates of the Pareto exponent that range between 0.28 and 0.33.

Table 4 details some salient cross-sectional features of the talent premium in pay. Panels A.1 and B.1 replicate the analysis with a split of CEO talent, where we now estimate equation (2)

[14] Here we also control for CEO tenure.

separately in sub-samples based on different levels of the talent distribution of the incoming CEO. As our model predicts, irrespective of the talent proxy used and of whether we consider short-run (appointment sample in Panel A.1) or long-run (entire ExecuComp in Panel B.1) elasticities, we find larger elasticities of CEO pay to talent at the very top of the distribution of talent. In fact, we estimate coefficients up to five (long-run) or ten (short-run) times larger going from the top 50% to the top 5% of the distribution of CEO talent. In addition, the talent premium is significantly larger for larger firms and this result holds irrespective of whether we consider short-run (appointment sample in Panel A.2) or long-run (entire ExecuComp in Panel B.2) elasticities.

Our final set of results related to Prediction T1 presents evidence supporting a talent interpretation of previous results in the literature. In particular, Panel A of Table 5 addresses the debate that ensued after Gabaix and Landier (2008) with their evidence of a robust size effect. Their model (and ours) makes this prediction due to the fact that talented CEOs are efficiently matched to larger firms, thereby maximizing their impact. However, there remains substantial controversy on how to interpret the size effect. For example, Frydman and Saks (2010) argue that the size effect is a largely cross-sectional result, as estimates of the effect that include firm fixed effects are substantially lower.

To investigate whether CEO talent is likely to be an important determinant of the size effect, we implement the following. The intuition underlying the test is simple: if the size effect is driven by CEO talent due to positive assortative matching, then the part of firm size that is systematically related to talent should be more strongly related to CEO pay than the part of firm size that is unrelated to talent. Panel A of Table 5 reports the results. We run a first stage regression of firm size on our CEO talent proxies (results for *Press* are reported; *Fast-Track Career* delivers similar results) and use the estimated residual from this first stage regression to decompose firm size into a component that is systematically related to CEO talent and a component that is orthogonal to it. We then use these two components as explanatory variables in a standard CEO pay regression (which includes firm fixed-effects). As shown in Panel A, the evidence supports a strong version of our hypothesis, as only the component of firm size that is systematically related to CEO talent (Predicted Size) generates a size effect in pay. Moreover, when we use assets as a measure of size, we obtain estimates of the size effect that are close to those originally documented in Gabaix and Landier (2008).

Panel B of Table 5 addresses another important debate which followed the original finding by Bertrand and Schoar (2003) that executive fixed effects or styles are both a significant determinant and explain a large fraction of the total variation of CEO pay. An important question is whether and to what extent managerial styles reflect CEO talent. To make progress on this question, we run executive fixed effect regressions on total pay (R^2 of about 75%), estimate the implied CEO fixed effects, and ask how much of the variation in CEO pay fixed effects we can explain with our CEO talent proxies. Panel B of Table 5 reveals that the answer is quite a bit, up to 30%. This result is most striking given that it is well known that standard biographical CEO characteristics, such as age and having an MBA have relatively limited explanatory power (only 0.3% incremental R^2 in our case).

Identification and Robustness Panel A of Table 6 shows that, consistent with measurement error leading to attenuation, both our T-Factor and GMM estimates of the pay-talent sensitivity tend to be somewhat larger than their OLS counterparts. When we address potential biases due to measurement error, our estimated sensitivity ranges between 0.29 and 0.35. Moreover, our convexity findings are robust to addressing measurement error. Panel B of Table 6 verifies that our estimated elasticities are also robust to including controls for governance mechanisms, as well as using *Good Press* as an alternative talent proxy. In particular, we control for external corporate governance using the GIM index of Gompers, Ishii, and Metrick (2003), and for internal governance using the size and degree of independence of the firm's board of directors. Our estimates are little affected by the inclusion of governance controls. Moreover, we fail to find evidence that governance variables have predictive power for CEO pay, with the slight exception of the GIM index.

In summary, we document robust evidence of a first-year elasticity of CEO pay to talent of about 0.5 and an overall elasticity of about 0.3, with both elasticities being higher among CEOs appointed from outside the firm. Our estimated elasticities are also higher at the top of the distribution of CEO talent, consistent with pay being a convex function of talent. Our estimates are robust to addressing measurement error, selection issues, and controlling for firm governance. Finally, we also present evidence supporting a talent interpretation of previous findings of pay for size (Gabaix and Landier (2008)) and pay for style (Bertrand and Schoar (2003)).

4.3 Analysis of CEO Appointments and Firm Performance

In this section, we derive empirical estimates of the impact of CEO talent on firm performance. Based on Prediction T2 from our model, we expect talented CEOs to have a positive impact on firm performance. A key distinguishing feature of our research setting is that it allows us to derive *quantitative* estimates of CEO impact. To tee this up, we first examine announcement and long-term abnormal stock returns around CEO successions. Investor perception is an informative and intuitive indicator of anticipated future performance conditional on all relevant information (see Warner, Watts, and Wruck (1988), Denis and Denis (1995), Huson, Malatesta, and Parrino (2004), and Perez-Gonzalez (2006)). Thus, we expect to see positive abnormal returns for talented CEOs at the time of the hiring announcement relative to their less talented peers. Panel A of Table 7 shows evidence that indeed investors expect a positive impact of talented CEO on performance. In particular, we present mean abnormal returns for five-day event windows around CEO succession announcements for all successions, and for successions when management changes are broken down by internal and external successions, and by good and bad prior-year industry-adjusted firm performance.[15]

The first column of Table 7 shows that on average, CEO successions are associated with a statistically significant (albeit small at 0.7%) abnormal return and successions of talented CEOs carry a statistically significant 1.5% excess return. The positive average return is in contrast to previous studies tend to find insignificant returns on average for earlier time periods (e.g., Huson, Malatesta, and Parrino (2004)). However, this difference is easily explained by the fact that internal appointments, which constitute a larger fraction of the total sample in earlier studies, are associated with abnormal returns that are not different from zero. By contrast, investors react positively to appointments of outside CEOs, which constitute a larger fraction of our sample and on average are associated with a significant 2.7% return. We see an even larger 3.3% return after bad prior performance, and a full 5.5% return if such an external hire is more talented. For the overall sample and especially among outside CEOs, the third column of Table 7 shows that the positive stock market reaction is driven by appointments of talented CEOs (upper quartile of *Press*

[15] Abnormal returns are calculated using the capital asset pricing model (CAPM) and standard event study methodology (see MacKinlay (1997) for a detailed review). We use the market model and CRSP equally-weighted return as the market return to estimate the market model parameters from event day -210 to event day -11.

and *Fast-Track Career*), which in the entire sample carry a 1.5% return. While the differences in mean returns between less versus more talented CEOs are all statistically significant, using the Mann-Whitney test we can reject equality of the distributions of returns only for outside successions.

A potential concern with short-term announcement returns is that, as emphasized by Khurana (2002), an anticipated positive impact of CEO talent does not necessarily imply a realized positive impact. It is possible that investors (and board of directors themselves) might irrationally overreact to the appointment of a popular and charismatic CEO and thus lead to a positive stock market reaction that is unrelated to CEO talent. Panels B-C of Table 7 partially addresses the overreaction concern by looking at long-term abnormal returns as these are more likely to capture subsequent information on CEO talent that is revealed slowly over time. As it is standard in the literature (see, for example, Huson, Malatesta, and Parrino (2004) and Perez-Gonzalez (2006)), we calculate monthly calendar-time portfolio returns for portfolios that buy shares in firms subject to a CEO transition within the following 36 months, as well as for portfolios invested in firms that underwent a succession in the preceding 36 months. We estimate abnormal returns using the four-factor market-model (see Fama and French (1993) and Jegadeesh and Titman (1993)).

Panels B and C of Table 7 report the resulting average abnormal returns for the CEO talen proxies of *Press* and *Fast-Track Career,* respectively.[16] Before CEO transitions, firms did not earn significant abnormal returns and actually the sub-sample of firms that appointed outside CEOs earned negative abnormal returns. These findings are in line with the existing literature. By contrast, the portfolio of post-CEO transition firms earned large and statistically significant abnormal returns of about 7% on average, significant at the five-percent level. Consistent with our previous finding of a more positive short-term announcement return for talented CEOs, portfolios

[16] Abnormal returns are estimated using calendar-time portfolio regressions. In each month t, all firms subject to a CEO succession within the next (prior) 36 months are included in that month's pre (post) transition portfolio. Mean portfolio returns, rp_t are used to estimate abnormal returns using the following regression: $(rp_t - rf_t) = \alpha + \beta_1(rm_t - rf_t) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \varepsilon_t$, where rf_t is the risk-free rate calculated using one-month Treasury-bill rates, $(rm_t - rf_t)$ is the market risk premium, calculated as the difference between the value-weighted return on all NYSE, AMEX, and NASDAQ stocks from CRSP less the risk-free rate, SMB_t is the return difference between portfolios of small stocks and big stocks, HML_t is the return difference between portfolios of high book-to-market stocks and low book-to-market stocks, and UMD_t is the return difference between portfolios of high prior-return stocks and low prior-return stocks. The reported abnormal returns are the intercept (α) estimated from the regression above. The implied one-year abnormal return is calculated as$[(1+\alpha)^{12}-1]$. Data on the factors were obtained from Ken French's website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french.

of firms that appoint talented CEOs earn higher abnormal returns after transitions relative to firms that appoint less talented CEOs (upper versus lower quartile of Press and Fast-Track Career). Implicit one-year excess returns are, depending on the talent proxy used, between 8% and 9% for talented CEOs versus 6% to 7% for less talented CEOs. Thus, there is about 1.5% return premium earned by investors of firms that appoint talented CEOs. This return premium is even larger in the sub-sample of external appointments (about 5%).

Overall, both short-term and long-term abnormal returns support the view that talented CEOs are more likely to have a positive impact on firm performance. However, these results are only suggestive and do not establish that there is indeed a positive impact of CEO talent on firm performance. The results might also be driven by anticipation effects, such as the fact that appointment decisions by themselves reveal information related to firms' prospects, irrespective of CEO talent. Moreover, lower significance might also be driven by the fact that some transitions were expected and already incorporated into prices. In order to address these concerns, we pursue an alternative strategy based on estimating equation (2) and using changes in operating performance as our dependent variable. Thus, our strategy is to identify the impact of CEO talent on performance by testing whether there are significant differences in firm performance before and after CEO successions for firms that appoint talented CEOs versus firms appointing relatively less talented CEOs.

The advantage of our approach, which is akin to difference-in-differences, is that we can estimate CEO impact in a setting that explicitly controls for time-invariant differences in firm characteristics that may affect performance (see Perez-Gonzalez (2006) for a similar approach in the context of family successions). We use two different measures of operating performance which are standard in the CEO turnover literature: (1) operating return on assets (OROA), and (2) net income to assets (ROA). While effective at addressing anticipation concerns, we acknowledge that one potential limitation of these measures is that they only capture current profitability. Thus, we also report results for the difference between these measures three years after and one year prior to the CEO's appointment. We consider industry-adjusted OROA and ROA, as well as prior performance-adjusted ROA to address potential concerns with the results being driven by industry-wide trends or firm-level mean-reversion,[17] and propensity-score matched ROA to

[17] To construct control-group adjusted performance,we follow the Barber and Lyon (1996) matching method.

address selection concerns.

Before presenting the results of our formal tests, we plot univariate evidence in Figure 2. The figure plots sample median OROA over the period from four years before to four years after CEO succession for our entire sample of successions (denoted *All*) and for the sub-sample of outside successions (denoted *Outsider*). In each of the two samples, the dotted lines represent median OROA, the solid bold lines represent median OROA for talented CEOs, and the solid thin lines represent median OROA for relatively less talented CEOs. Talented and untalented CEOs, respectively, are drawn from the upper and lower quartiles of the distribution of *Press*.[18] The OROA "smile" in the figure suggests that, on average, CEO turnover follows a period of deteriorating firm performance which tends to be reversed subsequently. This pattern is more pronounced for outside successions. In both cases, however, a striking feature that emerges is that the smile is an artifact of averaging out performance in a sample that pools *talented* CEOs together with relatively less talented ones. In fact, there is a pronounced OROA smile only among talented CEOs, who more than simply reverse prior underperformance. By contrast, the OROA smile turns into a smirk for less talented CEOs, who do not appear to be able to reverse the deteriorating performance.

The results reported in Panel A of Table 8 show that the positive impact of CEO talent on performance holds in a regression setting, where we estimate equation (2) using changes in the two measures of performance as dependent variables. On the right hand side, we rely on *Press* and *Fast-Track Career* as CEO talent proxies, firm size, the level of pre-transition operating performance (to control for performance persistence), a dummy for the status of the successor CEO as insider, and a dummy for forced successions. To facilitate an intuitive interpretation of the economic significance of results, we follow Milbourn (2003) and construct the CDFs of our talent proxies. Consistently across our two CEO talent proxies and the three different measure of adjusted performance, we estimate a statistically and economically significant impact of CEO talent, with estimates ranging from 2.7% to 4.5%. This range of estimates implies that replacing

In particular, each sample firm is matched to comparison firms with the same two-digit Compustat SIC code whose performance measures over the year before the turnover are within 10% of the sample firm's performance. Each sample firm's performance is adjusted by subtracting the median performance of its control group. We then calculate changes in adjusted performance.

[18]We uncover qualitatively similar results using *Fast-Trace Career* as our talent proxy, as well as when we estimating performance using OROS and ROA.

the CEO of median talent in our sample with the most talented CEOs would have a positive impact on firm performance between 1.3% and 2.3%. This estimate of CEO impact is in line with the 1.7% impact of CEO deaths in Bennedsen, Perez-Gonzalez, and Wolfenzon (2006).

We find a consistently larger (up to twice as large) impact of CEO talent in the sub-sample of outside successions. Controlling for CEO talent, we only find weak evidence that outside and forced successions lead to higher subsequent performance. Moreover, in unreported results available upon request, we find that short-term abnormal returns predict ex post changes in operating performance only for talented CEOs, suggesting that investors' expectations of a positive impact of CEOs are validated ex post. Of course, we cannot completely rule out the possibility that anticipation effects might be partially driving our stock-market results. Finally, Panel A.4 of Table 8 shows that the results are robust to using a propensity-score matching estimator that addresses the issue that there is endogenous sorting of talented CEOs.

Our finding of a significant positive impact of CEO talent opens the intriguing question of what it is exactly that talented CEOs manage to do better than their less talented peers. This question is related to the evidence in Bertrand and Schoar (2003) that there are significant differences in firm policies across CEOs. Thus, we next ask whether CEO talent has explanatory power for changes in firm policies around CEO successions. Panel B of Table 8 reports results that are aimed at answering this question. In particular, we now estimate equation (2) using the same set of controls as in the performance analysis with the addition of the lagged (pre-transition) level of the dependent variable in each regression. We consider a set of investment, financial, and organization firm policies analogous to the one studied in Bertrand and Schoar. Our results on the impact of CEO talent on firm decisions paint a picture that fits remarkably well with anecdotal accounts of talented CEOs serving as aggressive turnaround specialists. In particular, talented CEOs are more likely to cut investment and M&A expenditures and shed excess-capacity with respect to their less talented peers. Moreover, they are more likely to cut leverage and increase internal financing (cash). However, and perhaps not surprisingly, our estimates show that the stronger association is between CEO talent and firm operating decisions, as talented CEOs generate higher cash flows and pursue more aggressive (sales) growth strategies.

Identification and Robustness Panel A of Table 9 shows that, consistent with measurement error leading to attenuation, both our T-Factor and GMM estimates of the impact of CEO talent tend to be somewhat larger than their OLS counterparts. When we address potential biases due to measurement error, our estimates of the impact of CEO talent range between 1% and 3.6%. Panel B of Table 9 verifies that our estimates are robust to including controls for governance mechanisms. We again control for the GIM index and for the size and degree of independence of the firm's board of directors. Our estimates are little affected by the inclusion of governance controls. Moreover, we fail to find evidence that governance variables have predictive power for differential firm performance around CEO transitions.

In summary, we document robust evidence of a significant impact of CEO talent on firm performance, which is higher among CEOs appointed from outside the firm. Our estimates cannot be explained by temporary over-reaction or anticipation effects as they are derived using long-term measures of operating performance and are not likely to be driven by selection on observable size or pre-transition performance. Moreover, our estimates are robust to addressing measurement error, selection issues, and controlling for firm governance. Finally, we offer suggestive evidence that the impact of CEO talent is related to classical turnaround skills.

4.4 Analysis of CEO Turnover

In our final set of tests, we ask whether CEO talent has predictive power for the cross-sectional variation in another important outcome of the CEO labor market, the turnover-performance sensitivity. Based on Prediction T3 of our model, we expect this sensitivity to be higher at the top of the talent distribution.

Figure 3 presents simple univariate evidence. In particular, we plot the level of forced CEO turnover by year, by succession type, and by CEO talent. We use *Press* as our proxy for talent and classify as most talented those CEOs in the upper quartile (or decile) of the distribution of *Press* (*Fast-Track Career* yields analogous results). Both the time-variation and average forced CEO turnover in our sample (2.8%) are of similar magnitude to previous studies (see Warner, Watts, and Wruck (1988) and Jenter and Kanaan (2006)). The striking feature that emerges is that there is large cross-sectional heterogeneity in average forced turnover rates across CEOs with different levels of talent. Moreover, consistent with our talent-hypothesis, talented CEOs display higher rates of forced turnover. Especially among outside CEOs, these cross-sectional differences in forced turnover rates are pronounced: forced turnover rates for talented outside CEOs are about twice as high as the average (up to a 5% turnover rate). Moreover, they are particularly pronounced in periods of relatively high turnover (about 8% in 2002 compared to 4% on average).

To implement a formal test of whether the CEO job is riskier at the top, we run a standard cross-sectional probit regression:

$$Prob\left(Forced\ Turnover_{jt}\right) = \alpha + \beta_1 * Firm\ Return_{jt} + \beta_2 * Firm\ Return_{jt} * Talent_{jt} \quad (4)$$
$$+\beta_3 * Firm\ Return_{jt} * Controls_{jt} + \beta_4 * Talent_{jt} + \beta_5 * Controls_{jt} + \varepsilon_{jt}$$

where *Forced Turnover* is a dummy which equals one for any given firm j experiencing a forced CEO turnover in a given year t and $Controls$ includes firm size and CEO age and tenure. We present results for both a baseline specification where $Firm\ Return$ is simply a firm's annual stock market return, and a second specification where we decompose overall firm returns into a firm-specific and a (2-SIC) industry-wide part as in Jenter and Kanaan (2006).[19]

We proxy for $Talent$ using the cumulative distribution functions (CDFs) of Press and Fast-Track Career. Thus, we interact the empirical CDF of our talent proxies with the appropriate stock market return variable so that the estimated turnover-performance sensitivity is $\beta_1 + \beta_2 * CDF\left(Talent\right)$, where CDF is the empirical cumulative density of our CEO talent proxies. The range of coefficients is β_1 for CEO at the lowest level of the talent distribution and $\beta_1 + \beta_2$ for the most talented CEOs. The coefficients for the median talent CEO is $\beta_1 + 0.5 * \beta_2$. If our talent hypothesis is descriptive of the data, we expect a stronger turnover-performance sensitivity for talented CEOs, that is, we expect negative coefficients on the interactions between performance and CEO talent proxies. Specifically, our null hypothesis is $\beta_2 < 0$.

Table 10 reports the results from our baseline regression (4), where $Talent$ is given by *Press* (Columns 1-2) and *Fast-Track Career* (Columns 3-4). The table reports the marginal changes

[19] In particular, industry performance benchmarks are calculated as equal-weighted (and value-weighted for robustness) average stock returns (Compustat/CRSP firms are our industry comparison group). We then decompose firm performance into a systematic and an idiosyncratic component by running the following cross-sectional regression: $r_{i,t-1} = \beta_0 + \beta_1 r_{industry,t-1} + \varepsilon_{i,t-1}$, where t is the fiscal year of CEO turnover and $r_{industry,t-1}$ is industry stock return. We run this regression using annual returns for all sample firms. The estimated value from the regression, $\widehat{\beta}_0 + \widehat{\beta}_1 r_{industry,t-1}$, is our second measure of industry performance, and the estimated residual, $\widehat{\varepsilon}_{i,t-1}$, is our proxy for firm-specific performance.

in the probability of forced CEO turnover implied by the probit coefficient estimates that result from a unit change in the explanatory variables. Robustly across our two talent proxies and our two measures of stock market performance, the interaction coefficient of talent and performance is negative, consistent with our prediction T3 that the turnover-performance sensitivity increases with CEO talent. In particular, columns 1 and 3 report results for firm stock market returns (not industry-adjusted): for *Press* (Column 1), the coefficient estimate of the interaction between CEO talent and firm performance is significant at -0.035.

To evaluate the economic significance of this result, it is useful to consider what it implies for the CEO of median talent. For the median CEO, the sensitivity of forced turnover to performance is about 1.5%. That is, a one standard deviation (40%) decline in performance increases the likelihood of forced turnover by about 0.6% (this sensitivity is computed by evaluating the coefficients of the regression at median values of the CDFs of Press). This effect is economically significant, given that the unconditional probability of CEO dismissal in our sample is relatively low at 2.8%. The relatively low frequency of CEO dismissals is consistent with the prior literature. The median sensitivity is somewhat greater than those reported in Murphy (1999) between 1970 and 1995 and its significance is in contrast with his finding that turnover is not related to performance in the first half of the 1990s.

To see how the turnover-performance sensitivity varies across CEO with different levels of talent, we keep all controls at median values, and vary our CEO talent proxy (Press) to assume minimum and maximum values. The sensitivity of forced CEO turnover to performance is not statistically significantly different from zero for a CEO with minimum Press, while it is 3.5% for a CEO with maximum Press. The range of turnover-performance values in the cross-section is reasonably large: a decline in firm performance from its 75th to its 25th percentile leaves the likelihood of forced turnover unchanged for the least talented CEOs, while increasing it by 50% from 2.8% to 4.2% for the most talented CEOs. Moreover, this result holds not only for extreme values of CEO talent, but also for reasonable talent cutoffs. In particular, CEOs in the top quartile of the distribution of talent are twice as likely to be forced out after bad performance than CEOs in the bottom quartile (choosing the median as cutoffs leads to qualitatively similar results) of the talent distribution. These results suggest that there are economically significant differences in performance pressure across CEOs with different levels of talent. Moving to the third and fourth columns, there are two noteworthy results. First, the interaction coefficient of talent and performance is relatively stable across alternative measures of CEO talent and firm performance. Second, while for Press we find a statistically significant interaction of CEO talent and industry performance, this is not the case for Fast-Track Career.

In summary, the evidence presented in Table 10 is consistent with our theory that performance pressure is optimally higher for talented CEOs. To lend further support to our theory, we test whether the turnover-performance relation is also different for CEOs who have been appointed from inside the firm versus CEOs hired from the external labor market. If the status of outsider captures additional aspects of CEO talent which are not captured by our proxies, we would expect that forced turnover should be more sensitive to firm performance for outside CEOs. Thus, we run our baseline regression (4) separately for talented CEOs (upper-quartile of the distribution of talent) that are insiders and outsiders.

The results are reported in Table 11 in Panels A and B. Robust across our two main talent proxies and our two measure of stock market performance, pressure is higher for outside CEOs. In particular, the first column in Panel A shows that the sensitivity of forced CEO turnover to firm performance for talented outside CEOs is as high as 6% and significant. The magnitude of this effect is impressive since it is about four times as large as its counterpart for CEOs of median talent. Thus, a one standard deviation (40%) decline in performance increases the likelihood of forced turnover by about 0.6% for the median CEO, but increases by about 2.5% for a talented outside CEO, which is double the unconditional probability of forced turnover in our full sample.

Identification and Robustness Panel A of Table 12 shows that, consistent with attenuation, both our T-Factor and GMM[20] estimates of (4) that address measurement error tend to be more precise and larger than their OLS counterparts, especially with respect to Fast-Track Career. However, both sets of estimates are close in magnitude to the ones discussed with respect to Press. Panel B of Table 12 report results of a battery of robustness tests for our analysis of forced CEO turnovers. In particular, we verify that our results are driven by forced rather than voluntary CEO turnovers which bolsters our interpretation that they are related to the value of CEO effort. Moreover, we verify that our results are robust to using value-weighted rather than

[20] Our GMM estimates are for a linear probability model.

equally-weighted returns to construct our industry benchmarks and Good Press rather than Press as a CEO talent proxy.

In our last set of robustness checks, we include our controls for external and internal governance mechanisms. Our results are unaffected. Moreover, we fail to find evidence that governance variables have predictive power for CEO turnover in our sample. Finally, in unreported results available upon request, we verify that all our results (pay, appointments, and turnover) are robust to the following alternative specifications: (1) measuring firm size by the market value of equity; (2) adding controls for cash flow and return volatility; (3) excluding firm in the following industries: defense, transportation, utility, and financial services; (4) controlling for firm dual-class status.

5 Conclusion

CEO successions are important instances when managerial talent is in play. We argue that focusing on the labor market for CEOs at these critical decision points can augment our understanding of the role of managerial talent as a determinant of executive pay and firm performance. To that end, using a large, hand-collected sample of recent CEO turnovers, we find robust evidence that talented CEOs display significantly higher turnover rates, and their appointments lead to significantly higher pay and greater firm performance. We show that these results are robust to controlling for other CEO and firm characteristics, as well as to corporate governance mechanisms. Moreover, they are stronger for CEOs hired from outside the firm, which is again supportive of the importance of the market for CEO talent we suggest here. In sum, our work represents the first direct estimates of the returns to CEO talent for both shareholders and the executives themselves.

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6 Appendix A: Details on the Article-Based Proxies

To construct our Press and Good Press proxies, we include the following publications in our search:

BusinessWeek, Dow Jones News Service, Financial Times, Forbes, Fortune, International Herald Tribune, Los Angeles Times, The Economist, The New York Times, The Wall Street Journal, The Wall Street Journal Asia, The Wall Street Journal Europe, The Washington Post, USA Today.

Our Good Press proxy excludes from the total count articles containing the following keywords:

scandal or investigat* or (cut w/2 jobs) or resign* or (force* w/3 quit) or dismiss* or demote* or demotion or accuse* or critici* or allegation* or indict* or arrest* or guilty or fraud or litigation or abrasive or excessive pay or overpaid or perquisites or (force* w/3 step down) or under fire or under scrutiny or under pressure or law suit or class action or in trouble.

7 Appendix B: Factor Analysis and Measurement Error

Factor analysis allows us to combine our various proxies of CEO talent to obtain a more reliable measure of the latent CEO talent variable (our discussion is based on Black and Smith (2006), but see Harman (1976) for details on factor analysis). Formally, suppose that across all CEOs $E\left(CEO\ Talent_{it}^{*}\right) = 0$, which is a harmless normalization that keeps notation simple. Let $T = (T_1, ..., T_k)$ be a K-vector of noisy signals of CEO talent, such that for a CEO with talent $CEO\ Talent_{it}^{*}$, the value of each signal is $T_{ki}= CEO\ Talent_{i}^{*}+u_{ki}$ with $E\left(T_{ki}\right) = 0$, $E\left(u_{kit}^{2}\right) = \sigma_{k}^{2}$, $E\left(u_{kj}u_{kh}\right) = 0$, $\forall j \neq h$, $E\left(u_{kj}u_{lj}\right) = 0$, $\forall k \neq k$, and $E\left(CEO\ Talent_{it}^{*}u_{ki}\right) = 0$ and the time subscripts are omitted to save on notation. We construct a measure of CEO talent by taking a linear combination of the signals. Define $\widehat{T}= \sum_{k=1}^{K} \tau_k T_k$ (where there is no need for an intercept term because the expected value of $CEO\ Talent_{i}^{*}$ is normalized to zero). We select the τ_k's to minimize the expected squared distance between $\widehat{T}$ and $CEO\ Talent^{*}$, or

$$min_{\tau,...,\tau_k} E\left(CEO\ Talent^{*} - \widehat{T}\right)^2 .$$

The necessary conditions for minimization are

$$Var\,(CEO\ Talent^{*}) - \sum_{l=1}^{K} \tau_l Var\,(CEO\ Talent^{*}) - \tau_k \sigma_k^2 = 0, \qquad \forall k$$

or

$$1 - \sum_{l=1}^{K} \tau_l - \tau_k r_k = 0, \qquad \forall k$$

where $r_k = \sigma_k^2 / Var(CEO\ Talent^{*})$ is the noise-to-signal ratio. For $k = 1$ and $k = l$, we have that $\tau_l = \tau_1 \frac{r_1}{r_l}$. Thus, we may solve for τ_1 to obtain

$$\tau_1 = \frac{r_1^{-1}}{1 + \sum_{l=1}^{K} r_l^{-1}}.$$

The remaining τ's have similar formulae. Thus, τ_k decreases in the variance of the idiosyncratic error u_k, so that signals that more accurately reflect latent CEO talent receive more weight in the forecast.

8 Appendix C: Variable Definitions

The variables used in this paper are either hand-collected or extracted from four major data sources: EXECUCOMP, COMPUSTAT, CRSP, and IRRC. For each data item, we indicate the relevant source in square brackets. The specific variables used in the analysis are defined as follows:

CEO Talent Proxies:

- Press: the number of articles containing the CEO's name and company affiliation that appear in the major U.S. and global business newspapers in a calendar year. For the analysis of newly appointed CEO, we use the press count in the year prior to the transition. For the analysis of the entire ExecuComp sample, we use one-year-lagged count, which measured as of fiscal year end prior. We also construct Good Press, which is the difference between Press and Bad Press, where the latter is the count the number of articles containing the CEO's name, company affiliation, and any of the words with a negative connotation that appear in the major U.S. and global business newspapers in a calendar year. Our text search uses both the CEO's last name and company name. Appendix A contains the detailed list of newspapers used in our Factiva search as well as of the negative words used to construct Bad Press. [Factiva searches]

- Fast-Track Career: age at which an individual got his first CEO job. We use a cohort-adjusted version of this measure, where we divide our sample of CEOs into three age cohorts and define Fast-Track Career as the difference between age of the first CEO job and median first CEO job age in the age cohort. [Dun & Bradstreet Reference Book of Corporate Managements (various years); Standard & Poor's Register of Corporations, Directors and Executives; Marquis Who's Who in

Finance and Industry; Biography Resource Center by Thomson Gale; Lexis-Nexis, Factiva, and web searches]

- Selective College: dummy which equals one if the CEO has attended a "very competitive" or more selective undergraduate institution (top 189 institutions) based on Barron's (1980) rankings, and zero otherwise. [Dun & Bradstreet Reference Book of Corporate Managements (various years); Standard & Poor's Register of Corporations, Directors and Executives; Marquis Who's Who in Finance and Industry; Biography Resource Center by Thomson Gale; Lexis-Nexis, Factiva, and web searches]

- CEO Talent Factor: linear combination of Press, Fast-Track Career, and Selective College, with weights calculated using factor analysis for the entire ExecuComp sample. The values of the factor loading are as follows: 0.705 for Fast-Track Career, 0.667 for Press, and 0.297 for Selective College.

CEO Pay and Turnover:

- CEO pay: log total compensation (TDC1), which is defined as the sum of short-term compensation (salary and bonus) and long-term compensation (long-term incentive plans, restricted stock, and stock appreciation rights), deflated by CPI in 1990. [EXECUCOMP]

- Insider: dummy which equals zero when successor CEOs has been with their firms for one year or less at the time of their appointments, and one for all other new CEOs. [Factiva searches]

- Forced: dummy defined as in Parrino (1997). It equals one for CEO departures for which the press reports that the CEO has been fired, forced out, or retired/resigned due to policy differences or pressure. It equlas zero for departing CEOs above and including age 60. All departures for CEOs below age 60 are reviewed further and classified as forced if either the article does not report the reason as death, poor health, or the acceptance of another position (including the chairmanship of the board), or the article reports that the CEO is retiring, but does not announce the retirement at least six months before the succession. [Factiva searches]

Firm Performance:

- Announcement CARs for CEO Appoinments: cumulative abnormal return to the appointing firm's stock for trading days (-2, +2) relative to the date of the first article covering the news of a new CEO appointment. Abnormal returns are calculated using the capital asset pricing model (CAPM) and standard event study methodology (see MacKinlay (1997) for a detailed review). We use the market model and CRSP equally-weighted return as the market return to estimate the market model parameters from event day -210 to event day -11. [CRSP]

- Monthly Abnormal Returns for CEO Appoinments: Abnormal returns are estimated using calendar-time portfolio regressions. In each month t, all firms subject to a CEO succession within the next (prior) 36 months are included in that month's pre (post) transition portfolio. Mean portfolio returns, rp_t are used to estimate abnormal returns using the following regression: $(rp_t - rf_t) = \alpha + \beta_1(rm_t - rf_t) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \varepsilon_t$, where rf_t is the risk-free rate calculated using one-month Treasury-bill rates, $(rm_t - rf_t)$ is the market risk premium, calculated as the difference between the value-weighted return on all NYSE, AMEX, and NASDAQ stocks from CRSP less the risk-free rate, SMB_t is the return difference between portfolios of small stocks and big stocks, HML_t is the return difference between portfolios of high book-to-market stocks and low book-to-market stocks, and UMD_t is the return difference between portfolios of high prior-return stocks and low prior-return stocks. The reported abnormal returns are the intercept (α) estimated from the regression above. The implied one-year abnormal return is calculated as$[(1+\alpha)^{12}-1]$. Data on the factors were obtained from Ken French's website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french. [CRSP]

- ROA: ratio of operating income after depreciation (item 178) to book value of assets (item 6). Industry-adjusted ROA is calculated by subtracting the median of industry (2-digit SIC) and year ROA; the industry and prior-performance-adjusted ROA is calculated by subtracting median ROA of a control group of firms with similar industry-adjusted performance. The control groups are created by dividing COMPUSTAT firms into deciles based on year-prior ROA. The yearly median of the relevant group of firms (ex-event) is then used as the control for each firm-year observation (see Barber and Lyon (1996) for more details on the construction of the performance-adjusted variables) [COMPUSTAT]

- OROA: ratio of net income (item 172) to the book value of assets (item 6). Industry-adjusted OROA is calculated by subtracting the median of industry (2-digit SIC) and year OROA; the industry and prior-performance-adjusted OROA is calculated by subtracting median OROA of a control group of firms with similar industry-adjusted performance. The control groups are created by dividing COMPUSTAT firms into deciles based on year-prior OROA. The yearly median of the relevant group of firms (ex-event) is then used as the control for each firm-year observation (see Barber and Lyon (1996) for more details on the construction of the performance-adjusted variables). [COMPUSTAT]

Firm Controls and Policies:

- Size: log of the book value of assets (item 6), deflated by CPI in 1990. [COMPUSTAT]

- Market-to-book: market value of assets divided by the book value of assets (item 6), where the market value of assets equals the book value of assets plus the market value of common equity less the sum of the book value of common equity (item 60) and balance sheet deferred taxes (item 74). [COMPUSTAT]

- CAPEX: capital expenditures (item 128) over total assets at the beginning of the fiscal year (item 6). [COMPUSTAT]

- Number of Mergers: total number of takeover bid offers that are classified as mergers (successful and unsuccessful) and are announced in a given year. To be included in the count, we require that the merger is material to the acquirer, as standard in the literature (e.g., Masulis, Wang, and Xie (2006)), and limit the sample to deals whose value is at least \$1 million and at least 1% of the market value of the assets of the acquirer. Finally, we require that the target is a U.S. public or private firm, or a subsidiary, division, or branch of a U.S. firm and that the acquirer controls less than 50% of the shares of the target prior to the acquisition announcement and obtains 100% of the target shares as a result of the transaction. [SDC Platinum, U.S. Mergers and Acquisitions database]

- Number of Acquisitions: total number of takeover bid offers that are classified as acquisitions of assets, such as divisions, brunches, and product lines, (successful and unsuccessful) and are announced in a given year [SDC Platinum, U.S. Mergers and Acquisitions database]

- Number of Divestitures: total number of asset sales, such as sales of divisions, brunches, and product lines (successful and unsuccessful) that are announced in a given year [SDC Platinum, U.S. Mergers and Acquisitions database]

- Number of Diversifying Mergers: total number of takeover bid offers that are classified as mergers and involve a target in the same (3-SIC) industry (successful and unsuccessful) and are announced in a given year [SDC Platinum, U.S. Mergers and Acquisitions database]

- Leverage: long term debt (item 9) plus debt in current liabilities (item 34) over the book value of assets (item 6). [COMPUSTAT]

- Cash holdings: cash (item 1) over book value of assets (item 6). [COMPUSTAT]

- Dividend Payouts: dividends (item 21) over book value of assets (item 6). [COMPUSTAT]

- R&D: ratio of R&D expenditures (item 46, or 0 is missing) over book value of assets (item 6). [COMPUSTAT]

- Advertising: ratio of advertising expenditures (item 45, or 0 if missing) over book value of assets (item 6). [COMPUSTAT]

- Cash Flow: sum of earnings before extraordinary items (item 18) and depreciation (item 14) over book value of assets (item 6). [COMPUSTAT]

- Sales Growth: change in total sales (item 12) from year $t-1$ to t, scaled by book value of assets (item 6). [COMPUSTAT]

CEO Controls:

- CEO age: current age of the CEO (years since year of birth). [EXECUCOMP and Dun & Bradstreet Reference Book of Corporate Managements (various years); Standard & Poor's Register of Corporations, Directors and Executives; Marquis Who's Who in Finance and Industry; Biography Resource Center by Thomson Gale; Lexis-Nexis, Factiva, and web searches]

- CEO tenure: number of years in office as a CEO at the current firm. [EXECUCOMP and Dun & Bradstreet Reference Book of Corporate Managements (various years); Standard & Poor's Register of Corporations, Directors and Executives; Marquis Who's Who in Finance and Industry; Biography Resource Center by Thomson Gale; Lexis-Nexis, Factiva, and web searches]

- MBA: dummy which equals one if the CEO has an MBA degree. [Dun & Bradstreet Reference Book of Corporate Managements (various years); Standard & Poor's Register of Corporations, Directors and Executives; Marquis Who's Who in Finance and Industry; Biography Resource Center by Thomson Gale; Lexis-Nexis, Factiva, and web searches]

Governance Controls:

- GIM-index is an index of 24 antitakeover provisions from Gompers, Ishii, and Metrick (2003) [IRRC].
- Board size: total number of directors on the board in a given firm-year. [IRRC]
- Board independence: ratio of the number of independent directors to overall number of directors in a given firm-year. [IRRC]

Table 1: Sample Distribution by Year

The sample consists of 2,195 CEO successions between 1993 and 2005 for firms whose CEOs are covered by the ExecuComp database. This table presents an overview of the data set by showing the number and the frequency of forced, voluntary, and outside successions in the sample. Classification of each succession into forced or voluntary is based on the Factiva news database search following Parrino (1997). Successions are classified as internal when incoming CEOs were hired by the firm earlier than a year before succession, and external otherwise. Successions due to mergers and spin-offs are excluded.

Panel A: Sample Distribution by Year

Year	Number of successions	Number of forced successions	Number of outsiders appointed	Percent Firms with successions	Percent Firms with forced successions	Percent Firms with outsiders appointed
1993	110	22 (20.0%)	31 (28.1%)	9.6%	1.9%	2.7%
1994	125	31 (24.8%)	38 (30.4%)	8.1%	2.0%	2.5%
1995	158	32 (20.5%)	52 (32.9%)	10.0%	2.0%	3.3%
1996	155	45 (29.0%)	52 (33.5%)	9.5%	2.7%	3.1%
1997	185	46 (24.9%)	63 (34.1%)	11.1%	2.8%	3.8%
1998	186	49 (26.3%)	74 (39.8%)	10.8%	2.8%	4.2%
1999	224	67 (29.9%)	85 (38.0%)	12.5%	3.7%	4.7%
2000	244	59 (24.2%)	93 (38.1%)	13.6%	3.3%	5.2%
2001	173	49 (28.3%)	67 (38.7%)	10.4%	2.9%	4.0%
2002	195	68 (34.9%)	77 (39.5%)	11.8%	4.1%	4.6%
2003	166	40 (24.1%)	65 (34.3%)	9.9%	2.4%	3.9%
2004	152	37 (24.3%)	62 (40.8%)	9.8%	2.2%	3.7%
2005	122	30 (24.6%)	51 (41.8%)	9.5%	2.3%	3.9%
Total	2195	575 (26.2%)	810 (36.9%)	10.5%	2.8%	3.9%

Panel B: Annual Averages by Sub-Period

Period	Number of successions	Number of forced successions	Number of outsiders appointed	Percent Firms with successions	Percent Firms with forced successions	Percent Firms with outsiders appointed
1993-95	131	28 (21.8%)	40 (30.5%)	9.2%	2.0%	2.8%
1996-00	199	53 (26.9%)	73 (36.7%)	11.5%	3.1%	4.2%
2001-05	162	45 (27.2%)	64 (39.0%)	10.3%	2.8%	4.0%

Table 2: Summary Statistics

The sample consists of 2,195 CEO successions between 1993 and 2005 for firms whose CEOs are covered by the ExecuComp database. This table shows pairwise correlations of our CEO talent measures (Panel A) and summary statistics for our talent measures, firm characteristics and performance measures, and other CEO and firm controls by CEO succession type (Panel B). Classification of each succession into forced or voluntary is based on the Factiva news database search following Parrino (1997). Successions are classified as internal when incoming CEOs were hired by the firm earlier than a year before succession, and external otherwise. Press is the number of articles containing the CEO's name and company affiliation that appear in the major U.S. and global business newspapers in a calendar year. Good Press is constructed as Press, using nonnegative press coverage only. Fast-Track Career is the age of first CEO job. A CEO is classified as having attended a selective college when he or she was reported to have attended a "very competitive" undergraduate institution or better using Barron's (1980) rankings, and less selective college, otherwise. MBA is a binary variable that takes the value of one if the CEO has an MBA degree.

Panel A: CEO Talent Variables: Pairwise Correlations

	Press	Good Press	Fast-Track Career	College Selectivity
1. All Successions [N=2,195]				
Press	1.000			
Good Press	0.901***	1.000		
Fast-Track Career	0.141***	0.171***	1.000	
College Selectivity	0.071***	0.095***	0.033*	1.000
2. Outside Successions [N=810]				
Press	1.000			
Good Press	0.920***	1.000		
Fast-Track Career	0.176***	0.206***	1.000	
College Selectivity	0.089**	0.072**	0.022*	1.000
3. Outside Successions, Top Quartile Press [N=202]				
Press	1.000			
Good Press	0.885***	1.000		
Fast-Track Career	0.343***	0.405***	1.000	
College Selectivity	0.131**	0.186**	0.089*	1.000
4. All ExecuComp [N=20,904]				
Press	1.000			
Good Press	0.892***	1.000		
Fast-Track Career	0.103***	0.141***	1.000	
College Selectivity	0.063**	0.068**	0.029*	1.000

Panel B: CEO Talent and Other CEO Characteristics by Succession Type

Variable	All N=2195	Type of Succession: Forced N=581	Outside N=810	Inside N=1385
B.1: Outgoing CEO				
Talent Proxies				
Press	7.2	7.7	6	7.4
Good Press	5.2	5.8	4.9	5.8
Fast-Track Career (years)	49	46	48	49
College Selectivity	65%	64%	64%	67%
Other CEO Characteristics				
MBA	26%	28%	27%	25%
Age	61	54	59	61
Tenure	7.7	4.8	6	8
B.2: Successor CEO				
Talent Proxies				
Press	7.9	10.8	9.1	6.9
Good Press	5.2	6.5	7	5.2
Fast-Track Career (years)	49	45	48	50
College Selectivity	63%	64%	63%	62%
Other CEO Characteristics				
MBA	33%	33%	37%	32%
Age	54	54	54	54
CEO Pay				
Total CEO Pay (log tdc1, $000)	7.8	7.8	7.9	7.6
CEO Share Ownership (%)	0.8%	0.9%	0.5%	0.8%
B.3: Firm Variables (year prior to transition)				
Size (log total assets, $mil)	7.4	7.3	7.1	7.6
Firm Stock Return	-14.1%	-28.3%	-21.4%	-10.1%
Industry Stock Return (EW)	13.9%	13.0%	14.7%	13.4%
Industry Adjusted OROA	0.014	-0.041	-0.043	0.024
Industry Adjusted OROS	0.017	-0.043	-0.024	0.020
Industry Adjusted ROA	0.014	-0.022	-0.015	0.023
GIM index	9	9	9	9
Board Size	9	9	9	9
Board Independence	65%	64%	66%	64%

Table 3: Pay for CEO Talent

This table reports pooled OLS regression results for the determinants of total CEO pay from 1993 to 2005 for newly appointed CEOs (Panel A.1) and all CEOs in ExecuComp (Panel B). Panel A.2 reports results of a propensity-score matching estimator. The dependent variable is the logarithm of total pay (tdc1). CEO Talent is proxied by Press and Fast-Track Career. High CEO Talent is a dummy for the top quartile of the distribution of the talent proxies. Variable definitions are in Appendix C. Coefficients are reported as marginal effects. Variation across time is controlled for by including year fixed effects, and variation across industries is controlled for by including industry fixed effects with industry defined by two-digit SIC code (coefficient estimates are suppressed). In addition, several variables that have been shown in previous research to affect total CEO pay are included as controls. Standard errors are robust to heteroskedasticity. Levels of significance are denoted by ***, **, and * for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: New CEOs Only

	Press			Fast-Track Career		
—	All	Internal Only	External Only	All	Internal Only	External Only
Panel A.1: OLS						
CEO Talent	0.544***	0.432***	0.893***	0.494**	0.261	0.963**
	(0.089)	(0.104)	(0.180)	(0.205)	(0.224)	(0.429)
Performance_{t-1}	0.000	0.005	-0.332***	-0.037	0.076	-0.431***
	(0.001)	(0.004)	(0.012)	(0.048)	(0.053)	(0.112)
Size	0.309***	0.287***	0.335***	0.428***	0.426***	0.452***
	(0.017)	(0.020)	(0.028)	(0.015)	(0.017)	(0.027)
CEO Age	-0.013***	-0.009	-0.017**	-0.018**	-0.005	-0.041***
	(0.005)	(0.006)	(0.007)	(0.007)	(0.008)	(0.014)
Insider	-0.356***			-0.448***		
	(0.059)			(0.015)		
Forced Succession	0.056	-0.127	0.283***	0.160**	0.049	0.263**
	(0.082)	(0.127)	(0.102)	(0.064)	(0.078)	(0.108)
R^2	32.5%	28.2%	40.6%	42.8%	48.1%	35.2%
Observations	2122	1319	803	1958	1247	711
Panel A.2: Propensity Score						
High CEO Talent	0.676***	0.551***	0.833***	0.380**	0.297**	0.899**
	(0.085)	(0.109)	(0.148)	(0.121)	(0.139)	(0.382)

Panel B: All CEOs (ExecuComp)

	Press			Fast-Track Career		
—	All	Internal Only	External Only	All	Internal Only	External Only
CEO Talent	0.288***	0.243***	0.380***	0.287***	0.149	0.492**
	(0.055)	(0.054)	(0.122)	(0.088)	(0.114)	(0.275)
Performance_{t-1}	0.233***	0.287***	0.177***	0.251***	0.289***	0.173***
	(0.020)	(0.023)	(0.034)	(0.018)	(0.023)	(0.034)
Size	0.410***	0.407***	0.413***	0.251***	0.430***	0.450***
	(0.010)	(0.012)	(0.019)	(0.017)	(0.012)	(0.019)
CEO Age	0.000	0.005*	-0.002	0.008**	-0.001	-0.019**
	(0.003)	(0.003)	(0.007)	(0.003)	(0.006)	(0.008)
Insider	-0.153***			-0.170***		
	(0.044)			(0.028)		
R^2	44.0%	53.2%	33.7%	43.4%	52.1%	33.3%
Observations	18841	13967	4874	18232	13616	4616

Table 4: CEO Pay and Talent: Convexity in CEO Talent and Complementarity with Firm Size

This table reports pooled OLS regression results for the determinants of total CEO pay from 1993 to 2005 for newly appointed CEOs (Panel A) and all CEOs in ExecuComp (Panel B). The dependent variable is the logarithm of total pay (tdc1). CEO Talent is proxied by Press and Fast-Track Career. Variable definitions are in Appendix C. Coefficients are reported as marginal effects. Variation across time is controlled for by including year fixed effects, and variation across industries is controlled for by including industry fixed effects with industry defined by two-digit SIC code (coefficient estimates are suppressed). In addition, fim-level controls are as in Table 3 (coefficients omitted for brevity). Standard errors are robust to heteroskedasticity. Levels of significance are denoted by ***, **, and * for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: New CEOs Only

A.1: By CEO Talent

	Press				Fast- Career Track			
Variable	50% to Top 25%	Top 25%	Top 10%	Top 5%	50% to Top 25%	Top 25%	Top 10%	Top 5%
CEO Talent	2.138***	4.278***	7.880***	25.009**	0.668***	1.160**	4.457**	13.540**
	(0.586)	(1.224)	(2.934)	(11.753)	(0.283)	(0.553)	(1.894)	(6.036)
R^2	30.2%	23.7%	21.4%	21.0%	54.5%	55.0%	62.5%	74.7%
Observations	580	669	275	140	507	491	206	105

A.2: By Firm Size

	Size quantile is				Size quantile is			
Variable	bottom 25%	below median	above median	top 25%	bottom 25%	below median	above median	top 25%
CEO Talent	0.261	0.352**	0.577***	1.242***	0.200	0.281*	0.544***	1.115***
	(0.231)	(0.143)	(0.154)	(0.184)	(0.216)	(0.166)	(0.199)	(0.400)
R^2	31.2%	35.7%	38.6%	36.0%	30.5%	26.7%	43.9%	42.0%
Observations	600	1,388	1,406	596	571	1,319	1,308	494

Panel B: All CEOs (ExecuComp)

B.1: By CEO Talent

	Press				Fast- Career Track			
Variable	50% to Top 25%	Top 25%	Top 10%	Top 5%	50% to Top 25%	Top 25%	Top 10%	Top 5%
CEO Talent	0.692***	1.676***	5.515**	31.694**	0.541***	1.507**	6.496**	14.762**
	(0.218)	(0.421)	(2.734)	(15.350)	(0.163)	(0.665)	(2.986)	(6.896)
R^2	38.8%	34.4%	32.1%	33.2%	46.2%	43.0%	38.8%	38.8%
Observations	4625	4857	1667	844	4552	4628	1621	798

B.2: By Firm Size

	Size quantile is				Size quantile is			
Variable	bottom 25%	below median	above median	top 25%	bottom 25%	below median	above median	top 25%
CEO Talent	0.176*	0.196***	0.507***	0.796***	0.202	0.233**	0.319***	0.595***
	(0.086)	(0.055)	(0.064)	(0.076)	(0.169)	(0.093)	(0.064)	(0.098)
R^2	29.4%	37.9%	36.5%	37.5%	34.5%	35.6%	39.5%	39.9%
Observations	4037	7148	7256	4664	3773	6156	7045	3987

Table 5: Pay for Size and Pay for Style: The Role of CEO Talent

This table reports pooled OLS regression results for the determinants of total CEO pay from 1993 to 2005. In Panel A (Pay for Size), the dependent variable is the logarithm of total pay (tdc1). In Panel B (Pay for Style), the dependent variable is the executive fixed-effect of logarithm of total pay (tdc1). Variable definitions are in Appendix C. Variation across time is controlled for by including year fixed effects, and variation across industries is controlled for by including industry fixed effects with industry defined by two-digit SIC code (coefficient estimates are suppressed). In addition, several variables that have been shown in previous research to affect total CEO pay are included as controls. Standard errors are robust to heteroskedasticity. Levels of significance are denoted by ***, **, and * for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Pay for Size

	All CEOs (ExecuComp), S&P 500 Only	
Variable	Size is Assets	Size is Stock Market Value
Predicted Size	0.338**	0.403***
	(0.157)	(0.151)
Residual Size	0.093	0.163*
	(0.083)	(0.096)
Performance_{t-1}	0.171***	0.128***
	(0.049)	(0.044)
CEO Age	-0.007	-0.165
	(0.005)	(0.187)
CEO Tenure	0.228**	0.222*
	(0.091)	(0.131)
R^2	59.3%	59.7%
Observations	3725	3726

Panel B: Pay for Style

Variable	New CEOs				All CEOs (ExecuComp)			
Press	0.422***	0.413***	0.410***	0.409***	0.301***	0.357***	0.394***	0.394***
	(0.011)	(0.012)	(0.012)	(0.012)	(0.013)	(0.013)	(0.014)	(0.014)
Fast-Track Career		0.147**	0.150**	0.149**		0.209***	0.215***	0.214***
		(0.035)	(0.065)	(0.065)		(0.068)	(0.070)	(0.070)
Selective College			0.102***	0.093***			0.072**	0.063**
			(0.030)	(0.030)			(0.030)	(0.031)
MBA				0.060**				0.035**
				(0.031)				(0.032)
CEO Age				0.009***				0.012***
				(0.003)				(0.003)
R^2	20.2%	29.6%	29.9%	30.2%	18.0%	27.1%	27.3%	28.0%
Observations	2195	2195	2195	2195	4594	3583	3583	3583

Table 6: CEO Pay Analysis: Identification and Robustness

This table reports pooled OLS regression results for the determinants of the logarithm of total pay from 1993 to 2005 for all CEOs in ExecuComp (Panel B). The dependent variable is the logarithm of total pay (tdc1). In Panel A (Identification), CEO Talent is proxied by a factor extracted using principal component analysis from Press, Fast-Track Career, and Selective College. GMM columns indicate results for optimally weighted GMM estimates where Fast-Track and Selective College are used as instruments for Press. In Panel B (Robustness), CEO Talent is proxies by Press and Fast-Track Career. Variable definitions are in Appendix C. Coefficients are reported as marginal effects. Variation across time is controlled for by including year fixed effects, and variation across industries is controlled for by including industry fixed effects with industry defined by two-digit SIC code (coefficient estimates are suppressed). In addition, several variables that have been shown in previous research to affect total CEO pay are included as controls. Panel B includes additional governance controls. Standard errors are robust to heteroskedasticity. Levels of significance are denoted by ***, **, and * for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Identification (All CEOs (ExecuComp))

	Talent Factor			GMM		
Variable	All	50% to Top 25%	Top 25%	All	50% to Top 25%	Top 25%
CEO Talent	0.291***	0.624***	1.033***	0.351**	0.816**	1.515**
	(0.049)	(0.224)	(0.360)	(0.177)	(0.415)	(0.604)
$Performance_{t-1}$	0.175***	0.182***	0.193***	0.221***	0.233***	0.162*
	(0.014)	(0.026)	(0.029)	(0.023)	(0.058)	(0.094)
Size	0.184***	0.269***	0.152***	0.286***	0.259***	0.025
	(0.020)	(0.042)	(0.044)	(0.079)	(0.083)	(0.133)
CEO Age	0.005***	0.012	-0.002	-0.008	0.007	-0.219*
	(0.002)	(0.008)	(0.006)	(0.036)	(0.094)	(0.126)
Insider	-0.072	-0.074	-0.099	-0.001	-0.054	0.236
	(0.047)	(0.074)	(0.137)	(0.002)	(0.053)	(0.173)
R^2	73.3%	76.3%	76.1%	45.5%	11.6%	16.2%
Observations	13421	3352	3379	13261	3309	3321

Panel B: Robustness (New CEOs Only)

	Good Press			Press		Fast-Track Career	
Variable	All	50% to Top 25%	Top 25%	All	50% to Top 25%	All	50% to Top 25%
CEO Talent	0.644***	1.836***	5.766***	0.560***	2.063***	0.528***	0.720**
	(0.093)	(0.403)	(0.998)	(0.107)	(0.634)	(0.197)	(0.351)
$Performance_{t-1}$	0.000	0.002	0.004	0.000	0.002	-0.035	-0.094
	(0.001)	(0.002)	(0.004)	(0.001)	(0.002)	(0.048)	(0.082)
GIM				0.009	0.038*	0.011	-0.013
				(0.010)	(0.020)	(0.011)	(0.018)
Board Size				-0.011	-0.025	-0.014	0.012
				(0.012)	(0.023)	(0.014)	(0.021)
Board Indep.				0.326*	-0.084	0.200	-0.202
				(0.172)	(0.305)	(0.180)	(0.277)
R^2	23.2%	26.3%	26.1%	25.5%	26.9%	26.8%	29.8%
Observations	2122	580	669	1814	456	1758	432

Table 7: CEO Appointments, Talent, and Shareholder Value

Panel A of this table reports short-run cumulative abnormal returns around CEO appointments during the period from 1993 to 2005. CEO Talent is proxied by Press. Abnormal returns are calculated using the capital asset pricing model (CAPM). The (-2,+2) window of analysis is relative to actual announcement dates of CEO appointments (in days), where t=0 is the day of the announcement. Stock returns data are from CRSP. Panel B reports long-run abnormal returns around CEO transitions. Abnormal returns are estimated using calendar-time portfolio regressions. In each month t, all firms subject to a CEO succession within the next (prior) 36 months are included in that month's pre (post) transition portfolio. Mean portfolio returns, rp_t are used to estimate abnormal returns using the following regression: $(rp_t - rf_t) = \alpha + \beta_1(rm_t - rf_t) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \varepsilon_t$, where rf_t is the risk-free rate calculated using one-month Treasury-bill rates, $(rm_t - rf_t)$ is the market risk premium, calculated as the difference between the value-weighted return on all NYSE, AMEX, and NASDAQ stocks from CRSP less the risk-free rate, SMB_t is the return difference between portfolios of small stocks and big stocks, HML_t is the return difference between portfolios of high book-to-market stocks and low book-to-market stocks, and UMD_t is the return difference between portfolios of high prior-return stocks and low prior-return stocks. The reported abnormal returns are the intercept (α) estimated from the regression above. Variable definitions are in Appendix C. Robust standard errors are in parentheses and the numbers of successions is reported in square brackets. Levels of significance are denoted by ***, **, and * for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Short-Run Cumulative Abnornal Returns around Succession Announcements

CAR [-2,+2]	All	Press			Fast-Track Career		
		Low	High	Difference	Low	High	Difference
All Appointments	0.007***	0.006	0.015**	0.009*	0.005	0.015***	0.010*
	(0.002)	(0.004)	(0.006)	(0.007)	(0.004)	(0.004)	(0.006)
	[2036]	[429]	[430]		[419]	[432]	
{t-stat}				{1.400}			{1.682}
{|z|-stat}				{0.759}			{0.511}
By Type of Succession:							
Internal Appointments	-0.002	-0.003	-0.002	0.001	-0.002	-0.003	-0.001
	(0.002)	(0.004)	(0.004)	(0.006)	(0.004)	(0.005)	(0.006)
	[1296]	[303]	[323]		[307]	[319]	
{t-stat}				{0.194}			{0.180}
{|z|-stat}				{0.877}			{0.867}
External Appointments	0.027***	0.009	0.044***	0.035**	0.010	0.039***	0.029***
	(0.005)	(0.009)	(0.012)	(0.015)	(0.008)	(0.009)	(0.013)
	[740]	[180]	[182]		[176]	[177]	
{t-stat}				{2.356}			{2.006}
{|z|-stat}				{2.470}			{1.258}
External Appointments, Negative Prior Return	0.033***	0.015*	0.055***	0.040***	-0.002	0.035***	0.037**
	(0.007)	(0.010)	(0.013)	(0.016)	(0.016)	(0.007)	(0.018)
	[373]	[96]	[92]		[94]	[96]	
{t-stat}				{2.550}			{2.036}
{|z|-stat}				{2.017}			{1.604}

Panel B: Long-Run Abnormal Stock Returns around CEO Transitions: Press

	Before			After		
	All	Press		All	Press	
		Low	High		Low	High
All Appointments	-0.0009	-0.0001	-0.0013	0.0056**	0.0054**	0.0066**
	(0.0010)	(0.0019)	(0.0014)	(0.0019)	(0.0017)	(0.0025)
Implied 1-year abnormal return (%)	-1.07	-0.12	-1.55	6.93	6.68	8.21
By Type of Succession:						
Internal Appointments	0.0009	0.0004	0.0018	0.0046*	0.0047	0.0049**
	(0.0012)	(0.0015)	(0.0018)	(0.0021)	(0.0029)	(0.0019)
Implied 1-year abnormal return (%)	1.09	0.48	2.18	5.66	5.79	6.04
External Appointments	-0.0046**	-0.0046*	-0.0053**	0.0099***	0.0067*	0.0105***
	(0.0017)	(0.0022)	(0.0024)	(0.0012)	(0.0040)	(0.0024)
Implied 1-year abnormal return (%)	-5.38	-5.38	-6.18	12.55	8.34	13.54

Panel C: Long-Run Abnormal Stock Returns around CEO Transitions: Fast-Track Career

	Before			After		
	All	Fast-Track Career		All	Fast-Track Career	
		Low	High		Low	High
All Appointments	-0.0009	-0.0003	-0.0027*	0.0056**	0.0048**	0.0074**
	(0.0010)	(0.0013)	(0.0015)	(0.0019)	(0.0019)	(0.0030)
Implied 1-year abnormal return (%)	-1.07	-0.36	-3.19	6.93	5.91	9.25
By Type of Succession:						
Internal Appointments	0.0009	0.0012	0.0007	0.0046*	0.0051	0.0054**
	(0.0012)	(0.0014)	(0.0018)	(0.0021)	(0.0029)	(0.0020)
Implied 1-year abnormal return (%)	1.09	1.45	0.84	5.66	6.29	6.68
External Appointments	-0.0046**	-0.0042*	-0.0046*	0.0099***	0.0073**	0.0133***
	(0.0017)	(0.0019)	(0.0027)	(0.0012)	(0.0021)	(0.0025)
Implied 1-year abnormal return (%)	-5.38	-4.93	-5.38	12.55	9.12	17.18

Table 8: Measuring the Impact of CEO Talent: Evidence from CEO Appointments

This table reports pooled OLS regression results for changes in firm performance (Panel A, 1-3) and firm policies (Panel B) around 2195 CEO successions between 1993 and 2005. Panel A.4 reports results of a propensity-score matching estimator. The change in performance is calculated from one year before to three years after CEO succession. We report results for three performance measures: (1) industry-adjusted operating return on assets (OROA): the ratio of operating income to the book value of assets, less the median OROA of the relevant industry (two-digit SIC); and the following industry-and performance adjusted measures: (2) OROA, and (3) net income to assets (ROA). Performance controls are created by dividing COMPUSTAT firms into deciles sorted by the relevant industry-adjusted variable in the year prior transition. The annual median of the relevant performance group of firms (ex-event) is then used as control. CEO Talent is proxied by Press and Fast-Track Career. High CEO Talent is a dummy for the top quartile of the distribution of the talent proxies. Controls include dummies for inside and forced successions, firm size and pre-transition performance (coefficients suppressed). Variable definitions are in Appendix C. Year dummies are also included. Robust standard errors are in parentheses. Levels of significance are denoted by ***, **, and * for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Differential Firm Performance around CEO Successions

Performance	Press			Fast-Track Career		
[(t=+3)-(t=-1)]	All	Internal	External	All	Internal	External
1. Industry adjusted operating return on assets (OROA)						
CEO Talent	0.041**	0.020	0.111**	0.036**	0.020	0.037**
	(0.019)	(0.020)	(0.047)	(0.016)	(0.018)	(0.016)
Insider	-0.018*			-0.008		
	(0.010)			(0.007)		
Forced Succession	0.011	-0.002	0.033	0.013	0.002	0.043***
	(0.015)	(0.017)	(0.025)	(0.010)	(0.015)	(0.013)
Observations	740	518	222	642	437	205
R^2	0.07	0.05	0.11	0.23	0.32	0.39
2. Industry and performance adjusted OROA						
CEO Talent	0.027**	0.018	0.057**	0.033**	0.030**	0.049**
	(0.013)	(0.014)	(0.026)	(0.013)	(0.012)	(0.023)
Insider	-0.013*			-0.012		
	(0.007)			(0.010)		
Forced Succession	-0.008	-0.010	-0.016	0.001	-0.003	0.018
	(0.008)	(0.009)	(0.014)	(0.007)	(0.011)	(0.012)
Observations	923	628	295	891	606	285
R^2	0.05	0.10	0.10	0.07	0.12	0.18
3. Industry and performance adjusted net income/assets (ROA)						
CEO Talent	0.043**	0.035*	0.058**	0.032**	0.034	0.035**
	(0.017)	(0.020)	(0.028)	(0.015)	(0.048)	(0.017)
Insider	0.005			-0.002		
	(0.015)			(0.012)		
Forced Succession	-0.005	-0.020	0.017	0.010	0.012	0.004
	(0.018)	(0.021)	(0.032)	(0.016)	(0.015)	(0.013)
Observations	954	646	308	945	642	303
R^2	0.13	0.13	0.14	0.06	0.05	0.09
4. Propensity Score Matched, industry adjusted net income/assets (ROA)						
High CEO Talent	0.064**	0.040	0.093**	0.031**	0.014	0.078**
	(0.028)	(0.026)	(0.040)	(0.015)	(0.019)	(0.031)

Panel B: Differential Firm Decisions around CEO Successions

Firm Policy [(t=+3)-(t=-1)]	Press All	Press Internal	Press External	Fast-Track Career All
1. Investment Policy				
CAPEX	-0.015**	-0.011	-0.023**	-0.015**
	(0.006)	(0.007)	(0.011)	(0.008)
Number of Mergers	-0.091**	-0.043	-0.251**	-0.064*
	(0.048)	(0.054)	(0.124)	(0.037)
Number of Acquisitions	-0.205	-0.240	-0.048	0.067
	(0.128)	(0.168)	(0.140)	(0.074)
Number of Divestitures	0.266**	0.201	0.376**	0.265**
	(0.108)	(0.135)	(0.186)	(0.107)
2. Financial Policy				
Leverage	-0.086***	-0.041*	-0.156*	-0.061**
	(0.025)	(0.024)	(0.091)	(0.028)
Cash Holdings	0.031**	0.012	0.077**	0.047***
	(0.015)	(0.014)	(0.033)	(0.016)
Dividend Payouts	-0.002	-0.003	0.003	0.002
	(0.002)	(0.003)	(0.003)	(0.002)
3. Organizational Strategy				
Number of Diversifying Mergers	0.035	0.055	-0.089*	-0.041*
	(0.033)	(0.038)	(0.049)	(0.023)
R&D Expenditures	0.003	-0.006	0.018	0.002
	(0.015)	(0.013)	(0.034)	(0.12)
Advertising Expenditures	0.000	0.002	-0.003	0.001
	(0.002)	(0.002)	(0.003)	(0.002)
4. Operating Decisions				
Cash Flow	0.990*	0.877	1.215*	0.600**
	(0.559)	(0.607)	(0.653)	(0.290)
Sales Growth	0.168**	0.069	0.324***	0.130**
	(0.068)	(0.083)	(0.122)	(0.059)

Table 9: CEO Succession Analysis: Identification and Robustness

This table reports pooled OLS regression results for changes in firm performance (Panel A) and firm policies (Panel B) around 2195 CEO successions between 1993 and 2005. In Panel A (Identification), CEO Talent is proxied by a factor extracted using principal component analysis from Press, Fast-Track Career, and Selective College. GMM columns indicate results for optimally weighted GMM estimates where Fast-Track and Selective College are used as instruments for Press. In Panel B (Robustness), CEO Talent is proxies by Press and Fast-Track Career. The change in performance is calculated from one year before to three years after CEO succession. We report results for four performance measures: (1) industry-adjusted operating return on assets (OROA): the ratio of operating income to the book value of assets, less the median OROA of the relevant industry (two-digit SIC); and the following industry-and performance adjusted measures: (2) OROA , (3) operating return on sales (OROS): the ratio of operating income to sales, and (4) net income to assets. Performance controls are created by dividing COMPUSTAT firms into deciles sorted by the relevant industry-adjusted variable in the year prior transition. The annual median of the relevant performance group of firms (ex-event) is then used as control. Controls include dummies for inside and forced successions, firm size and pre-transition performance (coefficients suppressed). Panel B includes additional governance controls. Variable definitions are in Appendix C. Year dummies are also included. Robust standard errors are in parentheses. Levels of significance are denoted by ***, **, and * for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Identification

Performance [(t=+3)-(t=-1)]	Talent Factor	GMM
1. Industry adjusted operating return on assets (OROA)		
CEO Talent	0.048**	0.058**
	(0.020)	(0.025)
Insider	-0.027	-0.003
	(0.019)	(0.014)
Forced Succession	0.041***	0.025*
	(0.014)	(0.013)
Observations	650	561
R^2	0.07	0.10
2. Industry and performance adjusted OROA		
CEO Talent	0.021**	0.072***
	(0.010)	(0.027)
Insider	-0.016	-0.025
	(0.011)	(0.027)
Forced Succession	0.000	0.050
	(0.007)	(0.031)
Observations	873	750
R^2	0.10	0.15
3. Industry and performance adjusted net income/assets (ROA)		
CEO Talent	0.040***	0.060**
	(0.014)	(0.025)
Insider	0.004	0.016
	(0.014)	(0.013)
Forced Succession	0.008	-0.019
	(0.018)	(0.022)
Observations	866	1155
R^2	0.05	0.11

Panel B: Robustness

Performance [(t=+3)-(t=-1)]	Good Press	Press	Fast-Track Career
	All	All	All
1. Industry adjusted operating return on assets (OROA)			
CEO Talent	0.043**	0.042**	0.038**
	(0.017)	(0.018)	(0.018)
GIM		0.001	0.008
		(0.001)	(0.008)
Board Size		-0.000	-0.000
		(0.002)	(0.002)
Board Indep.		-0.000	-0.012
		(0.018)	(0.020)
Observations	850	840	789
R^2	0.10	0.11	0.23
2. Industry and performance adjusted OROA			
CEO Talent	0.038**	0.041**	0.041***
	(0.019)	(0.017)	(0.015)
GIM		-0.002	-0.001
		(0.001)	(0.001)
Board Size		0.001	0.001
		(0.002)	0.001
Board Indep.		0.028	0.020
		(0.026)	(0.025)
Observations	802	790	775
R^2	0.13	0.12	0.09
3. Industry and performance adjusted net income/assets (ROA)			
CEO Talent	0.031**	0.026**	0.047**
	(0.012)	(0.013)	(0.021)
GIM		-0.002*	-0.001
		(0.001)	(0.002)
Board Size		0.001	0.001
		(0.001)	(0.003)
Board Indep.		0.015	0.034
		(0.021)	(0.024)
Observations	966	886	855
R^2	0.12	0.11	0.09

Table 10: Forced CEO Turnover and Talent

This table reports pooled probit regression estimates of the likelihood of forced CEO turnover during the period from 1993 to 2005. The dependent variable equals one if CEO turnover is forced, and zero otherwise. CEO Talent is proxied by Press and Fast-Track Career. Model 1 uses Firm stock return as measure of performance, Model 2 uses EW industry-adjusted stock return as measure of firm performance and EW 2-digit SIC average industry stock return as measure of industry performance. Coefficients are reported as marginal effects. Variation across time is controlled for by including year fixed effects, and variation across industries is controlled for by including industry fixed effects with industry defined by two-digit SIC code (coefficient estimates are suppressed). In addition, we control for firm size, CEO age and tenure. Variable definitions are in Appendix C. Standard errors are robust to heteroskedasticity. Levels of significance are denoted by ***, **, and * for statistical significance at the 1%, 5%, and 10% level, respectively.

	Press		Fast-Track Career	
	Model 1	Model 2	Model 1	Model 2
Variable	(1)	(2)	(3)	(4)
Firm Return	-0.010	-0.006	-0.026*	-0.022
	(0.012)	(0.013)	(0.015)	(0.015)
Industry Return		0.003		0.005
		(0.014)		(0.016)
Talent*Firm Return	-0.035***	-0.034***	-0.026**	-0.030**
	(0.008)	(0.010)	(0.013)	(0.015)
Talent*Industry Return		-0.028**		-0.018
		(0.012)		(0.012)
Talent	0.004	0.002	0.008	0.011
	(0.004)	(0.004)	(0.010)	(0.009)
Tenure*Firm Return	0.012	0.007	0.026**	0.030**
	(0.008)	(0.010)	(0.013)	(0.014)
Tenure*Industry Return		0.007		0.010
		(0.011)		(0.014)
Age*Firm Return	-0.018**	-0.015*	-0.020**	-0.028**
	(0.007)	(0.008)	(0.011)	(0.012)
Age*Industry Return		-0.007		-0.008
		(0.010)		(0.012)
Size*Firm Return	0.001	-0.000	-0.002*	-0.003
	(0.002)	(0.002)	(0.002)	(0.002)
Size*Industry Return		-0.001		-0.003
		(0.002)		(0.002)
CEO Tenure	0.023***	0.016***	0.026***	0.028***
	(0.004)	(0.003)	(0.005)	(0.005)
CEO Age	-0.015***	-0.022***	-0.026***	-0.025***
	(0.003)	(0.003)	(0.007)	(0.006)
Size	0.002***	0.001**	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
R^2	7.6%	7.2%	6.9%	6.7%
Observations	17566	17245	16885	16659

Table 11: Forced Turnover and Talented CEOs – Insiders vs. Outsiders

This table reports pooled probit regression estimates of the likelihood of forced CEO turnover during the period from 1993 to 2005. The dependent variable equals one if CEO turnover is forced, and zero otherwise. CEO Talent is proxied by Press (Panel A) and Fast-Track Career (Panel B). The regression is performed within subsamples, by whether or not the CEO is internal. Model 1 uses Firm stock return as measure of performance, Model 2 uses EW industry-adjusted stock return as measure of firm performance and EW 2-digit SIC average industry stock return as measure of industry performance. Coefficients are reported as marginal effects. Variation across time is controlled for by including year fixed effects, and variation across industries is controlled for by including industry fixed effects with industry defined by two-digit SIC code (coefficient estimates are suppressed). In addition, we control for firm size, CEO age and tenure. Variable definitions are in Appendix C. Standard errors are robust to heteroskedasticity. Levels of significance are denoted by ***, **, and * for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Press

Variable	Model 1		Model 2	
	High Talent	Low Talent	High Talent	Low Talent
Internal Appointments Only				
Firm Return	-0.042***	-0.005	-0.043***	-0.005
	(0.006)	(0.003)	(0.006)	(0.004)
Industry Return			-0.020	0.013
			(0.013)	(0.009)
Tenure	0.030***	0.022***	0.030***	0.020***
	(0.008)	(0.007)	(0.008)	(0.006)
Age	-0.016*	-0.022***	-0.015**	-0.022***
	(0.008)	(0.004)	(0.008)	(0.004)
Size	0.004***	-0.002	0.004***	0.013
	(0.001)	(0.001)	(0.001)	(0.009)
R^2	15.4%	9.3%	16.5%	9.7%
Observations	1866	2993	1771	2940
External Appointments Only				
Firm Return	-0.059***	-0.020**	-0.062***	-0.023**
	(0.007)	(0.008)	(0.008)	(0.008)
Industry Return			-0.048**	-0.028**
			(0.020)	(0.011)
Tenure	0.007	0.024**	0.007	0.021***
	(0.013)	(0.008)	(0.014)	(0.007)
Age	0.004	-0.020**	0.005	-0.016
	(0.013)	(0.008)	(0.015)	(0.010)
Size	0.008***	0.003	0.008***	0.003
	(0.002)	(0.002)	(0.002)	(0.002)
R^2	13.9%	11.3%	13.8%	12.3%
Observations	960	1645	921	1561

Panel B: Fast-Track Career

Variable	Model 1		Model 2	
	High Talent	Low Talent	High Talent	Low Talent
Internal Appointments Only				
Firm Return	-0.038***	-0.019**	-0.040***	-0.020**
	(0.006)	(0.006)	(0.006)	(0.006)
Industry Return			-0.006	0.000
			(0.011)	(0.005)
Tenure	0.030***	0.036***	0.029***	0.035***
	(0.008)	(0.010)	(0.009)	(0.010)
Age	-0.019	-0.013	-0.018	-0.012
	(0.018)	(0.021)	(0.018)	(0.020)
Size	0.005***	0.001	0.005***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
R^2	13.9%	10.4%	14.3%	10.8%
Observations	1741	3339	1741	3339
External Appointments Only				
Firm Return	-0.045**	-0.028***	-0.044**	-0.027***
	(0.008)	(0.007)	(0.012)	(0.007)
Industry Return			-0.051**	-0.019
			(0.016)	(0.012)
Tenure	0.047**	0.049***	0.050**	0.049***
	(0.016)	(0.015)	(0.017)	(0.015)
Age	-0.012	0.022	-0.014	0.022
	(0.064)	(0.027)	(0.067)	(0.027)
Size	0.005	0.006***	0.005	0.006***
	(0.004)	(0.002)	(0.005)	(0.002)
R^2	16.0%	15.8%	16.4%	15.8%
Observations	428	1306	428	1306

Table 12: CEO Turnover Analysis: Identification and Robustness

This table reports pooled probit regression estimates of the likelihood of forced EO turnover during the period from 1993 to 2005. The dependent variable equals one if CEO turnover is forced, and zero otherwise. In Panel A (Identification), CEO Talent is proxied by a factor extracted using principal component analysis from Press, Fast-Track Career, and Selective College. GMM columns indicate results for optimally weighted GMM estimates where Fast-Track and Selective College are used as instruments for Press. Model 1 uses Firm stock return as measure of performance, Model 2 uses EW industry-adjusted stock return as measure of firm performance and EW 2-digit SIC average industry stock return as measure of industry performance. Coefficients are reported as marginal effects. Variation across time is controlled for by including year fixed effects, and variation across industries is controlled for by including industry fixed effects with industry defined by two-digit SIC code (coefficient estimates are suppressed). In addition, we control for firm size, CEO age and tenure. Panel B includes additional governance controls. Variable definitions are in Appendix C. Standard errors are robust to heteroskedasticity. Levels of significance are denoted by ***, **, and * for statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Identification

	Talent Factor		GMM	
Variable	Model 1	Model 2	Model 1	Model 2
Firm Return	-0.005	0.000	0.016	0.009
	(0.016)	(0.015)	(0.016)	(0.017)
Industry Return		0.005		0.040
		(0.014)		(0.034)
Talent*Firm Return	-0.031**	-0.024**	-0.033***	-0.035***
	(0.015)	(0.011)	(0.008)	(0.008)
Talent*Industry Return		-0.013		-0.008
		(0.010)		(0.015)
Talent	-0.007	-0.007	-0.034	-0.040
	(0.006)	(0.005)	(0.097)	(0.093)
Tenure*Firm Return	0.019	0.024**	-0.021	-0.022
	(0.014)	(0.011)	(0.013)	(0.015)
Tenure*Industry Return		-0.005		-0.012
		(0.009)		(0.022)
Age*Firm Return	-0.024*	-0.027***	0.011	0.016
	(0.014)	(0.004)	(0.011)	(0.013)
Age*Industry Return		-0.005		-0.003
		(0.009)		(0.017)
Size*Firm Return	0.000	-0.001	-0.005***	-0.005**
	(0.002)	(0.002)	(0.002)	(0.002)
Size*Industry Return		0.002		-0.005*
		(0.002)		(0.003)
CEO Tenure	0.027***	0.024***	0.030***	0.029***
	(0.005)	(0.004)	(0.007)	(0.007)
CEO Age	-0.021***	-0.023***	-0.016***	-0.014**
	(0.005)	(0.004)	(0.006)	(0.006)
Size	0.003***	0.003***	0.007	0.008
	(0.001)	(0.001)	(0.009)	(0.008)
R^2	9.7%	9.9%	4.3%	4.6%
Observations	13437	13352	13232	13251

Panel B: Robustness

Variable	Alternative Specifications			Governance Controls		
	Voluntary Turnovers	Forced Turnovers	Forced Turnovers	Forced Turnovers	Forced Turnovers	Forced Turnovers
	Model 2	Model 3	Good Press	GIM	Board Size	Board Indep.
Firm Return	-0.045**	-0.001	-0.009	-0.006	-0.006	-0.003
	(0.021)	(0.015)	(0.016)	(0.013)	(0.017)	(0.019)
Industry Return	-0.003	0.011	0.003			
	(0.028)	(0.018)	(0.016)			
Press*Firm Return	0.008	-0.035***	-0.025**	-0.033***	-0.023**	-0.022**
	(0.015)	(0.011)	(0.012)	(0.009)	(0.011)	(0.010)
Press*Industry Return	0.030	-0.013	-0.032**			
	(0.021)	(0.014)	(0.013)			
Press	0.010	0.005	0.001	0.003	0.005	0.005
	(0.007)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)
Tenure*Firm Return	0.011	0.012	0.006	0.008	0.015	0.014
	(0.013)	(0.010)	(0.011)	(0.009)	(0.011)	(0.011)
Tenure*Industry Return	-0.024	0.008	0.005			
	(0.019)	(0.013)	(0.012)			
Age*Firm Return	-0.014	-0.018**	-0.022**	-0.010	-0.012	-0.012
	(0.017)	(0.009)	(0.009)	(0.008)	(0.010)	(0.010)
Age*Industry Return	-0.027	-0.001	-0.011			
	(0.024)	(0.012)	(0.011)			
Size*Firm Return	0.005**	-0.001	-0.000	-0.000	-0.001	-0.001
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Size*Industry Return	0.001	-0.002	-0.000			
	(0.003)	(0.002)	(0.002)			
GIM*Firm Return				-0.002		
				(0.010)		
Board*Firm Return					0.000	-0.007
					(0.001)	(0.016)
CEO Tenure	0.020***	0.023***	0.015***	0.015***	0.027***	0.027***
	(0.007)	(0.004)	(0.004)	(0.003)	(0.005)	(0.005)
CEO Age	0.161***	-0.021***	-0.022***	-0.020***	-0.018***	-0.018***
	(0.008)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Size	0.000	0.001*	0.002***	0.001	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
GIM				0.000		
				(0.003)		
Board					0.000	0.010
					(0.000)	(0.006)
R^2	11.3%	7.4%	7.8%	6.7%	9.1%	9.2%
Observations	17145	16659	17571	15779	10956	10956

Figure 1: Pay and Talent for New CEOs

This figure plots the logarithm of total CEO pay (tdc1) against the distribution of talent quantiles for newly appointed CEOs from 1993 to 2005. CEO Talent is proxied by Press. Variable definitions are in Appendix C.

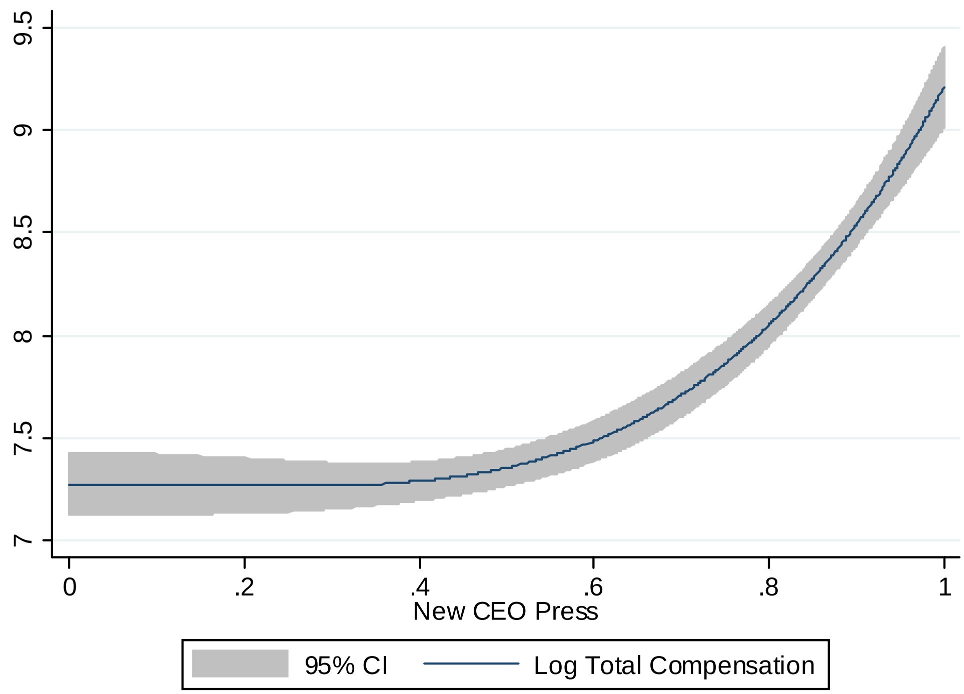

Figure 2: CEO Talent and Firm Performance

This figure plots median industry-adjusted operating return on assets (OROA) around CEO succession events from 1993 to 2005. CEO Talent is proxied by Press. Variable definitions are in Appendix C.

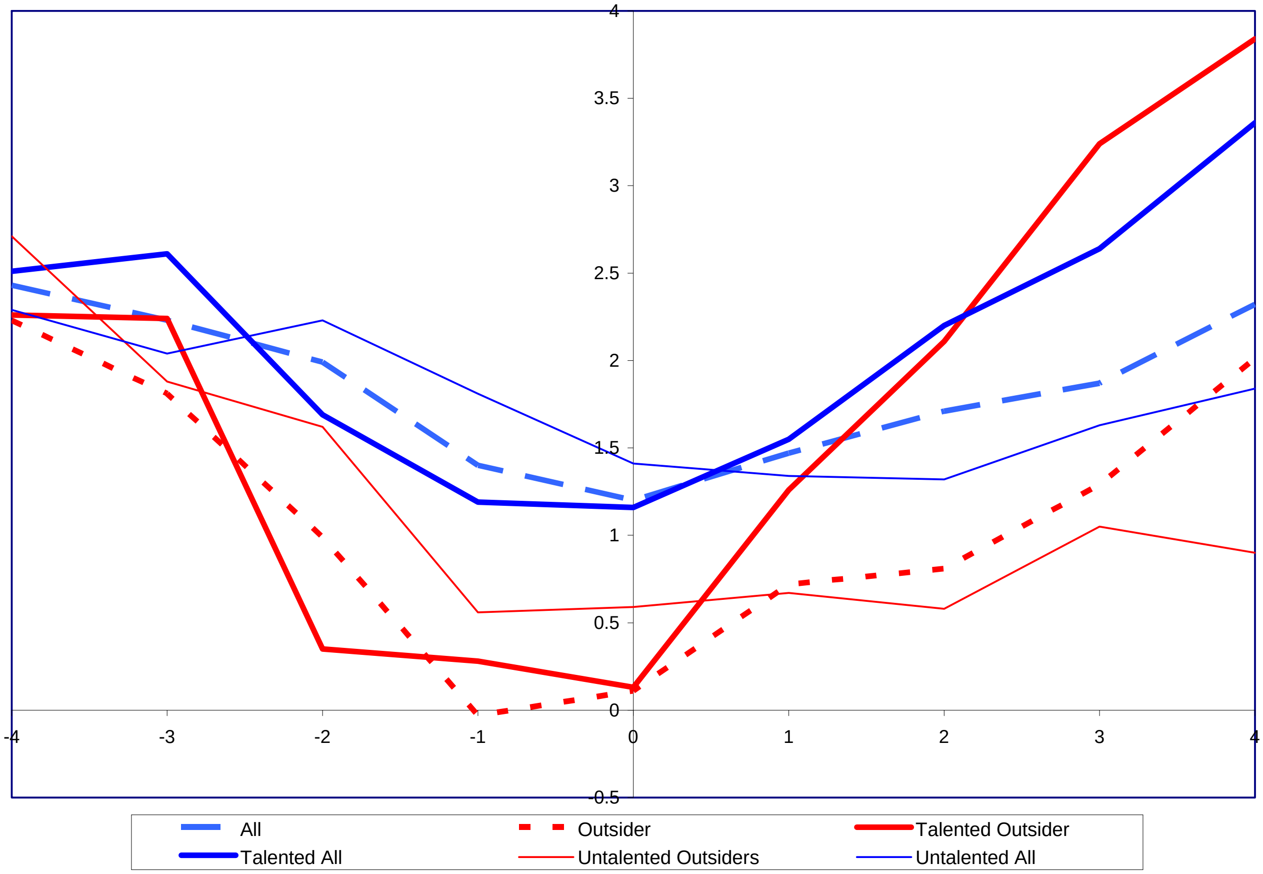

Figure 3: Incidence of Forced CEO Turnover, 1993-2005

This figure plots the percentage of firms that experience a forced CEO turnover by year from 1993 to 2005. CEO Talent is proxied by Press. High Talent is either the top decile or the top quartile of the distribution of Press. Successions are classified as internal when incoming CEOs were hired by the firm earlier than a year before succession, and external otherwise. Variable definitions are in Appendix C.