Manager Attribute and CEO Selection

by

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We thank Walid Saffar, Damien Brooks, Lewis Tam, seminar participants at The Hong Kong Polytechnic University, and conference participants at the 2013 Financial Management Association (FMA) Asian Conference and European Conference, the 2013 Midwest Finance Association (MFA) Annual Meeting, and the 2013 Journal of Contemporary Accounting and Economics (JCAE) Symposium for providing useful comments.

Abstract In Goel and Thakor (2008), CEO promotion favors overconfident over rational managers but boards fire overconfident CEOs upon knowing their confidence attribute. In this paper, we examine and demonstrate distinctive attribute transition patterns between forced turnovers and retirements. Specifically, firms show a correctional pattern of attribute convergence by replacing fired CEOs with rational CEOs but firms show an attribute continuity pattern by replacing retiring CEOs with CEOs of the same attribute. Hence, confidence attribute is an important factor assessed by the board for CEO selection. Importantly, we find disproportionately more overconfident CEOs working and retiring in innovative industries.

Keywords Manager Attribute, CEO Overconfidence, CEO Selection, Corporate Investment

Although overconfident CEOs often distort corporate activities,[1] a significant proportion of CEOs in modern firms are characterized as overconfident (e.g., Malmendier and Tate 2005; Campbell et al. 2011).[2] Goel and Thakor (2008) explain through a model in which CEO selection is a promotion tournament game to replace a retiring CEO from among managers with overconfident, rational, and diffident attributes (hereafter called "confidence attributes"). Due to personal attributes, an overconfident manager in the game often underestimates the risk and *inadvertently* realizes the highest payoff. Consequently, under a value-maximizing governance structure, an overconfident manager is more likely to win in the tournament game to be promoted to replace the retiring CEO than a rational or diffident manager, as long as the board does not recognize the problem of overconfidence. However, if the board knows about the problem and views the promoted CEO as overconfident, the model predicts that the overconfident CEO will be fired. This has been confirmed by Campbell et al. (2011) and Choi et al. (2013).[3]

However, Goel and Thakor (2008) do not explore whether the selection bias will be corrected by the board after it fires an overconfident CEO and how the promotion tournament game will evolve further. Some interesting questions are therefore left unanswered: Will the promotion result be different if the board recognizes the overconfidence problem? Will

[1] The literature documents that overconfident CEOs may overinvest corporate resources (Malmendier and Tate 2005), conduct more mergers and acquisitions (Malmendier and Tate 2008), issue optimistic earnings forecasts (Schrand and Zechman 2012), delay loss recognition and use more aggressive financial reporting (Ahmed and Duellman 2013), etc.

[2] Malmendier and Tate (2005) show that in a sample of 1,200 CEOs over the period 1980–1994, 74.6% (895) were perceived to be overconfident by the market, where market perception is obtained from press coverage about the CEOs and their firms in leading business publications, including *The Wall Street Journal*, *The New York Times*, *Business Week*, *Financial Times*, and *The Economist*. Campbell et al. (2011) use CEOs' option exercises to capture their personal character and classify 34.1% of the CEOs as overconfident in a large sample of 3,352 CEOs between 1992 and 2006.

[3] Campbell et al. (2011) show that high-optimism (similar to "overconfident") and low-optimism (similar to "diffident") CEOs are likely to be fired. However, this phenomenon exists only for firms with good corporate governance. Choi et al. (2013) find that overconfident CEOs are likely to be fired regardless of firms' governance quality when the CEO turnover sample goes beyond U.S. They also observe that overconfident CEOs are disproportionately followed by overconfident ones, which does not seem to support Campbell et al.'s (2011) view of moderate optimism being optimal.

overconfident managers be screened out in the subsequent CEO selection process? Can the board distinguish overconfident managers from rational managers? Do succession decisions differ between firms in innovative industries and those in non-innovative industries, as Hirshleifer, Low, and Teoh (2012) argue that overconfident managers are more suitable for risky and challenging projects? These questions are important to understand if manager attribute is a factor assessed by the board in the appointment of a CEO and how CEOs are selected in modern firms in general.[4]

We address these questions by exploring the transition of confidence attributes associated with CEO succession. Specifically, we want to see if this transition exhibits different patterns conditional on the nature of the CEO departure. The cycle of CEO promotion, departure, and succession is an integral, dynamic process, and all CEO selections are essentially triggered by an incumbent CEO leaving the office. We expect that the selection of succeeding CEOs, as reflected by the successors' attributes, would differ between an incumbent CEO's normal retirement set by the Goel-Thakor model and an incumbent CEO's forced departure. The different selection patterns describe the board's assessment of manager attribute in CEO selection.

Two forces may be involved in the attribute transition inherent in CEO succession. One force originates implicitly from the incumbent CEO. A CEO has considerable power over the selection of subordinate managers. If the subordinates have the same mind-set and share the same vision as the CEO, they are more likely to follow the CEO's path. For that reason, a CEO

[4] Although a substantial study examined the replacement of CEOs under modern governance mechanisms, the majority focuses on the departure of incumbent CEOs (e.g., Kini, Kracaw, and Mian 2004; Franks, Mayer, and Renneboog 2001; Denis, Denis, and Sarin 1997; Murphy and Zimmerman 1993; Warner, Watts, and Wruck 1988), and few examine the selection of succeeding CEOs.

may prefer to hire like-minded subordinates during hiring decisions.[5] From the subordinates' standpoint, they may prefer to work with a like-minded CEO because they are more likely to be appreciated and get promoted. Therefore, consciously or subconsciously an incumbent CEO may cultivate certain confidence attributes among the management team. The succeeding CEO, who is typically selected from the subordinate managers, is likely to share the same type of confidence attribute as the incumbent CEO.

The other force comes explicitly from the board. As modeled by Goel and Thakor (2008) and Campbell et al. (2011), "rational" is typically the optimal confidence attribute. When the board of directors sees the incumbent CEO has a suboptimal confidence attribute, they may perform a correction by firing the incumbent CEO and replacing her with a rational successor.

The two forces may have different impacts on the selection of successors, conditional on the nature of an incumbent CEO's departure. In a normal retirement, the board is likely to be satisfied with the departing CEO's performance and therefore sees no problem with the CEO's attribute. In this case, the board may tend to side with the departing CEO, and the successor is likely to have the same type of confidence attribute as the departing CEO. In a forced turnover, however, the board is likely to be dissatisfied with the departing CEO's performance and sees a problem with the CEO's attribute.[6] The board will be cautious and avoid hiring another CEO with the same attribute. As the boards attempt to perform corrections on the CEO attribute, the

[5] Davidson, Dey, and Smith (2015) find that a frugal CEO is more likely to appoint a frugal CFO. In practice, Warren Buffett, the world-known value investor, also deliberately intends to select another like-minded value investor to succeed him.

[6] Poor performance in a firm may be driven by many factors. However, as shown in existing studies (Malmendier and Tate 2005, 2008; Schrand and Zechman 2012; Ahmed and Duellman 2013), managerial overconfidence and diffidence are a significant reason that cause decision distortions and consequently destroy firm value. Campbell et al. (2011) show that overconfident and diffident CEOs are more likely to be fired.

successors are likely to concentrate on the rational attribute. Therefore, the different patterns of attribute transition will show the board's assessment of manager attributes in CEO selection.[7]

However, the board's correction of the CEO attribute is constrained by the supply of rational managers within a firm. As a pair of CEO subordinates is likely to share similar attributes, in a firm where the incumbent CEO has a suboptimal attribute, there may be not enough qualified rational managers for the board to choose among when performing a correction. As a result, the board may have to recruit a rational succeeding CEO from outside. Therefore, given the similarity of attributes among subordinate managers cultivated by the incumbent CEO, the board's correction of the CEO attribute will be weakened if the succession is decided through an internal promotion instead of an external recruitment.

Given that "rational" is the optimal attribute, one may wonder why rational CEOs may be forced to leave or why non-rational CEOs may remain until retirement. There could be economic explanations.[8] For instance, forced turnovers of rational CEOs could be driven by factors unrelated to the CEO confidence attribute, such as poor performance (as has been well documented in the literature). More importantly, overconfidence is not always suboptimal. As Hirshleifer, Low, and Teoh (2012) contend, overconfident managers are more suitable for innovative projects that are more risky and challenging. Graham, Harvey, and Puri (2013) also document that more confident and risk-tolerant CEOs are more likely to run growth companies.

[7] Fee, Hadlock, and Pierce (2013) examine the causal role of managerial style in corporate policies and performance after CEO turnovers. They do not find much causal effect on exogenous departures such as death or health problems accompanied by natural retirements. However, they find a strong effect on endogenous departures in the form of forced turnovers. They interpret their results as the board deliberately chooses new CEOs with certain styles to move the firm in a certain direction and anticipate such effects.

[8] There also could be statistical explanations. See Section 4.1 for a discussion of the definition of manager attribute.

Thus, the boards of "innovative" firms might view their overconfident CEOs as suitable for their business or industry, leading to different succession decisions with those in non-innovative firms.

We test our predictions with 1,063 CEO replacements over the period from 1992 to 2010, including 356 forced departures and 707 retirements. We categorize the departing CEOs, the succeeding CEOs, and the next five non-CEO senior managers (hereafter, "senior managers") into three categories based on these attributes. We then use two approaches to conduct our analysis: a non-parametric approach, in which we examine the attribute distributions across different sample groups, and a parametric approach, in which we run probit regressions to examine the probability of CEOs or senior managers with certain confidence attributes being fired or chosen as successors. We find the following results.

We confirm that overconfident managers are more likely to be promoted to CEO positions than rational ones, consistent with the prediction of Goel-Thakor's tournament model. We also find that overconfident CEOs are more likely to be fired than rational ones, in keeping with Campbell et al.'s (2011) findings.

Second, we observe distinctive attribute transition patterns for the normal retirement and forced departure samples. For firms that experience normal CEO retirement, there is a high continuity in the confidence attributes of the departing and succeeding CEOs. That is, when an overconfident CEO retires, the successor tends to also be overconfident, whereas, when a diffident CEO retires, the successor tends to also be diffident. This confirms our conjecture that overconfidence and diffidence may not be perceived as problematic by the boards of firms in which CEOs with such attributes retire normally.

In contrast, successors in firms with forced turnovers are typically rational, irrespective of the attributes of the ousted CEOs. This evidence confirms our conjecture that forced turnovers

indicate that overconfidence and diffidence are perceived by the company board as problematic. Such boards fire overconfident and diffident CEOs and correct the situation through the subsequent CEO selection process.

Third, most of the successors come from within the company, although firms tend to look for outside replacements under forced turnovers. Importantly, the proportion of "rational" succeeding CEOs is found to be significantly smaller in firms where successors are chosen through internal promotions than in firms that recruit replacements from the outside. This evidence confirms our conjecture that a board's effort on attribute correction is weakened if the succeeding CEO is selected internally.

Fourth, we observe that firms in innovative industries seem to prefer overconfident CEOs. There are more CEOs and managers who are overconfident in innovative industries than in non-innovative industries. Furthermore, disproportionally more CEOs who are overconfident retire in innovative industries than in non-innovative industries. This result is consistent with our suggestion that the retirement sample consists of CEOs whose attributes are in line with the needs and preferences of their companies.

Since the CEO confidence attribute is directly related to the over- or underinvestment problem, we also examine changes in the corporate investment rate upon CEO succession to determine whether a board correction is helpful. Our results indicate a sharp difference in terms of the nature of the CEO's departure. Following the forced departure of an overconfident CEO, the overinvestment problem is significantly reduced during the post-turnover period. In contrast, following the retirement of an overconfident CEO, there is no significant change in the investment rate during the post-turnover period. The results indicate that the decision distortions associated with overconfidence can be forestalled by establishing an effective CEO selection

mechanism through which overconfident managers can be screened out in the promotion tournament.

This study provides important contributions to the literature. The study extends Goel and Thakor's (2008) analysis of CEO selection by investigating the attribute transitions associated with CEO succession.[9] The distinctive transition patterns for the normal retirement and forced turnover samples suggest that manager attribute is a factor assessed by the board during the CEO selection process in modern firms. Moreover, the board has the ability to identify manager attributes with probabilistic accuracy and to successfully make corrections when necessary. This is consistent with Fee, Hadlock, and Pierce (2013), who suggest that the board deliberately chooses a new CEO with a certain style to move the firm in a certain direction. Cornelli, Kominck, and Ljungqvist (2013) show that boards collect "hard" (i.e., verifiable) and "soft" (i.e., nonverifiable) information about CEOs' competence when making replacement decisions.

We also find disproportionally more CEOs and managers who are overconfident work and retire in innovative industries, consistent with Hirshleifer, Low, and Teoh (2012) and Graham, Harvey, and Puri (2013). The findings suggest that industry innovativeness has an impact on management selection and turnover decisions. The different selection patterns between innovative and non-innovative industries provide a perspective for understanding the phenomenon of widespread CEO overconfidence in modern firms other than suggested in Goel-Thakor's tournament model.

This study also contributes to the line of literature that examines the association of corporate culture and finance (e.g., Zingales 2015). According to Bloom and Van Reenen (2007),

[9] We take the Goel-Thakor model as given without testing its validity although we did test several of its basic predictions. In addition, we did not look into the factors that drive the CEO turnover decision and factors that induce the board to realize the overconfidence problem. Needless to say, all these issues are important and worth further exploration, but they are beyond the current focus.

management practices are part of a firm's organizational structure and behavior, which typically evolve slowly over time even as CEOs come and go. To some extent, the manager attribute constitutes part of the corporate culture. Through the selection of subordinates and a successor who share similar attributes with the CEO, a firm's culture is more likely to be created and be inherited.

The remainder of the paper is structured as follows. We develop our hypotheses, define key variables with their measurements, and explain the sample formation process in Section 1. Section 2 presents the basic key results concerning attribute transition after CEO succession. Further results on the differences in attribute distribution between innovative and non-innovative industries and the impacts of attribute transition on corporate investment are provided in Section 3. In Section 4, potential problems about the measure of overconfidence and the impacts of board strength on attribute transition are discussed. Section 5 concludes the study.

1. Hypothesis Development, Attribute Definition, and Sample Construction

1.1. Hypothesis Development

According to Goel and Thakor (2008), overconfident managers are more likely to be promoted in the promotion competition. However, CEOs with suboptimal attributes often distort corporate decisions, which can destroy firm value. Consequently, overconfident and diffident CEOs are more likely to be fired than rational ones. Since this study is an empirical extension of Goel and Thakor's analysis of CEO selections, we first test the two basic propositions from their model:

H1a: Overconfident managers are more likely to be promoted to the CEO position.

H1b: Overconfident and diffident CEOs are more likely to be fired than rational ones.

We then have our key, "two-force" proposition on the possible difference in transition patterns between normal and forced turnovers. Under a normal retirement, the board sees the retiring CEO as unproblematic and has no intention to perform corrections on the CEO attribute. In this case, the implicit force from the incumbent CEO that cultivates a certain confidence attribute among the subordinate managers may dominate the selection of the successor. Consequently, the succeeding CEO tends to share the same confidence attribute as the retiring CEO, and this is particularly so if the successor is promoted internally. However, when the board sees the incumbent CEO as having a problematic attribute, the explicit force from the board dominates through which the board fires the incumbent CEO and performs attribute correction by choosing a "rational" successor.

H2a: Under normal retirement, the retiring CEO and the succeeding CEO tend to share the same confidence attribute, especially when the succeeding CEO comes from internal promotion.

H2b: Under forced turnover, the ousted CEO tends to be either overconfident or diffident. The succeeding CEO tends to be rational, especially when the succeeding CEO is recruited from outside.

Next, we look into the fact that some overconfident CEOs retire normally without being forced to leave by investigating the possibility that overconfidence is not always suboptimal. Hirshleifer, Low, and Teoh (2012) argue that overconfident managers are more suitable to

undertake innovative projects that are inherently risky. Graham, Harvey, and Puri (2013) also find that growth companies are more likely run by confident CEOs. We thus hypothesize that a possible difference exists in transition patterns in innovative and non-innovative industries.

H3a: Disproportionately more number of overconfident CEOs and overconfident managers work in innovative industries than in non-innovative industries.

H3b: Disproportionately more number of overconfident CEOs retires in innovative industries than in non-innovative industries.

As discussed at the beginning, we care about CEO confidence attributes because they could cause overinvestment and underinvestment problems. Now, if the transition patterns for normal and forced turnovers are different, then we should also expect to see a corresponding difference in the subsequent changes in investment. We thus formulate another set of hypotheses:

H4a: Overconfident CEOs tend to overinvest, and diffident CEOs tend to underinvest.

H4b: CEO turnover under normal retirement will not lead to significant changes in the corporate investment level.

H4c: After the forced turnover of an overconfident CEO, the corporate investment level will decline significantly.

H4d: After the forced turnover of a diffident CEO, the corporate investment level will increase significantly.

We use non-parametric and parametric tests. For the non-parametric test, we examine the attribute distributions of CEOs and managers across various testing samples to see if the subsample differences are significant. For the parametric test, we run different regression models to be specified later.

1.2. Defining Confidence Attributes

Overconfidence carries different definitions and different measurements. Malmendier and Tate (2005) define a CEO as overconfident if she holds on to her options even when they are deep in the money (i.e., more than 67% moneyness). This measure of overconfidence builds on Hall and Murphy's (2002) theory, in which the portfolios of risk-averse managers are not diversified, and such managers should, therefore, exercise their options early if the options are sufficiently in the money. This measure is also adopted by Hirshleifer, Low, and Teoh (2012) to investigate the impact of manager overconfidence on firm innovation activity. Campbell et al. (2011) take a similar approach, although they use the term "optimism." Specifically, they set the deep-in-the-money cutoff for "high optimism" at or above 100% of the option exercise price and the cutoff for "low optimism" at or below 30% of the option exercise price.

In this study, we follow Campbell et al. (2011) to estimate CEO option moneyness and exercise price based on the ExecuComp database, using the authors' cutoffs to define overconfident and diffident CEOs.[10] Rational CEOs are those who are classified as neither overconfident nor diffident. We also define and classify key non-CEO senior managers similarly to determine how succeeding CEOs are selected from among them. Non-CEO senior managers include those whose total compensation is among the top five in the company in the year

[10] Our results remain qualitatively the same if we use Malmendier and Tate's (2005) cutoff of 67% moneyness to define overconfidence.

immediately preceding the change in CEO, as reported by the ExecuComp dataset. These executives typically hold key positions in the firm, such as chief operating officer (COO), chief financial officer (CFO), president, vice-president, or CEO or other senior managers for important subdivisions. Normally, the new CEO is selected from among these senior managers.

The option moneyness for overconfidence is calculated in the following way. We first estimate the average realizable value per option by dividing the total realizable value of the options by the number of exercisable options for each year. We then subtract the average realizable value from the fiscal year-end stock price to get the average exercise price of the option. Therefore, the average moneyness of an option is obtained as the average realizable value divided by the average exercise price.

To calculate the percentage moneyness of the exercised options for diffidence, we first estimate the average realized value per option from the exercise by dividing the total value realized from the option exercise by the number of options exercised. We then subtract the average realized value per option from the fiscal year-end stock price to get the estimated average exercise price. Therefore, the average percentage moneyness of the exercised option is obtained as the average realized value divided by the average exercise price.

In the calculation, we exclude CEOs and senior managers who have all of their options out of the money or who have no options at all. We apply the chosen cutoffs to the entire sample and require an executive to exhibit the relevant option holding/exercise behavior at least twice during the sample period to be classified as overconfident/diffident. Since most of the CEOs in the sample are internally promoted, the classification begins while they still hold positions as key

senior managers and ends during their final year in the CEO position.[11] For CEOs who are externally recruited, we trace back their option exercise behaviors in their old firms.

However, it is possible that an executive's option holding/exercise behavior may change if he is promoted from a key senior manager position to the CEO position, given that a CEO has more power in a firm and faces more pressure from the board and investors. The option holding/exercise behavior may also change with the corporate setting. Therefore, we conduct robustness tests by defining CEO attributes as beginning from when a CEO position is acquired. The primary results are qualitatively the same as those reported when we compare the attribute distributions of the departing and succeeding CEOs and of the internal and external succeeding CEOs across the retirement and forced departure samples.

1.3. Identifying CEO Turnover

We use ExecuComp to identify the year in which a CEO changes. CEO departures are classified as retirements if all of the following conditions are met: (1) the departing CEO is above the age of 59 when he leaves the firm, (2) the succeeding CEO is not above the age of 59 when he is appointed CEO, and (3) the turnover is not classified as "DECEASED" or "RESIGNED" by the ExecuComp dataset. CEO departures are classified as forced if all of the following conditions are met: (1) the departing CEO is under the age of 59 when he leaves the firm, (2) the departing CEO does not leave the firm because of death, and (3) the departing CEO

[11] This classification enables us to compare the attribute distribution between the internal succeeding CEOs and the pool of senior managers from which the succeeding CEOs are selected. The comparison is essential to confirm whether overconfident managers are more likely to be promoted to CEO positions than their rational peers as argued by Goel and Thakor (2008). As a robustness test, we also conduct the comparison by defining the attribute of internal succeeding CEOs as only during the period of key non-CEO senior managers. The results are qualitatively the same as those reported in Table 3.

does not serve on the board of the firm after leaving the CEO position. Our classification of forced turnover is quite similar to that of Campbell et al. (2011).

1.4. Sample Formation and Summary Statistics

The sample includes only firms with option data on the departing CEO, the succeeding CEO, and the five senior managers. We collect data on firm characteristics from Compustat and collect stock data from CRSP. We get an ultimate sample of 21,081 total CEO-firm-year observations across 4,596 CEO-firms over the period from 1992 to 2010. The sample includes 707 CEO retirements and 356 forced CEO turnovers.[12]

1.4.1 General Patterns of Confidence Attributes

(Insert Table 1 here)

Table 1 presents the attribute distribution of the CEOs in the sample based on the nature of the CEO turnovers. In Panel A, for all 4,596 CEOs in the full sample, 35.2% are classified as overconfident, 59.3% as rational, and 5.4% as diffident.[13] Taking this as the benchmark for the attribute distribution of CEOs in the CEO labor market, we see that, of the 707 departing CEOs in the retirement turnover sample, 37% are overconfident, 58% are rational, and 5% are diffident.

[12] We do not look at voluntary turnovers because our key proposition is the fundamental difference in the forced turnover and normal retirement samples. In the turnover literature, it is difficult to cleanly identify voluntary turnovers. Furthermore, a serious endogeneity problem could be involved as a CEO may appear to leave "voluntarily" when she feels she does not fit the "attribute culture" of the company she works with. Thus, it is hard to infer whether the company board endorses or does not endorse the confidence attribute of a CEO who leaves voluntarily.

[13] The attribute distribution in the sample is quite similar to that documented by Campbell et al. (2011). With the same measure of overconfidence, they classify 34.1% of CEOs as overconfident, 57% as rational, and 8.9% as diffident in a sample of 3,352 CEOs between 1992 and 2006.

This attribute distribution for retiring CEOs is not statistically different from that of the full sample.

More importantly, for all three types of attributes, the distributions are not statistically different between departing and succeeding CEOs, with the *t*-statistic -1.11, 1.12, and -0.13 for the overconfident, rational, and diffident attributes, respectively. Such insignificant differences in the attribute distributions provide preliminary support for H2a. We suggest that the board of directors performs no "correction" of CEO attributes during the selection of succeeding CEOs in the case of retiring CEOs. In other words, when overconfident and diffident CEOs retire, the CEOs' companies do not see overconfidence or diffidence as a problem.

A different picture is revealed in the forced turnover sample. Of the 356 departing CEOs, 41% are overconfident. However, this percentage drops to 26% in succeeding CEOs. The difference in "overconfident" percentages across the two groups is highly significant (t = 2.09). Similarly, the "diffident" percentage drops from 7% in departing CEOs to 5% in succeeding CEOs, although the difference is not statistically significant (t = 0.24). Evidently, fewer succeeding CEOs are overconfident or diffident, in comparison to their predecessors. However, 52% of the departing CEOs are classified as "rational," but this percentage increases to 69% in succeeding CEOs. The difference is statistically significant (t = -2.04). The board of directors appears to perform corrections by bringing in rational CEOs to replace overconfident and diffident CEOs. This provides the first piece of evidence for a "correction" tendency regarding CEO attributes in the forced turnover sample and lends support to H2b.

Goel and Thakor (2008) predict that excessively overconfident and diffident CEOs are more likely to be fired. Consistent with their line of thinking, the "overconfident" percentage of departing CEOs in the forced turnover sample is significantly larger than that in the full sample,

with a *t*-statistic of 2.19. The "diffident" percentage of fired CEOs is also larger than that in the full sample, though the difference is not statistically significant (t = 1.04). Such result thus provides some support for H1b.

Panel B of Table 1 reports the recruitment origin of the succeeding CEOs. Most of the replacements come from internal promotions. However, the replacements differ greatly across the nature of the CEO's departure. In the retirement sample, 630 out of 707 (89.1%) succeeding CEOs are selected through internal promotions, but in the forced turnover sample, only 258 of 356 (72.5%) are promoted internally. These results indicate that firms are more likely to select CEOs internally when incumbent CEOs retire but are more likely to hire CEOs externally when incumbent CEOs are fired.[14]

Internal promotion results in the selection of successors who are relatively more overconfident and diffident, whereas external recruitment results in the picking of successors who are more rational. Using the retirement sample as an example, of 630 succeeding CEOs chosen through internal promotion, 52% are rational, while 39% and 9% are overconfident and diffident, respectively. Yet of the 77 CEOs recruited from the outside, 78% are rational, but only 19% and 3% are overconfident and diffident, respectively. The differences are all highly significant, with *t*-statistics of -5.04, 3.93, and 3.06, respectively. The forced turnover sample exhibits a similar pattern, though to a lesser extent.

Panel C of Table 1 presents the positions of internal succeeding CEOs in the year immediately before the CEO turnover. The majority of succeeding CEOs in the retirement sample are promoted from the COO position. Specifically, of the 630 succeeding CEOs, 53.3%

[14] Warner, Watts, and Wruck (1988) and Denis and Denis (1995) found that fewer than 21% of the senior management as a whole are recruited from outside. For a recent sample of 1993-2005, Cremers and Grinstein (2014) find that 71% of new CEOs come from internal promotions. Parrino (1997) showed that half will be recruited from outside for forced turnovers. Huson, Parrino, and Starks (2001) also documented a trend that more firms replace their forced-out CEOs with outsiders.

act as COOs before the promotion, 4.1% act as CFOs, 27.5% as other senior managers (including as presidents, vice-presidents, and CEOs/senior managers of key subdivisions).[15] These figures indicate that the selection of successors in the retirement sample focuses on continuing the policy and strategy adopted by the incumbent CEO.

Interestingly, of the 258 successors in the forced departure sample, only 35.7% are promoted from the COO position; instead, 9.7% are promoted from the CFO position and 39.1% from other senior manager positions. The differences between the retirement and forced departure samples for "COO," "CFO," and "Other" are highly significant with *t*-statistics of -4.84, 2.77, and 3.31, respectively. In the forced departure sample, the successors' backgrounds are more diversified, indicating that the boards of directors focus more on changes in current corporate policy and strategy.

1.4.2 Patterns of Firm and CEO Characteristics across Confidence Attributes

We also seek to gain a general idea of the kinds of firms and types of CEOs who tend to have certain confidence attributes. Table 2 provides interesting results.

(Insert Table 2 here)

For firm characteristics, relative to diffident and rational CEOs, overconfident CEOs work in firms with higher performances in terms of stock return, return on assets (ROA), and sales growth. However, these firms also have higher firm-specific and industry stock volatilities, indicating that the firms are more risky. Interestingly, on average, these firms possess the

[15] The majority of COOs also act contemporaneously as presidents in the firm. In five cases, the COO also acts contemporaneously as CFO.

smallest asset sizes but the highest valuations in terms of the market-to-book ratio; in contrast, firms run by diffident CEOs possess the largest asset sizes and the lowest valuations.

Firms with overconfident CEOs also show higher levels of investment than those with rational CEOs, which are higher than those of firms with diffident CEOs. This is consistent with Goel and Thakor's (2008) argument that overconfident CEOs typically overinvest, while diffident ones underinvest.

For CEO characteristics, although overconfident CEOs do not seem to receive particularly higher compensation packages, they are granted more stock options and restricted stocks, and their shareholdings in their firms are also much larger. This evidence is consistent with Gervais, Heaton, and Odean's (2011) argument that rational and mildly overconfident managers are more likely to work at safe, diversified-value firms with relatively flat compensation contracts. In contrast, highly overconfident managers are more likely to be attracted to the compensation convexity offered by risky, growth-focused firms.

Finally, at the bottom of Table 2, we report the stock performances for the retirement and forced turnover samples in the year before the CEO's departure. Firms in the forced turnover sample perform poorly compared to their industry peers, since the mean and median values of *AReturn* are uniformly negative. These results are consistent with the turnover literature (e.g., Murphy and Zimmerman 1993; Warner, Watts, and Wruck 1988), which shows that stock performance has a significant effect on forced turnover decisions. More importantly, for the forced turnover sample, the raw and industry-adjusted stock returns of firms operating under overconfident CEOs are significantly lower than the stock returns of firms operating under rational CEOs. In contrast, the stock performance of firms run by overconfident CEOs, who could hold tenure through retirement, is significantly higher than that of firms run by rational

CEOs. These results, again, indirectly validate the importance of our classification of forced turnovers and retirements, as well as our conjecture that overconfident CEO retirement is an indication of a company board failing to see overconfidence as problematic (for good reason, since overconfidence could be an optimal characteristic for some companies).

2. Key Results

2.1. Conditional Attribute Distributions

We begin our analysis with a non-parametric approach to check the inherent link between departing CEOs and their successors and senior managers. Essentially, we compare the attribute distributions of the succeeding CEOs and the senior management pool, conditional on the confidence attributes of the departing CEOs. Table 3 reports the results.

(Insert Table 3 here)

2.1.1. Internal Succeeding CEOs

First, we consider the succeeding CEOs who are promoted internally. When the retiring CEOs are overconfident, 60.3% (144 of 239) of the succeeding CEOs are still overconfident; however, only 36.4% and 3.3% are rational and diffident, respectively. Similarly, when the retiring CEOs are rational, 61.4% of the succeeding CEOs are also rational. This pattern exists for the diffident attribute. When the retiring CEOs are diffident, 35.5% of the succeeding CEOs are diffident. Although this is not the highest weighting in the corresponding attribute

distribution, it is extremely high compared to the typical weightings of diffidence (around 5% to 10%) in other groups.

Thus, in the retirement sample, there seems to be a general link in attributes between departing CEOs and their successors. The link in attributes, in our viewpoint, may be driven by the force from the incumbent CEO in the promotion tournament game. Davidson, Dey, and Smith (2015) finds that a frugal CEO is more likely to appoint a frugal CFO, implying that a CEO may prefer to hire like-minded subordinates during hiring decisions. Since a retiring CEO typically has a longer tenure inside her company than a fired one, she may be able to better groom a management team with similar attributes.[16] Moreover, the retiring CEO may recommend a subordinate with a similar attribute to the board as her successor. As the board is likely to be satisfied with the performance of a retiring CEO and to see no problem with her attribute, the board will tend to accept her recommendation for a potential succession candidate, leading to a general "attribute continuity" pattern in cases of retirement turnover. In any case, the conditional attribute distribution patterns support the first part of H2a.

The link in attributes, however, decreases significantly in cases of forced turnover, in which internal succeeding CEOs tend to cluster around the "rational" attribute. When overconfident CEOs are fired, 39.8% (43 of 108) of successors are overconfident, which is significantly smaller than the corresponding figure of 60.3% in the retirement sample (t = 3.59). Meanwhile, 55.6% of successors are rational, in contrast with only 36.4% in the retirement sample (t = -3.39).

[16] This argument is supported by the comparison of the conditional attribute distribution of senior managers between the retirement sample and the forced turnover ample. As reported in Table 3, of the 1,022 senior managers who are potential candidates to replace the 239 retiring overconfident CEOs, 49.5% are overconfident. This figure is significantly larger than the corresponding figure of 43.4% (t = 2.22) found in the forced turnover sample, in which 484 senior managers are available to replace 108 overconfident CEOs. Similarly, 31.8% of 132 senior managers are diffident in firms in which diffident CEOs retire. This figure is larger than the 28.4% found for firms in which diffident CEOs are fired (t = 0.55).

Evidently, following the forced turnover of overconfident CEOs, firms tend to recruit successors not so overconfident, leaning toward rational CEOs instead. Similarly, when diffident CEOs are fired, only 13.6% of successors are diffident, which is significantly smaller than the 35.5% found for the retirement sample (t = 1.80). Again, succeeding CEOs are mostly rational, with a percentage of 77.3%, larger than the 61.3% found for the retirement sample.

Thus, in contrast to the "attribute continuity" pattern found for cases of retirement turnover, there seems to be a "convergent attribute" (specifically, to the rational attribute) pattern in CEO succession in cases of forced turnover. The attribute convergence, in our viewpoint, may be driven by the force from the board of directors in the CEO selection process. The board may realize the problem of overconfidence and/or diffidence, causing the board to become unsatisfied with the incumbent CEO. In such cases, the board will fire overconfident and diffident CEOs and make adjustments to the CEO selection process to avoid choosing successors with the same attribute, leading to a convergence to the rational attribute in CEO succession.[17] Overall, the results support the first part of H2b.

2.1.2. External Succeeding CEOs

Then, we consider the succeeding CEOs who are recruited externally. Again, there is an "attribute continuity" pattern in the retirement sample and an "attribute convergence" pattern in the forced turnover sample. For instance, 45.8% of successors (11 of 24) are still overconfident in firms in which overconfident CEOs retire, in contrast to 18.4% in firms in which

[17] Nevertheless, underneath this correctional tendency, we still observe the influence of the implicit force from the incumbent CEO when reading the figures more carefully. For instance, 39.8% of successors are overconfident in firms in which overconfident CEOs are fired. Even though this figure is smaller than the corresponding figure of 60.3% in the retirement sample, it is larger than the unconditional figure of 35.2%, which is the overconfidence distribution of CEOs in full sample (shown in Panel A of Table 1). Similarly, 13.6% of diffident successors replace fired diffident CEOs—a percentage that is also larger than the unconditional figure of 5.4% in the full sample.

overconfident CEOs are fired. The difference between these percentages is highly significant (t = 2.38). However, 54.2% of successors are rational in the retirement sample, which is a significantly smaller percentage than the 78.9% found for the forced turnover sample (t = -2.10).

However, the "attribute continuity" pattern in the retirement sample is decreased in cases of external successors, compared to internal successors. For instance, when overconfident CEOs retire, 45.8% of external successors are overconfident. This figure is smaller than the corresponding figure of 60.3% for internal successors (t = -1.37). Meanwhile, 54.2% of external successors are rational, which is a significantly larger percentage than the 36.4% of internal successors who are rational (t = 1.71). Obviously, firms choose more successors who are overconfident through internal promotion but more rational ones through external recruitment. This result indicates the incumbent CEO has a stronger influence on the selection of successors through internal promotion than through external recruitment and thus supports the second part of H2a.[18]

The "attribute convergence" pattern in the forced turnover sample is more evident for external successors than for internal successors. For instance, when overconfident CEOs are fired, 18.4% of external successors are overconfident, which is a much smaller percentage than the 39.8% of internal successors who are overconfident (t = -2.42). Meanwhile, 78.9% of external successors are rational, which is a larger percentage than the corresponding 55.6% of internal successors (t = 2.59). Clearly, more successors who are overconfident are chosen through

[18] One explanation is that the percentage of senior managers who share the same attribute as the departing CEO is larger inside the firm than in the labor market. An incumbent CEO in a firm may hire more subordinates who have the same attribute, leading to a stronger influence by the incumbent CEO in the selection of successors through internal promotion. This explanation is supported by a comparison of the conditional attribute distribution of senior managers reported in Table 3 and the unconditional attribute distribution of a sample of 24,434 senior managers collected from the ExecuComp dataset for the 4,596 CEO-firm combinations, of which 23% are classified as overconfident, 73.5% as rational, and 3.5% as diffident.

internal promotion, but more rational ones are chosen through external recruitment, indicating a better correction of CEO overconfidence. This is consistent with the second part of H2b. More importantly, this evidence indicates an interaction between the two forces in CEO selection. Given the incumbent CEO's influence, the board's effort to correct the CEO's attribute is weakened in the process of selecting successors through internal promotion.

2.1.3. Internal Manager Pool

Lastly, we examine the conditional attribute distribution for the pool of senior managers, some of whom will be promoted as CEO successors.[19] In the retirement sample, of the 1,022 managers who are potential candidates to replace the retiring overconfident CEOs, 49.5% are overconfident. Yet following the promotion, 60.3% of succeeding CEOs are overconfident. The difference between these numbers is highly significant (t = -3.00). Meanwhile, 48.1% of managers are rational, which is a significantly larger percentage (t = 3.29) than the 36.4% among the internal successors. These differences show that overconfident managers are more frequently promoted to CEO positions than rational managers—a finding that supports Goel and Thakor's (2008) argument, as stated in H1a.

When diffident CEOs retire, of the 132 managers available for promotion, 31.8% are classified as diffident and 65.2% as rational. Yet after promotion, 35.5% of succeeding CEOs are diffident, and 61.3% are rational. Thus, more diffident managers than rational managers are promoted to CEO positions following the retirement of diffident CEOs, again confirming the influence of the incumbent CEO at work in successor selection.

[19] We do not report the attribute distribution of senior managers for firms in which the succeeding CEOs are recruited from the outside.

In contrast, in the forced turnover sample, the forced departure of overconfident and diffident CEOs leads to a correction in CEO attributes. In firms in which overconfident CEOs are fired, 43.4% of senior managers are overconfident; however, among those promoted, only 39.8% of successors are overconfident. In contrast, 52.7% of managers are rational, but 55.6% of successors are rational. Although the differences are not statistically significant, the results show that rational managers are more frequently promoted to CEO positions than overconfident managers, confirming the "preferred attribute" influence in CEO selection. Similarly, in firms in which diffident CEOs are fired, there is also a trend of choosing rational successors, since 77.3% of successors are rational, which is a higher percentage than the corresponding 67.4% of rational managers. In contrast, 13.6% of successors are diffident, which is a smaller percentage than the corresponding 28.4% of diffident managers.

In summary, our results provide preliminary support for the first two sets of hypotheses and are best interpreted as two co-existing forces that drive the attribute transition that accompanies CEO succession. One force is developed by the incumbent CEO, and the other is defined by the board. When the board does not see an incumbent CEO's attribute as problematic, the incumbent CEO works through her tenure until retirement. In this case, the two attribute forces work congruently, leading to observed attribute continuity from the retiring CEO to the succeeding CEO. However, when the board sees "overconfidence" or "diffidence" as problematic, the board fires the incumbent CEO, and the two forces are inconsistent, leading to an attribute correction through CEO succession.

2.2. Regression Analysis

After the non-parametric analysis, in this section, we provide further evidence of the distribution of CEO attributes in the dynamic process of succession by performing firm-level, probit regression analysis with the first model as follows:

$$Prob(Forced_{i,t} = 1) = \alpha_0 + \alpha_1 OCEO_{i,t-1} + \alpha_2 DCEO_{i,t-1} + \alpha_3 Firm\ Char_{i,t-1} + \alpha_4 CEO\ Char_{i,t-1} + \alpha Year_t + \varepsilon_{i,t} \quad (1)$$

where $Forced_{i,t}$ equals one if the departing CEO for firm *i* is fired in year *t*, and zero otherwise. $OCEO_{i,t-1}$ ($DCEO_{i,t-1}$) is the attribute dummy of the departing CEO, which equals one for overconfidence (diffidence) for firm i in year $t-1$, and zero otherwise. $Firm\ Char_{i,t-1}$ is the set of firm characteristics for firm i in year $t-1$, which include firm size, financial leverage, sales growth, stock return, return on assets, market-to-book ratio, stock volatility, and industry stock volatility. $CEO\ Char_{i,t-1}$ is the set of CEO characteristics for firm i in year $t-1$, which include age, tenure, total compensation, compensation ratio, and share percentage. Variable definitions for firm and CEO characteristics are provided in the table description of Table 2. $Year$, an annual dummy, is included in the regression.

If H1b is correct, that is, overconfident and diffident CEOs are more likely to be fired than rational ones, we expect to see significant positive coefficients for α_1 and α_2. We use the full sample of 21,081 CEO firm-year observations across 4,596 CEO-firms to run Model (1). The results are reported in Table 4.

(Insert Table 4 here)

In both specifications, the estimated coefficients of OCEO are significantly positive, which confirms Goel and Thakor's (2008) argument that overconfident CEOs are more likely to be fired than rational ones. The estimated coefficients of DCEO are also positive, although not statistically significant. Thus, H1b is supported by the regression results. For firm performance, Return, ROA, and M/B are all significantly negatively related to forced turnover, indicating that underperforming CEOs are likely to be fired.

The second model aims to test H2a and H2b on the link in confidence attributes between a succeeding CEO and a departing CEO and senior managers. The test is conducted with the following multinomial logit model:

$$\begin{aligned} Prob(ATTR_i = j) = {} & \beta_0 + \beta_1 OCEO_i + \beta_2 DCEO_i + \beta_3 Forced_i + \beta_4 OCEO_i * Forced_i \\ & + \beta_5 DCEO_i * Forced_i + \beta_6 External_i + \beta_7 OCEO_i * External_i \\ & + \beta_8 DCEO_i * External_i + \beta_9 OCEO_i * External_i * Forced_i \\ & + \beta_{10} DCEO_i * External_i * Forced_i + \beta_{11} OMgr_i + \beta_{12} DMgr_i \\ & + \beta_{13} OMgr_i * Forced_i + \beta_{14} DMgr_i * Forced_i \\ & + \beta_{15} Firm\ Char_i + \beta Year + \epsilon_i \end{aligned} \quad (2)$$

where $ATTR_i$ is the attribute of the succeeding CEO in firm i with a j type of attribute. We run the model using "Rational" as the "pivot" attribute. $OCEO_i$ and $DCEO_i$ are the departing CEO's attribute dummies, as previously defined. $Forced_i$ equals one if the departing CEO is fired, and zero if the departing CEO retires. $External_i$ equals one if the succeeding CEO is selected through external recruitment, and zero if she is selected through internal promotion. $OMgr_i$ ($DMgr_i$) is the attribute dummy for individual senior managers, and it equals one for

overconfidence (diffidence), and zero otherwise. $Firm\ Char_i$ and $Year$ are defined and used as in Model (1).[20]

We focus on the coefficients of $OCEO_i$ and $DCEO_i$, which show the CEO attribute transitions for the retirement group. If H2a is correct, β_1 should be significantly positive, and β_2 should be significantly negative. The interaction of $Forced_i$ with $OCEO_i$ and $DCEO_i$ indicates a possible difference in CEO attribute transitions between the retirement sample and the forced turnover sample. If H2b is correct, β_4 should be significantly negative, and β_5 should be significantly positive. The interaction of $External_i$ with $OCEO_i$ and $DCEO_i$ shows the possible difference in CEO attribute transitions between internal promotion and external recruitment, testing the second part of H2a and H2b.

Similarly, the coefficients of $OMgr_i$ and $DMgr_i$ show the extent of the attribute link between a succeeding CEO and senior managers for the retirement group. The interaction of $Forced_i$ with $OMgr_i$ and $DMgr_i$ shows a possible difference in the extent of the attribute link between the retirement and forced turnover samples.

(Insert Table 5 here)

Table 5 reports the regression results for Model (2). Specifications (1) to (4) are the regression results for overconfident successors, and specifications (5) to (8) are the results for diffident successors.

[20] In regression Model (2), we do not include the individual characteristics of succeeding CEOs as control variables, since a portion of succeeding CEOs are recruited from the outside, and we do not have some of the needed individual characteristics of these externally recruited CEOs. As a robustness test, we run regression Model (2) with a sample of only internal successors. When the characteristics of succeeding CEOs are included, the results are similar to those reported in specifications (1) and (5) of Table 5. The results are also quite similar to those reported in specifications (4) and (8) of Table 5 when the characteristics of senior managers are included in regression Model (2).

In Specification (1), OCEO is significantly positively related to overconfident successors, with an estimated coefficient of 0.318 (t = 7.88). In contrast, DCEO is significantly negative. These results indicate that when an overconfident CEO retires, the succeeding CEO is *more* likely to be overconfident than rational and diffident. In contrast, if a diffident CEO retires, the succeeding CEO is *less* likely to be overconfident. This is consistent with our suggestion of an "inherited attribute" force in CEO selection for retirement. However, the interaction term, OCEO*Forced, is significantly negative, with a coefficient of -0.214 (t = -3.37). This result indicates that the confidence attribute transition between the departing and succeeding CEOs is significantly weakened under a forced turnover, which is consistent with our suggestion of a "preferred attribute" force in CEO selection under forced turnovers.

In Specification (2), the coefficient of OCEO is significantly positive, while that of DCEO is significantly negative. These results indicate a strong attribute continuation between the departing and succeeding CEOs in firms in which successors are promoted internally. However, this continuation tendency is weakened in firms in which successors are recruited externally, since OCEO*External is significantly negative.

Specification (3) conducts a further test on the confidence attribute transition by interacting OCEO (DCEO) with External and Forced together. Again, OCEO is significantly positive, while DCEO is significantly negative. The interaction of OCEO with External is negative, with a coefficient of -0.055, but the t-statistic of -0.52 lacks statistical significance. This result indicates that in cases of retirement turnover, there is no significant difference in attribute transition between internal promotion and external recruitment.

However, the interaction of OCEO with External and Forced is significantly negative, with a coefficient of -0.201 and a t-statistic of -2.03. This result indicates that in cases of forced

turnover, the attribute transition from departing CEOs to successors is significantly weakened when successors are selected through external recruitment (instead of through internal promotion). This result confirms our proposition that the board's correction is weakened if the successor is selected internally.

Specification (4) includes a test of the link of the confidence attribute between the succeeding CEO and senior managers. OMgr has a significantly positive coefficient of 0.435, with a *t*-statistic of 23.25, whereas DMgr has a significantly negative coefficient of -0.084, with a *t*-statistic of -2.63. These results suggest that, when an old CEO retires, if the firm has more senior managers who tend to be overconfident, the succeeding CEO is more likely to be overconfident; however, if more managers are diffident in the firm, the succeeding CEO is less likely to be overconfident. This result echoes our earlier observation of the "attribute continuity" pattern in the retirement sample.

The strong attribute link between the succeeding CEO and senior managers, however, is decreased in the forced turnover sample. OMgr*Forced is significantly negative, with an estimated coefficient of -0.316 and a *t*-statistic of -3.85. This result indicates that overconfident managers are less likely to succeed as overconfident CEOs when the incumbent CEO is forced to leave than when the incumbent CEO retires.

The corresponding testing results from the multinomial logit Model (2), which uses diffident successors as the dependent variable, are reported in Specifications (5) to (8) and provide a similar picture. Across all specifications, OCEO is significantly negative, while DCEO is significantly positive. Again, these results indicate a strong link in attributes between the departing and succeeding CEOs in retirement turnover. A diffident successor is more likely to be chosen if the retiring CEO is also diffident. In contrast, if the retiring CEO is overconfident, a

diffident successor is less likely to be chosen. The attribute link, however, is weakened in cases of forced turnover, as the interaction of DCEO and Forced is significantly negative. The attribute link is also marginally weakened in firms in which successors are recruited from outside, as the interaction of DCEO and External is negative.

When looking at Specification (8), the senior manager pool behaves similarly: That is, DMgr is significantly positive, while OMgr is significantly negative, indicating that the succeeding CEO is more likely to be diffident if a firm employs more diffident managers and fewer overconfident managers in cases of CEO retirement. However, this strong link is decreased in a forced turnover sample, as the interaction of DMgr with Forced is significantly negative.

To summarize, the regression results are in line with the non-parametric results and thus provide further support for H2a and H2b. The board engages in minimal correction of the CEO confidence attribute in cases of normal CEO retirement. That is, when overconfident or diffident CEOs retire, successors with the same attribute are more likely to be chosen, leading to high attribute continuity between predecessors and successors. However, overconfident and diffident CEOs are also more likely to be fired. Following the incumbent CEOs' forced departure, the boards engage in corrections of CEO attributes in selecting succeeding CEOs. As overconfident and diffident managers are not as easily promoted as they were before, the attribute continuity between the predecessor and the successor is largely weakened in cases of forced turnover. The correction is more evident in firms in which successors are recruited from the outside.

3. Further Analysis

3.1. Innovative vs Non-innovative Industries

A significant portion of rational CEOs in this sample are fired while a portion of overconfident and diffident CEOs remain in their positions until retirement. According to Hirshleifer, Low, and Teoh (2012), overconfident managers are more suitable for innovative projects that are more risky and challenging. This argument indicates that overconfident managers are more likely to be found in innovative industries. Therefore, we examine the matching of confidence attributes with industry innovativeness.

Following Hirshleifer, Low, and Teoh (2012), we define industry innovativeness by corporate R&D expenditure. We first calculate each industry's average R&D expenditure, scaled by book assets per year per industry, where industries are classified at the two-digit SIC level. Firm-years with missing R&D information are treated as having zero R&D expenditures. An industry is defined as innovative if its R&D expenditure in a given year is above the median R&D expense across all industries for more than 50% of the sample period.[21]

(Insert Table 6 here)

Table 6 presents the attribute distributions of CEOs in innovative and non-innovative industries. First, we consider departing CEOs. One clear pattern is that more (fewer) overconfident (diffident) CEOs retire in firms in innovative industries than in firms in non-innovative industries. For instance, 45.3% of 212 retiring CEOs in innovative industries are overconfident, which is a significantly larger percentage than the corresponding 33.7% of the

[21] The full list of innovative industries is reported in the Appendix. Hirshleifer, Low, and Teoh (2012) also use patent citations (i.e., the average citation count per patent in the industry) to define industry innovativeness. Due to the limitation on data collection, we do not adopt such a method, since the latest available data for patent citations goes up only to 2006. Nonetheless, we apply the patent citation method as a robustness test for data between 1992 and 2006, with no qualitative change in the primary results.

495 retiring CEOs in non-innovative industries (t = 2.92). However, 1.9% of retiring CEOs in innovative industries are diffident, representing a significantly smaller percentage than the corresponding 5.9% in non-innovative industries (t = -2.81).

For the forced turnover sample, the attribute distributions of departing CEOs are not statistically different between innovative and non-innovative industries. For instance, 40.6% of 128 fired CEOs in innovative industries are overconfident, which is a slightly smaller percentage than the corresponding 41.2% of fired CEOs in non-innovative industries (t = -0.11).

Second, we consider the succeeding CEOs who are promoted internally.[22] In the retirement sample, 43.6% of succeeding CEOs in innovative industries are overconfident, compared to 37% in non-innovative industries. For the forced turnover sample, 31.9% of succeeding CEOs in innovative industries are overconfident, compared to 23.8% in non-innovative industries. In the retirement and forced turnover samples, overconfident successors are chosen more frequently in innovative industries than in non-innovative industries.

Third, we consider the attribute distribution for internal senior manager pools. In the retirement sample, 33.7% of senior managers in innovative industries are overconfident, which is a significantly larger percentage than the corresponding 24.6% in non-innovative industries (t = 4.7). For the forced turnover sample, 28% of senior managers are overconfident in innovative industries, compared to 24.3% in non-innovative industries. Again, the results show that firms in innovative industries favor overconfident managers, which is consistent with Hirshleifer, Low, and Teoh's (2012) argument.

[22] Here, we report the attribute distribution of internal succeeding CEOs in order to compare the attribute distribution between internal succeeding CEOs and senior managers. Unreported results for external succeeding CEOs also show that more successors who are overconfident are chosen in innovative industries. Specifically, in the retirement sample, 22.6% of the 31 external successors in innovative industries are overconfident, compared to 17.4% of the 46 external successors in non-innovative industries. For the forced turnover sample, 25.6% of the 39 external successors in innovative industries are overconfident, compared to 25.4% of the 59 external successors in non-innovative industries.

In addition, Table 6 reports a comparison of attribute distribution between internal senior managers and internal succeeding CEOs. In the retirement sample, the overconfidence distribution is significantly larger among succeeding CEOs than among senior managers in both innovative and non-innovative industries. In contrast, in the forced turnover sample, the attribute distribution between them is statistically insignificant. The results again confirm that overconfident managers are more likely to be promoted if the board does not realize the problem of overconfidence. Once the board realizes the problem, overconfident managers are not promoted as easily as before.

Overall, the results support H3a and H3b. That is, firms in innovative industries tend to favor overconfident managers and CEOs, and these overconfident CEOs experience retire at a disproportionately higher rate than those who work in non-innovative industries.

3.2. Changes in Corporate Investment Levels

The literature shows that overconfident managers often overinvest, that diffident managers underinvest, and that both behavioral distortions destroy firm value (e.g., Ben-David, Graham, and Harvey 2007; Campbell et al. 2011). Therefore, one intriguing issue is whether a board's efforts to correct CEO attributes through the selection of succeeding CEOs can successfully reduce overinvestment and underinvestment problems. Thus, we go a step further to examine possible changes in corporate investments after changes in CEO attributes resulting from turnovers, as stipulated in the set of H4 hypotheses.

3.2.1. Non-parametric Contrast

Again, we begin the examination with a non-parametric contrast at the pre-turnover and post-turnover investment levels. A firm's pre-turnover investment level is the firm's time-series average of annual, industry-adjusted investment levels over the entire tenure period of the departing CEO. The industry-adjusted investment level is obtained as the firm's raw investment level by deducting the median level of industry peers with the same two-digit SIC code, where the raw investment level is calculated as the amount of capital expenditure, divided by the year-beginning property, plant, and equipment. A firm's post-turnover level is computed in a similar fashion but over the tenure period of the succeeding CEO. Note that the computed investment level is industry-adjusted; thus, a positive figure indicates overinvestment, and a negative figure indicates underinvestment.

(Insert Table 7 here)

Table 7 reports the investment level comparisons for the retirement and forced turnover samples divided according to the attributes of the departing CEOs. The figures show two important patterns. The first pattern is related to the overinvestment problem of overconfident CEOs. In firms in which overconfident CEOs retire, the average investment level is 0.063 during the pre-turnover period, which is statistically different from zero, with a *t*-statistic of 11.72. This result indicates that overconfident CEOs tend to overinvest relative to their industry peers. The average investment level slightly decreases to 0.055 during the post-turnover period; however, the level is not statistically different from the level before turnover (t = -1.06).[23]

[23] We obtain similar results if we separate the total sample according to whether subsequent CEOs are internally promoted or externally recruited.

In firms in which overconfident CEOs are fired, the investment level during the pre-turnover period is even higher, with an average level of 0.095 (t = 9.98). This figure is significantly larger than that in the retirement sample (t = -2.93). The high investment level is likely a reason for the forced departure of these CEOs.[24] Even for rational CEOs, the investment level of the forced turnover sample is significantly higher than that of the retiring sample (t = -2.85). In any case, there is some support for H4a.

The second pattern is related to the change in investment levels. In the last column, investment changes are not statistically different between the pre- and post-turnover periods across three confidence attributes in the retirement sample, which supports H4b. This result is also consistent with the earlier observation that there is no correction of the CEO attributes after the CEO retires.

In firms in which overconfident CEOs are fired, the investment level decreased to 0.039 during the post-turnover period, with a highly significant t-statistic of -4.53. Evidently, the overinvestment problem is largely decreased following the forced departures of overconfident CEOs.[25] Similarly, the underinvestment problem for diffident CEOs is also mitigated. In firms in which diffident CEOs are fired, the average investment level increases from -0.004 before the turnover to 0.023 after the turnover. The results support H4c and H4d.

[24] Unreported results show that the probability of a forced departure is significantly positively related to the level of industry-adjusted investment.

[25] Further decomposition of this sub-sample shows that the decrease in the overinvestment problem during the post-turnover period exists mainly in firms that recruit rational or diffident successors. Specifically, for firms that recruit rational successors, the median investment level decreases from 0.101 in the pre-turnover period to 0.035 in the post-turnover period, and the decrease is highly significant, with a z-statistic of -6.30. For firms that recruit diffident successors, it decreases from 0.049 during the pre-turnover period to -0.015 during the post-turnover period, with a z-statistic of -2.27. In contrast, for firms that recruit overconfident successors, the median investment level increases from 0.047 during the pre-turnover period to 0.053 during the post-turnover period, although the increase is statistically insignificant, with a z-statistic of 0.02. Not surprisingly, we also find that of the 50 overconfident successors, 11 are replaced again several years later.

3.2.2. Regression Results

After the comparison, we run the following regression model to test changes in corporate investments upon instances of CEO turnover:

$$\begin{aligned} Invest_{i,t} = {} & \omega_0 + \omega_1 OCEO_{i,t} + \omega_2 DCEO_{i,t} + \omega_3 After_{i,t} + \omega_4 OCEO_{i,t} * After_{i,t} \\ & + \omega_5 DCEO_{i,t} * After_{i,t} + \omega_6 Forced_{i,t} + \omega_7 OCEO_{i,t} * After_{i,t} * Forced_{i,t} \\ & + \omega_8 DCEO_{i,t} * After_{i,t} * Forced_{i,t} + \omega_9 Firm\ Char_{i,t} \\ & + \omega_{10} CEO\ Char_{i,t} + \omega Year_t + \mu_{i,t} \end{aligned} \quad (3)$$

where $Invest_{i,t}$ is the industry-adjusted investment level of firm *i* in year *t*, as defined above. $After_{i,t}$ is a dummy variable to show whether an observation year *t* in firm *i* is a pre- or post-CEO-turnover observation. The dummy variable is set to one for a post-turnover year and zero for a pre-turnover year. All other variables are defined as before.

In regression Model (3), a significant positive ω_1 indicates an overinvestment problem for overconfident CEOs, while a significant negative ω_2 indicates an underinvestment problem for diffident CEOs. The interaction of $OCEO_{i,t}$ with $After_{i,t}$ and $Forced_{i,t}$ shows whether the overinvestment problem is decreased after the forced departure of an overconfident CEO. If the overinvestment problem is decreased, ω_7 should be significantly negative. Similarly, ω_8 should be significantly positive if the underinvestment problem is mitigated following the forced departure of a diffident CEO.

(Insert Table 8 here)

Table 8 reports the regression results. Specification (1) shows the results for the total sample of 21,081 CEO-firm-year observations across 4,596 CEO-firm combinations. After controlling for firm characteristics, OCEO is significantly positively related to investment level, with an estimated coefficient of 0.026 and a *t*-statistic of 7.04. This confirms that overconfident CEOs often overinvest. In contrast, DCEO is negatively related to the investment level, though with no statistical significance, indicating that diffident CEOs tend to underinvest. The results are consistent with the non-parametric results and support H4a.

In Specification (2), which controls for firm and CEO characteristics together, OCEO is still significantly positive, while DCEO is negative. Moreover, the investment level is significantly positively related to a CEO's share holdings and compensation ratio. This suggests that standard incentives are not effective in reducing the overinvestment problem associated with manager overconfidence, as documented in Malmendier and Tate (2005).

Specification (3) shows the effect of CEO succession on the change in corporate investment levels in the turnover sample. OCEO is significantly positive, indicating that overconfident CEOs in the retirement sample overinvest during the pre-turnover period. The interaction of OCEO with After is positive but lacks statistical significance, indicating that the investment level remains high during the post-turnover period for firms whose overconfident CEOs retire. More importantly, the interaction term OCEO*After*Forced is significantly negative, with an estimated coefficient of -0.032 (t = -3.36). This result clearly shows that the overinvestment problem is largely decreased during the post-turnover period for firms that fire their overconfident CEOs. The interaction term DCEO*After*Forced is positive but lacks statistical

significance, indicating that the underinvestment problem is also mitigated during the post-turnover period for firms that fire their diffident CEOs.

In sum, the overinvestment (underinvestment) problem is decreased after the forced departures of overconfident (diffident) CEOs, indicating that boards' efforts to correct CEO attributes through the selection of succeeding CEOs are successful. Goel and Thakor (2008) argue that the behavioral distortions associated with manager overconfidence stem, in effect, from the CEO selection process, suggesting distortions can also be resolved by establishing effective CEO selection mechanisms that screen out overconfident and diffident managers. The results confirm their argument and lend support to H4b, H4c, and H4d.[26]

4. Robustness Tests

4.1. Problems with the Overconfidence Measure

We follow the literature (e.g., Hirshleifer, Low, and Teoh 2012; Campbell et al. 2011; Malmendier and Tate 2005) to construct the measure of the three manager confidence attributes. However, there may be concerns with the construct. One concern is that the confidence attribute is a continuous variable by nature; however, the variable becomes a discrete variable in the construct. Thus, there is the potential for misclassification. For example, the group of CEOs categorized as "rational" may contain CEOs who are actually overconfident (or, at least, more overconfident than the others) and CEOs who are actually diffident (or, at least, more diffident

[26] Some firms may conduct acquisitions instead of conducting research themselves. Therefore, we also check the yearly number of completed acquisitions for sample firms during the pre-turnover and post-turnover periods. Again, we find that the yearly number of completed acquisitions is significantly positively related to CEO overconfidence. Moreover, the average yearly acquisition number does not change significantly between the pre- and post-turnover periods when overconfident CEOs retire. In contrast, there is a significant drop in the average yearly acquisition number (from 0.355 to 0.166; t = 5.41) in firms that fire their overconfident CEOs.

than the others).[27] This misclassification problem cannot be avoided as long as we categorize the confidence attribute, but we believe that the problem is not large enough to be consequential. Since the focus is the difference in CEO succession attributes between the forced turnover and normal retirement samples, any misclassifications, if they exist, should affect both equally in normal retirement cases and forced turnover cases.

Another concern is that managers' option holding/exercise behavior may reflect movement in the stock price after options are granted. Managers who work at the same firm have probably received options with the same exercise price. If the subsequent stock price has never doubled since the managers received their options, all these managers will be categorically treated not as overconfident according to the construct. However, if the stock price has doubled since the managers received their options, it is possible that all of the managers will be mechanically grouped as overconfident. Thus, the manager option exercise behavior may be driven by the stock performance after options are granted.

Last, a manager's option holding/exercise behavior may be driven by factors such as insider information, board expectations, and investor pressure. If that is the case, the confidence attribute defined by the manager's option/exercise behavior would then be driven by these external factors and not by the manager's *genuine* confidence attribute.

To examine these concerns, we conduct a robustness test on the findings by deleting the firms from the sample at which managers share the same type of attribute. The rationale is as follows. On the one hand, if managers' decisions are *really* driven by inside information, board

[27] The measurement error can provide a statistical explanation for why some rational CEOs are fired while some overconfident and diffident ones remain until retirement. It is quite conceivable that company boards *correctly* fire those CEOs who are actually non-rational and/or are only "marginally" rational, replacing them with truly rational ones, but that statisticians *mistakenly* include the fired CEOs in the "rational" category *ex ante*. Similarly, some CEOs *mistakenly* categorized by statisticians as "overconfident" or "diffident" may not actually be overconfident or diffident; thus, they work until retirement.

expectations, investor pressure, or subsequent price movement, managers should exhibit similar patterns of option holding/exercise behaviors, and thus be *mechanically* (and mistakenly) classified as the same type of confidence attributes *even though they actually have different confidence attributes*. By deleting firms with managers who all share the same type of confidence attribute, the sample will be cleaner.

On the other hand, managers who work at the same firm should face the same investor pressure, board expectation, or subsequent price movement but if they still display different behaviors in exercising their options, that should reflect to a great extent their genuine personal attributes. This is consistent with the psychological notion that confidence in judgment differs among individuals (e.g., Block and Peterson 1955; Cutler and Wolfe 1989; West and Stanovich 1997; Kleitman and Stankov 2001).

Overall, by deleting firms at which all managers share the same type of attribute, we can ensure that the managers competing for the promotion have different attributes. We re-compare the attribute distribution of the internal succeeding CEOs and the internal senior managers. The results are reported in Table 9.

(Insert Table 9 here)

In Table 9, for both normal retirement and forced turnover samples, the observations of succeeding CEOs and the senior manager pool decrease relative to those reported in Table 3. However, the decrease mainly clusters in firms in which the departing CEOs are rational. Specifically, 360 retiring CEOs are rational in Table 3, while this number decreases to 251 CEOs in Table 9. Similarly, 128 fired CEOs are rational in Table 3, while only 75 CEOs in Table 9. A

significant portion of firms are excluded in which the managers share the same type of "rational" attribute.[28] This exclusion happens in both normal retirement and forced turnover samples, consistent with our conjecture.

Importantly, in the normal retirement sample, there is still an attribute continuity pattern of replacing retiring CEOs with CEOs with the same attribute. For instance, when 225 overconfident CEOs retire, 132 (58.7%) succeeding CEOs are still overconfident. In the forced turnover sample, there is still a correctional pattern by replacing overconfident and diffident CEOs with rational CEOs. For instance, when 104 overconfident CEOs are fired, 60 (57.7%) succeeding CEOs are rational.

Overconfident managers are more likely to be promoted in the normal retirement sample, but not in the forced turnover sample. For instance, when overconfident CEOs retire, 47.3% of the 974 senior managers available for promotion are overconfident. Yet the promotion result is that 58.7% of succeeding CEOs are overconfident (t = 3.07). In contrast, when overconfident CEOs are fired, 41.1% of managers are overconfident, while only 37.5% of succeeding CEOs are overconfident (t = -0.67). Again, these results confirm distinctive transition patterns for the normal retirement and forced turnover samples.

4.2. Board Strength and CEO Succession

Our basic assumption of the analysis is that a forced turnover indicates that the board realizes the incumbent CEO is overconfident (or diffident). However, this assumption relies on the board being effective. If the board is ineffective, an overconfident (or diffident) CEO will not be identified. In fact, Campbell et al. (2011) show that only firms with good corporate

[28] A possible explanation is that the stock prices of these firms after options are granted do not double the exercise prices of the options. These managers have to exercise their options below 100% of the exercise price, and thus be classified as "rational."

governance would fire high-optimism (similar to "overconfident") or low-optimism (similar to "diffident") CEOs. Thus, we examine how a board's strength affects the turnover decision based on the CEO's confidence attribute and the attribute transition that accompanies CEO succession.

For turnover decisions, we expect that a strong board is more capable and thus more likely to fire an overconfident CEO than a weak board. For the attribute transition, however, we do not expect that it differs between firms with strong boards and those with weak boards, regardless of the nature of the CEO's departure. As we have contended, a forced departure indicates the board (no matter strong or weak) realizes the problem of overconfidence. Thus, naturally the board will perform a correction of the CEO's attribute and choose a "rational" CEO as the successor. Similarly, we argue that normal retirement is an indication the board does not see a problem with the retiring CEO. Thus, the board (no matter strong or weak) has no intention of performing a correction of the CEO's attribute.

We test our predictions with two measures of board strength. The first measure is constructed using CEO tenure. Following Harford and Li (2007), we calculate the median serving year of CEOs for all CEO-firms reported in the ExecuComp dataset over the period 1992 to 2010. A board is classified as strong in a year for a firm with CEO tenure below the median serving year of all CEOs in that year, and weak otherwise (this classification is recalculated each year).[29]

The second measure is constructed based on CEO power. Morse, Nanda, and Seru (2011) and Adams, Almeida, and Ferreira (2005) construct a power index of a CEO's personal influence

[29] This classification is based on the notion that the board's strength changes with the CEO's tenure year. Hermalin and Weisbach's (1998) model suggests that when a CEO has a longer tenure in a firm, she will recommend her friends as independent directors, and the board's independence will gradually weaken. Naturally, there is an endogenous problem of adopting CEO tenure as a measure of board strength since fired CEOs typically have shorter tenure than retired CEOs. However, our focus is not on γ_2 but on γ_3 of Model (4), i.e., the impact of board strength on the sensitivity of the CEO forced turnover to overconfidence. In any case, the second measure of board strength has similar results.

on the board. They classify a CEO as "strong" if she is the board chairman and the president in the firm, "medium" if she is only the board chairman, and "weak" if she does not hold a position on the board. As a powerful CEO may reduce the strength of the board, we classify a board as strong if the CEO will be classified as "weak" in Morse et al. and Adams et al. Otherwise, the board will be classified as "weak."

We first examine the impact of board strength on the sensitivity of CEO forced departure to overconfidence with the following regression model modified from Model (1):

$$Prob(Forced_{i,t} = 1) = \gamma_0 + \gamma_1 OCEO_{i,t-1} + \gamma_2 BS_{i,t-1} + \gamma_3 OCEO * BS_{i,t-1} + \gamma_4 Firm\ Char_{i,t-1} + \gamma_5 CEO\ Char_{i,t-1} + \gamma Year_t + \pi_{i,t} \quad (4)$$

where BS is a dummy variable for board strength with a value of one for a strong board, and zero otherwise. Other variables are defined as before.

For both measures of board strength, γ_3 is significantly positive in Model (4).[30] This indicates that overconfident CEOs are more likely to be fired in firms with strong boards, which is consistent with our predictions.

We then examine the impact of board strength on attribute transition after CEO succession. We make similar modifications to Model (2) by adding in the dummy variable BS and interacting it with the major variables in the model. We find that for the normal retirement and forced departure samples, the attribute link of departing and succeeding CEOs is not statistically different between firms with strong boards and firms with weak boards. The results are consistent with our argument that the forced departure of overconfident CEOs indicates that the

[30] To save space, the empirical results for this regression and the following regression are not reported but are available upon request.

board realizes the problem of overconfidence, and under such circumstances, the board strength is irrelevant. Similarly, the normal retirement of overconfident CEOs indicates that the board views overconfidence as unproblematic, and again, board strength is irrelevant.

5. Conclusion

Goel and Thakor (2008) model CEO promotion as a tournament game that favors senior managers with overconfident attributes over senior managers with rational and diffident attributes. The intriguing phenomenon we aim to study in this paper is that the promotion process is almost invariably triggered by the departure of an incumbent CEO. We argue that the promotion tournament game differs between the normal retirement and forced turnover samples because retirement indicates the board sees an incumbent CEO's attribute as unproblematic, while a forced turnover may indicate attribute problems.

The empirical results show distinctive patterns in attribute transitions associated with the CEO succession process. The retirement sample shows an attribute continuity pattern in which retiring and succeeding CEOs share the same attributes. The forced turnover sample shows a correctional pattern of attribute convergence, in which CEOs with overconfident or diffident attributes are fired and replaced by CEOs with rational attributes. Further analysis shows that board strength has no impact on the attribute continuity/correction patterns.

The results are best interpreted as the coexistence of two forces in a company that affect the attribute transition associated with the CEO succession process. One force results from the influence of the incumbent CEO and prevails during normal CEO retirement, leading to an attribute continuity pattern. Another force comes from the board and prevails during forced

turnovers, leading to a correctional pattern of attribute convergence. However, the force from the incumbent CEO seems powerful and limits the extent of such correction, unless the board chooses to recruit a replacement from outside to circumvent the internal influence.

We also observe that overconfident CEOs invest more than industry peers do. The overinvestment problem is largely decreased after these overconfident CEOs are fired, indicating that the boards' correction of the CEO attribute is helpful. In contrast, following the retirement of overconfident CEOs, the overinvestment problem is not mitigated during the post-turnover period.

Importantly, we also find evidence that disproportionately more CEOs who are overconfident work and retire in firms in innovative industries, indicating that overconfidence need not always be a suboptimal attribute.

References

Adams, R., H. Almeida, and D. Ferreira. 2005. Powerful CEOs and their impact on corporate performance. *Review of Financial Studies* 18: 1403–32.

Ahmed, A. S., and S. Duellman. 2013. Managerial overconfidence and accounting conservatism. *Journal of Accounting Research* 51: 1–30.

Ben-David, I., J. R. Graham, and C. R. Harvey. 2007. Managerial overconfidence and corporate policies. *Working Paper*, NBER.

Block, J., and P. Peterson. 1955. Some personality correlates of confidence, caution, and speed in a decision situation. *Journal of Abnormal and Social Psychology* 51: 34–41.

Bloom, N., and J. Van Reenen. 2007. Measuring and explaining management practices across firms and countries. *Quarterly Journal of Economics* 122: 1351–1408.

Campbell, T. C., M. Gallmeyer, S. A. Johnson, J. Rutherford, and B. W. Stanley. 2011. CEO optimism and forced turnover. *Journal of Financial Economics* 101: 695–712.

Choi, H. S., S. P. Ferris, N. Jayaraman, and S. Sabherwal. 2013. Overconfidence, corporate governance, and global CEO turnover. *Advances in Financial Economics* 16: 10–38.

Cornelli, F., Z. Kominek, and A. Ljungqvist. 2013. Monitoring managers: Does it matter? *Journal of Finance* 68: 431–81.

Cremers, K. J. M. and Y. Grinstein. 2014. Does the market for CEO talent explain controversial CEO pay practices? *Review of Finance* 18: 921–60.

Cutler, B. L., and R. N. Wolfe. 1989. Self-monitoring and the association between confidence and accuracy. *Journal of Research in Personality* 23: 410–20.

Davidson, R., A. Dey, and A. Smith. 2015. Executives' "off-the-job" behavior, corporate culture, and financial reporting risk. *Journal of Financial Economics* 117: 5–28.

Denis, D. and D. Denis, 1995. Performance changes following top management dismissals. Journal of Finance v50n4, 1029–58.

Denis, D., D. Denis, and A. Sarin. 1997. Ownership structure and top executive turnover. *Journal of Financial Economics* 45: 193–221.

Fee, C. E., C. J. Hadlock, and J. R. Pierce. 2013. Managers with and without style: Evidence using exogenous variation. *Review of Financial Studies* 26: 567–601.

Franks, J., C. Mayer, and L. Renneboog. 2001. Who disciplines management in poorly performing companies? *Journal of Financial Intermediation* 10: 209–48.

Gervais, S., J. B. Heaton, and T. Odean. 2011. Overconfidence, compensation contracts, and capital budgeting. *Journal of Finance* 66: 1735–77.

Goel, A. M., and A. V. Thakor. 2008. Overconfidence, CEO selection, and corporate governance. *Journal of Finance* 63: 2737–84.

Graham, J. R., C. R. Harvey, and M. Puri. 2013. Managerial attitudes and corporate actions. *Journal of Financial Economics* 109: 103–21.

Hall, B. J., and K. J. Murphy. 2002. Stock options for undiversified executives. *Journal of Accounting and Economics* 33: 3–42.

Harford, J., and K. Li. 2007. Decoupling CEO wealth and firm performance: The case of acquiring CEOs. *Journal of Finance* 62: 917–49.

Hermalin, B. E., and M. S. Weisbach. 1998. Endogenously chosen boards of directors and their monitoring of the CEO. *American Economic Review* 88: 96–118.

Hirshleifer, D., A. Low, and S. H. Teoh. 2012. Are overconfident CEOs better innovators? *Journal of Finance* 67: 1457–98.

Huson, M. R., R. Parrino, and L. T. Starks. 2001. Internal monitoring mechanisms and CEO turnover: A long-term perspective. *Journal of Finance* 56: 2265–97.

Kleitman, S., and L. Stankov. 2001. Ecological and person-oriented aspects of metacognitive processes in test-taking. *Journal of Applied Cognitive Psychology* 15: 321–41.

Kini, O., W. Kracaw, and S. Mian. 2004. The nature of discipline by corporate takeovers. *Journal of Finance* 59: 1511–52.

Malmendier, U., and G. Tate. 2005. CEO overconfidence and corporate investment. *Journal of Finance* 60: 2661–2700.

———. 2008. Who makes acquisitions? CEO overconfidence and the market's reaction. *Journal of Financial Economics* 89: 20–43.

———, and J. Yan. 2011. Overconfidence and early-life experiences: The effect of managerial traits on corporate financial policies. *Journal of Finance* 66: 1687–1733.

Morse, A., V. Nanda, and A. Seru. 2011. Are incentive contracts rigged by powerful CEOs? *Journal of Finance* 66: 1779–1821.

Murphy, K. J., and J. Zimmerman. 1993. Financial performance surrounding CEO turnover. *Journal of Accounting and Economics* 16: 273–315.

Parrino, R. 1997. CEO turnover and outside succession: A cross-sectional analysis. *Journal of Financial Economics* 46: 165–97.

Schrand, C. M., and S. Zechman. 2012. Executive overconfidence and the slippery slope to financial misreporting. *Journal of Accounting and Economics* 53: 311–29.

Warner, J., R. Watts, and K. Wruck. 1988. Stock prices and top management changes. *Journal of Financial Economics* 20: 461–92.

West, R. F., and K. E. Stanovich. 1997. The domain specificity and generality of overconfidence: Individual differences in performance estimation bias. *Psychonomic Bulletin & Review* 4: 387–92.

Zingales, L. 2015. The "cultural revolution" in finance. *Journal of Financial Economics* 117: 1–4.

Table 1
Distribution of Confidence Attributes of CEOs

Panel A presents the distribution of confidence attributes for 4,596 CEO-firm combinations collected from the ExecuComp database between 1992 and 2010, which include 707 CEO retirements and 356 forced CEO departures. Panel B presents the distribution of the confidence attributes for succeeding CEOs by their recruitment origin. Panel C presents the managerial positions of internally promoted successors in the year before the departures of the incumbent CEOs, which are classified as COO, CFO, Other (including as presidents, vice-presidents, and CEOs/senior managers of key subdivisions), and Unknown. We report the percentages (%) and observations (Obs.) for the attribute distribution. A CEO is classified as overconfident if she holds options at 100% or greater moneyness, as diffident if she exercises options at 30% or lower moneyness, and as rational if she is classified as neither overconfident nor diffident. *T*-statistics are reported for the comparison of confidence distributions. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

Panel A. Attribute distribution of CEOs

		Overconfident		Rational		Diffident		Total	
		%	Obs.	%	Obs.	%	Obs.	%	Obs.
Full Sample	All CEOs	35.2%	1,620	59.3%	2,726	5.4%	250	100%	4,596
Retire	Departing CEOs	37%	263	58%	411	5%	33	100%	707
	Succeeding CEOs	37%	260	55%	387	8%	60	100%	707
	T-statistic								
	Depart. vs All	1.01		-0.59		-0.85			
	Depart. vs Succeed.	-1.11		1.12		-0.13			
Forced	Departing CEOs	41%	146	52%	186	7%	24	100%	356
	Succeeding CEOs	26%	94	69%	245	5%	17	100%	356
	T-statistic								
	Depart. vs All	2.19**		-2.61***		1.04			
	Depart. vs Succeed.	2.09**		-2.04**		0.24			

(Continued)

Panel B. Recruitment origin of succeeding CEOs

		Overconfident		Rational		Diffident		Total	
		%	Obs.	%	Obs.	%	Obs.	%	Obs.
Retire	Internal promotion	39%	245	52%	327	9%	58	100%	630
	External recruitment	19%	15	78%	60	3%	2	100%	77
	T-statistic								
	Internal vs External	3.93***		-5.04***		3.06***			
Forced	Internal promotion	27%	69	67%	174	6%	15	100%	258
	External recruitment	26%	25	72%	71	2%	2	100%	98
	T-statistic								
	Internal vs External	0.24		-0.91		1.84*			

Panel C. Pre-turnover positions of internal succeeding CEOs

	COO		CFO		Other		Unknown		Total	
	%	Obs.	%	Obs.	%	Obs.	%	Obs.	%	Obs.
Retire	53.3%	336	4.1%	26	27.5%	173	15.1%	95	100%	630
Forced	35.7%	92	9.7%	25	39.1%	101	15.5%	40	100%	258
T-statistic	-4.84***		2.77***		3.31***		0.16			

Table 2
Descriptive Statistics

This table presents the descriptive statistics for a sample of 21,081 CEO-firm-year observations across 4,596 CEO-firm combinations between 1992 and 2010, which include 707 CEO retirements and 356 forced CEO departures. At the bottom of the table, the stock returns are reported for the 707 retiring CEOs in the year before they retire and for the 356 fired CEOs in the year before they are fired. Sample firms are divided into three groups based on the confidence attribute of incumbent CEOs: overconfident (Ovt), rational (Ran), and diffident (Dft). A CEO is classified as overconfident if she holds options at 100% or greater moneyness, as diffident if she exercises options at 30% or lower moneyness, and as rational if she is classified as neither overconfident nor diffident. We report the mean and the median values. All dollar values are measured in constant 2010 dollars (millions for firm characteristics, thousands for CEO compensation). Return is the annual raw stock return during the fiscal year. AReturn is the annual stock return, adjusted by the two-digit SIC industry median return. ROA is the accounting return on assets, obtained as the ratio of net income to total assets. Leverage is obtained as the book value of liability, divided by the book value of total assets. Growth is the percentage change in sales, compared to the previous year. MV is the market value of assets, obtained as the book value of total assets, minus the book value of equity, plus the market value of equity. AT is the book value of total assets. M/B is the market-to-book ratio, obtained as the ratio of MV and AT. Volatility is the standard deviation of annual stock returns in the past five years. Industry Volatility is the average Volatility of the firms with the same two-digit SIC industry code. Investment is the industry-adjusted investment rate, obtained as a firm's capital expenditure divided by the firm's year-beginning property, plants, and equipment, deducting the median rate of the whole two-digit SIC code industry in the same year. Cash Pay is the sum of salary and annual bonus. Equity Pay is the sum of the value of restricted stock granted during the year, the value of stock options granted during the year, and long-term incentive payouts. Total Pay is the sum of salary, bonus, other annual compensation, value of restricted stock granted, value of stock options granted during the year, long-term incentive payouts, and all other compensation. Compensation Ratio is obtained as Equity Pay divided by Total Pay. Share Percentage is the percentage of firm shares held by the CEO. Age is the CEO's age in the fiscal year. Tenure is calculated from the beginning of the year in which the CEO is hired (or from the year 1992, if the beginning year cannot be tracked) to the current fiscal year. *, **, and *** indicate significance at the 10%, 5%, and 1% levels for the *t*-test and the two-tailed Wilcoxon test.

	Mean			*t*-statistic		Median			*z*-statistic	
	Ovt	Ran	Dft	Ovt-Ran	Ovt-Dft	Ovt	Ran	Dft	Ovt-Ran	Ovt-Dft
Return	0.184	0.102	0.097	12.74***	8.17***	0.142	0.074	0.074	12.7***	7.21***
AReturn	0.015	-0.050	-0.058	10.73***	7.20***	-0.004	-0.054	-0.056	10.54***	6.24***
ROA	0.097	0.071	0.086	12.29***	3.89***	0.099	0.077	0.079	18.07***	9.47***

Leverage	0.560	0.587	0.609	-7.38***	-8.98***	0.553	0.588	0.622	-7.73***	-9.60***
Growth	0.198	0.133	0.082	3.43***	11.66***	0.116	0.060	0.056	25.71***	15.38***
MV	7125	5418	8714	5.96***	-2.18**	1524	1249	2010	9.17***	-4.90***
AT	7191	11608	16661	-1.76*	-2.66***	1460	1696	3008	-4.58***	-11.80***
M/B	2.153	1.671	1.625	15.28***	13.41***	1.616	1.358	1.291	25.01***	14.30***
Volatility	0.532	0.451	0.377	6.55***	13.68***	0.393	0.317	0.285	20.22***	16.72***
Industry Volatility	0.662	0.621	0.594	8.89***	9.09***	0.636	0.568	0.536	11.48***	9.45***
Investment	0.062	0.022	0.008	10.51***	10.19***	0.018	0.005	0	7.67***	7.88***
Cash Pay	1403	1165	1362	8.82***	1.08	950	862	1009	8.85***	-3.57***
Equity Pay	2538	1804	2526	6.29***	0.06	615	367	694	10.52***	-3.52***
Total Pay	4402	3416	4414	7.45***	-0.05	1938	1574	2078	12.28***	-2.26***
Compensation Ratio	0.351	0.304	0.364	10.83***	-1.67*	0.363	0.273	0.376	10.26***	-1.98**
Share Percentage	0.027	0.018	0.010	10.1***	16.53***	0.0054	0.0022	0.0021	29.35***	18.15***
Age	55.5	55.5	55.4	0.22	0.85	56	56	56	0.08	0.27
Tenure	6.68	5.37	7.29	11.81***	-2.54**	6	5	7	11.21***	-2.96***
Return: retirement	0.211	0.107	0.084	8.35***	5.66***	0.177	0.087	0.051	7.93***	5.42***
AReturn: retirement	0.043	-0.044	-0.057	7.13***	4.71***	0.026	-0.042	-0.065	6.95***	4.35***
Return: forced	-0.091	0.019	-0.003	-2.08**	-0.79	-0.166	0.018	-0.033	-3.06***	-1.20
AReturn: forced	-0.219	-0.156	-0.209	-1.39	-0.16	-0.254	-0.140	-0.228	-2.03**	-0.59

Table 3
Conditional Attribute Distribution of Succeeding CEOs and Senior Managers

This table presents the conditional attribute distributions of succeeding CEOs promoted internally, of succeeding CEOs recruited externally, and of the pool of senior managers from which internal succeeding CEOs are selected, for a sample of 707 CEO retirement turnovers and a sample of 356 CEO forced turnovers collected from the ExecuComp database over the period from 1992 to 2010. The percentage of each attribute's distribution is reported above the number of observations. The sample is first divided into two groups based on the nature of CEO turnover; then, each group is further divided into three subgroups according to the attribute of the departing CEOs (*i.e.*, overconfident (Ovt), rational (Ran), or diffident (Dft)). The conditional distributions of succeeding CEOs (or senior managers) with the same attribute are compared between cases of retirement turnover and those of forced turnover, with *t*-statistics reported at the bottom of the table. The conditional attribute distributions of succeeding CEOs promoted internally are compared with those of succeeding CEOs recruited externally and of senior managers with the same attribute, with *t*-statistics reported in the brackets. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

		Internal Succeeding CEOs				External Succeeding CEOs				Internal Senior Managers			
		Ovt	Ran	Dft	Total	Ovt	Ran	Dft	Total	Ovt	Ran	Dft	Total
Retire	Ovt	60.3%	36.4%	3.3%	100%	45.8%	54.2%	0%	100%	49.5%	48.1%	2.3%	100%
		144	87	8	239	11	13	0	24	506	492	24	1,022
						[-1.37]	[1.71]*	[-2.87]***		[-3.00]***	[3.29]***	[-0.79]	
	Ran	27.8%	61.4%	10.8%	100%	7.8%	88.2%	3.9%	100%	15.2%	78.2%	6.6%	100%
		100	221	39	360	4	45	2	51	244	1,259	107	1,610
						[-4.45]***	[5.13]***	[-2.16**]		[-4.99]***	[6.07]***	[-2.39]**	
	Dft	3.2%	61.3%	35.5%	100%	0%	100%	0%	100%	3%	65.2%	31.8%	100%
		1	19	11	31	0	2	0	2	4	86	42	132
						[-1.00]	[4.35]***	[-4.06]***		[-0.06]	[0.40]	[-0.39]	
Forced	Ovt	39.8%	55.6%	4.6%	100%	18.4%	78.9%	2.6%	100%	43.4%	52.7%	3.9%	100%
		43	60	5	108	7	30	1	38	210	255	19	484
						[-2.42]**	[2.59]**	[-0.60]		[0.68]	[-0.54]	[-0.33]	
	Ran	18.8%	75.8%	5.5%	100%	31%	67.2%	1.7%	100%	14.2%	80.3%	5.5%	100%
		24	97	7	128	18	39	1	58	82	464	32	578
						[1.86]*	[-1.22]	[-1.41]		[-1.21]	[1.14]	[0.03]	
	Dft	9.1%	77.3%	13.6%	100%	0%	100%	0%	100%	4.2%	67.4%	28.4%	100%
		2	17	3	22	0	2	0	2	4	64	27	95

					[-1.45]	[2.49]**	[-1.82]*	[-0.74]	[-0.90]	[1.43]
t-stat	Ovt	3.59***	-3.39***	-0.55	2.38**	-2.10**	-1.00	2.22**	-1.65*	-1.57
	Ran	2.15**	-3.14***	2.06**	-3.22***	2.72***	0.68	0.56	-1.05	0.98
	Dft	-0.83	-1.22	1.80*	-	-	-	-0.46	-0.35	0.55

Table 4
Logit Regression of CEO Forced Turnover on CEO Attribute

This table reports the results of the logit regression of CEO forced turnover on the CEO attribute for a sample of 21,081 CEO-firm-year observations across 4,596 CEO-firm combinations between 1992 and 2010, which include 356 CEO forced departures. The dependent variable *Forced* is a dummy variable that equals one if the incumbent CEO is fired and zero otherwise. *OCEO* is the attribute dummy of the departing CEO, which equals one for overconfidence and zero otherwise. *DCEO* is another attribute dummy of the departing CEO, which equals one for diffidence and zero otherwise. Other variables are as defined in Table 2. All variables are measured in the year immediately before the CEO change. *T*-statistics are reported in brackets. *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), based on standard errors corrected for heteroscedasticity and autocorrelations.

	(1)	(2)
Intercept	0.031***	0.022**
	[3.80]	[2.52]
OCEO	0.006**	0.007**
	[2.15]	[2.04]
DCEO	0.0006	0.0007
	[0.24]	[1.56]
Log MV	0.0004*	0.002***
	[1.86]	[3.06]
Leverage	-0.0005	-0.003
	[-0.12]	[-0.94]
Growth	0.001	-0.001
	[0.66]	[-0.67]
Return	-0.01***	-0.01***
	[-3.36]	[-3.06]
ROA	-0.022**	-0.024**
	[-2.07]	[-2.05]
M/B	-0.0004*	-0.001**
	[-1.89]	[-2.32]
Volatility	-0.0003	0.007
	[-0.06]	[0.55]
Industry Volatility	0.002	0.003
	[0.74]	[0.86]
Age		-0.0005***
		[-4.24]
Tenure		-0.001***
		[-6.04]
Total Pay*100,000		0.014*
		[1.85]
Compensation Ratio		-0.009***
		[-3.06]
Share Percentage		0.046***
		[3.18]
Year Dummies	Yes	Yes
Adj R-square	0.013	0.015
F-value	4.79***	4.16***
Observation	21,081	17,238

Table 5
The Attribute Link between Succeeding CEOs and Departing CEOs and Senior Managers

This table reports the results of the multinomial logit regression of the attributes of succeeding CEOs on those of departing CEOs and senior managers. The sample includes total 3,921 senior manager-firm-year observations between 1992 and 2010, during which time 707 CEOs retire and 356 CEOs are forced to leave. The dependent variable is the attribute of the succeeding CEO, which equals one for overconfidence (or diffidence) and zero otherwise. *OCEO* is the attribute dummy of the departing CEO, which equals one for overconfidence and zero otherwise. *DCEO* is another attribute dummy of the departing CEO, which equals one for diffidence and zero otherwise. *Forced* is a dummy variable that equals one if the departing CEO is forced to leave and zero for retirement. *External* is a dummy variable that equals one if the succeeding CEO is selected through external recruitment and zero if the CEO is selected through internal promotion. *OMgr* is the attribute dummy for the senior manager, which equals one for overconfidence and zero otherwise. *DMgr* is another attribute dummy of the senior manager, which equals one for diffidence and zero otherwise. Other variables are as defined in Table 2. Variables are all measured in the year immediately before the CEO turnover. *T*-statistics are reported in brackets. *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), based on standard errors corrected for heteroscedasticity and autocorrelations.

	Overconfident successors				Diffident successors			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.254*	0.352**	0.276***	0.114*	-0.128	0.002	0.059	-0.107***
	[1.86]	[2.15]	[3.71]	[1.88]	[-1.61]	[0.03]	[1.51]	[-2.92]
OCEO	0.318***	0.265***	0.284***	0.185***	-0.071***	-0.058***	-0.057***	-0.035***
	[7.88]	[8.32]	[9.06]	[10.39]	[-3.57]	[-3.27]	[-3.17]	[-3.31]
DCEO	-0.206**	-0.185***	-0.190***	-0.130***	0.225***	0.158***	0.178***	0.180***
	[-2.73]	[-3.10]	[-2.93]	[-3.62]	[5.11]	[4.55]	[4.50]	[8.32]
Forced	-0.009		-0.07	0.015	-0.043*		-0.036**	-0.028***
	[-0.23]		[-1.37]	[0.84]	[-1.86]		[-2.14]	[-2.58]
OCEO*Forced	-0.214***			-0.150***	0.069**			0.032*
	[-3.37]			[-5.34]	[2.02]			[1.87]
DCEO*Forced	0.068			0.020	-0.139**			-0.136***
	[0.52]			[0.36]	[-2.07]			[-4.05]
External		-0.062	-0.044			-0.016	-0.056**	
		[-1.32]	[-0.90]			[0.62]	[-2.15]	
OCEO*External		-0.164**	-0.055			0.051	0.009	
		[-2.36]	[-0.52]			[0.45]	[0.15]	
DCEO*External		0.007	-0.046			-0.152*	-0.212	

		[0.03]	[-0.13]			[-1.88]	[-1.19]	
OCEO*External*Forced			-0.201**				0.064	
			[-2.03]				[0.93]	
DCEO*External*Forced			0.072				0.038	
			[0.16]				[0.15]	
OMgr				0.435***				-0.039***
				[23.25]				[-3.42]
DMgr				-0.084***				0.401***
				[-2.63]				[20.89]
OMgr*Forced				-0.316***				0.023
				[-3.85]				[1.21]
DMgr*Forced				0.002				-0.232***
				[0.03]				[-6.91]
Log MV	-0.033***	-0.032**	-0.035***	-0.019***	0.018***	0.009	0.016***	0.012***
	[-3.30]	[-2.55]	[-3.38]	[-4.31]	[3.09]	[1.30]	[2.68]	[4.42]
Leverage	0.293***	0.238***	0.254***	0.255***	-0.018	-0.041	-0.015	-0.003
	[4.16]	[2.82]	[4.18]	[8.41]	[-0.44]	[-0.95]	[-0.37]	[-0.17]
Growth	0.093*	0.085	0.091*	0.056**	0.017	0.010	0.021	0.018
	[1.89]	[1.50]	[1.92]	[2.55]	[0.60]	[0.30]	[0.64]	[1.40]
Return	0.075**	0.082**	0.068**	0.054***	-0.027	-0.018	-0.031*	-0.020**
	[2.44]	[2.27]	[2.53]	[4.10]	[-1.52]	[-0.95]	[-1.72]	[-2.46]
ROA	0.198	0.205	0.204	0.172***	0.036	-0.003	0.047	0.052
	[1.58]	[1.47]	[1.62]	[2.90]	[0.49]	[-0.04]	[0.65]	[1.46]
M/B	0.045***	0.022	0.054***	0.030***	-0.005	0.002	-0.005	0.0004
	[3.54]	[1.39]	[3.41]	[5.41]	[-0.64]	[0.30]	[-0.53]	[0.11]
Volatility	0.072	0.111	0.103	0.067	-0.251	-0.246	-0.226	-0.215***
	[0.26]	[0.38]	[0.86]	[0.58]	[-1.60]	[-1.62]	[-1.47]	[-3.08]
Industry Volatility	-0.054	-0.073	-0.068	-0.053**	0.062*	-0.016	0.058**	0.050***
	[-0.95]	[-0.92]	[-0.56]	[-2.13]	[1.87]	[-0.39]	[2.16]	[3.35]
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R-square	0.157	0.147	0.168	0.275	0.062	0.067	0.073	0.181
F-value	6.50***	4.49***	8.53***	54.76***	3.51***	1.98***	3.65***	32.24***
Observation	1,063	1,063	1,063	3,921	1,063	1,063	1,063	3,921

Table 6
Distribution of Confidence Attributes of CEOs and Senior Managers by Industry Innovativeness

This table presents the attribute distribution of departing CEOs, internal succeeding CEOs, and the pool of senior managers from which the internal succeeding CEOs are selected for a sample of 707 CEO retirement turnovers and a sample of 356 CEO forced turnovers between 1992 and 2010. The percentage of each attribute's distribution is reported above the number of observations. Both turnover samples are divided into subgroups of innovative industries and non-innovative industries. A CEO/manager is classified as overconfident (Ovt) if she holds options at 100% or greater moneyness, as diffident (Dft) if she exercises options at 30% or lower moneyness, and as rational (Ran) if she is classified as neither overconfident nor diffident. The distributions of CEOs/managers with the same attribute are compared between the two types of industries, with *t*-statistics reported for comparison. The distributions of internal succeeding CEOs are also compared with those of senior managers with the same attribute, with *t*-statistics reported in brackets. The classification of industry innovativeness is reported in the Appendix. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

		Departing CEOs				Internal Succeeding CEOs				Internal Senior Managers			
		Ovt	Ran	Dft	Total	Ovt	Ran	Dft	Total	Ovt	Ran	Dft	Total
Retire	Innovative	45.3%	52.8%	1.9%	100%	43.6%	49.2%	7.2%	100%	33.7%	59.1%	7.2%	100%
		96	112	4	212	79	89	13	181	274	481	59	814
										[-2.55]**	[2.45]**	[0.03]	
	Non-Inno.	33.7%	60.4%	5.9%	100%	37%	53%	10%	100%	24.6%	69.6%	5.8%	100%
		167	299	29	495	166	238	45	449	480	1,356	114	1,950
										[-4.98]***	[6.41]***	[-2.76]***	
	T-statistic												
	I vs Non-I	2.92***	-1.87*	-2.81***		1.56	-0.87	-1.19		4.7***	-5.18***	1.33	
Forced	Innovative	40.6%	53.1%	6.3%	100%	31.9%	59.6%	8.5%	100%	28%	64.5%	7.5%	100%
		52	68	8	128	30	56	8	94	109	251	29	389
										[-0.75]	[0.89]	[-0.34]	
	Non-Inno.	41.2%	51.8%	7%	100%	23.8%	72%	4.3%	100%	24.3%	69.3%	6.4%	100%
		94	118	16	228	39	118	7	164	187	532	49	768
										[0.15]	[-0.68]	[1.17]	
	T-statistic												
	I vs Non-I	-0.11	0.25	-0.28		1.42	-2.05**	1.29		1.35	-1.63	0.67	

Table 7
Pre-turnover and Post-turnover Investment Levels

This table presents the average pre-turnover and post-turnover investment levels for 707 CEO retirement turnovers and 356 CEO forced turnovers over the period between 1992 and 2010. Both groups of CEO turnovers are divided into three subgroups according to the attribute of the departing CEO (i.e., overconfident (Ovt), rational (Ran), or diffident (Dft)). The pre- (post-) turnover investment level is defined as the time-series average of the annual industry-adjusted investment rate over the entire tenure period of the departing (succeeding) CEO at the firm. A firm's industry-adjusted investment rate is calculated as the firm's raw investment rate minus the median rate of industry peers with the same two-digit SIC code, where the raw investment rate is calculated as capital expenditures divided by year-beginning property, plants, and equipment. A CEO is classified as overconfident if she holds options at 100% or greater moneyness, as diffident if she exercises options at 30% or lower moneyness, and as rational if she is classified as neither overconfident nor diffident. *T*-statistics are reported in brackets. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

		Pre-turnover	Post-turnover	*T*-statistic (Post- vs Pre-)
Retire	Ovt	0.063*** [11.72]	0.055*** [11.39]	-1.06
	Ran	0.020*** [6.30]	0.013*** [3.72]	-1.39
	Dft	0.011 [1.39]	0.006 [1.01]	-0.57
Forced	Ovt	0.095*** [9.98]	0.039*** [4.91]	-4.53***
	Ran	0.040*** [6.48]	0.026*** [4.92]	-1.62
	Dft	-0.004 [-0.24]	0.023** [2.42]	1.50
T-statistic (Retire vs Forced)				
	Ovt	-2.93***	1.81*	
	Ran	-2.85***	-2.03**	
	Dft	0.87	-1.58	

Table 8
Regression of Investment Level on CEO Attribute

This table reports the results for the regression of the investment level on the CEO attribute. The sample includes 21,081 CEO-firm-year observations across 4,596 CEO-firm combinations between 1992 and 2010, during which time 707 CEOs retire and 356 CEOs are forced to leave. The dependent variable is a firm's annual industry-adjusted investment level, calculated as the firm's raw investment level minus the median level of industry peers with the same two-digit SIC code, where the raw investment level is calculated as capital expenditures divided by year-beginning property, plants, and equipment. *OCEO* is the attribute dummy of the departing CEO, which equals one for overconfidence and zero otherwise. *DCEO* is another attribute dummy of the departing CEO, which equals one for diffidence and zero otherwise. *After* is a dummy variable that equals one for post-turnover years and zero otherwise. *Forced* is a dummy variable that equals one if the departing CEO is forced to leave and zero if the CEO retires. Other variables are as defined in Table 2. *T*-statistics are reported in brackets. *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), based on standard errors corrected for heteroscedasticity and autocorrelations.

	(1)	(2)	(3)
Intercept	0.076	0.088	0.125**
	[1.37]	[1.06]	[2.01]
OCEO	0.026***	0.029***	0.033***
	[7.04]	[7.07]	[6.06]
DCEO	-0.018	-0.006	-0.003
	[-1.05]	[-1.56]	[-1.35]
After			-0.006
			[-1.01]
OCEO*After			0.001
			[0.11]
DCEO*After			-0.006
			[-0.45]
Forced			0.01**
			[2.00]
OCEO*After* Forced			-0.032***
			[-3.36]
DCEO*After* Forced			0.008
			[1.43]
Log MV	-0.007***	-0.008**	-0.006***
	[-3.16]	[-2.44]	[-4.21]
Leverage	-0.054***	-0.043***	-0.033***
	[-4.12]	[-3.22]	[-3.26]
Growth	0.086***	0.088***	0.097***
	[8.06]	[7.57]	[12.93]
M/B	0.008***	0.006***	0.007**
	[3.49]	[2.74]	[3.53]
Return	-0.013***	-0.012***	-0.012**
	[-3.73]	[-3.19]	[-2.43]
ROA	0.131***	0.196***	0.144***
	[4.00]	[4.30]	[5.43]

Volatility	0.019***	0.013***	0.005**
	[2.79]	[2.61]	[2.04]
Industry Volatility	-0.066***	-0.074***	-0.037***
	[-8.89]	[-6.56]	[-4.32]
Age		-0.003	-0.0004
		[-0.02]	[-1.56]
Tenure		-0.008*	-0.003***
		[-1.73]	[-4.43]
Total Pay*100,000		-0.083	0.029
		[-0.38]	[0.92]
Compensation Ratio		0.089***	0.022***
		[4.46]	[2.79]
Share Percentage		0.071**	0.084**
		[2.27]	[2.39]
Year Dummies	Yes	Yes	Yes
Adj R-square	0.062	0.066	0.094
F-value	95***	60***	17***
Observation	21,081	17,238	7,586

Table 9
Robustness Tests about Conditional Attribute Distribution of Succeeding CEOs and Senior Managers

This table presents the robustness tests about the conditional attribute distributions of succeeding CEOs promoted internally and the pool of senior managers from which internal succeeding CEOs are selected for a sample of 506 CEO retirement turnovers and a sample of 200 CEO forced turnovers collected from the ExecuComp database over the period from 1992 to 2010. Senior managers within each sample firm have different types of confidence attribute. The percentage of each attribute's distribution is reported above the number of observations. The sample is first divided into two groups based on the nature of the CEO turnover; then, each group is further divided into three subgroups according to the attribute of the departing CEOs (*i.e.*, overconfident (Ovt), rational (Ran), or diffident (Dft)). A CEO/manager is classified as overconfident (Ovt) if she holds options at 100% or greater moneyness, as diffident (Dft) if she exercises options at 30% or lower moneyness, and as rational (Ran) if she is classified as neither overconfident nor diffident. The conditional distributions of succeeding CEOs (or senior managers) with the same attribute are compared between cases of retirement turnover and those of forced turnover. The conditional attribute distributions of succeeding CEOs promoted internally are also compared with senior managers with the same attribute. *, **, and *** indicate significance at the 10%, 5%, and 1% levels for the comparison.

		Internal Succeeding CEOs				Internal Senior Managers				*t*-statistic		
		Ovt	Ran	Dft	Total	Ovt	Ran	Dft	Total	Ovt	Ran	Dft
Retire	Ovt	58.7%	37.8%	3.6%	100%	47.3%	50.2%	2.5%	100%	3.07***	-3.38***	0.82
		132	85	8	225	461	489	24	974			
	Ran	39.8%	44.6%	15.5%	100%	22.4%	67.8%	9.8%	100%	5.23***	-7.00***	2.33**
		100	112	39	251	244	740	107	1,091			
	Dft	3.3%	63.3%	33.3%	100%	3.2%	67.7%	29.1%	100%	0.05	-0.46	0.45
		1	19	10	30	4	86	37	127			
Forced	Ovt	37.5%	57.7%	4.8%	100%	41.1%	54.8%	4.1%	100%	-0.67	0.53	0.33
		39	60	5	104	191	255	19	465			
	Ran	32.0%	58.7%	9.3%	100%	22.8%	68.3%	8.9%	100%	1.69*	-1.62	0.12
		24	44	7	75	82	246	32	360			
	Dft	9.5%	81%	9.5%	100%	4.4%	71.1%	24.4%	100%	0.73	0.91	-1.87*
		2	17	2	21	4	64	22	90			

t-statistic	Ovt	3.63***	-3.43***	-0.51	2.23**	-1.65	-1.55
	Ran	1.23	-2.15**	1.52	-0.16	-0.18	0.51
	Dft	-0.84	-1.36	2.18**	-0.48	-0.53	0.76

Appendix
Tabulation of Innovative Industries

This table presents the number of years that each industry in the sample is classified as innovative between 1992 and 2010. An industry is defined as innovative in a year if the average R&D expense, scaled by total industry assets during the preceding year, is greater than the median expense across all industries, where industries are classified at the two-digit SIC level. The description for each industry is based on Hirshleifer, Low, and Teoh (2012).

2-digit SIC	Description	No. of years in sample	No. of years classified as innovative	Proportion of innovative years (%)	Innovativeness
2	Agricultural products—poultry & eggs, meat animals	19	0	0	Non-innovative
7	Agricultural services	19	0	0	Non-innovative
8	Forestry products	19	0	0	Non-innovative
9	Agricultural—fishery services	15	0	0	Non-innovative
12	Coal mining & coal mining services	19	0	0	Non-innovative
13	Petroleum & natural gas	19	0	0	Non-innovative
14	Mining & quarrying non-metallic minerals	19	0	0	Non-innovative
15	Build construction	19	0	0	Non-innovative
16	Heavy construction (not building contractors)	19	0	0	Non-innovative
17	Construction—special contractors	19	0	0	Non-innovative
21	Tobacco products	19	0	0	Non-innovative
24	Lumber & wood products, excluding furniture	19	0	0	Non-innovative
25	Household & office furniture	19	0	0	Non-innovative
26	Paper & allied products	19	0	0	Non-innovative
27	Printing & publishing	19	0	0	Non-innovative
30	Rubber & plastic products	19	0	0	Non-innovative
31	Leather & leather products	19	0	0	Non-innovative
32	Stone, clay, glass, & concrete products	19	0	0	Non-innovative
33	Primary metal	19	0	0	Non-innovative
34	Fabricated products, excluding machinery & transportation equipment	19	0	0	Non-innovative
40	Railroad transportation	19	0	0	Non-innovative
41	Transit & passenger transportation	19	0	0	Non-innovative
42	Motor freight transportation, warehousing	19	0	0	Non-innovative
45	Air transportation	19	0	0	Non-innovative
46	Pipelines, excluding natural gas	19	0	0	Non-innovative
51	Wholesale-nondurable goods	19	0	0	Non-innovative
52	Retail—building material, hardware, garden	19	0	0	Non-innovative
53	Retail—general merchandise stores	19	0	0	Non-innovative
54	Retail—food stores	19	0	0	Non-innovative
55	Retail—auto dealers & gas stations	19	0	0	Non-innovative
56	Retail—apparel & accessary stores	19	0	0	Non-innovative
57	Retail—home furniture & equip stores	19	0	0	Non-innovative

58	Retail—eating & drinking places	19	0	0	Non-innovative
59	Retail—misc	19	0	0	Non-innovative
60	Banking	19	0	0	Non-innovative
62	Security & commodity brokers	19	0	0	Non-innovative
63	Insurance carriers	19	0	0	Non-innovative
67	Credit agencies other than banks	19	0	0	Non-innovative
70	Lodging places	19	0	0	Non-innovative
72	Personal services	19	0	0	Non-innovative
76	Electrical repair shops	19	0	0	Non-innovative
79	Services—amusement & recreation	19	0	0	Non-innovative
81	Legal services	17	0	0	Non-innovative
83	Job training & related services	19	0	0	Non-innovative
89	Auditing, bookkeeping, & miscellaneous	6	0	0	Non-innovative
10	Metal mining & metal mining services	19	1	0.052632	Non-innovative
22	Textiles	19	1	0.052632	Non-innovative
23	Apparel & other finished products	19	1	0.052632	Non-innovative
29	Petroleum refining	19	1	0.052632	Non-innovative
39	Consumer goods	19	1	0.052632	Non-innovative
44	Water transportation	19	1	0.052632	Non-innovative
48	Communications	19	1	0.052632	Non-innovative
50	Wholesale—durable goods	19	1	0.052632	Non-innovative
65	Real estate agents	19	1	0.052632	Non-innovative
75	Services—auto repair & parking	19	1	0.052632	Non-innovative
1	Agricultural production—crops	19	2	0.105263	Non-innovative
20	Food & drink products	19	2	0.105263	Non-innovative
47	Transportation services	19	2	0.105263	Non-innovative
49	Electric services—utilities	19	2	0.105263	Non-innovative
64	Insurance agents, brokers, & services	19	2	0.105263	Non-innovative
78	Services—motion pictures	19	2	0.105263	Non-innovative
82	Services—educational	19	2	0.105263	Non-innovative
80	Services—health	19	3	0.157895	Non-innovative
86	Business associations & professional organizations	8	4	0.5	Non-innovative
37	Transportation equip	19	9	0.473684	Non-innovative
99	Industrial conglomerate	19	9	0.473684	Non-innovative
87	Legal, engineering, architectural, and surveying services	19	12	0.631579	Innovative
35	Commercial mach & computer hardware	19	18	0.947368	Innovative
36	Electric equip & electronic equip	19	18	0.947368	Innovative
38	Measuring & control equip, medical equip	19	18	0.947368	Innovative
73	Business services	19	18	0.947368	Innovative
28	Chemicals & pharmaceutical products	19	19	1	Innovative