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CEO overconfidence and agency cost of debt: An empirical analysis of CEO turnover events

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A B S T R A C T

We develop a model and characterize the differences between the investment policies of a rational CEO and an overconfident CEO. In the presence of risky outstanding debt, we show that an overconfident CEO has the incentive to overinvest more than that of a rational CEO. However, this incentive is mitigated by the discipline imposed by outside investors when an overconfident CEO seeks external financing. In contrast, when the firm has sufficient internal funds to meet its investment needs and outstanding debt is relatively safer, the overconfident CEO has no necessity to seek external funds and the overinvestment incentive persists. We examine bondholders' and stockholders' reaction around CEO turnover announcements and find evidence consistent with the over investment hypothesis.

1. Introduction

Overconfident CEOs are more likely to issue optimistically biased forecasts because they overestimate their ability to affect their financial results and/or underestimate the probability of unfavorable outcomes. Recent research has found that the overconfidence trait in CEOs causes distortions in investment policy in accordance with the first-best investment rule (Heaton, 2002; Malmendier & Tate, 2005).[1] Overconfident CEOs overpay for target companies and undertake value-destroying mergers (Malmendier & Tate, 2008), underestimate the probability of failure and pursue innovation (Galasso & Simcoe, 2011), and view external financing as costly and, hence, build financial slack for future investment needs by lowering the current dividend payout (Deshmukh, Goel, & Howe, 2013). Since a CEO's decision affects *all* stakeholders in a firm, it is logical to study the influence of a CEO's overconfidence on investment decisions in the context of bondholder-stockholder conflicts. We add to this literature by modeling the interaction between CEO overconfidence and investment decisions in the presence of shareholder-bondholder conflicts and use a CEO turnover event to study the stakeholders' return reaction.

We extend the model of Harikumar, Kadapakkam, and Singer (1994) to analyze the role of overconfidence. Specifically, we abstract from the biases caused by the perceived mispricing of security issues, as in Heaton (2002) and Hackbarth

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[1] The terms "overconfidence" and "overoptimism" are used interchangeably.

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(2009) and characterize the optimal investment policy adopted by rational and overconfident CEOs. We show that an overconfident CEO generally exhibits an incentive to overinvest relative to a rational CEO. This is because, an overconfident CEO overestimates the expected cash flows from a project and incorrectly perceives negative NPV projects as profitable, causing the CEO to invest in negative NPV projects that otherwise would not be undertaken by a rational CEO.

The presence of insufficient funds from the assets in place causes outstanding debt to be riskier and exacerbates the over-investment incentive of an overconfident CEO. However, this incentive is mitigated when the overconfident CEO seeks external financing to invest in a growth opportunity. The outside investors see through the overconfidence bias and refuse to provide the necessary funds to finance the project under the biased investment policy. This disciplines the overconfident CEO to follow a rational investment policy. When the assets in place generate more funds, outstanding debt is safer, and the need for external financing is lower, the investors are shown to be willing to provide the necessary funds despite the overconfident bias. This reduces the effect of disciplining and the over-investment incentive persists. Rational stakeholders anticipate these perverse incentives and the model predicts a positive reaction to the announcement of an overconfident CEO's departure. Since CEO turnovers are associated with potential changes in future investment policies, we examine the bondholders' and stockholders' reactions to announcements of CEO turnovers.

The CEO turnover sample covers the period from 1994 to 2011. As a starting point, we identified CEO departure dates and the firms to which they belonged using Standard and Poor's ExecuComp database. Because each actual announcement was likely to have occurred prior to the departure date, we hand-collected the actual date of each announcement using a FACTIVA search and classified the turnover events into voluntary and forced turnovers. The CEO overconfidence measures were constructed using the procedures of Campbell, Gallmeyer, Johnson, Rutherford, and Stanley (2011). Because ExecuComp does not provide data on previously granted options, we estimated the average exercise price by subtracting the per option realizable value, i.e., the excess of the stock price over the exercise price, from the fiscal year end price per share. We then defined the variable, *moneyness*, to equal the realizable value in an option divided by the exercise price. For our Execucomp sample we collected the relevant bond and stock data. For the bond sample, we use Mergent Fixed Income Securities Database (FISD) for the years 1994–2002 and TRACE for years 2002–2011. We merged TRACE with FISD to obtain ratings and maturity information and then employed the method in Bessembinder, Kahle, Maxwell, and Xu (2009) to calculate monthly bond abnormal returns. We estimated the daily abnormal stock returns using a market model.

We examine the model predictions by creating samples of firms that differ in their credit rating in order to differentiate the riskiness of outstanding debt. After controlling for firm characteristics, bond maturity, and changes in volatility we use cumulative abnormal bond and stock returns as dependent variables and examine their overall relation with CEO overconfidence. We find that bondholders' react negatively, *albeit* at a 10% level of significance, and stockholders react positively when an overconfident CEO leaves a firm with a BBB and lower credit rating. The negative bondholder reaction is not consistent with the predictions of our agency cost based model and probably reflects other benefits related to the overconfidence bias.[2] The positive stockholder reaction is consistent with a potential reduction in overinvestment. In the case of firms with relatively safer debt, bondholders and shareholders are both found to react positively to a turnover announcement of an overconfident CEO from a firm due to an expected decrease in overinvestment.

Our research makes the following contributions to the literature on overconfidence and corporate policy. From a theoretical perspective, we offer a simple agency theoretic framework that analyzes the differences in investment incentives between a rational and an overconfident CEO. Specifically, we relax the assumption of asymmetric beliefs held by overconfident CEOs and outside investors and provide testable implications of the incentive to overestimate future earnings.

We extend the literature on CEO turnovers. Campbell et al. (2011) examine the role of CEO optimism in the context of forced turnovers and focus on isolating the beneficial effects of a risk-averse CEO's moderate overconfidence. Adams and Mansi (2009) analyze the impact of forced and voluntary turnovers of CEOs on stakeholder wealth. We extend their work by analyzing turnovers of *overconfident* CEOs and highlight the influence of CEO type on agency cost of debt.

2. Relevant literature

Distortions in corporate investment policy occur when a manager (or CEO) foregoes positive NPV projects (underinvestment) or invests in negative NPV projects (overinvestment).[3] Such distortions result in a loss in firm value and adversely affect shareholders and bondholders. Rational CEOs, acting in the interest of shareholders, exhibit incentives to underinvest (Myers, 1977) or overinvest (Jensen & Meckling, 1976) in the presence of outstanding risky debt. The literature on contract design suggests that call and convertible features and other covenant restrictions are mechanisms to ameliorate such incentives and reduce the agency cost of debt (Barnea, Haugen, & Senbet, 1980, 1985; Kalay, 1982; Smith & Warner, 1979). We study the distortions in investment policy caused by CEO overconfidence and its relation with the agency cost of debt.

For rational investors, Heaton (2002) finds that underinvestment or overinvestment could occur when an optimistic manager incorrectly believes that investors undervalue risky securities issued by the firm. If an optimistic manager is forced to finance an investment opportunity through an external issue, he or she will underinvest when believing that the positive NPV generated by a good project is less than the extent of perceived underpricing. In contrast, an optimistic manager incor-

[2] See Campbell et al. (2011) for a discussion on the role of risk aversion in rational CEOs and the ability of the overconfidence bias to correct for risk aversion.

[3] The terms "CEO" and "manager" are used interchangeably.

rectly believes that some negative NPV projects are positive; therefore, he or she is liable to use the available free cash flow within the firm to finance negative NPV projects. Although distortion in investment policy occurs regardless of the type of external security issued, it is less severe for debt issues than for equity issues.

Malmendier and Tate (2005) empirically confirm Heaton's (2002) predictions by finding that the sensitivity of investment to cash flow increases with overconfidence. In addition, overconfidence significantly affects the sensitivity of investment to cash flow only in financially constrained firms. Using merger decisions as a corporate event, Malmendier and Tate (2008) find that overconfident CEOs undertake value-destroying mergers, especially when they have access to internally generated funds, due to overestimating the firm's ability to generate returns. The announcement effect of a merger bid made by an overconfident CEO is significantly lower (−90 basis points) relative to other CEOs (–12 basis points), further corroborating the nature of value-destroying investments.

The above studies show that the managerial overestimation of future returns and the resulting (perceived) underpricing of a firm's securities cause overinvestment that adversely affects the wealth of all claim holders. Our research assumes a symmetric distribution of future returns between CEOs and investors and studies the impact of overconfidence, i.e., the overestimation of future cash flows, on the agency cost of debt.

Hackbarth (2009) uses a real options framework and analyzes the investment and financing decisions of overconfident managers in the presence of shareholder-bondholder conflicts. His model shows that managerial over-optimism increases leverage, which results in a greater debt overhang problem. At the same time, incorrect overestimates of future earnings reduce the perceived number of states in which underinvestment can occur, thus resulting in a reduction in underinvestment. Hackbarth's theory predicts that the reduction in underinvestment dominates the negative effects of increased leverage in the presence of mildly biased managers, thereby reducing the agency cost of debt. His model implies that a mildly biased manager's turnover increases the expected underinvestment costs due to greater uncertainty regarding the type of replacement, thereby adversely affecting bondholders and stockholders.

If overconfident CEOs indeed add value to stakeholder wealth, then their departure could potentially cause a negative reaction. Adams and Mansi (2009) examine stockholder and bondholder reactions to turnover events and find evidence indicating a value increase for shareholders but a decrease for bondholders without any overall change in firm value. They do not consider the impact of CEO overconfidence and firm type in their analysis of turnover events.

3. Model and hypothesis development

We extend the model in Harikumar et al. (1994) by including a parameter that captures a CEO's overconfidence trait and tracing its' implications to the investment policy in the presence of outstanding risky (straight) debt. We compare the difference in the investment policies of an overconfident CEO and a rational CEO and develop hypotheses that are tested in the next section.

Consider the following sequence of events in a three-period model.

Period 0 (denoted as t_0):

A CEO with an overconfidence level $\alpha > 1$ (to be defined below) is hired.

Investment at t_0 (assets in place) is financed by equity and a zero-coupon bond that matures in period 2 (denoted as t_2) with a maturity value of \$$M$.

The assets in place generate a random cash flow of \$$X$ at t_1 and a growth opportunity that requires an investment of \$I and yields a cash flow of \$$H$ with probability p and \$$L$ with probability ($1-p$) in period 2 (denoted as t_2). The actual value of p is revealed at t_1.

Period 1 (denoted as t_1):

The cash flow from assets in place (\$$X$) is revealed.

The value of p and hence expected NPV of the growth opportunity is revealed.

A CEO turnover occurs.

The decision to invest \$$I$ in the growth opportunity is to be made and is possibly financed by junior debt with maturity value \$$F$ and maturity at t_2.

Period 2 (denoted as t_2):

The cash flow from the investment in the growth opportunity made at t_1 is realized and all claims are settled.

Firm value consists of the value of assets in place and the value of a growth opportunity that expires at t_1. The assets in place generate a random cash flow of $X > 0$ at time t_1. If accepted, the growth opportunity requires an investment outlay of I and generates a cash flow at t_2 of H with probability p or of L with probability (1-p), where $H > I > L > 0$. The internally available funds, X, can be used to finance the investment outlay.

The assets in place are financed by equity and a zero-coupon risky debt with a promised payment of M at t_2, where $H > M > L$. If $X > I$, the investment outlay is fully financed using internal funds. We assume that the outstanding debt contains restrictive dividend covenants that prohibit the distribution of excess funds left over after financing the investment outlay. If $X < I$, we assume that $I–X$ is financed by a junior debt issue with a promised payment of F at t_2, where ($H - M > F$). If the investment at t_1 is rejected, then the outstanding bondholders have priority over shareholders and receive Min (X, M) at t_1.

There is no informational asymmetry in this model. All participants are assumed to be risk-neutral, to share the same beliefs about the probability p, and to observe, simultaneously, the realization of X. An overconfident manager concurs with the other participants regarding the values of p and I but overestimates the cash flow from the growth opportunity by a factor of $\alpha > 1$. Specifically, an overconfident manager believes t_2 cash flows to be αH with probability p and αL with probability (1-p), where $\alpha > 1$ and a rational manager's belief is denoted by $\alpha = 1$.[4] This definition is consistent with Hribar and Yang (2013), who find that overconfident managers issue overoptimistic earnings forecasts that are subsequently inaccurate. Furthermore, our model differs from Heaton (2002) in that the overconfident manager and the outside investors in this model have the same beliefs about the probability p and that any difference in perceived valuation arises only due to differences in beliefs about the level of cash flows from the growth opportunity.

3.1. Optimal investment policies of an overconfident CEO

We abstract from the capital structure decision at t_0 and focus on the investment decision at t_1 in the presence of debt overhang (Myers, 1977). However, it is important to note that investors factor in the investment policy of the overconfident CEO when they price the securities at t_0. Let $p(\alpha)_i^*$ be the minimum probability of H at which a manager, acting in the interest of shareholders and with a bias factor of $\alpha \geq 1$, will accept a project, where $i = e$ denotes an all-equity financed firm at t_0 and $i = d$ denotes equity and debt financing at t_0 and hence presence of outstanding debt at t_1. Also, for notational convenience, let p_i^* denote $p(\alpha = 1)_i^*$ and p_{oi}^* denote $p(\alpha > 1)_i^*$.

3.2. All equity financing at t_0

The following proposition establishes a benchmark and states the investment policy of an overconfident CEO when the firm is fully financed by equity at t_0 and consequently with an absence of debt overhang at t_1.[5]

Proposition 1. *An overconfident CEO* ($\alpha > 1$) *of a firm with assets in place that is fully financed by equity, invests in a growth opportunity with* $p > p_{oe}^*$, *where*:

$$p_{oe}^* = \frac{I-L}{H-L} \text{ for } X < Q$$
$$p_{oe}^* = \frac{I-L}{\alpha H-L} \text{ for } Q \leqslant X < I, \text{ and }.$$
$$p_{oe}^* = \frac{I-\alpha L}{\alpha(H-L)} \text{ for } X \geqslant I.$$

and where Q denotes the minimum value of X at which the investment in the growth opportunity can be externally financed.

Substituting $\alpha = 1$ in the above proposition results in the investment policy of a rational CEO i.e., $p_e^* = (I - L)/(H - L)$ where only positive NPV projects are accepted. In comparison, when the extent of financing needed is greater than the amount $I - Q$, an overconfident CEO who follows the investment policy $p_{oe}^* = \frac{I-\alpha L}{\alpha H-L}$ is unable to obtain external financing because outside investors know the true value of the project and realize that cash flows from the project are not sufficient to meet the promised payment. Consequently, an overconfident CEO is *forced* to adopt a rational CEO's investment policy when the financing need exceeds $I - Q$. For values of $X > Q$, the need for external financing is lower and the overconfident CEO can obtain external financing under the biased investment policy. Since, $p_{oe}^* < p_e^*$, an overconfident CEO has an incentive to overinvest in projects with p such that $p_{oe}^* < p < p_e^*$. The overinvestment in this model is due to an overestimation of the level of cash flows and not due to perceived mispricing of a security issue, as is the case in Hackbarth (2009) and Heaton (2002).

3.3. Presence of debt financing at t_0

Myers (1977) shows that in the presence of outstanding risky debt at t_1, a rational CEO, acting in the interest of shareholders, might pass up positive NPV projects and underinvest if the expected benefits net of those accruing to outstanding bondholders is less than the investment outlay. In the next two propositions, we characterize the overconfident manager's investment policy in the presence of outstanding debt. Proposition 2 considers the overconfident CEO's investment policy in a situation with a relatively low value of assets in place as measured by the magnitude of X.

Proposition 2. *When the firm has outstanding debt at* t_1 *that carries a promised payment of* M *at* t_2, *an overconfident CEO invests in all projects with* $p \in [p_{od}^*, 1]$, *where*

$$p_d^* = p_{od}^* = \frac{I-X}{H-M} \text{ for } 0 \leqslant X < M$$
$$p_d^* = p_{od}^* = \frac{I-M}{H-M} \text{ for } M \leqslant X < Q.$$
$$p_{od}^* = \frac{I-M}{\alpha H-M} \text{ for } Q \leqslant X < I.$$

[4] A manager can also exhibit conditional overconfidence when he or she overestimates only the upside cash flow as αH (and correctly estimates the downside cash flow, L) or overestimates only the downside cash flow αL (and correctly estimates the upside cash flow, H).

[5] All proofs are contained in the Appendix.

The rational CEO's investment policy is the same as in Harikumar et al. (1994). As in Proposition 1, an overconfident CEO is unable to obtain junior debt financing for values of $X < Q$ under an investment policy that is based on the biased forecast of cash flows. The junior bondholders, however, are willing to provide the necessary financing if the overconfident CEO adopts a rational CEO's investment policy. Hence, $p_d^* = p_{od}^*$ for values of $X < Q$. Lower financing needs of an amount less than $I - Q$ is associated with lower promised payments to junior bondholders thereby enabling an overconfident CEO to obtain financing even under the investment policy that is based on a biased forecast of project cash flows. Since the investment policy $p_{od}^* = \frac{I-M}{\alpha H-M} < p_d^* = \frac{I-M}{H-M}$, the overconfident CEO overinvests in projects with p such that $p_{od}^* < p < p_d^*$.

Considering that the claims were priced at t_0 to reflect the overconfident CEO's investment policy, a turnover at t_1 implies a potential change in investment policy and consequently investors' react to the turnover announcement. Corollary 1 below describes the stakeholders' reaction to a turnover of an overconfident CEO.

Corollary 1. *For values of $X < Q$, the shareholders and outstanding bondholders do not react to the turnover of an overconfident CEO. For $X > Q$, the outstanding bondholders and shareholders react positively to a turnover of an overconfident CEO.*

For lower values of X, outstanding debt becomes riskier and the amount of external financing needed to undertake the project increases. In this situation, Proposition 2 shows that the rational behavior of outside investors forces the overconfident CEO into following the same investment policy as a rational CEO. As X increases, debt becomes less risky, the amount of external financing needed is less, and the overconfident CEO exhibits an incentive to overinvest. We now state our first testable hypothesis:

Hypothesis 1: In the presence of outstanding *risky* debt, the bondholders and stockholders are either neutral or react positively to a turnover of an overconfident CEO.

In the presence of sufficient internal funds to finance the investment outlay and if bonds carry covenants that restrict distribution, the investment policy of an overconfident manager is characterized in the following proposition.

Proposition 3. *When the firm has outstanding debt at t_1 that carries a promised payment of M and maturity t_2, the overconfident CEO invests in all projects with $p \in [p_{od}^*, 1]$, where $X^* = M + I - \alpha L$, and*

$$p_{od}^* = \frac{X-M}{\alpha H+(X-I)-M} \text{ for } I \leqslant X < X^* \text{ and,}$$

$$p_{od}^* = \frac{I-\alpha L}{\alpha(H-L)} \text{ for } X^* \leqslant X.$$

Substituting the value of $\alpha = 1$ in the investment policy described in Proposition 3 results in a rational CEO's investment policy. In comparison, the overconfident CEO's investment policy in Proposition 3 indicates a greater incentive to overinvest. In the presence of restrictive dividend covenants, the retained funds provide a cushion and reduce the riskiness of outstanding debt. Beyond a threshold, outstanding debt is risk-free and the investment policy of a rational CEO is restored to the first-best. Proposition 3 shows that overconfident CEOs continue to exhibit an incentive to overinvest. The bondholders and shareholders prefer a rational CEO and will react positively to a turnover of the overconfident CEO. We now state the second testable hypothesis:

Hypothesis 2: In the presence of outstanding debt that is relatively *safe*, the bondholders and shareholders react positively to a turnover of an overconfident CEO.

The difference between the two hypotheses hinges on the ability of outside investors to discipline the overconfident CEO. When outstanding debt is risky due to insufficient internal funds, the disciplining reduces the overinvestment incentive and consequently the stakeholders' reaction to a turnover. When internal funds become available, outstanding debt is safer, and the reduced disciplining results in the overconfident CEO's overinvestment incentive to persist. In this instance, the stakeholders' react positively to a turnover of the overconfident CEO. In order to test the above hypotheses, we operationalize the words '*risky* and '*safe'* using measures of credit rating and empirically test these hypotheses in the next few sections.

4. Sample and variable definitions

4.1. Overall sample

The CEO turnover sample covers the period from 1994 to 2011. As a starting point, we use the EXECUCOMP database to identify a sample of 2943 CEO turnovers.[6] Using this sample of turnovers, we collected the relevant bond data from Mergent Fixed Income Securities Database (FISD) and TRACE. As TRACE data were available only beginning in July 2002, we used the FISD to obtain data from prior to July 2002 and the TRACE database for the period after July 2002. In addition, because TRACE does not provide ratings information, we merged TRACE with FISD to obtain data on credit ratings and maturity. We started with a sample of 2,127,591 daily bond observations. The sample size dropped to 1,763,141 daily bond observations after we eliminated

[6] The actual announcement of a CEO's departure is likely to have occurred prior to the date recorded in the EXECUCOMP database. Hence, by using a FACTIVA search, we hand-collected the actual date of the announcement and whether the turnover was voluntary or forced.

trades where the trade volume is less than $100,000. The number of turnover events with the necessary bond information dropped from 2943 observations to 470 observations after we merged with EXECUCOMP and COMPUSTAT. Next, we used the CRSP database to obtain the returns data for the sample of 2943 turnover observations and found 2559 turnover events with the necessary equity information. Further, we merged these turnover events with EXECUCOMP and COMPUSTAT. The equity sample consists of 1626 turnover events with the relevant compensation related data.[7]

4.2. Overconfidence measure

We measure CEO overconfidence by estimating the extent to which the unexercised but exercisable portion of the option grants are in-the-money prior to the turnover announcement (i.e., *moneyness*). Because risk-averse CEOs are under-diversified and unable to trade their options or hedge by short-selling the firm's stock, it would be in their interest to exercise their options early if the stock price is sufficiently high. CEOs exhibit a certain level of overconfidence in their firms' future performance if they decide not to exercise their exercisable options. Therefore, the value of the CEO's unexercised but exercisable options is one way to capture CEO overconfidence (Campbell et al., 2011; Hirshleifer, Low, & Teoh, 2012; Malmendier & Tate, 2005, 2008; Malmendier, Tate, & Yan, 2011).

The estimation of *moneyness* requires the stock price and exercise price as inputs. While the stock price is easily obtainable, the exercise price on previously granted options needs to be estimated in the absence of detailed data on each option grant. In practice, the proxy statements provide aggregate information on the realizable value of a portfolio of options that have been previously granted, but not on the exercise price. Hence, the task is in estimating an 'average' exercise price per option derived from the portfolio of options and then comparing the realizable value per option to the exercise price to determine *moneyness*.[8] The variables we use from Execucomp are *OPT_UNEX_EXER_EST_VAL* for the total realizable value of the exercisable options, (*OPT_UNEX_EXER_NUM*) for the number of exercisable options. In addition, we collect the stock price at the end of the fiscal year (*PRCCF*) from Compustat.

4.3. Abnormal bond returns

We follow the methodology in Bessembinder et al. (2009) to compute abnormal bond returns. We and eliminate zero coupon bonds, puttable bonds, and matrix-priced bonds, and all trades that are less than $100,000. We follow the 'trade-weighted price, trade ≥$100,000' approach to compute bond prices and the 'matched portfolio' approach to compute abnormal bond returns.[9]

We address multiple bond issues made by the same firm by treating each firm as a portfolio and computing one composite (monthly) bond price for each firm. For each bond issue in a firm, we use the last (daily) transaction price and the corresponding trade volume for each day and compute a 'trade-weighted' bond price for the day.[10] To calculate one price for each firm, we aggregate the trade volume over a month for each firm and along the trade-weighted price for each bond computed above, compute one composite 'trade-weighted price' for each firm at the end of a month. We use this composite monthly price to compute raw monthly bond returns.

Bessembinder et al. (2009) calculate the abnormal returns using three different methods, namely, the mean-adjusted model, the matching portfolio model, and the factor return model. We use the matching portfolio model that controls for default risk and time-to-maturity and create six risk portfolios using rating categories (AAA through B) and segment these rating categories into time-to-maturity categories. The AAA sample is split into categories with 0–7 years to maturity and 7+ years to maturity. The remaining five rating buckets were split into maturity cutoffs of 0–5 years, 5–10 years, and 10 + years, giving us a total of 17 matching portfolios. We pair each bond within a firm with the appropriate matching portfolio, calculate the abnormal returns for each bond for every month and then aggregate these at the firm level using the trade-weighted approach as before. We report the bond cumulative abnormal returns for the interval between the six month and two months before the event (−6, −2), one month before the event (month −1), event month (month 0), one month forward (month 1), and two months forward (month 2). The abnormal return in month 0 is a representative reaction if the CEO departs at the beginning of the month. If the CEO turnover occurs towards the end of a month, say, the 25th day, then month 0 abnormal return only captures the reaction for 5 days and the rest of the monthly abnormal return is captured in month 1.

[7] We matched the bond and equity sample for each firm to study wealth transfers between the two groups of stakeholders. Due to the small sample that resulted from the merge, we did not obtain results that were statistically significant.

[8] Assume that there are N previously made option grants that are currently unexercised. Let S denote the current stock price and X_i denote the exercise price of option grant i. Although, the proxy statements do not report the exercise price on each option grant, they contain information about the realizable amount for all N options, which computed as $\sum_{i=1}^{N}(S - X_i)$. The average realizable value per option is then $\sum_{i=1}^{N}(S - X_i)/N = S - \overline{X}$and the average exercise price of the N option grants is $S - (S - \overline{X}) = \overline{X}$. *Moneyness* is defined as $(S - \overline{X})/\overline{X}$. We use *moneyness* as a continuous variable in our paper to be consistent with the interpretation of the overconfidence parameter α in our model.

[9] Bessembinder et al. (2009) require that the bond have three months of prior trade data to compute monthly returns using the mean adjusted model and at least ten of the twenty days prior to a simulated event to compute daily returns. We do not impose the twenty-day trading restriction for four reasons: (a) we use daily data and the 'trade-weighted' methodology in Bessembinder et al. (2009) to compute monthly returns, (b) we conduct an event study around a turnover event and not a simulated event, (c) we use the matched-portfolio instead of the mean adjusted model, and (d) this restriction vastly reduces the number of available observations, making it impractical for our study.

[10] Bessembinder et al. (2009) calculate raw bond returns using the clean price and the invoice price, which includes the clean price and the accrued interest, and find that the inclusion or exclusion of accrued interest does not create any meaningful differences in the results.

Conversely, if the turnover occurs on the 10th of a month, the abnormal return for month 0 captures the reaction for 10 days and any reaction during the prior days, if any, is captured in month −1. To partly rectify the limitation associated with the monthly approach, our analysis includes the cumulative abnormal returns for the past month (month −1), event month (month 0), one month forward (month 1), and two month forward (month 2).[11]

4.4. Abnormal stock returns

Like prior studies on turnover events[12], the estimation period for the daily market coefficients is comprised of 250 trading days, ending 30 days before the announcement date. We report equity cumulative abnormal returns over a three-day window from one day before to one day after the event (−1,+1), 30 days following the event date (month 1), and sixty days following the event date (month 2).[13] We also report the cumulative abnormal return for the interval between six months and two months (−6, −2), one month before the event (month −1). We report these for comparability with bond cumulative abnormal returns. Since the estimation window for the event study includes the interval between six months and two months we calculated the cumulative raw returns and subtracted the CRSP value weighted return for the same interval. We repeated the same for the cumulative abnormal return for one month before the event.

4.5. Control variables

4.5.1. Agency-cost-related controls

We merge the above data with COMPUSTAT to extract the firm-level control variables.

The underinvestment caused by the debt overhang problem is exacerbated in growth firms with higher levels of outstanding leverage. Myers (1977) predicts that such firms have an incentive to use shorter-term debt, a prediction supported by Johnson (2003), who finds evidence that firms trade off the cost of underinvestment problems against the cost of liquidity. However, because a value firm has relatively fewer growth opportunities and lower underinvestment costs, it does not have to rely on short-term debt. Nonetheless, if such firms are left with free cash flow after investing in all positive NPV firms, Jensen (1986) suggests that greater leverage will force the firm to pay out the free cash flow to avoid possible overinvestment. To account for differences in debt characteristics across firms, we include contemporaneous values of *maturity*, *leverage*, *free cash flow*, and *size* as control variables, which are defined as follows.

Maturity: the remaining maturity (maturity year minus the transaction year)

Leverage: the ratio of total long-term debt to total assets

Free cash flow: the operating income before depreciation net of taxes, interest expenses, preferred dividends provisions and total dividends as calculated per Lehn and Poulsen (1989)

Size: log of total assets

4.5.2. Volatility-related controls

CEO turnover is a significant event in the life of an organization. Clayton, Hartzell, and Rosenberg (2003) find that equity volatility is significantly larger after forced departures and outside successions following voluntary departures because of uncertainty regarding future operating performance and changes in investing and financing policies. Campbell and Taksler (2003) and Van Landschoot (2008) find that firm-specific volatility can explain variations in bond yields, thus providing evidence that equity volatility is an important element of corporate bond pricing. Following Adams and Mansi (2009), we include control variables that account for changes in the expected volatility stock returns from before the turnover event to after the event. Specifically, we define the variable *Volatility* as the natural log of the ratio of the rolling lagged 9-month standard deviation to the forward-looking 9-month standard deviation. Higher values of *Volatility* imply a decrease in volatility after the turnover announcement. Stakeholders' anticipation of this decline in volatility is likely to have a positive impact on abnormal returns.

4.5.3. Credit rating

The hypotheses in the previous section refers to the riskiness of outstanding debt. We measure riskiness based on the credit rating of the firm. Specifically, we assign a value of 1 to an AAA rated bond and 2 to a AA+ rated bond and work down to a value of 26 to a D rated bond. Bonds issued by the same firm could have different credit ratings. To calculate a bond credit rating for a firm, we extended the monthly volume-weighted approach for firm bond prices to credit ratings. Similarly, to analyze equity returns for differences in credit ratings, we rely on the firm credit ratings provided by COMPUSTAT. We classify *risky debt* as firms having a BBB and lower credit rating and *safe debt* as firms having credit rating in a A− and above (includes AAA, AA+, AA, AA−, A+, A, and A−), respectively.

[11] We thank an anonymous referee for pointing this limitation and suggesting that we add the (−6, −2 month) and (−1 month) cumulative abnormal returns.

[12] See Furtado and Rozeff (1987) and Adams and Mansi (2009).

[13] We realize that the event date reaction is typically captured quickly in abnormal stock returns relative to abnormal bond returns. Since the event in our study is a CEO turnover event, shareholders might take longer than a day to process the implications. In addition, the trades in the bond market that occur after the event month is likely to convey additional event related information. Hence, in addition to the event day, we examine cumulative abnormal returns over 30 and 60 days for stocks.

Table 1
This table contains the summary statistics of the bond and equity turnover samples. We define a CEO as overconfident if his or her *moneyness* value is greater than the median *moneyness*. Additionally, we perform a FACTIVA search of news articles around the time of the turnover event to classify the turnover event as *forced* or *voluntary*.

	Bond Sample		Equity Sample	
	Obs	%	Obs	%
Overall sample	470	100%	1626	100%
Forced turnover	63	13%	209	13%
Voluntary turnover	407	87%	1417	87%
Rational	196	42%	1066	66%
Overconfident	274	58%	555	34%

Table 2
This table contains summary statistics of firm-level variables and *moneyness* for the bond and equity samples. *Size* is the natural log of total assets. *MKBK* is the sum of the market value of equity, preferred stock, total long-term debt, and net current liabilities scaled by total assets. *Capx* is capital expenditures scaled by total assets. *Leverage* is defined as the ratio of total long-term debt to total assets. *Cash* is defined as cash and cash equivalents scaled by total assets. *ROA* is the ratio of operating income before depreciation to total assets. Per Lehn and Poulsen (1989), *free cash flow* is calculated as the operating income before depreciation net of taxes, interest expenses, preferred dividends provisions and total dividends. *RND* is the research and development expenditure scaled by total assets. *Ppent* is the net property plant and equipment scaled by total assets. *Rating* is the credit rating of the bond. Specifically, we assign a value of 1 to an AAA-rated bond and 2 to an AA-rated bond and work down to a value of 28 for a D-rated bond. *Maturity* is the remaining maturity defined as the maturity year minus the transaction year. V*olatility* is the natural log of the ratio of the lagged nine-month standard deviation of stock returns to the forward-looking nine-month standard deviation of stock returns.

	Bond Sample				Equity Sample			
Variable	Mean	Std Dev	N	Median	Mean	Std Dev	N	Median
SIZE	8.599	1.190	470	8.575	7.350	1.671	1626	7.243
MKBK	1.139	0.690	470	0.951	1.141	0.902	1626	0.886
CAPX	0.048	0.034	470	0.037	0.048	0.040	1626	0.038
LEVERAGE	0.279	0.146	470	0.261	0.169	0.151	1626	0.147
CASH	0.080	0.078	470	0.051	0.145	0.159	1626	0.077
FREE CASH FLOW	0.073	0.047	470	0.074	0.060	0.078	1626	0.068
ROA	0.131	0.064	470	0.126	0.108	0.093	1626	0.112
VOLATILITY	0.309	1.460	470	0.361	−0.011	0.516	1626	0.006
MONEYNESS	0.296	0.455	470	0.058	0.451	0.654	1626	0.157
MATURITY	11.000	6.000	470	10.000				
RATING	10.000	4.000	470	10.000				

5. Summary statistics, univariate, and multivariate regressions

Table 1 contains the summary statistics for the turnover events identified as bond and equity samples. We find that the overall bond sample consists of 470 turnover observations. Of these, 63 are identified as forced turnovers and 407 as voluntary turnovers. The 407 voluntary turnovers include turnovers of 196 rational CEOs and 274 overconfident CEOs.[14] Similar to the bond sample, voluntary turnovers constitute 87% of a total of 1626 turnover events. Furthermore, 58% (34%) of the turnovers in the bond (equity) sample constituted departures of overconfident CEOs.

Table 2 presents summary statistics of the firm types in the bond and equity samples. The mean firm size in the bond sample is $8.599 billion relative to $7.35 billion in the equity sample.

As expected, the mean leverage ratio in the bond sample is 27.9% relative to 16.9% in the equity sample. Both samples contained firms that were approximately similar in terms of MKBK, CAPX, and Free Cash Flow. It is interesting to note that the value of stock volatility in the bond sample is 0.309 and −0.011 in the equity sample. Stock volatility is the natural log of the ratio of the lagged nine-month standard deviation of stock returns to the forward-looking nine-month standard deviation of stock returns. A higher value of stock volatility indicates that the post turnover volatility is lower relative to the pre-turnover volatility. Considering that 58% of turnovers in the bond sample were overconfident CEOs, it is reasonable to observe a reduction in post-turnover volatility. Because 66% of turnovers in the equity sample were of rational CEOs, a marginal increase in post-turnover volatility is indicative of an increase in uncertainty surrounding the turnover event. Although the fraction of overconfident CEO turnovers in the equity sample is lower, the median *moneyness* is 15.7% relative to 5.8% in the bond sample. A median *moneyness* value of 15.7% implies that the stock price is 1.157 times the average exercise price, representing an in-the-money option that is exercisable but not exercised by the CEO (i.e., overconfidence). A typical firm in

[14] CEOs with a *moneyness* value less (greater) than median *moneyness* are classified as rational (overconfident). We examined the classification based on tertile values of *moneyness* and found the results to be robust.

the bond sample has bonds with 11 years to maturity and a credit rating of 10 (i.e., BBB− rating). We control for the above firm characteristics in the multivariate regressions that examine the abnormal return reaction to turnover events.

Table 3 contains summary statistics of the relative differences in firm type managed by overconfident CEOs. Both the bond and equity samples indicate that firms managed by overconfident CEOs, on average, have a higher market-to-book value, higher return on assets, higher capital expenditures, and more free cash flow. In addition, although the average maturity of the bonds is the same, the credit rating for bonds in firms managed by overconfident CEOs is marginally better than those managed by rational CEOs.

Table 3
This table contains firm-level summary statistics by CEO type for the bond and equity samples. *, **, ** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Rational CEO		Overconfident CEO			
Variable	Mean	Median	Mean	Median	T-Test	Median Test
Panel A – Summary statistics for Rational vs. Overconfident CEOs for the Bond Sample						
SIZE	8.596	8.566	8.601	8.582	−0.03	−0.11
MKBK	0.904	0.760	1.300	1.096	−6.36***	−3.15***
CAPX	0.042	0.034	0.053	0.040	−3.45***	0.93
LEVERAGE	0.288	0.260	0.272	0.261	1.21	3.08***
CASH	0.087	0.054	0.074	0.050	1.78**	1.04
FREE CASH FLOW	0.058	0.061	0.083	0.084	−5.90***	−5.52***
ROA	0.110	0.106	0.145	0.139	−6.07***	−5.73***
MATURITY	11.000	10.000	11.000	10.000	−0.39	−0.25
RATING	11.000	10.000	10.000	9.000	2.78***	2.75***
VOLATILITY	0.096	0.111	0.455	0.511	−2.63***	−2.45**
Panel B – Summary statistics for Rational vs. Overconfident CEOs for Equity Sample						
SIZE	7.359	7.231	7.332	7.272	0.32	0.21
MKBK	0.896	0.729	1.616	1.296	−14.41***	−14.62***
CAPX	0.046	0.035	0.052	0.041	−2.86***	−2.96***
LEVERAGE	0.181	0.163	0.148	0.118	4.27***	3.52***
CASH	0.139	0.071	0.157	0.095	−2.14**	−2.87***
FREE CASH FLOW	0.048	0.055	0.084	0.090	−9.06***	−9.66***
ROA	0.091	0.097	0.142	0.149	−10.69***	−10.94***
VOLATILITY	−0.031	−0.004	0.026	0.013	−2.21***	−1.44

Table 4
This table presents results on bond cumulative abnormal returns (*BCAR*) calculated as per Bessembinder et al. (2009), equity cumulative abnormal returns (*ECAR*). Bond (equity) returns are computed using monthly (daily) frequency. Panels A and B contain results for firms in BBB+ and lower rating and A− to AAA rating buckets, respectively. The difference in means (T-test) and the difference in medians (median test) are reported. *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Rational CEOs					Overconfident CEOs				T-Test	Median Test
Variable	Mean	Std Dev	N	Median	Mean	Std Dev	N	Median		
Panel A: Cumulative Abnormal returns for the Turnover of Rational vs. Overconfident CEOs in BBB+ and lower rating										
BCAR (−6,−2)	−0.2053	0.4681	216	−0.1148	−0.2321	0.4805	59	−0.0810	0.38	0.37
BCAR (month −1)	−0.0495	0.3633	171	−0.0010	−0.0124	0.0587	41	−0.0026	−1.27*	0.37
BCAR (month 0)	−0.0047	0.0910	270	−0.0025	−0.0176	0.1077	78	0.0013	0.96	−0.68
BCAR (month 1)	−0.0027	0.0413	230	−0.0002	−0.0098	0.0549	62	−0.0003	0.95	0.51
BCAR (month 2)	−0.0102	0.1171	183	−0.0008	0.0289	0.2169	53	−0.0001	−1.26*	−0.03
ECAR(−6,−2)	−0.0748	0.3226	917	−0.0653	0.0247	0.2918	503	0.0116	−5.92***	−6.19***
ECAR(month −1)	−0.0185	0.1629	917	−0.0124	0.0150	0.1484	503	0.0045	−3.93***	−4.00***
ECAR(−day 1, + day1)	0.0023	0.0997	917	0.0013	0.0035	0.0678	503	0.0018	−0.26	−0.78
ECAR (month 1)	−0.0085	0.2169	917	−0.0160	0.0068	0.1652	503	−0.0014	−1.49*	−1.65*
ECAR (month 2)	0.0043	0.2951	917	−0.0020	0.0142	0.2595	503	0.0067	−0.65	−0.63
Panel B: Cumulative Abnormal returns for the Turnover of Rational vs. Overconfident CEOs in A− to AAA rating										
BCAR (−6,−2)	−0.0521	0.3403	61	−0.0076	−0.0472	0.2702	37	−0.0547	−0.07	0.45
BCAR (month −1)	−0.0108	0.0424	45	−0.0026	−0.0061	0.0219	20	−0.0001	−0.59	−0.81
BCAR (month 0)	−0.0061	0.0210	77	−0.0028	0.0009	0.0114	45	−0.0014	−2.39***	−1.98**
BCAR (month 1)	−0.2440	1.9623	65	−0.0004	0.0011	0.0180	30	0.0004	−1.00	−1.77*
BCAR (month 2)	−0.0019	0.0105	53	−0.0004	0.0030	0.0122	24	−0.0002	−1.69*	−1.34
ECAR(−6,−2)	−0.0368	0.2752	142	−0.0117	0.0336	0.1589	48	0.0218	−2.16**	−1.91*
ECAR(month −1)	−0.0123	0.1133	142	−0.0139	−0.0149	0.0930	48	−0.0062	0.15	−0.24
ECAR(−day 1, + day1)	0.0014	0.0406	142	0.0015	0.0015	0.0493	48	0.0017	−0.02	0.99
ECAR (month 1)	−0.0118	0.1231	142	−0.0015	0.0120	0.1109	48	0.0061	−1.25*	−1.21
ECAR (month 2)	−0.0248	0.1906	142	−0.0117	0.0102	0.1545	48	−0.0090	−1.28*	−0.84

5.1. Univariate tests: announcement period abnormal returns

The hypotheses developed in Section III states that the reaction to the turnover of an overconfident CEO depends on the firm's credit rating. Table 4 contains the univariate analysis of the cumulative abnormal returns for the bond and stock samples categorized by credit rating for a variety of event related windows surrounding the turnover event. Results from statistical significance tests comparing the difference in mean and median reactions to the turnover across the two CEO types are also presented.

Panel A and B contain results for firms with a BBB+ and lower rating and A− to AAA rating buckets, respectively. Consider the results in Panel A. The bond cumulative abnormal returns (*BCAR*) in month −1 and month 2 indicate that bondholders react more negatively to a turnover of a rational CEO relative to an overconfident CEO. The equity cumulative abnormal returns (*ECAR*) indicate that stockholders also react more negatively to a turnover of a rational CEO. These univariate results are consistent with Hypothesis 1. For the firms in the A rating bucket in Panel B, the bondholders react significantly more negatively to the turnover of a rational CEO relative to an overconfident CEO's departure. This difference in reaction is evident during the month of the turnover and two subsequent months. The equity cumulative abnormal returns (*ECAR*) are similar to the bondholders' reaction. However, the differences are observed in the period prior to the event date and during the

Table 5

Results from Multivariate Regressions of the Impact of CEO Turnover on Stakeholders' Returns. The dependent variable is abnormal returns for the respective announcement period windows. Panels A and B contain results for firms in BBB + and lower rating and A− to AAA rating bucket, respectively. In each panel, the bond regressions are models 1–4 and the stock regressions are models 5–8. *Maturity* is the remaining maturity, defined as the maturity year minus the transaction year. *Volatility* is the natural log of the ratio of the lagged nine-month standard deviation of stock returns to the forward-looking nine-month standard deviation of stock returns, *Size* is the natural log of total assets. *Leverage* is defined as the ratio of total long-term debt to total assets. Per Lehn and Poulsen (1989), *free cash flow* is calculated as the operating income before depreciation net of taxes, interest expenses, preferred dividends provisions and total dividends, and *ROA* is the ratio of operating income before depreciation to total assets. Robust t-statistics are in parentheses. *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Bonds: Cumulative Abnormal Returns				Stocks: Cumulative Abnormal Returns			
VARIABLES	(1) Month −1	(2) Month 0	(3) Month 1	(4) Month 2	(5) Month −1	(6) Days (−1 to +1)	(7) Month 1	(8) Month 2
Panel A: (Hypothesis 1) Regression results for firms with a credit rating of BBB+ and lower								
Moneyness	0.0262	−0.0225**	−0.0074	0.0245	0.0266***	0.0009	0.0060	0.0046
	(0.9310)	(−1.9926)	(−0.8568)	(1.0175)	(3.5219)	(0.3212)	(0.8079)	(0.4304)
Maturity	−0.0050	−0.0006	0.0004	−0.0014				
	(−1.3114)	(−1.0985)	(1.0871)	(−0.6517)				
Volatility	−0.0095	−0.0048**	−0.0001	−0.0171	0.0402***	0.0001	0.0429***	0.0400**
	(−0.7964)	(−2.1157)	(−0.0386)	(−1.2689)	(4.4996)	(0.0286)	(3.6184)	(2.2715)
Size	0.0481	−0.0034	0.0008	0.0154	−0.0006	−0.0005	−0.0039	−0.0102*
	(1.4455)	(−0.8659)	(0.4347)	(1.3070)	(−0.1986)	(−0.2769)	(−0.9975)	(−1.9535)
Leverage	0.1782	−0.0786	0.0275	0.0804	−0.0146	0.0097	0.0075	0.1038*
	(1.4463)	(−1.2884)	(1.1534)	(0.6917)	(−0.4626)	(0.5441)	(0.1880)	(1.7663)
Free Cash Flow	−0.3300	0.0382	0.1889	0.3935	0.0712	0.1865*	0.1494	0.1499
	(−0.3986)	(0.2282)	(1.4847)	(1.5907)	(0.4345)	(1.6629)	(0.7250)	(0.4412)
Roa	0.9958	0.0742	−0.0563	−0.0693	0.0431	−0.1388	−0.3047*	−0.3734
	(1.4602)	(0.7565)	(−0.5690)	(−0.7889)	(0.3223)	(−1.4624)	(−1.7500)	(−1.3411)
Constant	−0.5485	0.0469	−0.0269	−0.1587	−0.0214	0.0082	0.0443	0.0917**
	(−1.6302)	(1.0488)	(−1.0670)	(−1.3997)	(−0.9232)	(0.4561)	(1.3725)	(2.2246)
Observations	200	332	277	222	1383	1383	1383	1383
R−squared	0.0488	0.0318	0.0332	0.0522	0.0389	0.0058	0.0206	0.0164
Panel B: (Hypothesis 2) Regression results for firms with a credit rating of A− to AAA rating								
Moneyness	0.0043	0.0069**	0.2720	0.0073***	0.0240*	0.0078	0.0164	0.0187
	(0.5131)	(2.1999)	(0.9754)	(2.7351)	(1.6958)	(1.1940)	(0.8498)	(0.7537)
Maturity	−0.0012	0.0001	0.0280	0.0000				
	(−1.1448)	(0.6151)	(0.9917)	(0.3414)				
Volatility	0.0026	0.0009	−0.0540	−0.0014*	−0.0020	−0.0059	0.0202	0.0744*
	(1.2536)	(0.9041)	(−0.8959)	(−1.6809)	(−0.1397)	(−1.2220)	(1.2107)	(1.7853)
Size	0.0025	0.0001	−0.1415	0.0005	0.0079	0.0050	−0.0030	0.0017
	(0.4454)	(0.0360)	(−0.9645)	(0.3036)	(1.0215)	(1.0905)	(−0.3430)	(0.1408)
Leverage	0.0255	0.0350	1.6209	0.0031	0.0707	−0.0091	0.0682	0.0614
	(0.5738)	(1.3585)	(0.9880)	(0.2324)	(0.7512)	(−0.4002)	(0.8570)	(0.4443)
Free Cash Flow	0.1587	0.1701	−0.6869	−0.0130	−0.5518	0.0458	0.1041	−0.2621
	(0.7688)	(1.6576)	(−0.2708)	(−0.2544)	(−1.1460)	(0.2544)	(0.2377)	(−0.4291)
Roa	0.0223	−0.0176	1.6048	0.0076	0.3667	−0.0052	0.0135	0.2142
	(0.2751)	(−0.5048)	(0.7447)	(0.1641)	(1.4818)	(−0.0400)	(0.0499)	(0.5722)
Constant	−0.0441	−0.0286	0.1961	−0.0083	−0.1152	−0.0483	−0.0031	−0.0593
	(−0.5956)	(−0.8787)	(0.4096)	(−0.4802)	(−1.4142)	(−0.9640)	(−0.0341)	(−0.4360)
Observations	64	119	93	75	190	190	190	190
R-squared	0.0770	0.1296	0.0475	0.1117	0.0335	0.0286	0.0270	0.0560

Robust t-statistics in parentheses, $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

succeeding one and two months. These results are consistent with Hypothesis 2. In general, the univariate results indicate that investors prefer a rational CEO to an overconfident CEO and react significantly negatively to a rational CEO leaving a firm relative to an overconfident CEO's departure. This reaction is consistent with the hypothesis that an overconfident CEO potentially engages in greater overinvestment relative to a rational CEO.

5.2. Multivariate regressions

Regression models (1) and (2) test the impact of an overconfident CEO's turnover on cumulative abnormal returns for bond holders (*BCAR*) and equity holders (*ECAR*) using the bond and equity samples, respectively:

$$BCAR_j(event\,window) = \alpha_1 + \beta_1 Moneyness_j + controls_J + u_j \quad (1)$$

$$ECAR_j(event\,window) = \lambda_1 + \gamma_1 Moneyness_j + controls_j + e_j \quad (2)$$

Table 5, Panels A and B contain results from the models that test Hypothesis 1 and 2, respectively. Panel A (B) contains results for firms with BBB+ and lower rating (A− to AAA rating). In each panel, regressions (1) through (4) pertain to model (1) above for event windows Month −1, Month 0, Month 1, and Month 2. Regressions (5) through (8) pertain to model (2) above for event windows Month −1, Days (−1 to +1), Month 1, and Month 2, respectively.

Consider the bondholders' reaction to a turnover event in regressions (1) through (4) in Table 5, Panel A. The coefficient on *moneyness* (β_1) is -0.0225 (statistically significant at the 10% level) in the event month regression. The sign of β_1 for regressions (1), (3) and (4) are not statistically significant. The lack of statistical significance for β_1 indicates no relationship between the reaction and overconfidence bias as measured by *moneyness*. This is consistent with the notion that bondholders are neutral to the type of CEO turnover.

The negative sign for β_1 in Month 0 implies that bondholders are unhappy when an overconfident CEO leaves a firm with BBB+ and lower rating. The summary statistics in Table 3 indicate that firms managed by an overconfident CEOs, on average, have a higher return on assets and marginally better credit rating. We find that the negative sign for β_1 persists even after controlling for these variables. Since our model is based on agency cost of debt, it is possible that the bondholders' reaction is attributable to some positive attributes that are associated with the overconfident bias that is unrelated to agency cost of debt. Campbell et al. (2011) use a large sample of turnovers and find strong empirical support for an interior optimum level of overconfidence that maximizes firm value.

The results from regressions (5) through (8) indicate a positive stockholders' reaction in Month −1 i.e., $\gamma_1 = 0.0266$ (statistically significant at the 1% level).[15] Even assuming the presence of some benefits that arise from overconfidence, the shareholders' reaction is consistent with an anticipation of a decrease in overinvestment that results from the turnover of an overconfident CEO.

Table 5, Panel B contains regression results pertaining to firms in the A− to AAA rating bucket. The bondholders react positively to a turnover announcement of an overconfident CEO as evidenced by a positive coefficient on *moneyness* in regressions (2) and (4). The value of $\beta_1 = 0.0069$ in the event month regression and is significant at the 5% level. We also observe a reaction in Month 2 regression where $\beta_1 = 0.0073$ and is significant at the 1% level. The stockholders' reaction is positive and statistically significant at the 10% level in Month −1. These results support Hypothesis 2 implying that stakeholders anticipate a reduction in overinvestment when an overconfident CEO leaves a firm.

6. Conclusion

In the presence of outstanding risky debt, rational CEOs, acting in the interest of shareholders, sometimes underinvest by passing up a valuable growth opportunity (Myers, 1977) or overinvest in projects with negative NPV (Jensen & Meckling, 1976). A growing body of literature examines the impact of CEOs' behavioral traits on their financial decisions. Overconfident CEOs are more likely to issue optimistically biased forecasts because they overestimate their ability to affect their financial results and/or underestimate the probability of unfavorable outcomes. Thus, we develop a model and empirically test the implications that arise from the interaction of overconfidence and agency cost of debt. Our results indicate that outside investors see through the overconfidence bias, refuse to provide the necessary funds to finance the project, and disciplines the overconfident CEO to follow a rational investment policy thereby mitigating overinvestment incentive. When the extent of required financing decreases, the investors are willing to provide the necessary funds despite the overconfident bias. This causes the overconfident CEO's investment policy to potentially exacerbate the overinvestment problem. The empirical analysis of the stakeholders' reaction to the announcement of overconfident CEO turnovers provides evidence supporting the theory that overconfident CEOs exhibit a greater incentive to overinvest relative to rational CEOs

Appendix 1

Proof of Proposition 1 (Assets in place is fully equity financed)

[15] Recall, that we include the return reaction to a turnover during the first (last) 15 days of a month in Month −1 (Month +1).

We consider following cases.

Case 1: $X = 0$ (full external financing at t_1)

If a manager decides to undertake the project, we assume new debt with a promised payment $\$F$ is issued to raise the funds needed to invest $\$I$ in the growth opportunity. This debt is repaid from the funds available at time t_2. The investors observe the value of p, X, I, H, L and α and price the debt issue based on the financing condition given in (A1) below:

$$pF + [1 - p]L = I \tag{A1}$$

The investment condition is based on the manager's biased view of the cash flows from the growth opportunity as shown in (A2):

$$p(\alpha H - F) \geqslant 0 \tag{A2}$$

Solving (A1) and (A2) yields,

$$p \geqslant \frac{I - L}{\alpha H - L} \tag{A3}$$

where, $p^*_{oe} = \frac{I-L}{\alpha H - L}$. To verify if financing is feasible under the investment policy p^*_{oe}, substitute p^*_{oe} in (A1). We find that the overconfident manager can raise $\$I$ by offering a promised payment of $F = \alpha H$. Since, the debtholders are rational (i.e., know α), they know that maximum cash flow from the project is H and is not enough to meet the promised payment $\$F$. Consequently, debtholders will not be willing to provide financing under p^*_{oe} and the overconfident manager cannot implement p^*_{oe}. Whenever the financing need results in $F > H$, the debtholders will provide funds only under the investment policy of a rational manager i.e., $p^*_e = \frac{I-L}{H-L}$.

Case 2: $0 < X < I$ (partial external financing at t_1)

The financing condition given in (A4) below:

$$pF + [1 - p]L = I - X \tag{A4}$$

and,

$$F = \frac{(I - X) - (1 - p)L}{p} \tag{A5}$$

Note, F is decreasing in X. Let Q denote the value of X where $F = H$ under $p^*_{oe} = \frac{I-L}{\alpha H - L}$. Thus, (A5) can be written as,

$$F = \frac{(I - Q) - (1 - p^*_{oe})L}{p^*_{oe}} = H \tag{A6}$$

Thus, as X increases, the amount of external financing needed decreases resulting in a lower level of $\$F$. Under the overconfident manager's investment policy p^*_{oe}, the bondholders demand a promised payment of $\$H$ but provide financing only $I - Q$. For values of p greater than p^*_{oe}, $F < H$ and financing is feasible. The overconfident manager's investment policy $p^*_{oe} < p^*_e$ resulting in an incentive to overinvest. As $X > Q$, $F < H$ and potentially risk-free when $F \leq L$ and p^*_{oe} can be implemented.

Case 3: $X \geq I$ (internal financing at t_1)

The manager will invest only if

$$p(\alpha H + X - I) + (1 - p)(\alpha L + X - I) \geqslant X \tag{A7}$$

Solving (A7) yields the condition that $p \geqslant \frac{I - \alpha L}{\alpha(H - L)} = p^*_{oe}$.

Proof of Proposition 2:

We consider following cases.

Case 1: $X < I$ (external financing at t_1)

If the manager decides to undertake the project, we assume new *junior* debt with a promised payment F is issued to raise $I - X$. This debt is paid from the funds available at time t_2. Recall that we assume that $(H - M > F)$ and $H > M > L$.

The manager will invest only if the following two conditions are satisfied:

Financing condition:

$$pF = I - X \tag{A8}$$

Investment condition:

$$p(\alpha H - M - F) \geqslant Max(X - M, 0) \tag{A9}$$

Assuming $0 \leq X < M$ and solving (A8) and (A9) gives

$$p^*_{od} = \frac{I - X}{\alpha H - M} for 0 \leqslant X < M \tag{A10}$$

To verify if financing is feasible under the investment policy p^*_{od}, substitute p^*_{od} in (A8). This results in $F = \alpha H - M$ resulting in an infeasible financing condition under p^*_{od}. Whenever $F > \alpha H - M$, junior debtholders will provide financing only under the rational manager's policy p^*_d (i.e., substitute $\alpha = 1$ in (A10)).

Assuming $M \le X < Q$ and solving (A8) and (A9) gives

$$p^*_{od} = \frac{I - M}{\alpha H - M} \tag{A11}$$

Substituting (A11) in (A8) yields, the values of F under investment policy (A11).

$$F = \frac{(I - X)}{(I - M)}(\alpha H - M) \tag{A12}$$

Let Q be the value of X where the value of F in (A12) $= H$. For values of $I > X \ge Q$, junior debtholders provide financing under investment policy (A11). The investment policy in (A11) reflects an incentive to overinvest relative to the rational manager's policy (i.e., $\alpha = 1$ in (A11)).

Proof of Corollary 1

Consider the case where $Q < X < I$.

*Bondholders' reaction:*For $X > Q$, the overconfident manager overinvests by following the investment policy in $p^*_{od} = \frac{I-M}{\alpha H-M}$. Outstanding bondholders prefer the investment in the growth opportunity only if $pM+(1-p)L > M$ (since $Q > M$). However, this preference holds only for $p > 1$. Hence, the bondholders prefer the overconfident manager not invest in the growth opportunity. Because, the rational manager invests in fewer states relative to the overconfident manager, the outstanding bondholders react positively when an overconfident manager leaves the firm.

Stockholders' reaction:

Shareholders prefer the investment in the growth opportunity is $p(H - M - F) > X - M$, where the value of F under the overconfident manager's investment policy is as in (A12) and is less than $H - M$ (since $X > Q$). Hence, shareholders prefer the investment if

$$p^*_{od}(H - M - F) > X - M \tag{A13}$$

where $p^*_{od} = \frac{I-M}{\alpha H-M}$.Substituting for p^*_{od} in (A13) yields the condition

$$(I - M)\left(\frac{H - M}{\alpha H - M}\right) > I - M \tag{A14}$$

However, given that $\alpha > 1$, the condition in (A14) does not hold. Hence, the shareholders also prefer the overconfident manager not invest in the growth opportunity.

Consider the case where $I < X$.

The shareholders prefer the investment only if

$$p(H + (X - I) - M) + (1 - p)Max(L + X - I - M, 0) > X - M \tag{A15}$$

For $X < I + M - L$, the condition in (A15) is $p(H + (X - I) - M) > X - M$, requiring $p > \frac{X-M}{H+X-I-M}$. Since $p^*_{od} = \frac{X-M}{\alpha H+X-I-M} < \frac{X-M}{H+X-I-M}$, the stockholders do not prefer the overconfident CEO to invest in the growth opportunity.

Proof of Proposition 3:

The manager will invest in the project if the following condition is satisfied:

$$p(\alpha H + (X - I) - M) + (1 - p)(\alpha L + (X - I) - M) \geqslant Max(X - M, 0) \tag{A16}$$

It is easy to see that, if $I < X < M$, the shareholders receive nothing if the project is rejected, but they receive a positive cash flow with a positive probability for all $p > 0$. Hence, the manager will adopt an extreme form of risk-taking, which results in overinvestment.

Suppose $X > M$ and denote $X^* = M + I - \alpha L$; then, for $X < X^*$, the cash flow in the lower state is not sufficient to pay M and the firm defaults, leaving nothing for shareholders. Hence, (A16) results in

$$p(\alpha H + (X - I) - M) \geqslant X - M \tag{A17}$$

Solving (A17) yields the investment policy

$$p^*_{od} = \frac{X - M}{\alpha H + (X - I) - M} \tag{A18}$$

If $X > M + I - L$, then debt is risk-free. The manager will invest in the project if the following condition is satisfied:

$$p(\alpha H + (X - I) - M) + (1 - p)(\alpha L + (X - I) - M) \geqslant X - M \tag{A19}$$

Solving (A19) yields the investment policy,

$$p^*_{od} = \frac{I - \alpha L}{\alpha(H - L)}$$

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