
Article:
Ataullah, A, Vivian, A and Xu, B orcid.org/0000-0003-3512-5834 (2018) Time-varying managerial overconfidence and corporate debt maturity structure. The European Journal of Finance, 24 (2). pp. 157-181. ISSN 1351-847X

https://doi.org/10.1080/1351847X.2016.1274266

Time-varying Managerial Overconfidence and Corporate Debt Maturity Structure

Ali Ataullah[a], Andrew Vivian[a] and Bin Xu[b*]

[a] School of Business and Economics, Loughborough University, Leicestershire, LE11 3TU, UK; [b] *Queen's Management School, Queen's University Belfast, Belfast, BT9 5EE, UK*

[*]Corresponding author. Email: b.xu@qub.ac.uk

Abstract: We examine the impact of managerial overconfidence on corporate debt maturity. We build upon the argument that managerial overconfidence is likely to mitigate the underinvestment problem, which is often the major concern for long-term debt investors. Within this context, we hypothesise that managerial overconfidence increases debt maturity. Our empirical evidence, based on time-varying measures of overconfidence derived from computational linguistic analysis and directors' dealings in their own companies' shares, supports this hypothesis. Specifically, we find that the changes in both first person singular pronouns and optimistic tone are positively related to the change in debt maturity. Moreover, we find that the insider trading-based overconfidence of CEO, who is most likely to influence investment decision and thus the underinvestment problem, has a stronger impact on debt maturity than the overconfidence of other directors (e.g. CFO). Overall, our study provides initial evidence for a positive overconfidence-debt maturity relation via overconfidence mitigating the agency cost of long-term debt.

Keywords: debt maturity, managerial overconfidence, first person pronouns, optimistic tone, Chairman's Statement, insider trading.

JEL classification: G30, G32, G02

1. INTRODUCTION

Initial work highlights that managerial overconfidence often leads to sub-optimal corporate financial decisions (e.g., Malmendier and Tate, 2005; 2008).[1] In contrast, some behavioural finance theories (Shefrin, 2007; Hackbarth, 2009) suggest that managerial overconfidence can have a positive impact by reducing agency problems (e.g. debt overhang or underinvestment problem). However, empirical analysis supporting a positive impact of overconfidence is limited.[2] We fill this gap by examining the debt maturity decision and providing evidence that managerial overconfidence significantly increases debt maturity. This is in line with managerial overconfidence mitigating the agency costs of long-term debt, namely the underinvestment problem (Myers, 1977).[3] An important policy implication of our finding is that the presence of overconfident managers may give firms freedom to choose their debt maturity structure instead of relying heavily on short-term debt as a mechanism to alleviate the underinvestment problem (see Barclay and Smith, 1995).

Given that debt maturity structure is an important element of the corporate financing strategy pursued by managers to influence their firms' cost of capital (e.g., Baker, Greenwood, and Wurgler, 2003), it is important to determine whether overconfident managers' tendency to underestimate risks associated with their firms' future prospects affect debt maturity. More specifically, our study is motivated by two strands of literature. On one hand, the behavioural finance literature suggests that managerial overconfidence can mitigate some agency problems including the underinvestment problem (Hackbarth, 2009). On the other hand, it is well established that agency problems are apparent in the debt maturity setting and that, for example, shortening debt maturity may reduce the underinvestment problem (e.g., Barnea et al., 1980). Combining these two strands of literature, it is plausible that a particular agency problem is the underlying channel through which managerial overconfidence affects debt maturity. This is the first study that examines the overconfidence-debt maturity relation from an agency perspective. We augment the emergent literature on the link between

[1] The managerial overconfidence literature builds upon an important finding in the psychological studies that people tend to be overconfident (Taylor and Brown, 1988). Overconfident people may overestimate their own abilities, the precision of their knowledge/information and the probabilities of good outcomes. In finance, Roll (1986) highlighted the significance of managerial overconfidence (i.e. hubris) in mergers and acquisitions decisions. More recently, Malmendier and Tate (2005, 2008) document that managerial overconfidence may lead to value-destroying corporate investments.

[2] Overconfidence can benefit shareholders because overconfident CEOs are better innovators (Hirshleifer et al., 2012).

[3] The underinvestment problem arises when managers forgo good investment opportunities that increase the firm value but not the value of their shareholders (Myers, 1977).

managerial overconfidence and debt maturity in four ways.

First, we develop a new hypothesis that managerial overconfidence increases debt maturity. This is in contrast to two previous studies. Landier and Thesmar (2009) show that overconfident managers rely on short-term debt in order to benefit from their overconfident beliefs about their firms' prospects. From the information asymmetry perspective, Huang et al. (2016) argue that managerial overconfidence is associated with perceived information advantage and hypothesize that overconfident managers prefer short-term debt since it is less subject to the perceived mispricing. We contribute to this literature by examining the relation between managerial overconfidence and debt maturity from agency perspectives. Building upon Hackbarth (2009), we argue that the presence of overconfident managers, who invest earlier and more than their rational counterparts because they underestimate the value of the option-to-wait, alleviates the underinvestment problem that is traditionally considered as a key reason behind firms' reliance on short-term debt. We thus hypothesise that managerial overconfidence increase debt maturity. Our empirical analysis, based on 192 public listed UK firms during 2000-2010, supports this hypothesis.

Second, unlike the existing empirical studies that use time-invariant measures of overconfidence (e.g., Graham et al., 2013), we examine the impact of various time-varying measures of managerial overconfidence on corporate debt maturity structure. This is important because the overconfidence level of managers is likely to change over time due to the self-attribution bias (SAB), which is defined as the tendency to attribute success (failure) to own ability (external factors) (Miller and Ross, 1975). From this perspective, as managers tend to attribute their companies' success to their own abilities, they learn to become overconfident.[4] Consequently, the use of static measures of overconfidence in the literature may be misleading and imprecise. Our empirical analysis addresses this issue by examining the relation between several time-varying measures of managerial overconfidence and debt maturity.

Third, unlike the existing literature on overconfidence and debt maturity that relies primarily on survey-based[5] measures of overconfidence, we employ 'words-based measures', as well as, 'action-

[4] Hilary and Hsu (2011) use "endogenous overconfidence" to describe the dynamic self-attribution-induced overconfidence. It is relevant to note that SAB is usually regarded as a dynamic counterpart of overconfidence (Hirshleifer, 2001).
[5] It is difficult to capture time-variation in managerial overconfidence using a survey approach. Graham et al. (2013) measure optimism of CEOs and CFOs based on their survey in 2006 and Landier and Thesmar (2009) use entrepreneur optimism measure that is based on two surveys in 1994 and 1998 respectively.

based measures' of managerial overconfidence. Our 'words-based measures' capture "what managers say" and our 'action-based measures' capture "what managers do" and both their words and actions may reflect their overconfident beliefs. As we explain in detail in section 3, our 'words-based measures' are derived using the computational linguistic analysis of the Chairman's Statement in firms' annual reports, while our 'action-based measures' are based upon directors' dealings in their own firms' shares. An additional benefit of our action-based measures is that they enable us to examine whether the identity of the overconfident managers matters. Specifically, we show that the link between debt maturity and overconfidence is primarily due to CEO overconfidence.

Finally, we examine further if the positive overconfidence-debt maturity relation is contingent upon investment opportunities and the level of existing debt. Specifically, our analysis shows that the link between overconfidence and debt maturity is greater for firms with more growth options in their investment opportunities. This is an important finding given that the literature (e.g., Barclay and Smith, 1995) suggests that firms with more growth options rely on short-term debt due to the underinvestment problem. In addition, our findings show that the relation between overconfidence and debt maturity depends on existing leverage. We argue that high leverage may reduce firms' ability to raise new debt, which, in turn, limits the impact of overconfidence on debt maturity decision.

To summarize, this study provides the important new finding that managerial overconfidence, as indicated by their words and trading activities, increases debt maturity. Our further analysis confirms that the channel through which managerial overconfidence increases debt maturity is the underinvestment problem rather than other agency problems (e.g. risk-shifting and overinvestment problems). Our findings are largely robust to alternative measures of debt maturity and overconfidence, and alternative estimation methods. Overall, our study suggests that overconfidence can be a desirable managerial trait in the sense that it mitigates the agency costs of debt.

The rest of the paper proceeds as follows. Section 2 briefly reviews the literature on the standard and behavioural determinants of debt maturity and develops hypotheses. Section 3 describes methodology and data. Section 4 discusses empirical results and section 5 concludes.

2. RELATED RESEARCH AND HYPOTHESES

2.1. The Determinants of Corporate Debt Maturity Structure

Why do some firms raise long-term debt while others rely on short-term debt? Within Modigliani-Miller's perfect capital markets setting, any variation in debt maturity structure is irrelevant to the firm value (Brick and Ravid, 1985). However, early literature on corporate debt maturity argues that in the presence of various market imperfections, such as information asymmetries and agency problems, short-term debt may be optimal for some firms. For example, building upon Myers (1977), Barclay and Smith (1995) argue that due to the agency cost of debt 'firm with more growth options in their investment opportunity sets have less long-term debt in their capital structure' (p. 609) because short-term debt enables managers to undertake investments without transferring benefits to existing debt-holders. Within this context, short-term debt acts as a solution to the underinvestment problem. Using market-to-book ratio as a measure of growth options in firms' investment opportunities, Barclay and Smith (1995) find support for the above argument. Overall, the traditional finance literature focuses primarily on various firm characteristics (e.g., firm size, investment opportunities, liquidity, effective tax rate and earnings volatility) and capital market conditions (e.g., term structure and interest rate volatility) to explain variations in corporate debt maturity structure (see Stohs and Mauer, 1996; Johnson, 2003; Barclay et al., 2003; Antoniou et al., 2006).

In contrast, the 'behavioural corporate finance' literature argues that, besides firm and market characteristics mentioned above, managerial overconfidence[6] is an important determinant of corporate finance and debt maturity (see, e.g., Hackbarth, 2008, 2009; Landier and Thesmar, 2009). We build upon this recent behavioural corporate finance literature and derive a hypothesis regarding the link between managerial overconfidence and debt maturity.

[6] The word "overconfidence" has often been used in a broad sense that subsumes several aspects of overconfidence including (1) miscalibration, that is overestimation of the precision of one's knowledge or belief, which leads to narrower confidence interval, (2) better-than-average effect, that is overestimation of one's ability or positive personal attributes, (3) illusion of control, that is overestimation of the control one has over events and outcomes (see Ackert and Deaves (2010) for an overview of various facets of overconfidence). A closely related psychological bias is optimism which makes people overestimate (underestimate) the probability of good (bad) outcomes. However, overconfidence and optimism are often used interchangeably in the finance literature.

2.2. Hypotheses Development

2.2.1. Managerial overconfidence increases corporate debt maturity

Firm value depends not only on its existing assets but also on the optimal exercise of growth options embedded in its investment opportunities (Myers, 1977). Myers (1977) shows that in the presence of risky debt, managers may decide not to undertake good investment opportunities because some of the value generated by these investments goes to existing debt-holders. This is the well-known 'underinvestment problem' considered as an agency cost of debt. The underinvestment problem arises because shareholders are unwilling to bear the costs of some investment that only benefits the debt-holders and it is assumed that managers maximize the equity value rather than the firm value. Following Myers (1977), several studies examine the significance of short-term debt in alleviating the underinvestment problem (e.g., Barnea, et al., 1980). Specifically, the literature suggests that, due to the underinvestment problem, firms rely on short-term debt that matures 'before an investment option is to be exercised' (Myers, 1977, p. 158) because it reduces managers' incentives to forgo investment opportunities that increase firm value (Barclay and Smith, 1995).

Managerial overconfidence may play a role in alleviating the underinvestment problem that creates a wedge between debt-holders' and managers' preferences about investment opportunities. We build upon Hackbarth's (2009) model that studies the agency conflicts between bondholders and shareholders in the presence of managerial overconfidence. Hackbarth proposes that overconfident managers tend to invest earlier and more than their rational counterparts. The intuition is that overconfident managers, who have lower perceived uncertainty associated with new projects, underestimate the value of the option-to-wait in order to obtain more information about the project. This "timing effect", in turn, reduces the underinvestment problem that arises when managers forgo investment that increase firm value but may not increase shareholders' wealth.[7]

In the traditional finance literature, firms utilise short-term debt in order to alleviate the underinvestment problem. Building upon Hackbarth (2009), we posit that managerial overconfidence increases the degree of congruence between long-term debt-holders' and managers' preferences

[7] Following the previous literature (e.g., Malmendier and Tate, 2005; Hackbarth, 2009), we also assume that overconfident managers maximize the perceived current shareholders' value (or the value of equity).

regarding the decisions to undertake future investment opportunities. This increased congruence in preferences is due to the timing effect that ensures that overconfident managers invest earlier and more than the rational managers (Hackbarth, 2009). Thus, overconfident managers make it less important for firms to rely on short-term debt as a mechanism to alleviate the underinvestment problem. In contrast, firms with rational managers, who are likely to underinvest, still have to rely heavily on short-term debt due to the underinvestment problem.

It is important to note that following Hackbarth (2009), we presume that rational debt-holders are able to distinguish between overconfident and rational managers and, in turn, price long-term and short-term debt accordingly. Specifically, rational debt-holders anticipate that the underinvestment problem is more severe in firms with rational managers who value the option-to-wait correctly than firms with overconfident managers. Consequently, potential debt investors are more willing to offer long-term debt to firms with overconfident managers who exhibit greater tendency to undertake future investment opportunities. Within this context, we propose the following hypothesis:

Hypothesis 1: Managerial overconfidence is positively related to debt maturity.

2.2.2. The significance of *managers' identity, investment opportunities and leverage*

This section highlights the significance of (1) managers' identity, (2) future investment opportunities, and (3) existing debt level in determining the relation between managerial overconfidence and debt maturity structure. Since we contend that the positive relation between overconfidence and debt maturity is due to the underinvestment problem, it is plausible that the director that is most involved in major investment decisions is most relevant in determining the relation between overconfidence and debt maturity. The existing literature suggests that CEO has a stronger influence on investment than other directors (e.g., CFO) (Malmendier and Zheng, 2012). Consequently, CEO overconfidence should be of particular importance for debt maturity under the mechanism outlined for hypothesis 1.

Hypothesis 2: The positive relation between managerial overconfidence and debt maturity is intensified for firms with high levels of CEO overconfidence.

As noted earlier, the agency cost of debt is exacerbated for firms with more growth options in their future investment opportunities (see Barclays and Smith, 1995). Thus, firms with future

investment opportunities rely on short-term debt to alleviate the underinvestment problem. Our earlier discussion lays emphasis on the presence of overconfident managers as a mechanism that alleviates the underinvestment problem and, consequently, increases the availability of long-term debt for firms with overconfident managers. We propose that managerial overconfidence plays a more important role in determining debt maturity for firms with higher future investment opportunities. The rationale for this is as follows. When firms have very few growth options in their future investment opportunities, the presence of overconfident managers does little to align the managers' and long-term debt-holders' investment preferences. These firms, therefore, receive little or no benefit from having overconfident managers in terms of their access to long-term debt. However, for firms with more growth options in their future investment opportunities, the presence of overconfident managers align the managers' and long-term debt-holders' investment preferences by ensuring that managers do not underinvest. These firms, therefore, are likely to benefit from having overconfident managers in terms of their access to long-term debt. Thus, given the importance of future investment opportunities, we propose the following hypothesis.

Hypothesis 3: The positive relation between managerial overconfidence and debt maturity is intensified for firms with high investment opportunities.

We also note that the link between managerial overconfidence and debt maturity may depend on the existing corporate debt levels. According to the trade-off theory of capital structure, highly leveraged firms have high financial distress costs and therefore will be reluctant to and find it difficult to raise additional long-term debt financing. Within this context, the effectiveness of managerial overconfidence to align managers and long-term debt holders' investment preferences is reduced. That is, for firms with high existing leverage, managerial overconfidence plays little or no role in enabling firms to raise long-term debt. Thus, we propose the following hypothesis.

Hypothesis 4: The positive relation between managerial overconfidence and debt maturity is reduced for firms with high levels of leverage.

2.2.3. The implications of other agency problems

To develop our main hypothesis (hypothesis 1), we focus on the agency conflict between shareholders and bondholders, namely underinvestment problem. It is also important to discuss whether other potential agency conflicts including risk-shifting (or asset substitution) and overinvestment problem could be the underlying channels through which managerial overconfidence increases debt maturity.[8]

Risk-shifting problem: The behavioural finance literature (e.g., Shefrin, 2007; Hackbarth, 2009) suggests that managerial overconfidence, in a real-option framework, can mitigate not only the underinvestment problem, as discussed in our hypothesis development, but also the risk-shifting problem, both of which are shareholder-bondholder conflicts. The risk-shifting problem may occur when managers attempt to shift risk from shareholders to bondholders by investing in highly risky projects (Jensen and Meckling, 1976). The purpose of risk-shifting is often to avoid or postpone firm bankruptcy. This means that the risk-shifting incentive of managers is more prevalent, especially when a firm is close to bankruptcy or financially distressed. Put differently, risk-shifting only becomes desirable from shareholders' perspective when firm performance deteriorates (e.g. Eisdorfer, 2008; Hackbarth, 2009). However, overconfident managers, who overestimate firm future performance, tend to underestimate the probability of bankruptcy. This underestimated probability of bankruptcy due to managerial overconfidence, in turn, increases the option value of waiting to risk-shift in a real-option model and thus reduces the incentive to shift risk (Hackbarth, 2009). Therefore, managerial overconfidence can mitigate agency costs associated with risk-shifting.

Furthermore, regarding the relationship between debt maturity and risk-shifting problem, prior literature (e.g., Barnea et al., 1980; Leland and Toft, 1996) suggests that longer-term debt increases the incentive for risk-shifting, while reducing debt maturity may mitigate the risk-shifting problem. This is primarily because the value of long-term debt is more sensitive to the changes in the value of firm assets than that of short-term debt. However, managerial overconfidence can mitigate risk-shifting, which makes it less necessary to use short-term debt to reduce this particular agency problem. Thus, an alternative channel through which managerial overconfidence increases debt maturity is risk-

[8] We thank an anonymous referee for pointing out these two agency problems as potential alternative explanations of the positive effect of managerial overconfidence on debt maturity.

shifting. If managerial overconfidence increases debt maturity by mitigating the risk-shifting problem, we expect the positive overconfidence-debt maturity relation to be more pronounced especially for firms that are financially distressed.

Hypothesis 5: The positive relation between managerial overconfidence and debt maturity is intensified for firms with high incentives for risk-shifting.

Overinvestment problem: Next, we discuss whether the overinvestment problem, the manager-shareholder conflicts, can be an alternative explanation of the positive overconfidence-debt maturity relation. The overinvestment problem refers to managers' tendency to purse their own interests at the expense of shareholders and is especially severe in firms with more free cash flow (Jensen and Meckling, 1976; Jensen, 1986). Hackbarth (2008) shows that managerial overconfidence can ameliorate the overinvestment problem. Specifically, overconfident managers underestimate the financial distress costs associated with debt financing and consequently may use more debt. The resulting higher debt level reduces the amount of free cash flow available for potential value-destroying activities of a self-interested manager. Thus, managerial overconfidence reduces overinvestment problem and makes it less necessary to enhance the monitoring of managers by using more short-term debt. This mechanism is also called the *"*leverage effect*"* and implies a positive relation between managerial overconfidence and debt maturity.[9] We examine whether the leverage effect works by testing the following relation.

Hypothesis 6: There is a positive relation between managerial overconfidence and leverage.

We empirically investigate whether risk-shifting and/or overinvestment can be alternative explanations of our findings in section 4.4 where hypotheses 5 and 6 are tested.

3. THE METHODOLOGY AND DATA

3.1. The Empirical Model

[9] In contrast, managerial overconfidence may exacerbate the overinvestment problem, because overconfident managers who overestimate the expected payoffs of future investment tend to overinvest (Gervais et al., 2011; Campbell et al., 2011). This exacerbated overinvestment problem due to managerial overconfidence makes debt investors reluctant to lend money to firms with overconfident managers. This is particularly true for long-term debt investors because long-term debt, unlike the short-term debt that often serves as an important tool to monitor managers, is not as effective as short-term debt in making the managers closely and frequently monitored (e.g., Stulz, 2004). Thus, managerial overconfidence makes the firm rely more on short-term debt and thus is negatively related to debt maturity. This prediction is however inconsistent with our findings.

Following the existing literature on debt maturity (e.g., Barclay and Smith, 1995; Stohs and Mauer, 1996), we use the following empirical model:

$$DM_{it} = \beta_0 + \gamma Z_{it} + \sum_{k=1}^{n} \beta_k X_{k,it} + \upsilon_i + \varepsilon_{it} \quad (1)$$

where, DM_{it} is a measure of the debt maturity of firm i in year t, Z is a measure of overconfidence, X is the vector of k control variables, υ_i represents time-invariant unobservable firm-specific effects, and ε_{it} is the error term. Our main interest lies in the coefficient γ, which measure the relation between debt maturity (DM) and managerial overconfidence (Z). Our debt maturity measure (DM) is the ratio of debt that matures in more than one year to total debt. We choose our control variables based on previous debt maturity studies.[10] As noted earlier, earlier empirical studies focus on firm- or market-characteristics that capture the effects of agency cost, liquidity risk and signalling, maturity matching and tax on debt maturity. Based on this literature, the control variables that we use (with their predicted signs in parenthesis) are as follows: M/B asset (-) controls for agency cost, asset maturity (+) controls for maturity matching, firm size (+) controls for bankruptcy costs, liquidity (+) controls for agency cost, earnings volatility (-) controls for bankruptcy costs, leverage (+) controls for liquidity risk, abnormal earnings (-) controls for firm quality, tax (+) controls for tax, price performance (+) controls for market timing. All the variables are defined in Appendix A.

3.2. The Measurement of Managerial Overconfidence

This section describes how we construct the time-varying words-based measures of managerial overconfidence using computational linguistic analysis and how we gauge different directors' (e.g., CEO and CFO) confidence levels based on their dealings in their own firms' shares.

3.2.1. Words-based Measures of Overconfidence: First Person Pronouns

We construct two words-based measures of overconfidence based on computational linguistic analysis of UK Chairman's Statement. The linguistic analysis of financial narratives is becoming increasingly

[10] For a review of debt maturity hypotheses, see Stohs and Mauer (1996) and Antoniou et al. (2006). For a summary of the debt maturity determinants and their predicted signs, see Table 1 in Antoniou et al. (2006).

popular in the academic research. Recent accounting and finance studies use several content analysis software (e.g., Diction, LIWC and General Inquirer) to analyse various dimensions of narratives[11] (e.g., personal pronouns, optimistic vs. pessimistic, forward-looking).

Our first words-based overconfidence measure is related to the use of first person pronouns in the Chairman's Statement. Previous accounting research suggests that the presence (absence) of first person pronouns in US chief executives' letters (Hyland, 1998) and UK Chairman's Statement (Clatworthy and Jones, 2006) may indicate the messengers' intention to internalise (distance themselves from) good (bad) performance or news. Li (2010a) proposes a measure of self-attribution bias based on the content analysis of Management Discussion and Analysis (MD&A) by LIWC software. In particular, Li uses the ratio of first person pronouns to second- and third-person pronouns in the MD&A as a proxy for self-attribution bias.[12] Clatworthy and Jones (2006) point out that the potential for self-attribution bias, as measured by first person pronouns, is enhanced by the unaudited nature of the Chairman's Statement. Therefore, UK Chairman's Statement is likely to be more suitable than the US MD&A for capturing self-attribution bias. In brief, first person pronouns can be utilised to construct proxies for dynamic self-attribution-induced overconfidence. Following Li (2010a), we use LIWC software to measure the proportion of first person pronouns (FPP_LIWC_{it}) in the Chairman's Statement as our first words-based overconfidence measure as follows: $FPP\_LIWC_{it} = (Number\ of\ FPP_{it}/Total\ Words_{it}) * 100$, where, FPP_{it} represents either first person singular pronouns (I) (e.g., I, me, mine) or first person plural pronouns (WE) (e.g., we, us, our) for firm i in year t[13] and Total Words_{it} is the total number of words in the Chairman's Statement for firm i in year t.

The reason why we test the effects of I and WE separately is that previous empirical studies use the sum of I and WE and the ratio of I to WE as proxies for self-attribution bias (Li, 2010a) and

[11] Various texts analysed in the finance and accounting literature include MD&A (Kothari et al., 2009; Li, 2010a), CEO interviews (Kim, 2013) and earnings announcement (Rogers et al., 2011). For a more comprehensive summary of textual analysis studies, see Appendix A2 in Li (2010b).

[12] Li (2010a) uses the percentage of first person pronouns as an alternative proxy for the SAB and finds similar results.

[13] Self-attribution bias takes the following two forms (Staw et al., 1983): (1) enhancing attribution, meaning that success is attributed to internal factors and (2) defensive attribution, meaning that failure is attributed to external factors. In terms of Li's self-attribution measure, the first person (second-and third-person) pronouns are used to capture the enhancing (defensive) attribution. However, we believe that the second-and third person pronouns are probably noisy/incomplete measures of defensive attribution, considering that Chairman may attribute failure to many external factors (e.g., the economy) without using any second-and third person pronouns (Li, 2010a). Therefore, our study focuses on self-referencing (i.e. the enhancing attribution) as time-varying measure of managerial overconfidence.

narcissism[14] (Chatterjee and Hambrick, 2007) respectively, both of which contribute to managerial overconfidence. Based on the above two operational definitions, the variable I is positively related to both constructs, however, variable WE is positively related to self-attribution bias but negatively related to narcissism. In brief, the relation between WE and managerial overconfidence might be ambiguous. Therefore, the results for the variable WE are expected to be more mixed given its differing relations to the components of managerial overconfidence.[15]

3.2.2. Words-based Measure of Overconfidence: Tone Analysis

Our use of tone analysis is based on the literature that suggests that tone used in corporate disclosures is potentially influenced by "manager-specific tendencies toward optimism or pessimism" (Davis et al. 2015; p. 671). We first construct individual tone measures based on the tone analysis[16]using the Chairman's Statement from the UK annual reports and then construct the composite tone indices.

To construct a composite index of tone, we use six individual wordlists. Our first three wordlists are the same as those in Rogers, Buskirk and Zechman (2011) and Davis et al. (2015), namely OPTIMISM, TONE_H and TONE_LM. OPTIMISM is a measure of net optimism[17] counted using a dictionary in Diction 6. [18] Eshraghi and Taffler (2012) use OPTIMISM as a measure of fund manager overconfidence. TONE_H and TONE_LM are two wordlists developed by Henry (2008) and Loughran and McDonald (2011) respectively to measure positive and negative words especially in a financial context. In particular, TONE_H and TONE_LM are calculated as the ratio of the difference between positive and negative words to the sum of positive and negative words.[19]

---

[14] A narcissistic personality is considered as a contributor to hubris (i.e. exaggerated self-confidence) (Hayward and Hambrick, 1997; Chatterjee and Hambrick, 2007). More specifically, narcissism is associated with "relative optimism and confidence about positive outcomes" (Chatterjee and Hambrick, 2007).

[15] We find that neither the first person pronouns (i.e. the sum of I and WE) nor the ratio of I to WE is statistically significantly related to debt maturity.

[16] Tone analysis (and more generally textual analysis) is becoming increasingly popular in recent accounting and finance studies. For example, Rogers, Buskirk and Zechman (2011) examine the relation between disclosure tone and shareholder litigation. For a review on studies of corporate disclosures, please see Li (2010a).

[17] In Diction, optimism is defined as "language endorsing some person, group, concept or event, or highlighting their positive entailments".

[18] As a unique feature of Diction software, there is standardization procedure when calculating a particular item. In particular, we compare our collected Chairman's Statements to three alternative norms in Diction including (1) all cases, (2) corporate financial reports and (3) corporate public relations. Our empirical results are qualitatively similar using alternative norms.

[19] The terms "positive/negative" and "optimistic/pessimistic" are often used interchangeably in the literature (e.g., Davis, Piger and Sedor, 2012). Li (2010b) standardize the terms to "positive/negative" instead of "optimistic/pessimistic".

In addition to the above measures, we also use CERTAIN1, CERTAIN2 and EMOTION, which are positively related to optimism. CERTAIN1 and EMOTION[20] are measured using dictionaries in LIWC 2007. CERTAIN2 is another measure of certainty[21] based on a dictionary in Diction 6. CERTAIN2 has also been used to measure overconfidence of fund managers (Eshraghi and Taffler, 2012). Similarly, Li (2010b) includes "uncertain tone", which is highly associated with negative tone, in his tone measure. Based on the above six individual tone measures, we form a composite tone index using principal component analysis. We define $Tone\ Index_{it}$ as the first principal components of the correlation matrix of six raw tone measures.[22]

$$\begin{aligned} Tone\ Index_{it} &= \sum_{j=1}^{6} Loading_j * Tone\_X_{ijt} \\ &= 0.489Emotion_{it} + 0.162Certain1_{it} + 0.452Optimism_{it} \\ &+ 0.002Certain2_{it} + 0.481Tone\_H_{it} + 0.547Tone\_LM_{it} \end{aligned} \quad (2)$$

where, $Tone\_X_{ijt}$ represent individual tone measure j of firm i in fiscal year t. $Loading_j$ is the loading for individual tone measure j. The loading for Certain1 and Certain2 is much lower compared with other tone measures. However, our empirical results are qualitatively similar when we exclude those two measures of certainty tone from the composite index. Furthermore, to address the concern that the raw tone might be contaminated by firm-specific variables[23], a composite index of the orthogonalized tone measures is constructed as follows. First, we regress each individual tone measure on standard determinants of debt maturity. Next, a composite index ($Tone\ Index_{it}^{\perp}$) is formed based on the first principal component of six residuals (i.e. $Tone\_X_{ijt}^{\perp} = \varepsilon_{ijt}$) from the above regressions.[24]

[20] An earlier version of LIWC has a category named "optimism", however in the 2007 version words are classified more broadly into "positive emotion" and "negative emotion".
[21] In Diction, certainty is defined as "language indicating resoluteness, inflexibility, and completeness and a tendency to speak ex cathedra".
[22] The first component, with an eigenvalue of 2.59, explains 43.2 percent of our sample variance. The eigenvalue of second component is close to one.
[23] In terms of the determinants of tone (e.g., current performance, growth opportunities, operating risks and complexity), Huang, Teoh and Zhang (2013) find that tone, as measured using Loughran and McDonald (2011) wordlist, is positively related to market-to-book and volatility of stock returns and negatively related to firm size, age and number of business segments. Our orthogonalized tone measure (TONE_RES) controls for all standard determinants of debt maturity.
[24] The first component explains 41.3 percent of the sample variance. The eigenvalues of first and second components are 2.48 and 1.16 respectively.

Suitability of Chairman's Statement for the construction of words-based overconfidence and a caveat: There are four reasons for using the Chairman's Statement[25] from the UK annual reports as the source of narrative to construct managerial words-based measures. First, Chairman's Statement is widely read by investors and analysts (Bartlett and Chandler, 1997). Indeed, according to Clatworthy and Jones (2003; p. 172), Chairman's Statement is "the most read of the UK's accounting narratives" and "the longest established". [26] Second, Chairman's Statement is largely unaudited and not heavily regulated. By contrast, the language used in Directors' Report is much more formal and standard, largely due to regulatory requirements, and thus is probably less likely to reflect managers' behavioural traits. Third, disclosure-related litigation is rare in the UK relative to the US. Therefore, the UK accounting narratives (e.g., Chairman's Statement) are relatively less constrained compared with the MD&A in the US 10-K report. Finally, while Chairman's Statement is signed by chairman, who is often a non-executive director in the UK, existing literature[27] seems to agree that the Statement communicates the view of the board rather than the view of the Chairman alone (Clatworthy and Jones, 2003, 2006). This means that firm's key financial decision makers (e.g., CEO/CFO) also have an influence on the choice of language in the Chairman's Statement. Overall, the Chairman's Statement that is widely read and is not heavily influenced by accounting/regulatory regimes is likely to allow us to capture the overconfident beliefs of managers.

However, an important caveat of using Chairman's Statement to gauge senior managers' overconfidence must be noted. In our analysis, we implicitly assume that senior managers (e.g. CEO) of all the firms in our sample have significant and similar impacts on the language used in Chairman's Statement. However, this assumption may be unrealistic, because the extent to which the preparation of Chairman's Statement is influenced by senior managers may vary from firm to firm. If this is the case, one may argue that Chairman's Statement reflect the managerial overconfidence in some, but not

[25] One may ask why our linguistic analysis only focuses on Chairman's Statement, given that other narratives, e.g., CEO review, financial review, business review, operational review, might also be available in the annual report. However, these reviews are relatively less standard, meaning that (a) not every firm provides statements made by CEO and CFO separately and (b) the structure, content and length of their statements vary greatly from firm to firm.

[26] Many previous studies on UK accounting narratives focus on Chairman's Statement (see e.g., Smith and Taffler, 2000; Clatworthy and Jones, 2003; Clatworthy and Jones, 2006). Smith and Taffler (2000) use Chairman's Statement to predict firm bankruptcy.

[27] For example, Clatworthy and Jones (2003) argue that accounting narratives such as UK Chairman's Statement allow "management" to describe corporate financial performance. Clatworthy and Jones (2006) also argue that managers tend to "elaborate on positive financial performance in the Chairman's Statement".

all, firms. It is extremely difficult for our empirical analysis to capture this type of heterogeneity because it is not feasible to investigate how each individual firm prepares their Chairman's Statement.[28] To summarise, the words-based measures broadly reflect the confidence level of senior managers. In what follows, we introduce action-based measures which more precisely capture the confidence level of individual directors.

3.2.3. Action-Based Measure of Overconfidence: Net Purchase Ratio (NPR)

Our third measure of overconfidence is based on the extent of directors' trading of their own firms' shares. The directors' trading patterns may reflect their perceptions about the prospects of their firms existing projects and future investment opportunities (Jenter, 2005). Overconfident managers tend to overestimate their firms' value and, hence, are more willing to purchase their own firms' stocks. This trading behaviour can be considered as managers' market timing in their personal portfolios. In the spirit of Malmendier and Tate (2005), Jenter (2005) and Jin and Kothari (2008), we use directors' trading-based measure of managerial overconfidence. In particular, we construct the valued-based and volume-based net purchase ratio (NPR) using the value and volume of open market purchases and sales respectively as follows: $NPR_{it} = (Buy_{it} - Sell_{it})/(Buy_{it} + Sell_{it})$, where, NPR_{it} is the value-based (or volume-based) NPR of directors of firm i in fiscal year t. Buy_{it} is the aggregate value (or volume) of insider purchases and $Sell_{it}$ is the aggregate value (or volume) of insider sales. Besides, the value-based and volume-based NPRs for individual directors including Chairman, CEO and CFO are also constructed. The NPR lies in the interval [-1, 1], with higher NPR indicating higher managerial overconfidence.

[28] To address this concern, we conduct some supplementary tests to check whether the Chairman's Statement reflects the beliefs of other members of the board of directors. We choose a random subsample of 300 annual reports from our main sample. We require that these reports have both Chairman's Statement and CEO's review available in them. We then examine whether the language dimensions constructed based on those two statements are similar. We find that pairwise correlation coefficients of the following variables: OPTIMISM (0.23), TONE_LM (0.43), NET EMOTION (0.46) and the tone index, TONE (0.49), I (0.24) and WE (0.45) are all statistically significant at 1% level. In addition, we investigate whether language used in CEO's review has a significant effect on the language used in Chairman's Statement. We regress language dimensions of Chairman's Statement on their counterparts constructed based on CEO's review. As expected, all language dimensions constructed based on CEO's reviews have positive and statistically significant impacts on those based on Chairman's Statement. Overall, based on the existing literature and on our supplementary tests, we assume that the measures based on the Chairman's Statement are good, albeit imperfect, proxies for managerial overconfidence.

3.3. Estimation Methods

Regarding estimation methods, we initially estimate our empirical model using pooled OLS, fixed effects and random effects estimators. Several diagnostic tests are conducted to decide which estimator is more suitable. First, the Breusch-Pagan Lagrange Multiplier (LM) test favours random effects against the pooled OLS. Hausman test is then conducted to decide between random effects and fixed effects estimators, which suggests that fixed effects estimator is superior. These two tests indicate that the fixed effects estimator seems to be more appropriate. Our discussion therefore focuses on the fixed effects estimation results. Furthermore, as robustness checks, we use random effects Tobit (RE-Tobit) estimator because our dependent variable, debt maturity ratio, is bounded between zero and one. In addition, following previous studies on debt maturity (e.g., Datta et al., 2005), we also use 2SLS regression where leverage and debt maturity are simultaneously determined.

3.4. The Sample

This study uses data from the following sources. The UK firms' financial data is obtained from Thomson Worldscope database. Directors' trading data is sourced from Hemmington Scott database. Chairman's Statements are manually collected from the company annual reports, which are downloaded either through Northcote website or directly from company websites. Our sample of unbalanced panel data is constructed as follows. The selection of sample period is guided by data availability. All financial and utility firms and firm observations with missing financial data are excluded. Firms in our sample must have at least three consecutive annual observations to examine the role of time-varying words-based overconfidence.

To construct words-based measures of overconfidence, we require the digital version of the UK company annual reports, so that the Chairman's Statement can be readable by the content analysis software (i.e. LIWC 2007 and Diction 6).[29] In addition, to construct insider trading-based measure of overconfidence, only those firms with insider transactions (i.e. open market purchases and/or sales) for at least three consecutive years are selected. Besides the NPRs of executive and non-executive

[29] In terms of the procedure of content analysis, we first extract Chairman's Statements from annual reports. Next, we detect transformation errors in the combined text file using the Spelling & Grammar function in Microsoft Word 2010. Finally, various types of errors (examples are available upon request) are corrected before the texts are inputted in the LIWC 2007.

directors, we also construct the NPR of individual directors including Chairman, CEO and CFO. Those directors with joint positions (e.g., CEO duality) or without job title information are excluded from our sample.[30] All the NPRs are constructed according to firms' fiscal year end. In terms of initial sample sizes and the impacts of various data filters, for financial and accounting information we obtain a list of UK public firms (3,318 firms) from Worldscope. A list of firms (2,024 firms) with insider trading data is from Hemmington Scott. We exclude financial and utility firms. We then merge the above two datasets using the SEDOL. The merged dataset includes 1,099 firms. Firms with less than three consecutive years' data are dropped and the sample size is reduced to 290 firms. Firms without machine-readable Chairman's Statements are also excluded. Firm-years with digital annual reports before the year 2000 are limited and are therefore excluded. To eliminate the effect of extreme values, all independent variables are winsorized at the 1st and 99th percentiles. The final sample comprises 192 firms and 865 firm-year observations over the period of 2000-2010.[31]

3.4.1. Descriptive Statistics

Table 1 Panel A shows descriptive statistics of our main variables. The mean of the debt maturity ratio (LTD/TD) is 0.664. The means of first person singular (I) and plural (WE) pronouns are 0.432 (percent of total words) and 2.743 (percent of total words) respectively. The total percentage of first person pronouns is therefore 3.175. This figure is much higher than the percentage of first person pronouns in the MD&A (i.e. 1.27) in Li (2010a). This could be attributed to the fact that the MD&A is more heavily regulated and subject to auditor's examination (Li, 2010a) while the Chairman's Statement is unaudited. From this perspective, Chairman's Statement seems to be a more suitable type of financial narrative from which to measure overconfidence. The mean of Henry's (2008) tone measure, Tone_H (mean= 0.705), is higher than that of Loughran and McDonald's (2011) tone measure, Tone_LM (mean= 0.545). This is because Loughran and McDonald's (2011) wordlist includes a more comprehensive list of negative words than that of Henry (2008). For the insider trading-based measure

[30] Due to data availability, the tests of the roles of the NPR of individual directors are based on a smaller sample.
[31] The Hemmington Scott database provides insider trading data from 1994. However, our sampling procedure ends up with very few observations between 1994 and 1999. That is why our sample period starts in 2000.

of overconfidence, on average, the NPRs of Chairman are the highest, while CEOs' NPRs are much lower compared with those of Chairman and CFO.

3.4.2. Correlation Analysis

Table 1 Panel B shows the correlation matrix with main variables. The first person pronouns, i.e. I and WE, are positively correlated. Both I and WE are positively correlated with most tone measures. Most of the tone measures (except Certain2) are positively correlated with each other. For example, Optimism is positively correlated with all other tone measures. Regarding the correlations between various NPRs, we find that (1) value-based and volume-based NPRs of the same individual are highly correlated, (2) the correlation between the NPRs of CEO and CFO is also high and (3) the correlation between the NPRs of Chairman and those of CEO is relatively low, while the correlation between Chairman and CFO is even lower. These correlation coefficients suggest that Chairman's trading activities are not perfectly consistent with CEO and especially CFO. In untabulated correlation analysis, we find positive and statistically significant relations between the debt maturity ratio and several independent variables including firm size, asset maturity, leverage and price performance, which is consistent with the theoretical predictions. Both I and WE are positively related to price performance.[32]

[Insert Table 1 here]

4. EMPIRICAL RESULTS

4.1. Managerial Overconfidence and Debt Maturity

This section presents empirical evidence on the impact of the level of overconfidence on the level of debt maturity. More specifically, we examine the effects of two words-based measures of overconfidence: first person pronouns and optimistic tone.

[32] Stock price is found to be interrelated with the presence of the self-attribution. Staw et al. (1983) document that good prior stock performance may lead to more enhancing attributions, followed by subsequent stock price increases.

4.1.1. The Role of First Person Pronouns

Table 2 (Panel A) examines the impact of first person pronouns (I and WE), as proxies for managerial overconfidence, on debt maturity. The coefficient estimates on the first person singular pronouns (I) are positive and statistically significant (p-value=0.027) in fixed effects regressions. This evidence is consistent with the hypothesis 1 that overconfidence has a positive effect on debt maturity. Results for the first person plural pronouns (WE) are more mixed. We find the coefficient estimate on WE is positive but statistically insignificant. The economic significance of the WE coefficient is also modest. The stronger results for I compared to WE likely reflects that I is positively associated with narcissism but WE is negatively associated with narcissism which contributes to overconfidence (Chatterjee and Hambrick, 2007). Although the effect of WE is insignificant in the full sample, we find, in untabulated tests, that the positive effect of WE on debt maturity is statistically significant at 10% level (p-value=0.058) for firm-year observations with below-median leverage but remains insignificant for other observations with above-median leverage. This finding is consistent with hypothesis 4 that high leverage weakens the positive effect of managerial overconfidence on debt maturity. We further test and discuss the moderating role of leverage in Section 4.3.2.

Next, by taking a closer look at the distribution of I and WE, we find that some firms do not use first person (especially singular) pronouns in their Chairman's Statement. Over 20% of I in our sample are zero. More importantly, those zero values of I tend to be in consecutive years, in which case there is no within-firm variation in the number of I used. Therefore, excluding firm-years with zero I from the sample will make the fixed effects estimator perform better. As expected, the positive coefficient on I_NON-ZERO is highly significant at 1% level (p-value=0.004) after excluding firm-years with zero I. In addition, around 8% of WE in our sample are zero. We also exclude those firm-years with zero WE. However, the relation between WE_NON-ZERO and debt maturity is still insignificant. To conclude, the highly significant positive effect of I_NON-ZERO on debt maturity provides strong support for the hypothesis of positive overconfidence-debt maturity relation (hypothesis 1).

To sum up, the positive and significant effects of I (model 1), Ln (I+1) (model 3) and I_NON-ZERO (model 5) on debt maturity support the prediction of the positive effect of overconfidence hypothesis (hypothesis 1). These findings are consistent with overconfidence being beneficial from

long-term debt-holders' perspective because overconfidence can ameliorate the agency cost of debt (Hackbarth, 2009). Thus, consistent with our hypothesis 1 overconfident managers have a longer debt maturity than realist managers.

[Insert Table 2 here]

4.1.2. The Role of Optimistic Tone

Table 2 (Panel B) examines the impacts of various measures of optimistic tone of Chairman's Statement on debt maturity. Considering that the tone-debt maturity relation might be potentially driven by unobserved time-invariant firm fixed effects, we present results from fixed effects estimators. Panel B shows that the coefficient estimates on all individual and composite tone measures are positive but statistically insignificant. However, in untabulated pooled OLS regressions (available upon request), OPTIMISM and TONE_LM have positive and statistically highly significant impacts on debt maturity (p-value=0.004 and 0.028 respectively). In addition, the coefficients on two composite tone indices, TONE and TONE_RES, are also positive and statistically highly significant at 1% level (p-value=0.002 and 0.001 respectively) without controlling for unobserved heterogeneity. Taken together, the positive tone-debt maturity relation is statistically highly significant in the OLS regressions but appears to be insignificant after controlling for firm fixed effects in the fixed effects regressions. This observation indicates the existence of managerial fixed effects that may drive firm policies as documented in Bertrand and Schoar (2003). Furthermore, Davis et al. (2015) find that the tone of earnings conference calls is also influenced by managerial "style" (i.e. manager-specific factors such as gender and early career experiences). To conclude, the positive tone-debt maturity relation seems to be driven by firm/managerial fixed effects. The implication of this observation is that it is important to control for firm fixed effects when examining the effect of tone on firm policies.

4.2. Change in Managerial Overconfidence and Change in Debt Maturity

Prior behavioural corporate finance literature focuses primarily on static overconfidence measures. Recall that overconfidence can vary over time because of self-attribution bias, thus time-variations in managerial overconfidence are potentially extremely important. However, static overconfidence

measures predominate in the behavioural corporate finance literature. Malmendier and Tate's (2005, 2008) option-based and press-based overconfidence measures are widely used, both of which are static measures. Graham et al. (2013) examine the relation between static survey-based overconfidence measure and debt maturity. Landier and Thesmar (2009) find that their survey-based optimism measure (i.e. expectation errors) tend to persist over the two time periods (i.e. year 1994 and 1998) they examine and do not provide evidence on the effect of changes of optimism on debt maturity. Thus, the effect of time-variation in overconfidence is largely under-researched.

In this section, we examine the effect of change in overconfidence on the change in debt maturity.[33] This is an important and novel extension of the existing literature on behavioural corporate financing. We need time-varying measures of overconfidence, such as the words-based measures examined in this paper to conduct this analysis. We can therefore shed new light on the question: how sensitive are changes in debt maturity to changes in overconfidence?

In Table 3, we examine the changes of words-based overconfidence measures on the change in debt maturity using OLS regressions with first differenced data. Consistent with our main result in Table 2 that I has a significantly positive effect on debt maturity, Δ I also has a positive and highly significant effect (p-value=0.011) on the change of debt maturity. In addition, we find that the changes in several tone measures, including Δ TONE_LM and Δ TONE_RES, have positive and statistically significant impacts on the change in debt maturity (p-value=0.078 and 0.100 respectively).[34] In brief, the above evidence shows that the increase in the level of words-based managerial overconfidence is significantly associated with increase in debt maturity. This observation supports the agency cost hypothesis of a positive relation between overconfidence and debt maturity **(**hypothesis 1**)**. More broadly, we provide new and novel evidence that time-variation in managerial overconfidence can have an important impact on corporate financing; thus the impact of time-variation in managerial overconfidence in other corporate finance contexts would be a fertile line for future research.

[Insert Table 3 here]

[33] Words-based overconfidence measures (including first person pronouns and especially tone measures) are quite volatile. Specifically, for example, the within, between and overall standard deviation of Tone_LM are 0.216, 0.195 and 0.290 respectively and the mean and standard deviation of the yearly average of Tone_LM are 0.533 and 0.084 respectively.

[34] The NPRs display relatively little time variation and hence we do not report the impact of a change in NPR here. For example, over 60% of the NPRs take the value of one.

4.3. Further Analysis of the Moderating Effects of Managers' Identity, Investment Opportunities and Leverage

4.3.1. The Role of NPRs of Chairman, CEO and CFO

This section is motivated by the fact that directors have different core duties (Malmendier and Zheng, 2012). Most existing studies focus on biased beliefs of CEOs. This is because CEO is often considered as the key corporate decision maker (Graham et al., 2013). On the other hand, Ben-David, Graham, and Harvey (2013) document that CFO's biased beliefs also have significant influence on various corporate policies. Malmendier and Zheng's (2012) empirical analysis suggests that CEO's have most influence upon investment decisions, while CFO has a greater effect on equity issuance. If the positive overconfidence-debt maturity relation is driven by reducing the agency cost of debt (i.e. underinvestment problem) then the overconfidence of director who has greatest influence over investment decisions, the CEO, should play a more significant role in increasing debt maturity.

Table 4 reports the results regarding the impact of NPRs of Chairman, CEO and CFO on debt maturity. The coefficients on both value-based and volume-based NPRs of CEO are significantly positive (p-value=0.062 and 0.076 respectively). However, the NPRs of CFO are insignificant. The NPRs of Chairman are also insignificant, which is perhaps not surprising considering that most UK Chairmen are non-executive directors. These results suggest that the Chairman's Statement in the annual reports does not only reflect Chairman's overconfident belief but also that of senior managers, especially the CEO[35]; this interpretation is consistent with prior research (Clatworthy and Jones, 2003, 2006). The positive significant relation found for the CEO (only) is consistent with hypothesis 2 that the overconfidence of CEOs, who have a greater influence upon investment policy (Malmendier and Zheng, 2012), has a more significant and positive effect on debt maturity.[36]

However, one may argue that the insider trading activities may reflect directors' private information, meaning that insiders with positive private information tend to purchase more their own

[35] The results for CEO are positive (consistent with all words-based measures) and significant (consistent with some words-based measures), while the results for CFO and Chairman do not have the same sign as those for the words-based measures.
[36] In unreported results we examined the NPRs of all the executive directors. These results confirm a positive relation between executive directors' overconfidence and debt maturity supporting hypothesis 1.

firm's shares and are reluctant to sell, which in turn increases the NPR. However, this alternative interpretation is not consistent with our empirical results. Based on the signalling model, managers will signal the quality of their firms by issuing short-term debt (Flannery, 1986). In this case, managers with positive private information, as indicated by high NPR, should use more short-term debt. This prediction, from the signalling model, is contradicted by the observed positive and significant relation between the NPRs of CEO and debt maturity. Thus, we tentatively suggest our evidence based on NPRs of CEO is not driven by private information.

[Insert Table 4 here]

4.3.2. The Moderating Effects of Investment Opportunities and Leverage

We perform subsample analysis to examine the sensitivity of overconfidence-debt maturity relation to several firm characteristics. The goal here is to examine if there is further support for the agency cost of debt mechanism that we hypothesise to have been driving the observed positive relation between overconfidence and debt maturity. Table 5 presents subsample analysis where the full sample is split into two subsamples based on measures of investment opportunities (market-to-book value of asset and market-to-book value of equity) and a measure of long-term debt capacity (leverage). This subsample analysis can shed light on the underlying mechanisms of the overconfidence-debt maturity relation by looking at the sensitivity of overconfidence-debt maturity relation to the above firm characteristics. Our subsample analysis focuses on three overconfidence measures: first person singular pronouns (I) and the NPRs of CEO (CEO_VA and CEO_VOL) which have positive and significant impacts on debt maturity in our main tests in Table 2 and 4 respectively.

Market-to-book value: Firms with more investment opportunities, as indicated by higher market-to-book value of asset or equity, have more severe agency problem of underinvestment (i.e. debt overhang). Put differently, the fewer investment opportunities, the less severe the potential conflict over the exercise of those investment options. If overconfidence influences debt maturity through the agency channel, we expect that the overconfidence-debt maturity relation will be stronger for high growth firms which are associated with more underinvestment problem. Consistent with hypothesis 3, Table 5 shows that the coefficients on both I and NPRs of CEO are more significant for firms with

higher market-to-book value of asset. These results are generally robust to an alternative measure of investment opportunities that is market-to-book value of equity.

Leverage: If a firm's leverage is high, according to trade-off theory of capital structure, the firm will be reluctant to use more debt. In other words, only firms with relatively low leverage will use debt and thus have to make debt maturity decision. Consistent with hypothesis 4, the positive overconfidence-debt maturity relation is found to be stronger for firms with lower leverage (see Table 5). Thus, we find that the overconfidence-debt maturity relation is intensified for firms that do not face long-term debt capacity constraints.

To summarise, our major finding is that the effect of managerial overconfidence is stronger when the firm has high growth opportunities. This supports our main agency cost hypothesis (that builds on the timing effect from Hackbarth's (2009) model), which posits that managerial overconfidence can reduce underinvestment problem, in a novel scenario where the underinvestment problem is exacerbated, i.e. for firms with more growth opportunities. In addition, high leverage makes firms less likely to use debt, which in turns weakens the positive overconfident-debt maturity relation.

[Insert Table 5 here]

4.4. Can Other Agency Problems Be Alternative Explanations?

As discussed in section 2.2.3, if the positive relation between managerial overconfidence and debt maturity can be explained by the risk-shifting problem, we expect that this positive relation is stronger for firms with higher risk-shifting incentives as indicated by deteriorating firm performance (hypothesis 5). Inconsistent with this hypothesis, Table 6 shows that the positive coefficients on overconfidence measures are generally stronger for better-performing firms with higher abnormal earnings (Panel A), higher average sales growth in the past five years (Panel B), and higher price performance (Panel C).

In addition, based on section 2.2.3, the positive relation between managerial overconfidence and debt maturity may also be explained by the overinvestment problem if we find that managerial overconfidence significantly increases leverage. However, inconsistent with hypothesis 6, we do not find significantly positive associations between our managerial overconfidence measures and leverage.

In results, available upon request, only the NPR-based overconfidence measures have positive but insignificant effects on leverage, while all the word-based overconfidence measures have negative effects on leverage. This finding is not surprising because overconfident managers may use debt conservatively (Malmendier, Tate and Yan, 2011). Overall, the above analysis suggests that neither risk-shifting nor overinvestment can explain the positive overconfidence-debt maturity relation.

[Insert Table 6 here]

4.5. Robustness Tests

We conduct a series of robustness tests in Table 7 based on alternative debt maturity measures, overconfidence measures, estimation methods, and controlling for ownership structure.

Alternative debt maturity measures: First, we attempt to construct an alternative debt maturity measure using more detailed long-term debt data, including debt that matures in greater than five years and less than 10 years (WC18284) and debt that matures in greater than ten years (WC18285). These two data items have been unfortunately discontinued by the Worldscope and are only available up to 2004. We create an alternative debt maturity measure, also used in the early UK studies (e.g., Ozkan, 2000), namely LTD5/TD. LTD5/TD is the ratio of debt that matures in over five years to total debt. In Panel A (models 1-4) of Table 7, we examine the effect of managerial overconfidence on LTD5/TD over the subperiod 2000-2004. The coefficients on first person singular pronouns (I) and CEO_VA and CEO_VOL are positive and statistically significant. In addition, in models 5-8, we use the ratio of long-term liabilities to total liabilities (LTL/TL) as an alternative measure of debt maturity and find consistent results. Thus, the positive relation between managerial overconfidence and debt maturity is robust to the alternative measures of debt maturity.

Alternative overconfidence measures: In untabulated tests (available upon request), we regress debt maturity on binary variables based on first person singular pronoun (I) and net purchase ratios (NPRs) of CEO. I_DUMMY is coded as 1 if I is in the top decile and 0 otherwise. CEO_NPD is net purchase dummy which takes the value of 1 if the NPRs of CEO are above zero and 0 otherwise. Consistent with our main findings, I_DUMMY has a positive and significant effect (p-value=0.053) on debt maturity in fixed effects regressions. In addition, the coefficients on CEO_NPD are positive and

statistically significant at 5% level. Therefore, the positive relation between overconfidence and debt maturity is robust to alternative measures of I and NPRs of CEO.

Alternative estimation methods: First, to address a potential endogeneity concern that debt maturity and leverage may be jointly endogenous variables, following Datta et al. (2005) we conduct the two-stage least squares (2SLS) regression analysis where these two variables are simultaneously determined. Specifically, we control for the predicted leverage, estimated from the first-stage regression, in the second-stage regression where the dependent variable is debt maturity. Consistent with the results from the fixed effects regressions, the positive coefficients on our main overconfidence measures are still significant in the second stage of 2SLS in models 1-4 of Panel B. Second, we use RE-Tobit estimator because the debt maturity ratio is bounded between zero and one.[37] We also find consistent results from the RE-Tobit regressions in models 5-6 of Panel B.[38]

Controlling for ownership structure: A potential limitation of our empirical analysis so far is that we do not incorporate any direct measure of corporate governance, although any time-invariant governance characteristics are controlled using the fixed effects estimator. We use two measures of ownership structure as additional control variables.[39] We first control for insider ownership concentration, constructed as the number of closely-held shares (CHS) as a percentage of total common shares outstanding. Worldscope defines the CHS as shares held by insiders (e.g. directors, firms and individual investors) (see Appendix A for the detailed definition). The CHS is an important component of the FTSE Institutional Investor Services (ISS) Corporate Governance Index. Doidge, Karolyi and Stulz (2007) document that insider ownership has a significantly negative effect on the quality of governance practices. Controlling for insider ownership, models 1-4 of Panel C show that the coefficients on various managerial overconfidence measures are still positive and significant.

[37] The RE-Tobit is estimated using Gauss-Hermite quadrature and our results are robust to quadrature sensitivity. We use the "quadchk" command to check whether the coefficients change substantially using different numbers of integration points.

[38] In untabulated tests, we use two-step system-GMM to address potential endogeneity concerns. Specifically, we examine a dynamic model where we control for the lagged debt maturity. The coefficients on the lagged debt maturity are around 0.35 and statistically significant, suggesting that the adjustment speed of debt maturity is reasonably high. Consistent with our previous results, the coefficients on two overconfidence measures, I and VA_CEO are positive and statistically significant at 10% level. However, the Sargan tests reject the validity of our internal instruments. Furthermore, as pointed out by Roodman (2009), the GMM results should be aggressively tested for sensitivity to different numbers of instruments. Unfortunately, our GMM results also seem to be sensitive to different lag structures.

[39] A detailed examination of the effects of a comprehensive set of corporate governance variables is beyond the scope of this study. Future study may attempt to examine the implications of other corporate governance variables, including various board characteristics.

Second, we control for managerial ownership, defined as the percentage of shares held by executive directors, which is constructed based on the ownership data from the Hemmington Scott insider trading database. We do not include both insider ownership and managerial ownership in the same regression simply because insider ownership also captures the shares held by firm directors. Datta et al. (2005) argue that managerial ownership helps align the interests of managers and shareholders and thus is relevant to debt maturity decision. Models 5-6 of Panel C show that the positive effect of managerial overconfidence, as measured by I, on debt maturity is robust to the inclusion of managerial ownership. In addition, controlling for CEO ownership in untabulated tests, the positive coefficient on I is also statistically significant at 5% level (p-value=0.044).

[Insert Table 7 here]

5. CONCLUSIONS

This study examines the impact of managerial overconfidence on corporate debt maturity. We argue that managerial overconfidence can mitigate the agency cost of long-term debt, especially the Myers (1977) underinvestment problem, by aligning managers' and debt-holders' preferences over the firm's future investments. This is based on Hackbarth's (2009) model that overconfident managers invest more and earlier than rational managers; therefore they are less likely to underinvest. Based on this argument, we hypothesise that overconfidence increase debt maturity. Our study is thus different from Huang et al. (2016) which suggest that the managerial overconfidence decreases debt maturity from the information asymmetry perspective. We also contribute to the literature by developing and using time-varying overconfidence measures, which is important since attribution bias (see Miller and Ross, 1975; Daniel et al., 1998) is a clear mechanism through which overconfidence is likely to be time-varying and it also makes it much easier to control for firm fixed effects.

There are three major findings, supporting the agency cost of debt hypothesis of a positive overconfidence-debt maturity relation (hypothesis 1). First, we confirm that there is in general a positive relation between overconfidence and debt maturity using a wide range of time-varying overconfidence measures and especially for changes in overconfidence. For example, first person

singular pronouns (I) has a significant and positive impact on debt maturity. In addition, first person plural pronouns (WE) has a significantly positive effect on debt maturity for firms with below-median leverage. Our findings related to the first person pronouns are consistent with previous US evidence (Li, 2010a). Furthermore, we find that the changes in I and several tone measures have positive and significant effects on the changes in debt maturity. Second, we examine the role of different directors' overconfidence. If the agency cost hypothesis holds, we anticipate the overconfidence of the director who has most impact on investment decisions, i.e. CEO, to be crucial. Consistent with this conjecture (hypothesis 2), we find that only the net purchase ratios (NPRs) of CEOs, as a proxy for CEO overconfidence, have significantly positive effects on debt maturity.

Third, we examine a scenario where the underinvestment problem is exacerbated. Consistent with hypothesis 3, we generally find the positive overconfidence-debt maturity relation is intensified for firms with potentially high underinvestment problem as indicated by high investment opportunities. This evidence further supports our agency cost hypothesis that underinvestment problem is the underlying channel through which managerial overconfidence increases debt maturity. In addition, we examine the moderating role of financial leverage, consistent with hypothesis 4, we find that the positive relation between managerial overconfidence, as measured by I, WE, and CEO NPRs respectively, and debt maturity are statistically and economically more significant for firm-year observations with below-median leverage, mainly because low-leverage firms are more able to issue long-term debt. Our further analysis suggests that neither agency issues of risk-shifting (hypothesis 5) nor overinvestment (hypothesis 6) are the main channels generating the positive relation between overconfidence and debt maturity. Instead, this study, overall, supports the view that managerial overconfidence reduces the agency cost of debt associated with the underinvestment problem. Thus, managerial overconfidence can have a positive effect. Future study may examine the effect of managerial overconfidence on the cost of debt. Moreover, our study emphasizes the importance of controlling for firm fixed effects when examining the effect of managerial overconfidence on corporate policies, in which case a time-varying overconfidence measure is particularly useful.

Table 1 Summary statistics and correlation matrix

Panel A presents the descriptive statistics of the main dependent and independent variables. Panel B shows Pearson correlation coefficients between selected variables (Note: a complete correlation matrix including all variables is available upon request).

Panel A: Summary statistics

Variable	Obs.	Mean	Median	Std. Dev.	Min.	Max.
I	865	0.432	0.310	0.453	0.000	3.430
WE	865	2.743	2.730	1.738	0.000	8.400
Net emotion	865	0.731	0.749	0.166	0.069	1.000
Certain1	865	0.991	0.920	0.418	0.000	3.270
Optimism	865	53.334	53.140	2.141	41.080	72.420
Certain2	865	45.606	46.000	3.284	22.550	54.530
Tone_H	865	0.705	0.754	0.241	-1.000	1.000
Tone_LM	865	0.545	0.575	0.296	-1.000	1.000
TONE	865	-0.000	0.192	1.611	-6.560	5.947
VA_CH	448	0.592	1.000	0.778	-1.000	1.000
VA_CEO	445	0.456	1.000	0.836	-1.000	1.000
VA_CFO	407	0.547	1.000	0.795	-1.000	1.000
VOL_CH	448	0.642	1.000	0.709	-1.000	1.000
VOL_CEO	445	0.498	1.000	0.791	-1.000	1.000
VOL_CFO	407	0.603	1.000	0.733	-1.000	1.000
LTD/TD	865	0.664	0.758	0.300	0.000	1.000
Tax	865	0.211	0.266	0.391	-1.717	2.046
Abnormal earnings	865	0.048	0.011	0.323	-0.858	1.917
Firm size	865	12.148	12.125	1.821	8.446	17.132
Liquidity	865	1.484	1.285	0.931	0.376	6.063
M/B asset	865	1.525	1.323	0.738	0.553	4.691
Asset maturity	865	9.388	6.659	11.041	1.318	95.028
Earnings volatility	865	0.114	0.060	0.212	0.003	3.183
Leverage	865	0.208	0.196	0.144	0.002	0.620
Price performance	865	-0.034	0.059	0.563	-1.911	1.213

Panel B: Pairwise correlation matrix (selected variables)

Variable	1	2	3	4	5	6	7	8	9
1. I	1								
2. WE	0.104	1							
3. Net emotion	0.128	0.101	1						
4. Certain1	0.177	0.088	0.145	1					
5. Optimism	0.183	0.112	0.445	0.246	1				
6. Certain2	0.044	0.019	-0.044	0.127	0.063	1			
7. Tone_H	-0.021	0.057	0.458	0.047	0.372	-0.025	1		
8. Tone_LM	0.071	0.072	0.612	0.097	0.520	-0.022	0.670	1	
9. TONE	0.126	0.112	0.788	0.261	0.728	0.004	0.774	0.881	1
10. VA_CH	0.053	-0.053	-0.110	0.050	-0.093	-0.014	-0.064	-0.077	-0.100
11. VA_CEO	0.032	-0.052	-0.068	-0.071	-0.116	0.005	-0.133	-0.139	-0.147
12. VA_CFO	0.051	-0.056	-0.081	-0.001	-0.020	-0.083	-0.083	-0.127	-0.098
13. VOL_CH	0.089	-0.042	-0.097	0.063	-0.065	0.004	-0.065	-0.071	-0.085
14. VOL_CEO	0.029	-0.041	-0.041	-0.071	-0.119	-0.030	-0.124	-0.129	-0.134
15. VOL_CFO	0.054	-0.075	-0.069	0.008	-0.027	-0.089	-0.096	-0.126	-0.099
16. LTD/TD	-0.000	0.044	0.092	0.086	0.116	0.002	0.046	0.076	0.109

Variable	10	11	12	13	14	15	16
10. VA_CH	1						
11. VA_CEO	0.477	1					
12. VA_CFO	0.401	0.763	1				
13. VOL_CH	0.951	0.505	0.405	1			
14. VOL_CEO	0.498	0.958	0.758	0.527	1		
15. VOL_CFO	0.432	0.756	0.959	0.446	0.788	1	
16. LTD/TD	-0.035	-0.032	-0.043	-0.009	-0.009	-0.033	1

Table 2 Words-based measures of overconfidence and debt maturity

This table presents regressions of debt maturity measure on first person pronouns (Panel A) and various tone measures of Chairman's Statement (Panel B) and control variables, as defined in Appendix A. The dependent variable is the ratio of long-term debt to total debt (i.e. LTD/TD). All the models are estimated using fixed effects (FE). p-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

Panel A: The effects of first person pronouns on debt maturity

Variable	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE
I	0.046**					
	[0.027]					
WE		0.003				
		[0.686]				
Ln(I+1)			0.071*			
			[0.066]			
Ln(WE+1)				0.021		
				[0.386]		
I_NON-ZERO					0.051***	
					[0.004]	
WE_NON-ZERO						-0.002
						[0.786]
Tax	-0.007	-0.008	-0.008	-0.008	-0.010	-0.010
	[0.631]	[0.598]	[0.624]	[0.596]	[0.563]	[0.530]
Abnormal earning	-0.008	-0.005	-0.008	-0.005	0.012	0.001
	[0.745]	[0.846]	[0.771]	[0.853]	[0.732]	[0.971]
Firm size	0.058**	0.058**	0.059**	0.058**	0.057	0.058*
	[0.040]	[0.037]	[0.038]	[0.039]	[0.106]	[0.064]
Liquidity	0.144***	0.144***	0.144***	0.145***	0.139***	0.154***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
M/B asset	0.006	0.005	0.006	0.006	0.023	0.011
	[0.748]	[0.782]	[0.762]	[0.762]	[0.401]	[0.625]
Asset maturity	-0.000	-0.000	-0.001	-0.001	-0.001	-0.001
	[0.823]	[0.827]	[0.806]	[0.801]	[0.797]	[0.823]
Earnings volatility	0.094	0.092	0.094	0.092	0.074	0.087
	[0.170]	[0.176]	[0.169]	[0.178]	[0.252]	[0.222]
Leverage	0.353**	0.352**	0.349**	0.355**	0.394**	0.404**
	[0.018]	[0.020]	[0.020]	[0.018]	[0.017]	[0.013]
Price performance	0.030*	0.031*	0.031*	0.031*	0.009	0.027
	[0.068]	[0.058]	[0.066]	[0.059]	[0.612]	[0.114]
Constant	-0.358	-0.348	-0.369	-0.362	-0.380	-0.350
	[0.307]	[0.312]	[0.296]	[0.302]	[0.384]	[0.359]
Obs.	865	865	865	865	685	795
Firms	192	192	192	192	180	184
R^2	0.143	0.137	0.142	0.138	0.139	0.151

Table 2 - continued

Panel B: The effects of optimistic tone on debt maturity				
Variable	(1) FE	(2) FE	(3) FE	(4) FE
Optimism	0.003			
	[0.393]			
Tone_LM		0.021		
		[0.548]		
TONE			0.002	
			[0.708]	
TONE_RES				0.002
				[0.714]
Tax	-0.009	-0.009	-0.009	-0.009
	[0.605]	[0.588]	[0.599]	[0.597]
Abnormal earning	0.012	0.012	0.012	0.012
	[0.688]	[0.670]	[0.681]	[0.683]
Firm size	0.059**	0.059**	0.059**	0.059**
	[0.031]	[0.030]	[0.033]	[0.032]
Liquidity	0.146***	0.145***	0.145***	0.145***
	[0.000]	[0.000]	[0.000]	[0.000]
M/B asset	0.012	0.011	0.012	0.013
	[0.552]	[0.576]	[0.566]	[0.522]
Asset maturity	-0.001	-0.001	-0.001	-0.001
	[0.723]	[0.696]	[0.716]	[0.716]
Earnings volatility	0.071	0.072	0.072	0.072
	[0.229]	[0.218]	[0.223]	[0.223]
Leverage	0.358**	0.352**	0.352**	0.349**
	[0.028]	[0.030]	[0.031]	[0.031]
Price performance	0.020	0.020	0.020	0.022
	[0.211]	[0.236]	[0.223]	[0.181]
Constant	-0.560	-0.357	-0.342	-0.344
	[0.197]	[0.291]	[0.320]	[0.315]
Obs.	865	865	865	865
Firms	192	192	192	192
R^2	0.157	0.156	0.156	0.156

Table 3 Changes of words-based measures of overconfidence and change of debt maturity

This table presents regressions of change of debt maturity measure on the changes of first person pronouns and various tone measures of Chairman's Statement and control variables, as defined in Appendix A. The dependent variable is the change of ratio of long-term debt to total debt (i.e. Δ LTD/TD). All the models are estimated using first difference (FD) estimator (i.e. first-differenced data with OLS regression). p-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

Variable	(1) FD	(2) FD	(3) FD	(4) FD	(5) FD	(6) FD
Δ I	0.049**					
	[0.011]					
Δ WE		0.001				
		[0.841]				
Δ Optimism			0.004			
			[0.288]			
Δ Tone_LM				0.059*		
				[0.078]		
Δ TONE					0.010	
					[0.108]	
Δ TONE_RES						0.009*
						[0.100]
Δ Tax	0.011	0.010	0.009	0.009	0.008	0.008
	[0.424]	[0.489]	[0.484]	[0.491]	[0.521]	[0.533]
Δ Abnormal earnings	-0.010	-0.006	-0.005	-0.002	-0.002	-0.003
	[0.756]	[0.837]	[0.871]	[0.941]	[0.923]	[0.920]
Δ Firm size	-0.014	-0.011	-0.007	-0.012	-0.011	-0.010
	[0.835]	[0.864]	[0.907]	[0.847]	[0.857]	[0.864]
Δ Liquidity	0.161***	0.159***	0.160***	0.160***	0.160***	0.158***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Δ M/B asset	0.025	0.024	0.022	0.019	0.019	0.023
	[0.339]	[0.351]	[0.387]	[0.450]	[0.460]	[0.372]
Δ Asset maturity	0.001	0.001	0.000	0.000	0.000	0.000
	[0.787]	[0.854]	[0.868]	[0.916]	[0.888]	[0.886]
Δ Earnings volatility	0.075*	0.073*	0.071*	0.066*	0.066	0.065
	[0.077]	[0.087]	[0.089]	[0.096]	[0.102]	[0.104]
Δ Leverage	0.160	0.162	0.171	0.172	0.184	0.172
	[0.294]	[0.291]	[0.269]	[0.262]	[0.242]	[0.266]
Δ Price performance	-0.010	-0.009	-0.009	-0.013	-0.012	-0.004
	[0.569]	[0.618]	[0.600]	[0.461]	[0.504]	[0.781]
Constant	0.007	0.007	0.006	0.007	0.007	0.007
	[0.516]	[0.556]	[0.560]	[0.478]	[0.482]	[0.481]
Obs.	663	663	663	663	663	663
Firms	192	192	192	192	192	192
R^2	0.150	0.142	0.144	0.148	0.146	0.147

Table 4 Action-based measures of overconfidence and debt maturity

This table presents regressions of debt maturity measures on the NPRs of Chairman, CEO and CFO and control variables, as defined in Appendix A. The dependent variable is the ratio of long-term debt to total debt (i.e. LTD/TD). All the models are estimated using fixed effects (FE). p-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

Variable	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE
VA_CH	-0.016					
	[0.274]					
VA_CEO		0.032*				
		[0.062]				
VA_CFO			-0.015			
			[0.456]			
VOL_CH				-0.012		
				[0.505]		
VOL_CEO					0.037*	
					[0.076]	
VOL_CFO						-0.014
						[0.533]
Tax	-0.035	-0.014	-0.009	-0.035	-0.013	-0.009
	[0.199]	[0.556]	[0.666]	[0.202]	[0.563]	[0.657]
Abnormal earning	-0.030	-0.067	-0.067	-0.030	-0.068	-0.067
	[0.384]	[0.127]	[0.140]	[0.386]	[0.123]	[0.140]
Firm size	0.132***	0.065*	0.035	0.131***	0.063*	0.037
	[0.001]	[0.080]	[0.435]	[0.001]	[0.088]	[0.412]
Liquidity	0.157***	0.192***	0.185***	0.156***	0.193***	0.185***
	[0.000]	[0.000]	[0.004]	[0.000]	[0.000]	[0.004]
M/B asset	0.029	-0.021	0.010	0.031	-0.020	0.011
	[0.332]	[0.593]	[0.756]	[0.303]	[0.606]	[0.737]
Asset maturity	0.003	0.005	0.000	0.003	0.005	0.000
	[0.445]	[0.414]	[0.900]	[0.448]	[0.393]	[0.901]
Earnings volatility	0.040	0.050	0.219	0.040	0.050	0.221
	[0.355]	[0.332]	[0.299]	[0.365]	[0.321]	[0.301]
Leverage	0.118	0.595***	0.527**	0.119	0.592***	0.524**
	[0.490]	[0.007]	[0.017]	[0.491]	[0.008]	[0.017]
Price performance	0.018	0.052**	0.037	0.017	0.052**	0.037
	[0.501]	[0.040]	[0.141]	[0.504]	[0.044]	[0.142]
Constant	-1.257***	-0.540	-0.151	-1.245***	-0.517	-0.176
	[0.007]	[0.255]	[0.792]	[0.007]	[0.274]	[0.760]
Obs.	448	445	407	448	445	407
Firms	162	156	141	162	156	141
R^2	0.179	0.233	0.144	0.178	0.234	0.143

Table 5 The moderating effects of investment opportunities and leverage

This table presents regressions of debt maturity measures on first person pronouns and NPRs of CEO and control variables, as defined in Appendix A. Subsamples split based on the medians of market-to-book value of asset (Panel A), market-to-book value of equity (Panel B) and leverage (Panel C) are estimated to examine the impacts of the above firm characteristics on the overconfidence-debt maturity relation. All firm level control variables are included in all models but not reported to save space. The dependent variable is the ratio of long-term debt to total debt (i.e. LTD/TD). All the models are estimated using fixed effects (FE) or first difference (FD) estimator. p-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

	(1) FE	(2) FE	(3) FD	(4) FD	(5) FE	(6) FE	(7) FE	(8) FE
Panel A: M/B asset	High	Low	High	Low	High	Low	High	Low
I	0.055*	0.014						
	[0.095]	[0.634]						
Δ I			0.049**	0.069*				
			[0.030]	[0.052]				
CEO_VA					0.049**	0.018		
					[0.046]	[0.412]		
CEO_VOL							0.056*	0.018
							[0.069]	[0.445]
Controls	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.162	0.163	0.166	0.125	0.250	0.269	0.252	0.268
Obs.	433	432	321	342	209	236	209	236
Panel B: M/B equity	High	Low	High	Low	High	Low	High	Low
I	0.065*	0.057						
	[0.058]	[0.111]						
Δ I			0.060**	0.054*				
			[0.014]	[0.093]				
CEO_VA					0.048*	0.042**		
					[0.067]	[0.046]		
CEO_VOL							0.054*	0.042*
							[0.088]	[0.088]
Controls	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.179	0.146	0.159	0.133	0.321	0.238	0.322	0.237
Obs.	432	433	324	339	219	226	219	226
Panel C: Leverage	High	Low	High	Low	High	Low	High	Low
I	0.043	0.060**						
	[0.186]	[0.049]						
Δ I			0.045*	0.067**				
			[0.061]	[0.032]				
CEO_VA					0.008	0.066*		
					[0.619]	[0.070]		
CEO_VOL							0.011	0.067*
							[0.614]	[0.095]
Controls	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.389	0.088	0.322	0.073	0.404	0.205	0.405	0.203
Obs.	433	432	333	330	222	223	222	223

Table 6 Can the overconfidence-debt maturity relation be explained by the risk-shifting problem

This table presents regressions of debt maturity measures on first person pronouns and NPRs of CEO and control variables, as defined in Appendix A. Subsamples split based on the medians of abnormal earnings (a proxy for firm quality) in Panel A, average sales growth in the past five years in Panel B and price performance in Panel C are estimated to examine the impacts of the above firm characteristics on the overconfidence-debt maturity relation. All firm level control variables are included in all models but not reported to save space. The dependent variable is the ratio of long-term debt to total debt (i.e. LTD/TD). All the models are estimated using fixed effects (FE) or first difference (FD) estimator. p-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

	(1) FE	(2) FE	(3) FD	(4) FD	(5) FE	(6) FE	(7) FE	(8) FE
Panel A: Abnormal earnings	High	Low	High	Low	High	Low	High	Low
I	0.075*	-0.003						
	[0.059]	[0.927]						
Δ I			0.062**	0.052**				
			[0.039]	[0.048]				
CEO_VA					0.062**	0.011		
					[0.044]	[0.766]		
CEO_VOL							0.077**	0.014
							[0.030]	[0.745]
Controls	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.180	0.120	0.158	0.104	0.430	0.250	0.430	0.250
Obs.	432	433	330	333	229	216	229	216
Panel B: Average sales growth	High	Low	High	Low	High	Low	High	Low
I	0.072**	0.015						
	[0.040]	[0.579]						
Δ I			0.085***	0.029				
			[0.002]	[0.277]				
CEO_VA					0.031	0.031		
					[0.145]	[0.219]		
CEO_VOL							0.040	0.030
							[0.129]	[0.289]
Controls	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.140	0.190	0.138	0.162	0.350	0.200	0.350	0.290
Obs.	458	407	344	319	204	241	204	241
Panel C: Price performance	High	Low	High	Low	High	Low	High	Low
I	0.063*	0.013						
	[0.092]	[0.587]						
Δ I			0.081***	0.032				
			[0.001]	[0.278]				
CEO_VA					0.021	0.025		
					[0.263]	[0.415]		
CEO_VOL							0.019	0.026
							[0.389]	[0.410]
Controls	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.140	0.140	0.110	0.170	0.210	0.320	0.210	0.320
Obs.	432	433	335	328	216	229	216	229

Table 7 Robustness tests

This table presents various robustness tests. Panel A reports the effects of first person pronouns and NPRs of CEO respectively on two alternative measures of debt maturity. The dependent variable in models 1-4 is LTD5/TD defined as the ratio of debt that matures in more than five years to total debt. The dependent variable in models 5-8 is LTL/TL defined as the ratio of long-term liabilities to total liabilities. Models 1-4 are based on the subperiod 2000-2004 due to limited availability of LTD5/TD. Panel B reports the results from two alternative estimation methods. Specifically, models 1-4 use 2SLS where debt maturity and leverage are simultaneously determined and models 5-8 use RE-Tobit. Panel C controls for insider ownership in models 1-4 and managerial ownership in models 5-8. All other firm level control variables are included in all models but not reported to save space. The dependent variable is the ratio of long-term debt to total debt (i.e. LTD/TD) in both Panel B and C. All the models in Panel A and C are estimated using fixed effects (FE) or first difference (FD) estimator. p-values are given in parentheses. ***, **, and * indicate that coefficient is significant at 1%, 5%, and 10% levels, respectively.

Panel A: Alternative debt maturity measures								
	Dependent variable=LTD5/TD				Dependent variable=LTL/TL			
	(1) FE	(2) FD	(3) FE	(4) FE	(5) FE	(6) FD	(7) FE	(8) FE
I	0.066*				0.026**			
	[0.092]				[0.023]			
Δ I		0.029				0.031***		
		[0.102]				[0.001]		
CEO_VA			0.078***				0.034*	
			[0.006]				[0.055]	
CEO_VOL				0.089***				0.037*
				[0.006]				[0.066]
Controls	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.090	0.121	0.500	0.510	0.260	0.187	0.280	0.280
Obs.	231	144	99	99	865	663	445	445
Panel B: Alternative estimation methods								
	(1)-(4) 2SLS (second-stage regressions)				(5)-(8) RE-Tobit			
I	0.046**				0.034*			
	[0.029]				[0.090]			
Δ I		0.057***				0.085***		
		[0.009]				[0.004]		
CEO_VA			0.033*				0.031*	
			[0.075]				[0.052]	
CEO_VOL				0.038*				0.034**
				[0.062]				[0.047]
Controls	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.142	0.085	0.232	0.233				
Log likelihood					-36.42	-256.40	-33.74	-33.64
Obs.	865	663	407	407	865	663	445	445
Panel C: Controlling for ownership structure								
	(1) FE	(2) FD	(3) FE	(4) FE	(5) FE	(6) FD	(7) FE	(8) FE
I	0.047**				0.061*			
	[0.025]				[0.080]			
Δ I		0.060***				0.076***		
		[0.002]				[0.007]		
CEO_VA			0.032*				0.027	
			[0.066]				[0.236]	
CEO_VOL				0.036*				0.027
				[0.080]				[0.301]
Insider ownership	-0.000	-0.002*	0.000	0.000				
	[0.792]	[0.090]	[0.692]	[0.709]				
Managerial ownership					0.000	-0.001	0.007***	0.007***
					[0.824]	[0.624]	[0.002]	[0.002]
Controls	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.140	0.127	0.230	0.230	0.180	0.119	0.290	0.290
Obs.	863	661	445	445	436	287	223	223

Appendix A Variable definitions

Variables	Definition
Panel A: words-based measure of overconfidence: first person pronouns	
I	The percentage of first person singular pronouns in the Chairman's Statement
WE	The percentage of first person plural pronouns in the Chairman's Statement
Panel B: words-based measure of overconfidence: optimistic tone	
Net emotion	Positive emotion minus negative emotion including (anxiety, anger and sadness) as defined by LIWC
Certain1	Measure of certainty (e.g. always, never) as one aspect of cognitive processes as defined by LIWC
Optimism	[praise+satisfaction+inspiration]-[blame+hardship+denial] as defined by Diction
Certain2	[tenacity+leveling+collectives+insistence]-[numerical terms+ambivalence+self reference+variety] as defined by Diction
Tone_H	The ratio of (positive words-negative words) to (positive words+negative words), based on Henry's (2008) word lists. Examples of positive (negative) words are positive, success, improve, etc. (negative, fail, worsen, etc.).
Tone_LM	The ratio of (positive words-negative words) to (positive words+negative words), based on Loughran and McDonald's (2011) word lists. Examples of positive (negative) words are enhance, excellent, profitable, etc. (weak, poor, loss, etc.).
TONE	Composite tone index (see Section 3.2.2 for more descriptions)
TONE_RES	Orthogonalized tone index (see Section 3.2.2 for more descriptions)
Panel C: action-based measure of overconfidence: net purchase ratio (NPR), defined as the difference between insider purchases and sales divided by the sum of insider purchases *and sales of own firm's shares*	
VA_CH	The value-based net purchase ratio of Chairman
VA_CEO	The value-based net purchase ratio of CEO
VA_CFO	The value-based net purchase ratio of CFO
VOL_CH	The volume-based net purchase ratio of Chairman
VOL_CEO	The volume-based net purchase ratio of CEO
VOL_CFO	The volume-based net purchase ratio of CFO
Panel D: firm characteristics	
LTD/TD	The ratio of long-term debt that matures in more than one year to total debt
LTD5/TD	The ratio of long-term debt that matures in more than five years to total debt
LTL/TL	The ratio of long-term liabilities to total liabilities
Tax	The ratio of income taxes to pre-tax income
Abnormal earnings	The difference between next year's and this year's earnings per share, scaled by this year's stock price
Firm size	The natural logarithm of total assets
Liquidity	The ratio of current assets to current liability
M/B asset	The ratio of book value of total assets minus book value of equity plus market value of equity to book value of total assets
M/B equity	The ratio of market value of equity to book value of equity
Asset maturity	The ratio of net property, plant and equipment to depreciation expense
Earnings volatility	The standard deviation of the first difference in EBITD in the past five years (at least three years), scaled by the average book value of assets
Leverage	The ratio of book value of total debt to book value of total assets
Price performance	The difference of natural logarithm of fiscal year-end share prices
Average sales growth	The average sales growth rate in the past five years
Insider ownership	The number of closely-held shares (CHS) as a percentage of total common shares outstanding. Worldscope defines the CHS as shares held by insiders including senior corporate officers, directors and their immediate families; trusts; any other corporation; pension/benefit plans; individuals who hold 5% or more of shares outstanding.
Managerial ownership	The percentage of shares held by executive directors

References

Antoniou, A., Guney, Y. and Paudyal, K. (2006). The determinants of debt maturity structure: evidence from France, Germany and the UK, European Financial Management, Vol. 12, pp. 161-194.

Ackert, L. F. and Deaves, R. (2010). Behavioral Finance: Psychology. Decision-Making, and Markets.

Baker, M., Greenwood, R. and Wurgler, J. (2003). The maturity of debt issues and predictable variation in bond returns, Journal of Financial Economics, Vol. 70, pp. 261-291.

Barclay, M. J. and Smith, C. W. (1995).The maturity structure of corporate debt, Journal of Finance, Vol. 35, pp. 1223-1234.

Barclay, M. J., Marx, L. M. and Smith, Jr. C. W. (2003). The joint determination of leverage and maturity, Journal of Corporate Finance, Vol. 9, pp. 149-167.

Bartlett, S. A. and Chandler, R. A. (1997). The corporate report and the private shareholder: Lee and Tweedie twenty years on, British Accounting Review, Vol. 29, pp. 245–261.

Barnea, A., Haugen, R. A. and Senbet, L. W. (1980). A rationale for debt maturity structure and call provisions in the agency theoretic framework, Journal of Finance, Vol. 35, pp. 1223-1234.

Bertrand, M. and Schoar, A. (2003). Managing with style: The effect of managers on firm policies, Quarterly Journal of Economics, Vol. 118, pp. 1169-1208.

Ben-David, I., Graham, J. and Harvey, C. (2013). Managerial miscalibration, Quarterly Journal of Economics, Vol. 128, pp. 1547-1584.

Brick, I. E. and Ravid, S. A. (1985). The relevance of debt maturity structure, Journal of Finance, Vol. 40, pp. 1423-1437.

Campbell, T. C., Gallmeyer, M., Johnson, S. A., Rutherford, J. and Stanley, B. W. (2011). CEO optimism and forced turnover, Journal of Financial Economics, Vol. 101, pp. 695-712.

Chatterjee, A. and Hambrick, D. C. (2007). It's all about me: narcissism CEOs and their effects on company strategy and performance, Administrative Science Quarterly, Vol. 52, pp. 351-386.

Clatworthy, M. and Jones, M. J. (2003). Financial reporting of good news and bad news: evidence from accounting narratives, Accounting and Business Research, Vol. 33, pp. 171-185.

Clatworthy, M. A. and Jones, M. J. (2006). Differential patterns of textual characteristics and company performance in the Chairman's Statement, Accounting, Auditing & Accountability Journal, Vol. 19, pp. 493–511.

Datta, S., Iskandar-Datta, M. and Raman, K. (2005). Managerial stock ownership and the maturity structure of corporate debt, Journal of Finance, Vol. 60, pp. 2333-2350.

Daniel, K., Hirshleifer, D. and Subrahmanyam, A. (1998). Investor psychology and security market under-and overreactions, Journal of Finance, Vol. 53, pp. 1839-1885.

Davis, A. K., Ge, W., Matsumoto, D. and Zhang, J. L. (2015). The effect of manager-specific optimism on the tone of earnings conference calls, Review of Accounting Studies, Vol. 20, pp.639-673.

Davis, A. K., Piger, J. M. and Sedor, L. M. (2012). Beyond the numbers: measuring the information content of earnings press release language, Contemporary Accounting Research, Vol. 29, pp. 845-868.

Doidge, C., Karolyi, G.A. and Stulz, R.M. (2007). Why do countries matter so much for corporate governance?, Journal of Financial Economics, Vol. 86, pp.1-39.

Eisdorfer, A. (2008). Empirical evidence of risk shifting in financially distressed firms, Journal of Finance, Vol. 63, pp. 609-637.

Eshraghi, A. and Taffler, R. (2012). Fund manager overconfidence and investment performance: evidence from mutual funds, Working Paper, University of Edinburgh and Warwick Business School.

Flannery, M. J. (1986). Asymmetric information and risky debt maturity choice, Journal of Finance, Vol. 41, pp. 19-37.
Gervais, S., Heaton, J. B. and Odean, T. (2011). Overconfidence, compensation contracts, and capital budgeting, Journal of Finance, Vol. 66, pp. 1735-1777.
Graham, J. R., Harvey, C. R. and Puri, M. (2013).Managerial attitudes and corporate actions, Journal of Financial Economics, Vol. 109, pp. 103-121.
Hackbarth, D. (2008). Managerial traits and capital structure decisions, Journal of Financial and Quantitative Analysis, Vol. 43, pp. 843-882.
Hackbarth, D. (2009). Determinants of corporate borrowing: A behavioral perspective, Journal of Corporate Finance, Vol. 15, pp. 389-411.
Hayward, M. L. and Hambrick, D. C. (1997). Explaining the premiums paid for large acquisitions: Evidence of CEO hubris, Administrative Science Quarterly, Vol. 42, pp. 103-127.
Henry, E. (2008). Are investors influenced by how earnings press releases are written? Journal of Business Communication, Vol. 45, pp. 363-407.
Hirshleifer, D. (2001). Investor psychology and asset pricing, Journal of Finance, Vol. 56, pp. 1533-1597.
Hirshleifer, D., Low, A. and Teoh, S. H. (2012). Are overconfident CEOs better innovators?, Journal of Finance, Vol. 67, pp. 1457-1498.
Hilary, G. and Hsu, C. (2011). Endogenous overconfidence in managerial forecasts, Journal of Accounting and Economics, Vol. 51, pp. 300-313.
Huang, X., Teoh, S. H. and Zhang, Y. (2013). Tone management, Accounting Review, Vol. 89, pp. 1083-1113.
Huang, R., Tan, K.J.K. and Faff, R. W. (2016). CEO overconfidence and corporate debt maturity, Journal of Corporate Finance, Vol. 36, pp. 93-110.
Hyland, K. (1998). Exploring corporate rhetoric: metadiscourse in the CEO's letter, Journal of Business Communication, Vol. 35, pp. 224-244.
Jenter, D. (2005). Market timing and managerial portfolio decisions, Journal of Finance, Vol. 60, pp. 1903-1949.
Jensen, M. C. and Meckling, W. H. (1976). Theory of the firm: managerial behavior, agency costs and ownership structure, Journal of Financial Economics, Vol. 3, pp. 305-360.
Jensen, M. C. (1986). Agency cost of free cash flow, corporate finance, and takeovers, American Economic Review, Vol. 76, pp. 323-329.
Jin, L. and Kothari, S. P. (2008). Effect of personal taxes on managers' decisions to sell their stock, Journal of Accounting and Economics, Vol. 46, pp. 23-46.
Johnson, S. A. (2003). Debt maturity and the effects of growth opportunities and liquidity risk on leverage, Review of Financial Studies, Vol. 16, pp. 209-236.
Kim, Y. H. (2013). Self-attribution bias of the CEO: evidence from CEO interviews on CNBC, Journal of Banking and Finance, Vol. 37, pp. 2472-2489.
Kothari, S. P., Li, X., and Short, J. E. (2009). The effect of disclosures by management, analysts, and business press on cost of capital, return volatility, and analyst forecasts: A study using content analysis, Accounting Review, Vol. 84, pp. 1639-1670.
Landier, A. and Thesmar, D. (2009). Financial contracting with optimistic entrepreneurs, Review of Financial Studies, Vol. 22, pp. 117-150.
Leland, H. E., Toft, K. B. (1996). Optimal capital structure, endogenous bankruptcy, and the term structure of credit spreads, Journal of Finance, Vol. 51, pp. 987–1019.
Li, F. (2010a). Managers' self-serving attribution bias and corporate financial policies, Working Paper, University of Michigan.

Li, F. (2010b). The information content of forward-looking statements in corporate filings-a naïve bayesian machine learning approach, Journal of Accounting Research, Vol. 48, pp. 1049-1102.

Loughran, T. and McDonald, B. (2011). When is a liability not a liability? textual analysis, dictionaries, and 10-Ks, Journal of Finance, Vol. 66, pp. 35-65.

Malmendier, U. and Tate, G. (2005). CEO overconfidence and corporate investment, Journal of Finance, Vol. 60, pp. 2661-2700.

Malmendier, U. and Tate, G. (2008). Who makes acquisitions? CEO overconfidence and the market's reaction, Journal of Financial Economics, Vol. 89, pp. 20-43.

Malmendier, U., Tate, G. and Yan, J. (2011). Overconfidence and early-life experiences: the effect of managerial traits on corporate financial policies, Journal of Finance, Vol. 66, pp. 1687-1733.

Malmendier, U. and Zheng, H. (2012). Managerial duties and managerial biases, Working Paper University of California at Berkeley.

Miller D. and Ross, M. (1975). Self-serving biases in attribution of causality: fact or fiction?, Psychological Bulletin, Vol. 82, pp. 213-225.

Myers, S. C. (1977). Determinants of corporate borrowing, Journal of Financial Economics, Vol. 5, pp. 147-175.

Ozkan, A. (2000). An empirical analysis of corporate debt maturity structure, European Financial Management, Vol. 6, pp. 197-212.

Roll, R. (1986). The hubris hypothesis of corporate takeovers, Journal of Business, pp. 197-216.

Rogers, J. L., Van Buskirk, A. and Zechman, S. L. (2011). Disclosure tone and shareholder litigation, Accounting Review, Vol. 86, pp. 2155-2183.

Roodman, D. (2009). A note on the theme of too many instruments, Oxford Bulletin of Economics and Statistics, Vol. 71, pp. 135-158.

Shefrin, H. (2007). Chapter 11 Application of real-option techniques to capital budgeting and capital structure. In Behavioral Corporate Finance: Decisions that Create Value. The McGraw-Hill Companies, NY, USA.

Smith, M. and Taffler, R. J. (2000). The chairman's statement-A content analysis of discretionary narrative disclosures, Accounting, Auditing & Accountability Journal, Vol. 13, pp. 624-647.

Stohs, M. H. and Mauer, D. C. (1996). The determinants of corporate debt maturity structure, Journal of Business, Vol. 69, pp. 279-312.

Staw, B. M., McKechnie, P. I. and Puffer, S. M. (1983). The justification of organizational performance, Administrative Science Quarterly, Vol. 28, pp. 582-600.

Stulz, R. (2004). Does financial structure matter for economic growth? A corporate finance perspective. Financial structure and economic growth: A Cross-country comparison of banks, markets, and development, pp. 143-188.

Taylor, S. E. and Brown, J. D. (1988). Illusion and well-being: a social psychological perspective on mental health, Psychological Bulletin, Vol. 103, pp. 193-210.