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The Credit Rating-Capital Structure Hypothesis – Does CEO Overconfidence Matter?

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ABSTRACT

In this paper, we look in to the impact of credit rating changes on the financing decisions of overconfident CEOs. Based on a sample of 817 US non-financial companies rated by Standard & Poor's (S&P) in the period 2006-2018, we find that overconfident CEOs adjust their company's financial structure to maintain a minimum credit rating. Specifically, they reduce net debt relative to net equity in response to a downgrade, but do not increase leverage in response to an upgrade. Furthermore, if their credit rating was upgraded the previous year, overconfident CEOs will rely more on internal cash flow to finance investment. CEOs who are not overconfident do not display this behavior. Our findings are robust to model specifications and to the self-selection bias.

JEL classification: G24, G30, G32, G40, G41

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1. Introduction

Over the past decades, opinions of credit rating agencies (CRAs) regarding the creditworthiness of debt issuers have played a prominent role in the financial system. Due to the information asymmetry in the lender-borrower relationship[1], credit ratings serve as the 'focal point' in assisting investors in investment decisions (White, 2010). The reliance on the credit ratings by investors in making pricing and investment decisions has greatly enhanced the implications of credit ratings for corporate capital structure policies (Graham and Harvey, 2001).

Kisgen (2006, 2009) is the first person to propose the credit rating-capital structure (CR-CS) hypothesis about the impact of credit ratings on capital structure decisions. Under the CR-CS hypothesis, firms tend to have a target credit rating, which guides them to an asymmetric capital structure adjustment after ratings are upgraded or downgraded. Specifically, firms decrease net debt issuance relative to net equity issuance following credit rating downgrades in order to regain the old higher credit rating, but do not increase net debt issuance versus net equity issuance following credit rating upgrades to avoid subsequent rating reversals. This financing behaviour under the CR-CS hypothesis has been noted in the follow-up work by Huang and Shen (2015) and Wojewodzki et al. (2018). However, none of these

[1] The lenders or investors might have little knowledge or limited reliable information about the quality of the borrowers because the companies have stronger incentives to release positive information to the market than negative information (Ederington and Goh, 1998).

studies consider the heterogeneity in personal traits of key executives who make capital structure decisions, thereby implicitly assuming they are homogeneous.

It is found in the behavioural finance literature that corporate managers tend to be excessively optimistic and overconfident (Sharot, 2011, Fast et al., 2012). Over-optimism and overconfidence have significant implications for the decisions of corporate managers, particularly financing decisions (Hackbarth, 2008, Malmendier et al., 2011, Shefrin, 2018). Overconfident managers exhibit a standard pecking order preference in their financing decisions. Specifically, they prefer internal capital to debt and only issue equity as the last resort to fund investment opportunities (Hackbarth, 2008). In comparison with non-overconfident managers, overconfident managers choose higher debt level and issue less equity as they believe that their firms' equities are undervalued in the broader market (Malmendier et al., 2011). In other words, overconfident CEOs perceive a smaller cost to issuing debt than equity. Because overconfident managers prefer internal cash flows (or riskless debt) to external financing, the investment of overconfident managers is strongly associated with the availability of internal cash flows (Malmendier and Tate, 2005a, Aktas et al., 2019).

Although there has been strongly documented empirical evidence for the impact of CEO overconfidence on firms' financing decisions, the literature remains silent on the effects credit ratings may have on the financing decisions of overconfident CEOs. This void in the literature leaves open the question as to whether overconfident CEOs exhibit the behaviour consistent with the CR-CS hypothesis. In this paper, we provide an answer to this question. Using a rich dataset containing 1,567 CEOs[2] from 817 US non-financial firms rated by S&P between 2006 and 2018, we examine the influence of CEO overconfidence on the CR-CS

[2] We use chief financial officer (CFO) data to fill the gaps for missing CEO data across the sample period. For brevity, we use 'CEOs' hereafter to represent all executive officers since CFOs only constitute 0.6% of the total of executive officers in the sample.

hypothesis and test whether rating changes induce significant changes in the investment-cashflow sensitivity in firms with overconfident CEOs compared with non-overconfident CEOs.

Our empirical results show that overconfident CEOs target a minimum credit rating level. Specifically, they issue significantly less net debt relative to net equity after downgrades, but do not issue significantly more less net debt relative to net equity after upgrades. Unlike overconfident CEOs, non-overconfident CEOs issue more net debt following rating upgrades and issue less net debt following rating downgrades. Net debt issuance relative to net equity issuance in firms with non-overconfident CEOs significantly increases by 1.24% as a result of one notch rating upgrade and decreases by 1.01% as a result of one notch rating downgrade in the previous year. This result implies that non-overconfident CEOs respond to rating changes as changes in the financial distress cost or benefits. The results are strongly robust to different sets of year and industry level fixed effects, and to a propensity score matching technique.

Our empirical models also reveal evidence for the asymmetric effects of rating changes (i.e. upgrades versus downgrades) on the investment-cash flow sensitivity of overconfident CEOs. Our estimates suggest that each credit rating upgrade by one notch is followed by 11.8 basis point increase in the response of capital expenditure to 100 basis point increase of cash flows in firms with overconfident CEOs in the following year. On the other hand, credit rating downgrades are not followed by any significant changes. The results remain consistent and robust to various model specifications. We attribute this result to the behavior of targeting rating level among overconfident CEOs since they rely more on internal capital for investment even though the access to debt financing has been relaxed by upgrades.

Our paper makes original contributions to the literature in two respects. Firstly, we fill the void in the behavioural finance literature and the credit rating literature. We provide original insights that credit ratings do not affect the capital structure decisions of overconfident CEOs

in the same way as they do for non-overconfident CEOs. Therefore, we argue that it is implausible to treat corporate managers as homogeneous when examining the CR-CS hypothesis. Namely, overconfident CEOs tend to target a minimum rating suggested by the CR-CS hypothesis, but non-overconfident CEOs simply associate rating changes as changes in financial distress costs (benefits). Secondly, we provide the first empirical evidence that rating upgrades can enhance the extent to which overconfident CEOs rely on internal resources for investments. Findings of our paper are particularly useful for corporate stakeholders to better understand how credit ratings affect capital structure decisions of overconfident CEOs.

The rest of the paper is organised as follows. Section 2 reviews the literature. Section 3 explains the hypotheses. Section 4 discusses the sample selection and the research methodologies. Section 5 summarises the data sample. Section 6 discusses our empirical results. Finally, Section 7 concludes.

2. Literature Review

2.1. CEO Overconfidence and Capital Structure

In recent years, behavioural corporate finance studies have challenged conventional ideas in the neoclassical corporate finance. While the traditional corporate finance researchers consider financial executives as rational decision makers, behavioural corporate finance researchers argue that managerial executives have different psychological characteristics and they might behave less than fully rational (Tversky and Kahneman, 1974). The effects of overconfidence on managerial decisions was first documented in Roll (1986). However, not until over a decade ago did the literature on managerial bias begin to grow. A majority of studies focus on the trait of overconfidence and optimism among corporate managers and how it impacts their decisions, including corporate investment, cash holding, financing and dividend policies (e.g Malmendier and Tate, 2005a, Malmendier et al., 2011, Deshmukh et al., 2013, Huang et al., 2016, Aktas et al., 2019, Chen et al., 2020).

The trait of overconfidence, which stems from the notion of a 'better-than-average' effect, is commonly found among corporate executives (i.e. CEO) (Larwood and Whittaker, 1977). Insufficient direct one-to-one comparison is one of the reasons why high-rank executives are prone to overconfidence bias.[3] This well-documented managerial bias is known to influence managers' capital structure decisions, i.e. choice between debt and equity. Hackbarth (2008) presents a theoretical model in which overconfident managers have a standard pecking order preference. Overconfident managers believe that their firms' risky securities are undervalued in the market, therefore they are less inclined to seek external financing. Additionally, excessive optimism and overconfidence cause the managers to believe that external finance is unduly costly, particularly equity. This is because equity prices are generally more sensitive to biases in beliefs than debt. Under the influence of the pecking order preference, Hackbarth (2008) argues that overconfident managers choose higher leverage than non-overconfident managers. This is because overconfident managers believe their firms are less risky and/or more profitable than they actually are, thereby are less prone to financial distress.

Based on a survey of 1,017 CEOs and 1,276 CFOs across different regions, Graham et al. (2013) show that firms with overconfident managerial executives (i.e. CEO and CFO) are likely to hold more debt. They also find significant differences in the personality traits between US and non-US managerial executives, where the former group is more optimistic than the latter. Using an international dataset, Antonczyk and Salzmann (2014) find that firms in highly individualist countries (e.g. the US and the UK) have higher debt ratios because the managers in these countries are prone to optimism and overconfidence bias. Moreover, the

[3] CEOs may conclude that they are better than average if they compare themselves to the average manager instead of other CEOs. Even so, it is hard to have direct comparison across firms since the decisions made by the CEOs are naturally complex, e.g. large-scale investments (Malmendier and Tate, 2005b).

overestimation of future returns from investment projects cause overconfident CEOs to believe that the future will be better than the recent past. Consistent with this view, Landier and Thesmar (2009) and Huang et al. (2016) find that overconfident CEOs use more short-term debt than rational CEOs because they believe they can refinance short-term debt at lower costs in the future.

In the absence of market imperfections, classic corporate finance models imply that a rational CEO is indifferent between all available sources of capital for an investment (Modigliani and Miller, 1958). However, in the behavioural finance setting, financing decisions and investment decisions are interdependent rather than separable (Shefrin, 2018). Because overconfident managers prefer internal capital to external equity financing, the investment policy of overconfident managers is greatly influenced by the availability of internal capital. In particular, Malmendier and Tate (2005a) show that overconfident CEOs present a higher sensitivity of investment to internal cash-flow than do non-overconfident CEOs.

In summary, the number of studies on the effects of CEO overconfidence bias on corporate financial policies is growing in the recent years and empirical results in many studies are consistent. Nevertheless, the literature provides little insight into the likely impact of credit ratings on managers who are subject to overconfidence bias.

2.2. Credit Ratings and Capital Structure

During the last two decades, the relationship between credit ratings and corporate decisions becomes one of the prominent research topics in corporate finance. A strand in the rating literature examines the determinants of corporate credit ratings. For example, researchers find that exercising a strong corporate governance and a corporate social responsibility policy can improve credit ratings (Bhojraj and Sengupta, 2003, Ashbaugh-Skaife et al., 2006, Attig et al., 2013, Jiraporn et al., 2014, Oikonomou et al., 2014). Another strand of rating literature

looks closer into the effects of ratings on corporate managers' decisions. Findings from many papers reveal that rating is an important consideration for major corporate decisions such as leverage policy, dividend smoothing, capital expenditure, and cash holdings (e.g Kisgen, 2006, Kisgen, 2009, Khieu and Pyles, 2012, Agha and Faff, 2014, Khieu and Pyles, 2016, Huang and Shen, 2015, Wojewodzki et al., 2018, Asimakopoulos et al., 2020).

Our paper is relevant to the second strand of the literature. Specifically, we examine the direct influence of credit rating changes on corporate capital structure policy. The most noteworthy finding in relation to this issue is the CR-CS hypothesis proposed by Kisgen (2006). Kisgen (2009) then tests it with US data and finds that firms target a minimum credit rating in their leverage decisions. Following Kisgen (2006) and Kisgen (2009), there have been several empirical studies testing the CR-CS hypothesis, but the findings are rather mixed. For instance, Kemper and Rao (2013) subject the CR-CS hypothesis to various firm characteristics including credit rating level. Their results only support the hypothesis in firms at B rating category, hence casting doubts on the validity of the CR-CS hypothesis. Samaniego-Medina and di Pietro (2019) apply the CR-CS hypothesis to the speed of leverage adjustment in European firms during the period 2004-2014. With a partial adjustment model proposed by Flannery and Rangan (2006) and estimated with system-GMM method, they find supporting evidence that rating is a first order consideration for corporate leverage decisions. Specifically, they show that firms near a downgrade or upgrade tend to slow the speed of adjustment to target leverage. The speed of adjustment decreases to zero for firms close to the investment-speculative threshold. Using a cross-country sample, Huang and Shen (2015) further document supporting evidence for the hypothesis, confirming the asymmetric adjustment of capital structure to rating downgrades and upgrades first documented for US firms by Kisgen (2009). Moreover, Huang and Shen (2015) find that firms in countries characterised by a strong governance and a well-established financial system adjust their capital structure in response to rating changes faster

than firms in countries with weaker governance and less developed financial system. Wojewodzki et al. (2018) add that firms with investment grade ratings adjust their capital structure more rapidly than firms with speculative grade ratings.

To sum up, the behavioural finance literature subjects CEO's overconfidence to empirical scrutiny with a focus on important decisions such as capital structure and capital budgeting. However, none of the existing studies look at the impact credit ratings may have on the decisions of CEOs prone to overconfidence bias despite the growing evidence of the implications of ratings for corporate policies. In this paper, we address this unexplored issue. We focus on the capital structure policy and make a novel contribution to the field.

3. Hypotheses Development

Kisgen (2009) shows that corporates tend to react to rating changes in a manner that maintains a minimum rating level. Accordingly, downgraded firms reduce leverage and revert to target leverage faster to achieve upgrades but upgraded firms do not adjust leverage in order to avoid subsequent rating reversal. Nevertheless, Agha and Faff (2014) find that, conditional on financial flexibility, firms might just react to rating changes as signals of changes in financial distress cost or benefits. Therefore, they increase leverage after rating is upgraded to capitalise on the benefits of rating upgrades. We believe that such conflicting results in prior studies might be driven by different psychological characteristics of corporate executives who decide on the capital structure adjustments. Overconfident CEOs exhibit great reluctance in issuing equity and a higher propensity to prefer debt than do non-overconfident CEOs. Therefore, they are more likely to target a minimum credit rating since rating plays a pivotal role in securing an uninterrupted access to debt financing. Non-overconfident CEOs, on the other hand, are more likely to treat ratings as a proxy for financial distress cost or benefits, so they are more willing than overconfident CEOs to issue equity where necessary. It follows that the desire to

achieve upgrades by reducing leverage following credit rating downgrades, or to avoid subsequent reversals of upgrades by not increasing leverage should be more prevalent among overconfident CEOs. In line with this reasoning, we propose the first hypothesis as follows:

H1: *Firms with overconfident CEOs decrease (or maintain) debt levels following a recent credit rating downgrade (upgrade).*

If overconfident CEOs target minimum rating levels, we expect that they will be more likely to finance investments with internal capital following rating upgrades despite the cost benefit of raising debt brought by the rating upgrades. Hence, we postulate that overconfident CEOs rely on internal cash flows for investments to a greater extent after their ratings are upgraded. Their behaviour of heavy reliance on internal cash flows intensifies firms' investment-cash flow sensitivity. A credit rating downgrade increases the cost of debt capital and limits the access to debt market. Therefore, given the reluctance of overconfident CEOs to issue equity and the significant influence of internal capital on the investment policy of overconfident managers, we hypothesise that a credit rating downgrade cause overconfident CEOs to consider to either curtail the investments, or fund them as much with retained earnings as possible. In the first scenario, overconfident CEOs curtail the investment after rating is downgraded because there is insufficient internal cash flow. In this case, the investment-cash flow sensitivity in firms with overconfident CEOs does not change in response to rating downgrades. In the second scenario, overconfident CEOs fund the investments as much with retained earnings as possible if they have ample internal cash flows, which increases the investment-cash flow sensitivity. If capital expenditure is unaffected by downgrades, we conjecture that overconfident CEOs finance them with internal cash flows. In the case of downgrades, the first scenario is more likely than the latter because downgrades often occur during episodes of deteriorating cashflows. This reasoning leads us to the expectation that the

investment-cash flow sensitivity of firms with over-confident CEOs does not change significantly following downgrades. This prediction leads to our second and third hypotheses specified as follows.

H2*: For firms with overconfident CEOs, a credit rating upgrade is followed by an increase in their investment-cash flow sensitivity.*

H3*: For firms with overconfident CEOs, a credit rating downgrade is followed by an insignificant change in their investment-cash flow sensitivity.*

Hypothesis 2 (Hypothesis 3) implies that firms with overconfident CEOs might expect a higher (an insignificant change in) investment-cash flow sensitivity following credit rating upgrade (downgrade). Hypothesis 2 and Hypothesis 3 are tested against a null that there is no change (significant increase or decrease) in the investment-cash flow sensitivity of firms with overconfident CEOs after rating upgrades (downgrades) occur.

4. Sample Selection and Methodology

4.1. Data Sample

Our sample consists of all non-financial publicly listed US firms rated by S&P in the period between 2006 and 2018. The beginning of the sample period is restricted by data availability. ExecuComp only started to provide data on executive package-level option holdings which are required to construct an overconfidence measure following changes in the reporting requirements by FAS 123R in 2006. Following the literature, we measure CEO overconfidence based on executive option exercise behaviour (Malmendier and Tate, 2005a, Campbell et al., 2011, Hirshleifer et al., 2012).

Rating information is collected from S&P Ratings Direct database whereas accounting and financial data are obtained from Compustat for the same period on an annual basis. We

exclude the companies in the financial services industry (SIC codes between 6000 and 6999) and utilities (SIC codes between 4900 and 4999). Following Khieu and Pyles (2016), we exclude firms in the bottom end of the rating spectrum, i.e. rating categories at and below CC, since these firms are either near or already in default. Financing and investment activities of those firms may be restricted by clauses in covenants or other contractual agreements, hence unlikely to be driven by credit rating changes.

Our final sample consists of 6,128 firm-year observations for which ratings, accounting data and CEO's stock option data are available. In total, there are 817 firms and 1,567 CEOs in the sample, of which 473 CEOs are overconfident according to our stock option-based identification of overconfident managers.

4.2. Methodology

4.2.1. Overconfidence Measure

Following Malmendier and Tate (2005a), we identify overconfident CEOs by their option exercise behaviour. The rationale behind this method is that overconfident CEOs overestimate the expected payoffs of investment projects, since they believe that the future stock price will continue to rise under their leadership. This belief induces them to postpone exercising rights. As a result, overconfident CEOs are less likely to exercise their in-the-money vested stock options than non-overconfident counterparts in order to benefit from the expected future gains (Malmendier and Tate, 2005a). Accordingly, we classify a CEO as overconfident after he/she fails to exercise options that are beyond a threshold of 67% in the money at least twice during their tenure period. The threshold of 67% is chosen based on a model of Hall and Murphy (2002) on executive stock holdings and exercising decisions. Because overconfidence is a persistent trait, a CEO once identified as overconfident remains so for the rest of the sample

period. Finally, we construct a dummy variable based on this option-based identification of overconfident CEOs as follows.

OVERCONF: a dummy variable that takes the value of one if a CEO fails to exercise vested options at least twice during his or her tenure and the option is at least 67% in the money, zero otherwise.

Following Campbell et al. (2011) and Hirshleifer et al. (2012), we measure in the money options with average moneyness of the CEO's option portfolio for each year using data from the Execucomp database. This measure of overconfidence generates similar results as in Malmendier and Tate (2005a). Specifically, the average option moneyness is calculated as follows:

$$OptM_{it} = \overline{RV}_{it}/\overline{K}_{it} \quad (1)$$

where $OptM$ is the average moneyness measured in percentages; $\overline{RV}$ is the average realisable value per option, which is equal to the total realisable value of options divided by the number of options held by the CEOs for each CEO-year.[4] $\overline{K}$ is the estimated average exercise price, which is derived by subtracting the average realisable value per option from the fiscal year-end closing stock price. We include only the vested options held by the CEOs as our main interest is to identify CEOs who chose to hold options that could have been exercised.

4.2.2. Empirical Models

We estimate the following baseline pooled linear regression model to test our Hypothesis 1:

[4] Total realisable value of the options is the difference between the exercise price of the options and the closing stock price of the company at fiscal year-end.

$$Y_{it} = \alpha + \beta_1 OVERCONF_{it} + \beta_2 UP_{i,t-1} + \beta_3 DOWN_{i,t-1} + \beta_4 UP_{i,t-1} * OVERCONF_{it} +$$

$$\beta_5 DOWN_{i,t-1} * OVERCONF_{it} + \gamma \boldsymbol{K}_{i,t-1} + \varepsilon_{it} \quad (2)$$

where Y_{it} indicates the capital market activities carried out by firm *i* in year *t*. We apply three measures of capital market activities as follows: net debt issuance (*NetD*) for the debt market activities, net equity issuance (*NetE*) for the equity market activities, and the issuance of net debt versus net equity (*NetDIss*) for the combination of activities in both markets. Following Kisgen (2006) and Kisgen (2009), we measure net debt issuance (*NetD*) by long-term debt issuance minus long-term debt reduction plus changes in current debt. Net equity issuance (*NetE*) is defined as the sale of common and preferred stock minus purchase of common and preferred stock. The issuance of net debt versus net equity (*NetDIss*) is equal to net debt issuance minus net equity issuance. All dependent variables are scaled by total assets at the beginning of the year.

$OVERCONF$ is the dummy variable for overconfident CEOs, zero otherwise. $UP_{i,t-1}$ and $DOWN_{i,t-1}$ are ordinal variables representing the number of notches by which ratings in the previous year have changed. Ratings in our paper are long-term domestic currency issuer credit ratings assigned by S&P, which are converted into numerical values based on a 19-notch scale. The numerical values are assigned as follows: AAA=19, AA+=18, AA=17, AA–=16, A+=15, A=14, A– =13, BBB+=12, BBB=11, BBB– =10, BB+=9, BB=8, BB– =7, B+=6, B=5, B– =4, CCC+=3, CCC=2 and CCC– =1.

UP: represents credit rating upgrade in the previous year. The variable takes value of 1, 2 and 3 if one-notch, two-notch and 3 and above-3 notch upgrade is recorded, and 0 otherwise.

DOWN: represents credit rating downgrade in the previous year. The variable takes value of 1, 2 and 3 if one-notch, two-notch and 3 and above-3 notch downgrade is recorded, and 0 otherwise.

$\boldsymbol{K}_{i,t-1}$ includes a parsimonious set of firm-specific characteristics that determine firms' capital market activities, including leverage, cash holdings and sales. *Leverage* is the ratio of total liabilities to total assets. *Sales* is the natural logarithm of sales. *Cash* is the ratio of cash and cash-equivalents to total assets. These variables have been found to be significant determinants of firms' financing decision by previous studies (e.g Kisgen, 2006, Agha and Faff, 2014). We also include a full set of year dummies and industry dummies[5] to control for the macro-economic conditions and the time-invariant industry heterogeneity. Additionally, Eq. (2) is also controlled for industry dummies by year to allow for the time-varying industry effects. The industry dummies by year capture all the time-variant shocks at industry level that affect both the corporate rating changes and the corporates' capital market activities, hence alleviate the potential omitted variable bias in our model. Finally, ε_{it} is the i.i.d idiosyncratic error-term

Our empirical baseline model might encounter sample selection bias if hiring overconfident CEOs might not in itself be a random decision. For example, Banerjee et al. (2020) document that firms are more likely to pick overconfident candidates for the role of CEO if they hire internally. Therefore, we employ a propensity score matching approach (PSM) to address the self-selection bias problem. The treatment group includes firms with overconfident CEOs, which are matched with a comparable control group comprising firms with non-overconfident CEOs. Using a probit regression, we first obtain the estimate of a propensity score (ρ_i) that statistically balances the firm-specific covariates between treated

[5] We define industries based on the Fama-French 12-industry classification.

group (firms with overconfident CEOs) and control group (firms with non-overconfident CEOs). The covariate set is made up of a full set of accounting variables, including leverage (*Leverage*), operating margin (*OM*), sales (*Sales*), Z-score (*Z*), market-to-book ratio (*MB*), cash holdings (*Cash*) and firm size (*Size*). For robustness check, we re-estimate Eq. (2) using the matched sample under PSM procedure.

Following Hovakimian and Hovakimian (2009), Hypothesis 2 and Hypothesis 3 will be examined by the following pooled linear regression model specified as follows:

$$CAPEX_{it} = \alpha + \beta_{15} MB_{it} + \beta_{16} CF_{it} + \beta_{17} UP_{i,t-1} + \beta_{18} DOWN_{i,t-1} + \beta_{19} UP_{i,t-1} * CF_{it} + \beta_{20} DOWN_{i,t-1} * CF_{it} + \varepsilon_{it} \quad (3)$$

where *CAPEX* represents capital expenditure to total assets, which is a proxy for investment. *MB* represents the market-to-book ratio and CF represents cash flows to total assets. $UP_{i,t-1}$ and $DOWN_{i,t-1}$ are ordinal variables defined similarly as in Eq. (2). ε is the i.i.d idiosyncratic error-term. We also include a full set of year dummies and industry dummies, industry dummies by year in the regression model to correct for the macro-economic conditions, the time-invariant industry heterogeneity, and the time-variant industry dynamics.

The regression model of Eq. (3) will be carried out separately for overconfident CEO and non-overconfident CEO subsamples, similar to Hovakimian and Hovakimian (2009). For robustness check, we re-estimate Eq. (3) with lagged cash flows (*lag_CF*) to account for the possibility that firms may finance their investments with cash flows of the previous fiscal year.

5. Descriptive Analysis

In this section, we describe the data for which full descriptive summary is provided by Table 1. Panel A (Panel B) of Table 1 presents the descriptive statistics of all the variables for the entire sample (sub-samples) over the period 2006-2017. We winsorise all continuous

accounting variables at the 1st and 99th percentiles to eliminate the effects of outliers. Panel A of Table 1 shows that the average net debt issuance is 2.4% of total assets, while the average net equity issuance is -2.6% of total assets. Sampled firms tend to issue more debt than repurchase debt and repurchase outstanding shares more than issue new shares. The average *NetDIss* is 5% of total assets, implying that, on average, firms issue more net debt than net equity. Firms are also heterogenous in terms of growth opportunities as the lowest MB ratio is 0.6 and its average value is as high as 1.7.

The average *Rating* in the sample is 9.3, which is equivalent to BB+. Our sample consists of non-defaulting firms that lie in all categories of the rating scale. The highest obtainable rating for US firms in our sample is 19 (which is equivalent to AAA), while the lowest is 2 (equivalent to CCC- rating). Figure 1 depicts the sample rating distribution in more detail. Specifically, it displays the sample distributions of S&P's corporate credit ratings separately for non-overconfident CEO and overconfident CEO subsamples. According to Figure 1, S&P's credit ratings for both types of managers follow a normal distribution, spanning the entire rating spectrum. The ratings of overconfident CEO subsample tend to cluster around the investment-speculative rating borderline (which are BB+ and BBB-), but the ratings of non-overconfident CEO subsample are slightly more dispersed.

In Panel B of Table 1, we further split the sample by non-overconfident CEOs and overconfident CEOs. Theoretically, firms with higher *MB* ratio are more likely to issue equity due to a lower cost of equity financing as a result of stock overvaluation. On average, we find that overconfident CEOs issue significantly more net debt relative to net equity than do non-overconfident CEOs at the 1% significance level even though the former has significantly higher *MB* ratio than the latter. Firms with overconfident CEOs hold significantly less *Cash* reserves than firms with non-overconfident CEOs. This result can be explained by the fact that overconfident CEOs tend to exhaust cash on capital expenditure faster than non-overconfident

CEOs due their pecking order preference in financing (Malmendier and Tate, 2005a, Hackbarth, 2008). Besides, firms with overconfident CEOs have higher credit quality and higher profitability than firms with non-overconfident CEOs (which are reflected by higher *Rating*, *OM* and *Z*). In addition, overconfident CEOs manage larger firms with higher sales than do non-overconfident CEOs.

Panel A of Table 2 presents the number of firm-year observations in the sample in which corporate credit rating is downgraded or upgraded in the previous year. There are 612 observations with rating upgrades and 591 observations with rating downgrades in the sample, a majority of which consists of one-notch rating change. In Panel B and Panel C of Table 2, we find that firms with non-overconfident CEOs experience more rating downgrades than firms with overconfident CEOs. In term of rating upgrades, firms with overconfident CEOs experience more rating upgrades than firms with non-overconfident CEOs.

Table 3 displays the capital market activities for firms experiencing rating upgrades and downgrades in the previous year. Panel A summarises the *Mean Net Debt Issues*, while Panel B summarises the *Mean Net Equity Issues* and Panel C summarises the *Mean Net Debt Versus Net Equity Issues* following rating changes in the previous year. In Panel A (Panel B) of Table 3, the *Mean Net Debt Issues* (*Mean Net Equity Issues*) of overconfident CEOs are higher (lower) than those of non-overconfident CEOs after rating changes. The difference between two groups is strongly significant at the 1% significance level. When comparing the magnitude of the change in net debt issuance within each sub-sample, overconfident CEOs in upgraded firms do not issue more net debt versus net equity compared to firms with stable ratings. Their mean *NetDIss* is 0.072 after rating upgrades, which is similar to firms with stable ratings. However, non-overconfident CEOs tend to increase net debt issuance versus net equity issuance after firms are upgraded. The average *NetDIss* in upgraded firms is 4.3% of total assets, which is slightly higher than that of firms with stable ratings. Our evidence in the case

of non-overconfident CEOs does not support the CR-CS hypothesis. Panel C of Table 3 shows that the CR-CS hypothesis holds only for firms with overconfident CEOs. Both overconfident CEOs and non-overconfident CEOs, when experiencing downgrades, tend to reduce net debt issuance. Taking both upgrades and downgrades together, the data reveals that non-overconfident CEOs do not target a minimum credit rating but respond to rating changes as changes in financial distress cost.

6. Empirical Results

6.1. Baseline Model Estimation

In this section, we discuss our empirical results concerning Hypothesis 1 tested with Eq. (2). The full results are presented in Table 4. Specifications (1), (2) and (3) use *NetD* as the dependent variable, specifications (4), (5) and (6) use *NetE* as the dependent variable and specifications (7), (8) and (9) use *NetDIss* as the dependent variable. In general, the results of the pooled-OLS regressions lend support to the Hypothesis 1 that overconfident CEOs target minimum credit ratings, but non-overconfident CEOs do not. Specifically, in Table 4, a credit rating downgrade in firms with overconfident CEOs is followed by a significant decrease in *NetDIss*, and a credit rating upgrade is not followed by a significant increase in *NetDIss*.

The coefficients on *OVERCONF* are significant at 1% level, have the expected sign in all specifications and are economically meaningful (see Table 4). All other things being equal, firms with overconfident CEOs issue 1.56% more *NetD* and 1.35% less *NetE* than firms with non-overconfident CEOs. Consistent with our expectation, the coefficient on *OVERCONF* in Eq. (2) suggests that firms with overconfident CEOs have higher *NetDIss* than firms with non-overconfident CEOs, which is significant at 1% level. Our findings support the behavioural corporate finance literature that overconfident managers follow a pecking order and choose more debt (less equity) than non-overconfident managers when accessing external financing.

The results remain robust after we control the model for year and industry fixed effects, as well as industry fixed effects by year.

In the year following rating downgrades, firms with non-overconfident CEOs issue 1.01% less net debt versus net equity as a percentage of total assets, which is significant at the 5% significance level (see Column 9 of Table 4). Since a credit rating downgrade is followed by an increase in the firms' cost of capital, managers are more likely to reduce debt, and substitute debt with equity to regain their target rating (Kisgen, 2009). Consistent with this expectation, *DOWN* is positive and significant in all the regressions for *NetE*. The result is statistically significant at the 1% significance level (see Column 6 of Table 4). In the case of overconfident CEOs, the coefficient estimates of $OVER_{it} * DOWN_{i,t-1}$ in Table 4 are insignificant in all specifications. Therefore, there is no significant difference between non-overconfident CEOs and overconfident CEOs in their capital structure adjustments following credit rating downgrades.

In Columns 1 to 3 of Table 4, the coefficients on *UP* are positive and significant at the 1% significance level. Spec. (3) shows that non-overconfident CEOs increase net debt issuance by 1.74% for a one notch increase in the credit rating in the previous year. Similarly, one-notch rating upgrade leads to an increase by 1.24% in net debt versus net equity issuance in firms with non-overconfident CEOs (Column 9 of Table 4). This finding contradicts Kisgen (2009) who show that firms do not reduce leverage after upgrades because they have a target rating level. More specifically, the coefficient of 0.0124 on *UP* in Spec. (9) of Eq. (2) implies that an average firm with $12.6 billion worth of assets managed by non-overconfident CEOs will increase $156.2 million[6] worth of net debt versus net equity issuance if their rating is upgraded

[6] The changes in *NetDIss* (1.24%) multiplied by *Mean Size* ($12.6 in billions).

by one notch in the previous year.[7] In Spec. (2) and Spec. (3), the coefficient estimates of $OVER_{it} * UP_{i,t-1}$ are negative and significant at the 5% significance level. The *t*-test results show that the sum of the coefficient estimates on *UP* and $OVER_{it} * UP_{i,t-1}$ are insignificantly different from zero, supporting the prediction that overconfident CEOs do not increase net debt issuance after a credit rating upgrade. The coefficients on *UP* and the coefficient estimates of $OVER_{it} * UP_{i,t-1}$ remain consistent after the inclusion of year and industry dummies and industry-year interaction dummies.

The estimated coefficients of *Leverage* are negative and statistically significant in the regressions of *NetD*, *NetE* and *NetDIss*. The significant and positive coefficients on *Sales* in the regression of *NetDIss* indicate that larger firms can issue more net debt relative to net equity as they have lower probability of default, which is consistent with Kisgen (2006) (see Columns 7 to 9 of Table 4). In addition, the coefficient of *Cash* shows positive sign in the regression for *NetD* and *NetDIss*. This finding suggests that cash rich firms issue more debt, which can be explained by the approach taken to mitigate the agency costs of cash. This is because debt financing reduces the cash flow available for spending at the discretion of self-interested managers due to the pre-commitment of interest payment (Jensen, 1986, Zhang, 2009).

To sum up, our baseline model shows that non-overconfident CEOs increase debt after firms are upgraded because they are less concerned about maintaining target credit ratings like overconfident CEOs do. Instead, non-overconfident CEOs in upgraded firms are willing to increase leverage to capitalise on the lower cost of debt, but overconfident CEOs are not in fear

[7] According to Kisgen (2009), firms do not increase debt after rating upgrades, but Agha and Faff (2014) argue that this finding is primarily driven by financially inflexible firms in the sample because financially flexible firms increase debts after a rating upgrade. Therefore, rating upgrades in the case of non-overconfident CEOs in our model are mainly in financially flexible firms. However, this argument is very unlikely to be warranted because the response of capital structure in financially flexible firms to rating downgrades should be negligible. This is because the cost of debt capital in financially flexible firms is not adversely affected by downgrades (Agha and Faff, 2014). According to our empirical results, the opposite is true. Specifically, non-overconfident CEOs reduce net debt versus net equity issuance after firms are downgraded, therefore it is unlikely to be the case that firms with non-overconfident CEOs in our sample are mainly financially flexible firms.

of rating upgrades being reversed. Our results imply that ratings matter to both non-overconfident CEOs and overconfident CEOs, but not in the same way. Non-overconfident CEOs respond to rating changes as changes in financial distress cost, but overconfident CEOs respond to rating changes to maintain a minimum rating level. Overall, overconfident CEOs, not non-overconfident CEOs, exhibit financing behaviour consistent with the CR-CS Hypothesis.

6.2. Propensity Score Matching

In order to mitigate the potential sample selection bias, it is essential to construct a matched sample where firms with overconfident CEOs and firms with non-overconfident CEOs share similar characteristics. Therefore, we perform the propensity score matching (PSM) on our sample across a set of firm-level covariates. The covariates are deemed to be balanced if there is no statistically significant difference in their means amongst treatment and control groups after matching (Rubin and Thomas, 1996). In this study, the treatment group comprises firms with overconfident CEOs and control group comprises firms with non-overconfident CEOs. Our matched sample satisfies the balancing assumption with the % bias of below five percent for each individual covariate.[8]

Table 5 presents the estimation result of Eq. (2) using the matched sample. The results after PSM procedure reaffirm those of the unmatched sample in Section 6.1. Specifically, Table 5 reveals that firms with overconfident CEOs decrease (do not increase) debt if ratings decrease (increase) in the previous year. Such behaviour of targeting minimum credit ratings is not prevalent among non-overconfident CEOs.

In the *NetD* regressions, the model shows that non-overconfident CEOs increase net debt issuance by 2.77% of total assets for every notch increase in rating in the previous year,

[8] The detailed balancing test results are available upon request.

which is significant at the 1% significance level (see Column 3 of Table 5). The coefficients on *UP* remain consistent and strong after controlling for year and industry fixed effects. Accordingly, at the 10% significance level, non-overconfident CEOs issue 2.16% more net debt versus net equity as a percentage of total assets and their behaviour following rating upgrades is robust to year-industry interaction dummies (see Column 9 of Table 5). The negative and significant coefficient estimates of $OVERCONF_{it} * UP_{i,t-1}$, along with the results of *t*-test, are consistent with our baseline regression model suggesting that upgraded firms with overconfident CEOs do not increase leverage (see Columns 1 to 3 and Columns 7 to 9 of Table 5). Therefore, Table 5 supports our Hypothesis 1 that maintaining a target credit rating is more prevalent among overconfident CEOs than non-overconfident CEOs.

In the year following rating downgrades, both non-overconfident and overconfident CEOs are more likely to reduce net debt issuance relative to net equity issuance. Specifically, negative and significant coefficients on *DOWN* in the regression of *NetDIss* indicate that every notch decrease in rating in the previous year cause non-overconfident CEOs to issue less net debt versus net equity, but its significance becomes weaker after we control the model for industry-year interaction dummies (see Columns 7 to 9 of Table 5). Meanwhile, the coefficients on *DOWN* in *NetE* specifications are positive and statistically significant, confirming that non-overconfident CEOs are more likely to issue equity following rating downgrade (see Columns 4 to 6 of Table 5). Insignificant coefficients on $OVERCONF_{it} * DOWN_{i,t-1}$ in all specifications in Table 5 imply that overconfident CEOs make the same capital structure adjustments as non-overconfident CEOs following rating downgrades.

In summary, Table 5 confirms our baseline results obtained from the regression on the unmatched sample in Section 6.1, supporting Hypothesis 1.

6.3. Other endogeneity concerns

Apart from the selection bias problem which has been addressed by propensity score matching in Section 6.2, we also aim to resolve the potential problems associated with endogeneity which might bias our results. Our primary concern is unobserved variable bias. For example, the industry level heterogeneity, industry level shocks and country level shocks might simultaneously affect a company's capital market activities, rating changes and the propensity for a company to appoint an overconfident CEO. For this reason, our baseline model controls for such unobserved factors with industry fixed effects, year fixed effects, and industry fixed effects by year. We also run the model with firm fixed effects which capture the company characteristics which are possibly correlated with both dependent variable(s) and independent variables in our model. The results (unreported) are largely consistent with the reported baseline results. Although the likelihood of reverse causality is low, we perform a diagnostic test on the strictly exogenous property of all the independent variables in the model with the difference-in-Hansen test produced after a system-GMM estimation. The test statistics (unreported) for our model fail to reject the null hypothesis that *OVERCONF, UP, DOWN,* and ***K*** are exogenous.[9]

6.4. Investment-Cash Flow Sensitivity Test

In this section, we turn our attention to the implications of credit rating changes for the use of internal capital to finance long term investments by overconfident CEOs. In particular we examine the changes in the sensitivity of investment to cash flows when ratings in the previous year increase or decrease. The full empirical results are presented in Tables 6 and Table 7. Specifically, Table 6 provides the estimation result of Eq. (3) for overconfident CEOs and Table 7 provides the estimation results of Eq. (3) for non-overconfident CEOs.

[9] Full test results are available upon request.

In general, the results of Eq. (3) support both Hypothesis 2 and Hypothesis 3 that credit rating upgrades have a significant influence on the investment-cash flow sensitivity of firms with overconfident CEOs. Specifically, a credit rating upgrade in firms with overconfident CEOs is followed by a significant increase in firms' investment-cash flow sensitivity. Downgrades in firms of overconfident CEOs, on the other hand, do not induce the similar effects on investment-cashflow sensitivity as do upgrades, which suggests that credit rating downgrade does not alter the investment-cashflow sensitivity. In contrast, neither upgrades nor downgrades affect the investment-cash flow sensitivity of firms with non-overconfident CEOs.

In Columns 1 to 3 of Table 6, the positive coefficient on cash flow (*CF*) in all specifications show that capital budgeting decisions of overconfident CEOs are heavily influenced by the availability of internal resources. The coefficient estimates of *CF* are highly significant at 1 % significance level in all model specifications. The coefficient of *CF* in Spec. (3) is 0.228, implying that an increase by 100 basis points in cashflows of firms with stable ratings is associated with capital expenditure increasing by 22.8 basis points. Consistent with our prediction underlying Hypothesis 2 and Hypothesis 3, the coefficients on $DOWN_{i,t-1} * CF_{it}$ are insignificant, whereas the coefficients on $UP_{i,t-1} * CF_{it}$ are positive and significant. The model shows that the sensitivity of investment to cashflows in firms with overconfident CEOs will increase by 11.8 basis points if there has been a notch increase in rating in the previous year (see Column 3 of Table 6). In contrast, the insignificant coefficients on $DOWN_{i,t-1} * CF_{it}$ in all model specifications suggest that the extent to which capital expenditure decision of overconfident CEOs relies on their firms' internal cash flows does not change due to downgrades. Our explanation for this finding is that overconfident CEOs might issue equity to finance perceived high-value investment (as documented in previous baseline models) or curtail the new investment projects which must be financed externally. Consistent with our expectation, the model shows that one notch downgrade results in reduction in capital

expenditure to total asset by 1.84 percentage points, which is significant at the 5% level (see Column 3 of Table 6). Therefore, credit rating downgrades put the pressure on overconfident CEOs to reduce capital expenditure, forcing them to be more selective in choosing investment project, while keeping their investment-cashflow sensitivity unaffected.

To check the robustness of the results, we replace *CF* with *lag_CF* in Eq. (3). The results are consistent with those of the baseline models. In Columns 4 to 6 of Table 6, the coefficients on the $UP_{i,t-1} * lag\_CF_{it}$ are significant and positive at the 1% significance level in all specifications, confirming that a credit rating upgrade intensifies the investment-cash flow sensitivity in firms with overconfident CEOs. Similar to previous regression results, the coefficients on $DOWN_{i,t-1} * lag\_CF_{it}$ are insignificant, with the only exception of the weakly significant coefficient in the specification with industry-year interactions. Overall, the results are consistent with Hypothesis 2 and Hypothesis 3.

In the case of non-overconfident CEOs, credit rating changes do not trigger any significant increase or decrease in their investment-cash flow sensitivity as the estimated coefficients of the interactions between *UP* (*DOWN)* and *CF* in Columns 1 to 3 of Table 7 are insignificant. The results do not change after we re-estimate Eq. (3) with *lag_CF*, except for the interaction term $DOWN_{i,t-1} * lag\_CF_{it}$, which becomes significant and negative at the 1% significance level. With the inclusion of fixed effects, the reduction in investment-cash flow sensitivity become smaller but remains strong (see Columns 4 to 6 of Table 7). One possible explanation is that non-overconfident CEOs are more likely to halt the usage of previous period's cash flows and hoard more cash for precautionary purposes following a credit rating downgrade (Khieu and Pyles, 2012), thereby reducing firms' investment-cash flow sensitivity.

7. Conclusion

In this paper, we investigate whether overconfident CEOs target minimum credit ratings in their capital structure decisions suggested by the CR-CS hypothesis in Kisgen (2009). Given the particularly strong preference for debt to equity, we hypothesise that credit rating plays a more significant role in the capital structure decisions of overconfident CEOs than non-overconfident CEOs. This prediction leads us to examine the second research question, 'Does rating upgrade or downgrade change the sensitivity of investment to cash flows in firms with overconfident CEOs?'

With a pooled-OLS model implemented on the full sample and a sample matched by propensity score matching technique, we find that overconfident CEOs have target credit ratings in their capital structure policy, hence comply with the CR-CS hypothesis. Due to their preference for maintaining a minimum credit rating, rating changes can alter the extent to which overconfident CEOs use internal capital for new projects. Our results reveal that the sensitivity of investment to cash flow can rise by as much as 11.8 basis points for overconfident CEOs if rating has been upgraded in the previous year. However, we do not find any significant increased investment-cashflow sensitivity effects in the case of rating downgrades.

The novelty of our research stems from the fact that there is no prior paper, up to present, that examines the influence of CEO overconfidence on CR-CS hypothesis. Therefore, this paper not only makes significant contributions to the rating literature, but also to the behavioural finance literature. Our research outcomes are particularly useful for board of directors of firms where CEOs are subject to overconfidence bias. Our study will help them to better understand how CEO overconfidence affects their capital structure policies. Correspondingly, boards may consider setting a threshold limit for internal cash flow usage or to employ debt overhang strategy to constrain overconfident CEOs.

Table 1: Firm characteristics summary statistics

This table presents the summary statistics for our dependent variables and firm-level control variables over the period 2006 to 2018. The Wilcoxon-Mann-Whitney U test is used to test the significance of the difference in the means between non-overconfident CEOs and overconfident CEOs. A CEO is classified as overconfident after they fail to exercise options that are at least 67% in the money two times or more during their tenure period. Rating is the credit rating assigned by S&P's, which has been converted to numerical form using 19-point credit rating scale. *NetD* is the net debt raised for the year; *NetE* is the net equity raised for the year, and *NetDIss* is net debt issuance minus net equity issuance. *NetD, NetE* and *NetDIss* are normalised by total assets at the beginning of the year. *Leverage* is the ratio of total liabilities to total assets. *OM* is the ratio of operating profit before depreciation to total assets. *Sales* is the natural logarithm of sales for the year. *Z* is the Z-score that represents the credit quality of the firms. *MB* is the ratio of market value of the firm to book value of total assets. *Cash* is the ratio of cash and cash-equivalents to total assets. *CAPEX* is the ratio of capital expenditures to total assets. *CF* is the ratio of earnings before extraordinary items plus depreciation to total assets. *Size* is the book values of total assets of the firm. Details of all variable measurements are provided in the Appendix A. Statistical significance at the 1%, 5% and 10% levels is denoted as ***, ** and * respectively.

Panel A: Full Sample

Variable	N	Mean	S.D.	Min	Max
Rating	6128	9.305	3.232	1.000	19.000
NetD	6128	0.024	0.136	-0.507	3.539
NetE	6128	-0.026	0.083	-1.490	1.722
NetDIss	6128	0.050	0.163	-1.645	2.847
Leverage	6128	0.459	0.325	0.000	2.034
OM	6128	0.141	0.073	-0.088	0.372
Sales	6128	8.266	1.397	5.141	11.721
Z	6128	0.634	0.947	-3.145	2.665
MB	6128	1.719	0.849	0.641	5.187
Cash	6128	0.114	0.113	0.001	0.575
CAPEX	6128	0.055	0.068	-0.029	1.291
CF	6128	0.084	0.110	-2.802	0.759
Size	6128	12678.390	24442.741	277.003	157818.000

Panel B: Sub-Samples

Variable	Non-overconfident		Overconfident		Difference (*t*-statistic)
	Mean	N	Mean	N	
Rating	9.143	3775	9.564	2353	-0.422***
NetD	0.019	3775	0.033	2353	-0.014***
NetE	-0.020	3775	-0.036	2353	0.016***
NetDIss	0.039	3775	0.069	2353	-0.030***
Leverage	0.461	3775	0.456	2353	0.005
OM	0.131	3775	0.156	2353	-0.025***
Sales	8.171	3775	8.420	2353	-0.249***
Z	0.537	3775	0.789	2353	-0.252***
MB	1.572	3775	1.956	2353	-0.384***
Cash	0.117	3775	0.109	2353	0.009***
CAPEX	0.052	3775	0.060	2353	-4.501***
CF	0.071	3775	0.104	2353	-12.739***
Size	12476.895	3775	13001.655	2353	-524.760***

Table 2: Credit rating upgrades and downgrades by sub-samples

This table shows the number of firm-year observations in the sample for which credit rating has been downgraded or upgraded in the previous year. Panel A summarises the entire sample, while Panel B and Panel C further partition the sample into non-overconfident CEOs and overconfident CEOs, respectively. In Panel A, a percentage represents the proportion of the number of downgrades (upgrades) to the total firm-year observations of full sample. In Panels B and C, percentage represents the proportion of the number of downgrades (upgrades) to the total firm-year observations of non-overconfident and overconfident sub-samples, accordingly. The credit rating is S&P's Domestic Currency Long-Term Issuer Credit Rating.

	Panel A: Full Sample		Panel B: Non-overconfident CEOs		Panel C: Overconfident CEOs	
	N	%	N	%	N	%
Upgrade by 1 rating notch	541	8.83	274	7.26	269	11.43
Upgrade by 2 rating notches	59	0.96	35	0.93	18	0.76
Upgrade by >2 rating notches	12	0.20	3	0.08	2	0.08
Downgrade by 1 rating notch	384	6.27	267	7.07	110	4.67
Downgrade by 2 rating notches	134	2.19	103	2.73	30	1.27
Downgrade by >2 rating notches	73	1.19	52	1.38	6.00	0.25

Table 3: Capital market activities following rating changes

This table presents the mean net debt issues, mean net equity issues and mean net debt issuance versus net equity issuance as percentages of total assets for firms experiencing rating upgrades/downgrades in the previous year and for firms with stable ratings. Wilcoxon-Mann-Whitney U test is used to test the significance of the difference in means between non-overconfident CEO and overconfident CEO subsamples. Statistical significance at the 1%, 5% and 10% levels is denoted as ***, ** and * respectively.

Rating Change (Previous Year)	Non-overconfident	Overconfident	Difference
Panel A: Mean Net Debt Issues			
Upgrade	0.021	0.035	-0.013***
Downgrade	0.018	0.033	-0.016***
No Upgrade/Downgrade	0.020	0.035	-0.015***
Panel B: Mean Net Equity Issues			
Upgrade	-0.022	-0.037	0.015***
Downgrade	-0.020	-0.036	0.017***
No Upgrade/Downgrade	-0.022	-0.038	0.016***
Panel C: Mean Net Debt Issuance versus Net Equity Issuance			
Upgrade	0.043	0.072	-0.028***
Downgrade	0.037	0.069	-0.032***
No Upgrade/Downgrade	0.042	0.072	-0.030***

Table 4: The impact of rating changes on capital structure decisions – Eq. (2)

This table presents the pooled ordinary least-squared regression results for Eq. (2) of Hypothesis 1. *OVERCONF* is a dummy variable for overconfident CEOs. *UP* and *DOWN* are ordinal variables representing the notch changes in ratings in the previous year (details in Section 4.2.2.). The bottom row *t*-test reports the p-value for the test that the sum of *UP* and *OVERCONF*UP* is zero. Control variables are defined in the Appendix A. *t*-statistics are shown in parentheses. Statistical significance at the 1%, 5% and 10% levels is denoted as ***, ** and * respectively.

	(1) NetD	(2) NetD	(3) NetD	(4) NetE	(5) NetE	(6) NetE	(7) NetDIss	(8) NetDIss	(9) NetDIss
OVERCONF	0.0179***	0.0153***	0.0156***	-0.0133***	-0.0139***	-0.0135***	0.0311***	0.0293***	0.0292***
	(4.532)	(3.856)	(3.880)	(-5.597)	(-5.944)	(-5.704)	(6.661)	(6.266)	(6.165)
UP	0.0178***	0.0169***	0.0174***	0.0043	0.0046	0.0050	0.0135*	0.0122*	0.0124*
	(2.982)	(2.830)	(2.891)	(1.194)	(1.316)	(1.415)	(1.912)	(1.749)	(1.751)
DOWN	-0.0042	-0.0034	-0.0016	0.0100***	0.0086***	0.0085***	-0.0142***	-0.0120**	-0.0101**
	(-1.004)	(-0.818)	(-0.379)	(4.007)	(3.477)	(3.381)	(-2.876)	(-2.441)	(-2.019)
OVERCONF * UP	-0.0228**	-0.0220**	-0.0213**	-0.0028	-0.0018	-0.0024	-0.0200*	-0.0202*	-0.0189*
	(-2.555)	(-2.471)	(-2.387)	(-0.527)	(-0.342)	(-0.463)	(-1.890)	(-1.932)	(-1.799)
OVERCONF * DOWN	-0.0065	-0.0062	-0.0074	0.0013	0.0010	-0.0000	-0.0077	-0.0071	-0.0074
	(-0.687)	(-0.658)	(-0.783)	(0.224)	(0.173)	(-0.001)	(-0.693)	(-0.647)	(-0.666)
Leverage	-0.0175***	-0.0189***	-0.0198***	-0.0102***	-0.0070**	-0.0059*	-0.0073	-0.0120*	-0.0139**
	(-3.195)	(-3.359)	(-3.493)	(-3.105)	(-2.101)	(-1.759)	(-1.125)	(-1.806)	(-2.090)
Sales	-0.0020	-0.0023*	-0.0022*	-0.0097***	-0.0080***	-0.0080***	0.0077***	0.0057***	0.0059***
	(-1.575)	(-1.800)	(-1.690)	(-12.815)	(-10.593)	(-10.633)	(5.159)	(3.784)	(3.899)
Cash	0.0285*	0.0443***	0.0404**	-0.0971***	-0.0800***	-0.0804***	0.1256***	0.1242***	0.1209***
	(1.815)	(2.587)	(2.352)	(-10.304)	(-7.928)	(-7.937)	(6.750)	(6.182)	(5.986)
Constant	0.0386***	0.0463***	0.0391***	0.0730***	0.0583***	0.0651***	-0.0344**	-0.0120	-0.0260*
	(3.384)	(3.495)	(3.142)	(10.674)	(7.468)	(8.877)	(-2.548)	(-0.772)	(-1.781)
N	6128	6128	6128	6128	6128	6128	6128	6128	6128
adj. R-sq	0.007	0.019	0.023	0.048	0.093	0.096	0.022	0.050	0.054
Year Effects	No	Yes	No	No	Yes	No	No	Yes	No
Ind Effects	No	Yes	No	No	Yes	No	No	Yes	No
*Ind*Year* Effects	No	No	Yes	No	No	Yes	No	No	Yes
t-test	0.448	0.444	0.555	0.717	0.470	0.512	0.410	0.310	0.406

Table 5: The impact of rating changes on capital structure decisions – Eq. (2) - Matched sample

This table presents the pooled ordinary least-squared regression results for Eq. (2) of Hypothesis 1 implemented on a sample matched by propensity score. *OVERCONF* is a dummy variable for overconfident CEOs. *UP* and *DOWN* are ordinal variables representing the notch changes in ratings in the previous year (details in Section 4.2.2.). The bottom row *t*-test reports the p-value for the test that the sum of *UP* and *OVERCONF*UP* is zero. Control variables are defined in the Appendix A. *t*-statistics are shown in parentheses. Statistical significance at the 1%, 5% and 10% levels is denoted as ***, ** and * respectively.

	(1) NetD	(2) NetD	(3) NetD	(4) NetE	(5) NetE	(6) NetE	(7) NetDIss	(8) NetDIss	(9) NetDIss
OVERCONF	0.0074	0.0058	0.0064	-0.0072**	-0.0091***	-0.0079**	0.0146**	0.0148**	0.0143**
	(1.453)	(1.118)	(1.215)	(-2.168)	(-2.790)	(-2.395)	(2.291)	(2.332)	(2.209)
UP	0.0262***	0.0252**	0.0277***	0.0056	0.0063	0.0061	0.0206*	0.0189	0.0216*
	(2.682)	(2.576)	(2.779)	(0.886)	(1.023)	(0.967)	(1.692)	(1.567)	(1.761)
DOWN	-0.0084	-0.0064	-0.0053	0.0138***	0.0106**	0.0114**	-0.0222**	-0.0170*	-0.0167
	(-1.012)	(-0.774)	(-0.625)	(2.583)	(2.025)	(2.136)	(-2.152)	(-1.662)	(-1.597)
OVERCONF * UP	-0.0302**	-0.0299**	-0.0315***	-0.0035	-0.0024	-0.0020	-0.0267*	-0.0275*	-0.0296**
	(-2.536)	(-2.523)	(-2.615)	(-0.457)	(-0.325)	(-0.258)	(-1.798)	(-1.881)	(-1.990)
OVERCONF * DOWN	-0.0037	-0.0047	-0.0049	-0.0017	-0.0006	-0.0013	-0.0020	-0.0041	-0.0036
	(-0.313)	(-0.394)	(-0.402)	(-0.222)	(-0.080)	(-0.172)	(-0.136)	(-0.279)	(-0.239)
Constant	0.0274***	0.0347***	0.0285***	-0.0297***	-0.0294***	-0.0180***	0.0571***	0.0641***	0.0466***
	(6.819)	(3.906)	(3.793)	(-11.426)	(-5.249)	(-3.809)	(11.399)	(5.850)	(5.023)
N	3769	3769	3769	3769	3769	3769	3769	3769	3769
adj. R-sq	0.002	0.013	0.013	0.004	0.065	0.067	0.003	0.036	0.036
Year Effects	No	Yes	No	No	Yes	No	No	Yes	No
Ind Effects	No	Yes	No	No	Yes	No	No	Yes	No
*Ind*Year* Effects	No	No	Yes	No	No	Yes	No	No	Yes
t-test	0.560	0.488	0.577	0.635	0.366	0.342	0.475	0.306	0.348

Table 6: The investment-cash flow sensitivity analysis – Eq. (3) - Overconfident CEOs

This table presents the pooled ordinary least-squared regression results for Eq. (3) of Hypothesis 2 and Hypothesis 3 for overconfident CEO subsample. The dependent variable is the firms' capital expenditures deflated by the beginning-of-the-year total assets. *MB* is the market-to-book ratio. *CF* is cash flow, defined as earnings before extraordinary items plus depreciation deflated by the beginning-of-the-year total assets. *lag_CF* is cash flow to total asset in the previous year. *UP* and *DOWN* are ordinal variables representing the notch changes in ratings in the previous year (details in Section 4.2.2.). *t*-statistics are shown in parentheses. Statistical significance at the 1%, 5% and 10% levels is denoted as ***, ** and * respectively.

	(1) CAPEX	(2) CAPEX	(3) CAPEX	(4) CAPEX	(5) CAPEX	(6) CAPEX
MB	-0.0203***	-0.0067***	-0.0066***	-0.0156***	-0.0024*	-0.0026*
	(-12.210)	(-4.510)	(-4.300)	(-9.751)	(-1.657)	(-1.769)
CF	0.3450***	0.2262***	0.2284***			
	(13.110)	(10.108)	(9.781)			
lag_CF				0.2353***	0.1021***	0.1135***
				(8.922)	(4.508)	(4.814)
UP	-0.0033	-0.0113	-0.0067	-0.0306***	-0.0273***	-0.0243***
	(-0.366)	(-1.524)	(-0.884)	(-3.119)	(-3.339)	(-2.903)
DOWN	-0.0034	-0.0133*	-0.0184**	-0.0063	-0.0167**	-0.0214***
	(-0.346)	(-1.657)	(-2.204)	(-0.733)	(-2.343)	(-2.900)
UP * CF	0.0728	0.1454***	0.1178**			
	(1.161)	(2.797)	(2.207)			
DOWN * CF	-0.0050	0.0640	0.0891			
	(-0.057)	(0.874)	(1.175)			
UP * lag_CF				0.2639***	0.2582***	0.2446***
				(3.998)	(4.710)	(4.365)
DOWN * lag_CF				0.0425	0.0915	0.1109*
				(0.580)	(1.498)	(1.763)
Constant	0.0606***	0.0609***	0.0616***	0.0636***	0.0654***	0.0654***
	(15.772)	(11.049)	(13.431)	(15.679)	(11.571)	(13.824)
N	2353	2353	2353	2353	2353	2353
adj. R-sq	0.101	0.389	0.380	0.076	0.368	0.362
Year Effects	No	Yes	No	No	Yes	No
Ind Effects	No	Yes	No	No	Yes	No
*Ind***Year* Effects	No	No	Yes	No	No	Yes

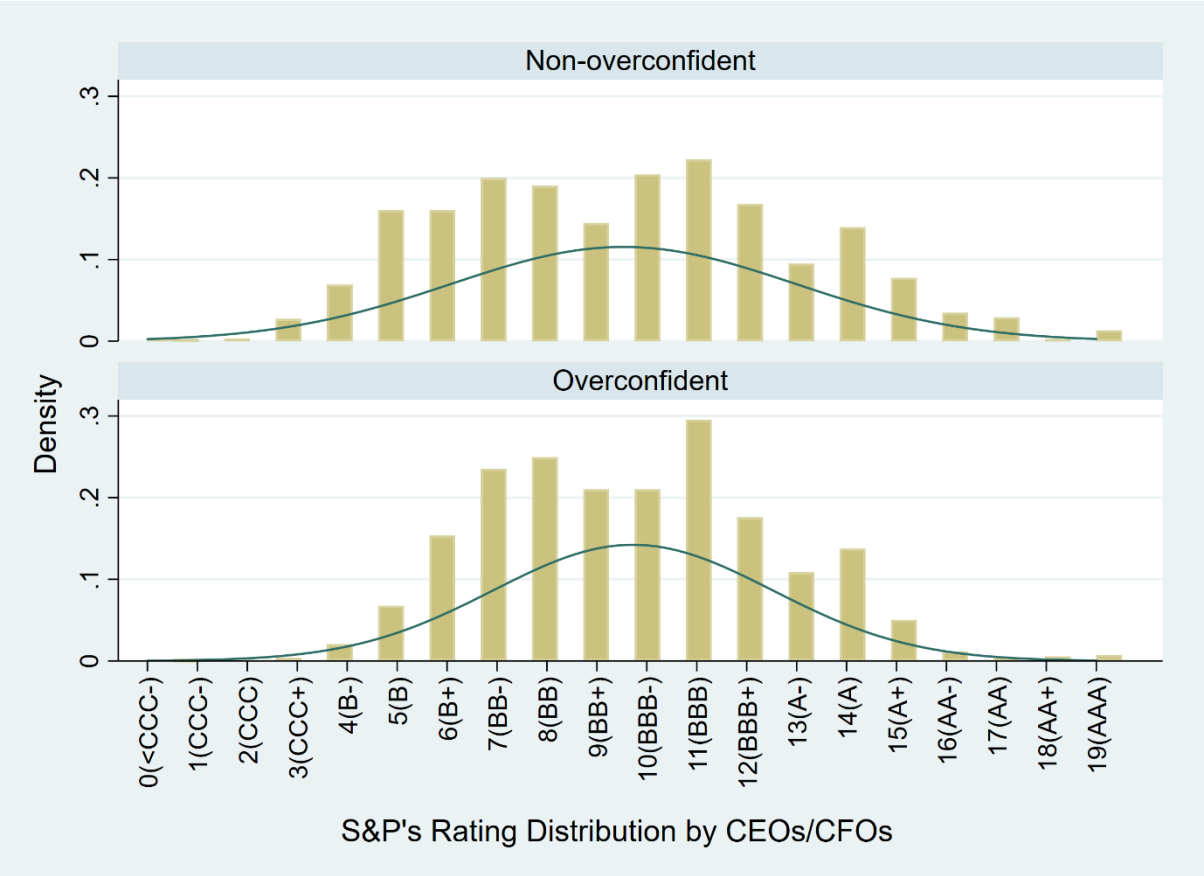
Table 7: The investment-cash flow sensitivity analysis – Eq. (3) – Non-overconfident CEOs

This table presents the pooled ordinary least-squared regression results for Eq. (3) of Hypothesis 2 and Hypothesis 3 for non-overconfident CEO subsample. The dependent variable is the firms' capital expenditures deflated by the beginning-of-the-year total assets. *MB* is the market-to-book ratio. *CF* is cash flow, defined as earnings before extraordinary items plus depreciation deflated by the beginning-of-the-year total assets. *lag_CF* is cash flow to total asset in the previous year. *UP* and *DOWN* are ordinal variables representing the notch changes in ratings in the previous year (details in Section 4.2.2.). *t*-statistics are shown in parentheses. Statistical significance at the 1%, 5% and 10% levels is denoted as ***, ** and * respectively.

	(1) CAPEX	(2) CAPEX	(3) CAPEX	(4) CAPEX	(5) CAPEX	(6) CAPEX
MB	-0.0134***	-0.0049***	-0.0043***	-0.0120***	-0.0029**	-0.0026**
	(-9.215)	(-3.975)	(-3.487)	(-8.568)	(-2.404)	(-2.126)
CF	0.1947***	0.1766***	0.1655***			
	(13.721)	(15.141)	(13.885)			
lag_CF				0.2190***	0.1653***	0.1568***
				(14.943)	(13.497)	(12.683)
UP	0.0044	0.0058	0.0080*	-0.0009	0.0036	0.0054
	(0.873)	(1.409)	(1.940)	(-0.160)	(0.787)	(1.197)
DOWN	-0.0002	-0.0038	-0.0006	0.0113***	0.0012	0.0042
	(-0.057)	(-1.307)	(-0.190)	(3.423)	(0.454)	(1.525)
UP * CF	0.0016	0.0006	-0.0108			
	(0.041)	(0.019)	(-0.333)			
DOWN * CF	-0.0124	-0.0199	-0.0136			
	(-0.364)	(-0.722)	(-0.491)			
UP * lag_CF				0.0396	0.0175	0.0127
				(0.937)	(0.508)	(0.370)
DOWN * lag_CF				-0.1727***	-0.0654***	-0.0744***
				(-5.602)	(-2.585)	(-2.938)
Constant	0.0561***	0.0449***	0.0446***	0.0507***	0.0440***	0.0420***
	(23.436)	(12.819)	(15.426)	(20.923)	(12.437)	(14.395)
N	3775	3775	3775	3775	3775	3775
adj. R-sq	0.062	0.391	0.410	0.068	0.382	0.403
Year Effects	No	Yes	No	No	Yes	No
Ind Effects	No	Yes	No	No	Yes	No
*Ind***Year* Effects	No	No	Yes	No	No	Yes

Figure 1: Sample distribution of Standard & Poor's credit ratings by groups

These bar charts present the sample distribution of S&P's domestic currency long-term issuer corporate credit rating for non-overconfident and overconfident CEO subsamples over the period 2006-2017.



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Appendix A: Variable measurements and definitions

Variable	Abbr.	Definition
Net Debt Issuance	*NetD*	Long-term debt issuance (dltis) minus long-term debt reduction (dltr) plus changes in current debt for firm *i* from time *t* to *t* + 1 (dlcch), scaled by total asset (at).
Net Equity Issuance	*NetE*	The sale of common and preferred stock (sstk) minus the purchase of common and preferred stock (prstkc), scaled by total asset (at).
Net Debt-to-Equity Issuance	*NetDIss*	Net debt issuance minus net equity issuance, divided by total asset (at).
Leverage	*Leverage*	The ratio of book long-term debt (dltt) plus book short-term debt (dlc) to total asset (at).
Operating Margin	*OM*	The ratio of operating profit before depreciation (oibdp) to total asset (at).
Sales	*Sales*	The natural logarithm of total sales of the firms (sale).
Z-score	*Z*	The product of 3.3 and pretax income (pi) plus the product of 1.4 and retained earnings (re) plus the product of 1.2 and working capital (act-lct), divided by total assets (at).
Market-to-Book ratio	*MB*	Book liabilities (lt+pstkl-txditc-dcvt) plus market value of equity (prcc_f*csho) divided by book value of total assets (at).
Cash Holdings	*Cash*	The ratio of cash and cash-equivalents (che) to total assets (at).
Capital Expenditures	*CAPEX*	The ratio of capital expenditures (capx) to beginning-of-period total assets (at).
Cash Flow	*CF*	The ratio of earnings before extraordinary items (ib) plus depreciation (dp) to beginning-of-period total assets (at).
Firm Size	*Size*	The natural logarithm of total assets of the firms (at).