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Ebrahimi, Tahera; Gupta, Jairaj; Ozkan, Aydin

DOI:
10.1002/ijfe.1765

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Tahera Ebrahimi
Department of Accountancy, Finance and Economics, University of Huddersfield, Huddersfield, HD1 3DH, UK; email: T.Ebrahimi@outlook.com

Jairaj Gupta
Department of Finance, University of Birmingham, Birmingham, B15 2TY, UK; email: J.Gupta@outlook.com

Aydin Ozkan
Department of Accountancy, Finance and Economics, University of Huddersfield, Huddersfield, HD1 3DH, UK; email: A.Ozkan@hud.ac.uk

September 2019

Abstract

This paper investigates the effects of credit rating downgrades, equity mispricing and CEO overconfidence on zero-leverage policy, using data for listed United States firms during the period 1980-2012. The results show that (1) the likelihood of zero-leverage increases significantly following a downgrade in credit rating; (2) zero-leverage is the outcome of the past attempts by firms to issue more overvalued equity capital; (3) firms with overconfident CEOs are more likely to choose zero-leverage. The results clearly suggest that the conditions prevailing in both credit and equity markets exert significant influence on zero-leverage policy. The analysis also advocates the inclusion of managerial biases in conjunction with the market-wide conditions in the analysis of zero-leverage policy. Overall, the findings reveal that zero-leverage firms find that the benefits of issuing overvalued equity outweigh the benefits associated with debt financing. These results are robust to a battery of checks.

Keywords: Zero-leverage; credit rating; equity mispricing; CEO overconfidence.

JEL Classification: G32, G34

1. Introduction

The relationship between firm leverage and value has been investigated intensively in the corporate finance literature. In their seminal paper, Modigliani and Miller (1958) show that under perfect capital markets the capital structure of a firm has no impact on the firm's cost of capital and the market value of its assets. Their analysis suggests that firm value is only determined by a firm's investment policy and cash flows. In this framework, firms are indifferent to the allocation of capital between debt and equity financing and investors will not be willing to pay a premium for a specific capital structure.

The assumptions and predictions of the Modigliani and Miller analysis are known to be inconsistent with the observed capital structure of firms. Relaxing the assumptions has led to various theoretical explanations of capital structure policy, which are better aligned with the empirical findings.[1] Although the predictions derived under capital imperfections vary, they all imply a significant relation between firm value and leverage. The relevance of leverage arises mainly from trading-off the tax benefits of debt financing against the expected bankruptcy costs (Kraus and Litzenberger 1973). Leverage also plays a significant role in reducing the costs of asymmetric information and agency conflicts (Jensen and Meckling 1976). Despite ample theoretical and empirical research, it is puzzling why some firms still do not fully exploit the benefits of debt financing, in particular the tax advantages arising from the deductibility of interest payments from taxable income (Graham 2000) . In extreme cases, firms choose to have zero debt in their capital structures, which has led to what has become known as the zero-leverage puzzle in the literature (Strebulaev and Yang 2013). Clearly, given the benefits of debt financing, zero-leverage firms are unlikely to maximise value and hence damage shareholder.

[1] See Ozkan and Trzeciakiewicz (2014) for a survey of debt financing policies of firms.

The zero leverage policy of firms has received a great deal of attention in recent years (see, e.g., Bessler *et al.* 2013, Strebulaev and Yang 2013). The main explanations of zero-leverage revolve around the lack of ability and significantly limited access of firms to debt markets. It is also argued that zero-leverage can be a strategic capital structure decision (Dang 2013, Joaquim *et al.* 2016). The limited access hypothesis is consistent with the view that highlights the need to consider the role of supply effects in debt financing decisions (see, e.g., Faulkender and Petersen 2006, Baker 2009, Bolton *et al.* 2013). However, previous research fails to consider all the possible supply channels which can help explain the zero-leverage phenomenon. Motivated by this gap in the literature, we aim to provide new insights into zero-leverage policy by investigating the impact of the supply-side aspects of financing choices on the zero-debt choice of firms. Our general approach to identifying the supply-side factors to include in the analysis of zero-leverage is influenced by the previous studies of Baker (2009) and Bakera and Wurglerb (2013). It is argued that there are channels through which supply factors can have an impact on capital structure, which are mainly shaped by the beliefs and preferences of managers and investors. While the changes in investor preferences and market sentiment can move the market value of a firm from its fundamental value, the responses of managers to these changes may strengthen the misvaluation and hence delay any possible corrections. It is also possible that the gap can close more quickly as a result of the actions taken by managers. Clearly, managers can also impact the supply-side factors as they are able to influence the issuance processes and pricing of financial securities. Consequently, in this paper we investigate the impact of both the shifts in credit and equity markets conditions and several important managerial characteristics, including behavioural biases, on the likelihood of firms having zero-leverage policies.

This paper provides several important contributions to the literature on zero-leverage and debt financing in general. Our first contribution stems from the detailed analysis of the interactions between credit constraints and the ability of firms to borrow. Contrary to the existing zero-leverage studies which mainly focus on firm characteristics such size, tangibility and dividends in measuring the extent of credit constraints, this paper investigates how the pricing of debt financing through credit rating can affect the zero-leverage decision. In a similar vein to Lemmon and Zender (2010), we employ a predictive model using data on a number of observable firm characteristics to estimate the likelihood that a firm can access the public debt market. Clearly, rating downgrades motivate firms to reduce leverage in their capital structure as lower credit rating levels are generally associated with higher cost of borrowing (Kisgen 2006, 2009). In our analysis, the difference in fitted values from the estimated predictive model is used as a proxy for the borrowing ability of firms. The results show that zero-leverage firms are mostly credit constrained and there is a significant increase in transformations from non-zero to zero-leverage policies following a downgrade in credit rating.

Our second contribution lies with the inclusion of the supply side conditions of equity capital in the analysis of zero-leverage policy. Prior research focuses only on the impact of the availability of debt financing on the choice of a zero-debt policy. To the best of our knowledge, there is no study that considers the interactions between the supply of equity capital and the zero-leverage decision. Our study complements Bessler *et al.* (2013), who focus only on the impact of the supply of debt financing on zero-leverage. We extend it by arguing that when market frictions create a wedge between the costs of external debt and external equity, managers attempt to time the market by considering the supply-side conditions in relation to both debt and equity capital markets in deciding the type of securities to issue or re-purchase (Baker 2009, Bakera and Wurglerb 2013). Specifically, in addition to the credit rating

conditions of firms, we examine whether the lower cost of overvalued equity capital can explain the zero-leverage choice of firms. To examine the effect of equity mispricing, we sort firms into different mispricing quintiles. As expected, the greatest portion of zero-leverage firms belongs to the most overvalued group, implying that these firms enjoy the lower cost of equity financing. The analysis also suggests that the level of investment in zero-leverage firms depends strongly on equity valuation. This is evidenced by the finding that the only group of zero-leverage firms which does not exhibit underinvestment is the group with overvalued equity. Additionally, we find that the more severe underinvestment problem is observed in the most undervalued group. We also document that the capital structure of zero-leverage firms is the cumulative result of the past attempts by firms to issue more equity capital in response to higher favourable valuation by the market (see Figure 1). It appears that, while on average these firms gradually deviate from their target debt ratios for several years prior to ending up with zero debt, overvalued equity capital induces firms to raise more equity capital. Overall, the results suggest that zero-leverage firms find that the benefits of issuing overvalued equity outweigh the benefits associated with debt financing.

Our third contribution is to investigate the effects of CEO overconfidence the probability of zero-leverage policy. To the best of our knowledge, the influence of overconfident managers in determining zero-leverage policy has not been analysed in prior research. Our analysis is the first attempt to examine this relationship and hence contributes to the existing literature.[2] There is a growing body of literature showing that overconfidence significantly influences several corporate policies (Malmendier *et al.* 2011, Ting *et al.* 2017). However, there is little consensus on managerial overconfidence affects leverage. For example, Heaton (2002) suggests that managerial overconfidence is associated with higher leverage as such managers believe that

[2] The notable exception is Malmendier *et al.* (2011) who examines the effect of overconfident managers on the tax benefit of debt financing.

equity is undervalued. In contrast, Hackbarth (2008) predicts that overconfident managers, who underestimate the riskiness of earnings (risk perception bias), tend to believe that debt is undervalued, which implies a greater cost of debt, in the market and hence they prefer equity.

To empirically test the relation between CEO overconfidence and zero-leverage, we use data on CEO option-holdings from ExecuComp database. Following earlier work, we classify a CEO as overconfident if he systematically maintains high personal exposure to firm-specific risk (Campbell *et al.* 2011, Malmendier *et al.* 2011, Ho *et al.* 2016). However, one important limitation of the existing studies is that when overconfidence proxy is an option-based measure, it may be correlated with other omitted variables (Cao 2009). To overcome this limitation, in contrast with prior research, we treat the managerial overconfidence variable as endogenous. We conduct a Hausman (1978) test of endogeneity and model the managerial overconfidence and zero leverage relation in a two-stage regression framework.

In addition to investigating the impact of CEO overconfidence on the probability of zero-leverage, this study also incorporates in the analysis several other important CEO characteristics, including their equity ownership, age, tenure, and previous experience. Our analysis of CEO overconfidence belong to the cohort of empirical studies that investigate the effects of managerial personal traits on capital structure (see, e.g., Matthews *et al.* 1994, Berggren *et al.* 2000, Strebulaev and Yang 2013). The estimated results yield strong support for a positive relationship between the probability of zero-leverage and managerial overconfidence. Further, we find that when CEOs have higher equity shareholdings, are younger, and have longer tenure, they are more likely to adopt a zero-leverage policy.

The rest of this paper is organized as follows. In Section 2 we develop a set of testable hypotheses in line with the related literature. Section 3 explains the dataset and discusses the

construction of the key variables. Section 4 reports the findings of univariate and multivariate analyses and discusses their implications. Finally, Section 5 concludes the paper.

2. Literature Review and Hypothesis

2.1. Credit Supply Effects

Prior research suggests that debt segmentation may put constraints on the ability of firms to borrow and observed debt ratios may not reflect a firm's demand for debt capital. Faulkender and Petersen (2006) show how having a credit rating can influence the cost of capital. It is acknowledged that debt ratings primarily have a positive impact on reducing informational frictions (Sufi 2009) and different credit rating levels are associated with varying interest rates on borrowing (Kisgen 2006). Furthermore, Kisgen (2009) provides evidence in favour of a significant relation between credit rating changes and capital structure decisions. Specifically, it is shown that firms reduce leverage following credit rating downgrades. In this study, we examine whether credit rating downgrades, which are likely to increase the cost of borrowing, is associated with a subsequent zero-leverage policy. We hence test the following hypothesis.

H_1: *Firms that experience credit rating downgrades are more likely to adopt a zero-leverage policy.*

2.2. Stock Market Supply Effects

The extant literature provides evidence that stock market conditions can influence equity issuance, which in turn make firms deviate from their optimal capital structure. To provide support for several empirical patterns which are not easy to reconcile with theoretical predictions, it is proposed that managers can take advantage of mispricing of their securities. For instance, Graham and Harvey's (2001) report that two-thirds of CFOs state that the degree of over- or undervaluation of their stocks is the most important consideration in issuing equity.

Elliott *et al.* (2007) test the market timing theory and find that the degree of equity overvaluation is positively associated with a firm's proportion of financing deficit that is funded by equity. Furthermore, as an accounting identity, the observed capital structure for any firm is the cumulative result of a long series of financing decisions. Capital is issued in response to the financial needs of firms. It is expected that firms are likely to issue equity capital when the cost of equity is lower than normal and hence equity is overvalued. This, in turn, reduces leverage and ultimately leads to zero-debt capital structure if the favourable conditions prevail long enough. This is likely to happen as equity overvaluation leads firms to substitute equity for debt issuance. The discussions above lead to the following testable hypotheses:

H_2: *The probability of firms having a zero-leverage policy increases with the overvaluation of equity.*

H3: *The probability of firms having a zero-leverage policy increases with the duration of equity overvaluation.*

2.3. CEO Overconfidence

The traditional view of corporate finance assumes that managers are rational economic agents with homogeneous expectations in relation to corporate financial and investment decisions. However, the behavioural view challenges the rational expectations view to argue that managers have several behavioural biases which may impact their decision making and lower firm value. In this respect, overconfidence is one of the managerial behavioural characteristics, which is in conflict with the rationality assumption (Heaton 2002, Baker 2009). Prior theoretical and empirical work shows that overconfidence may have either a positive or a negative impact on the level of debt financing. In Heaton (2002) managerial overconfidence is shown to favour a higher level of leverage. According to this approach, the overestimation

of future cash flows by overconfident managers leads them to be reluctant towards issuing external financing. This is especially the case for equity financing since equity issuance is more likely to be subject to mispricing compared to debt issuance. Consequently, firms will prefer to fund their investment by internal funds, and secondly by issuing debt financing and leaving the equity only as a last resort. A similar prediction is offered by Malmendier *et al. (*2011) that the pecking order type behaviour will be more pronounced in firms with overconfident managers. However, when overconfident managers underestimate the risk of earnings (i.e. risk perception bias), the pecking order behaviour can disappear. As shown by Hackbarth's (2008) model, equity financing can then become the preferred financing source as biased managers perceive equity (debt) as overvalued (undervalued). This in turn results in greater levels of equity issuance rather than debt. To test empirically the influence of managerial overconfidence on the probability of zero-leverage policy, we put forward the following hypothesis:

H4: *Firms with overconfident managers are more likely to adopt a zero-leverage policy.*

3. Data and Model

3.1. Sample Construction and Model

Our initial sample comprised of all firms on the annual Compustat dataset over the period 1980 to 2015. We exclude financial firms and utilities (SIC codes 4900-4999 and 6000-6999) due to the regulated nature of their capital structure. Furthermore, we restrict our sample to those firms with a FIC code equal to USA and with the minimum book value of 10 million dollars. We supplement our data with the measure of cost of equity (used in residual valuation model), which are calculated from monthly stock return file of CRSP. Similar to previous studies, we do not require firms to be available in dataset continuously. However, the estimation of residual model imposes a minimum of four years continuous data around the year

for which mispricing is estimated. Because of the data requirements for the residual income model, we have valuation estimates from 1980 to 2012, resulting in 96,800 firm-year observations. We use this set of data to test the first three hypotheses.

In addition, to examine the relation between CEO overconfidence and zero-leverage policy, we merge this data with the dataset of S&P "ExecuComp". Since overconfidence is the main variable of interest for this subsection of data, we require firms to have options holding data available for CEOs, and hence drop those without data on options. The limited availability of CEO option data led to a significant reduction in the number of observations. Consequently, the final sample reduced to 23,224 firm-year observations consisting of 2,466 individual firms over the period 1992-2012. This data set also covers several variables including chairman independence, CEO ownership, CEO age and tenure. Finally, to reduce the effect of outliers, all variables are winsorized at the 1st and 99th percentiles.

In examining the factors which drive the adoption of zero-leverage policy, we use a multivariate logit regression approach. Since our panel data consists of a large number of firms with significantly smaller number of years, using a pooled logit regression may yield inconsistent estimates of the parameters. Therefore, as suggested by Chamberlain (1980), we employ conditional fixed effects model. We estimate the following regression model:

$$P_i\ (Y_i\ = 1|\ X_i\ ) = \frac{1}{1+e^{(\alpha_i + X_{it}\beta)}} \qquad (1)$$

where the dependent variable is a binary variable, equals to 1 if the firm *i* in time *t* has no outstanding debt, and 0 otherwise. In addition, X includes firm-level characteristics that are likely to impact zero-leverage policy; β is the vector of coefficients; and α is an individual intercept. In what follows, we discuss the explanatory variables included in X and their potential effects on a firm's zero-leverage policy.

3.2 Construction of Variables

3.2.1. Downgrade in credit rating

Due to the complexity of financial markets and the presence of asymmetric information between insiders and outsiders, credit rating has become a widely used measure of the creditworthiness of firms when facilitating access to the credit market. Lemmon and Zender (2010) argue that, while the presence (or absence) of credit ratings influences the cost of borrowing, the use of observed rating as a proxy for debt capacity might pose a problem. This is because some firms might deliberately choose not to have a credit rating as the costs of having a credit rating can outweigh the benefits (Kisgen 2009). Therefore, identifying such firms as being constrained might lead to biased results. To address this concern, following Lemmon and Zender (2010), we employ a predictive model based on observable firm characteristics to estimate the likelihood that a firm can access the public debt market in a given year.[3] We take the difference between the fitted values of the predictive model in year *t* and *t*-1 and incorporate it in the empirical model as a proxy for the access to debt markets in year *t*.

3.2.2. Stock Overvaluation

While market-to-book ratio is widely used as a proxy of stock valuation, it is argued that it can be a weak proxy to measure the extent of mispricing (e.g. Dong *et al.* 2012, Warr *et al.* 2012). It is more likely to capture growth options and debt overhang problems rather than being a proxy for valuation. We use the residual income model (RIM) that was originally developed in the accounting literature (Ohlson 1995) and adopted in the finance literature. The residual income model is based on the ratio of the intrinsic value to the market value of the firm (Lee

[3] By adopting this approach, we can also extend our sample back to 1980 rather than 1986 (when credit ratings were first reported in Compustat).

et al. 1999, Elliott *et al.* 2007), where the intrinsic value is given by the book value of equity plus the discounted value of all expected future residual income, formulated as follows.

$$V_0 = B_0 + \sum_{t=1}^{n} \left(\frac{E_t - r \times B_{t-1}}{(1+r)^t} \right) + \left(\frac{E_t - r \times B_{t-1} + E_{t+1} - r \times B_t}{2r(1+r)^n} \right) \qquad (2)$$

In this setting, V_0 is the intrinsic value of equity at time 0; B_0 is the book value of equity at time 0; and E_t is the expected earnings before extraordinary items in year *t*. Time 0 is the year of estimated; *n* equals 2 years; and *r* is the cost of equity based on CAPM for any firm-year observation. The terminal value is the average of the last two years of the finite series and restricted to be non-negative as a negative terminal value implies that firm would continue to invest in negative net present value project in perpetuity.

We use the ratio $VP_0 = V_0 / P_0$ as a mispricing proxy, where P_0 represents market price of equity at time 0. A perfect capital market implies that there is no mispricing and $VP = 1$. For our sample of firms, the mean value of *VP* is significantly less than 1, similar to Bonaimé *et al.* (2014). In order to examine if favourable stock valuation drives a firm to use no debt, we need to apply one single measure of mispricing. To identify a precise benchmark for comparison, we first follow the approach in Dong *et al.* (2012) and use a continous measure of mispricing (degree of mispricing) that captures the deviation between fundamental and market values. Second, similar to Bonaimé *et al.* (2014), we employ the median value of mispricing as a threshhold for over-under valuation, assuming that the market provides a fair valuation over the sample period. We then estimate the number of years for each firm with overvalued stock as a proxy for duration of overvaluation.

3.2.3. CEO Overconfidence

The literature employs a number of different approaches in estimating overconfidence, including surveys and psychometric tests (Ben-David *et al.* 2013, Graham *et al.* 2013), stock option holding and exercising decision, CEO's net stock purchase and investment level (Hall and Murphy 2002, Campbell *et al.* 2011). To construct a measure of overconfidence of managers, this study exploits the overexposure of individual managers to the idiosyncratic risk in their own firms. Managers receive a large quantity of stocks and options as compensation. They cannot trade these options until a specific date, and hence the value of their human capital is timely and tightly linked to firm performance. Because of this under-diversification, it is expected that risk averse managers will exercise their options early if they are rational expected utility maximisers. However, if managers are optimistic about future performance they might persistently postpone exercising the vested options even when the option is sufficiently in the money. Malmendier and Tate (2005) classify a CEO as overconfident when he fails to exercise the option 67% in the money (i.e. when the stock price exceeds the exercise price by more than 67%). Following this approach, we adopt the same cut-off point in our study. This variable set to one for year *t* and zero otherwise. Similar to Campbell et al (2011), if in the following year we have a missing data on moneyness with the same CEO, the dummy variable is then set to what it was in the previous year. This approach is in line with the notion that overconfidence is a persistent trait (see, Malmendier and Tate 2005).

We do not have detailed data on the options holdings of managers and the exercise price of their holdings. We therefore adopt the method used by Campbell et al. (2011) in calculating the average moneyness of the option portfolio of managers in a given year. For each CEO-year, we measure the realizable value per option by dividing the total realizable value of all unexercised but exercisable options by the number of exercisable options. We then subtract the

average realizable value per option from the stock price to estimate the average exercise price. The average value of moneyness then is equivalent to stock price divided by the estimated strike minus one. We are only interested in options that exercisable by managers and hence we only rely on the vested options held by CEOs in our analysis.

3.2.4. Additional Variables

In the empirical analysis, we include several control variables that are identified in prior work as relevant in explaining the capital structure choice of firms. They include tax, growth, size, firm age, profitability, excess cash, tangibility, financial distress, volatility, and dividend paying dummy. Additionally, we incorporate a proxy to capture the underinvestment problem, which is likely to arise from the conflicts of interests between bondholders and shareholders (Myers 1977). Accordingly, firms with greater growth opportunities are expected to reduce debt to mitigate the underinvestment incentives. We therefore expect an increase in the likelihood of zero-leverage when firms face an underinvestment problem. We follow the framework of Richardson (2006) to build an investment expectation model. The fitted value from this model reflects the mandated investment in positive NPV project, and the residual value indicates overinvestment (underinvestment) if it is positive (negative). Accordingly, we construct a dummy variable equal to one if the deviation from the optimal investment is negative, and zero otherwise. Finally, in addition to the CEO overconfidence variable, which we discussed above, we include several variables to capture the impact of other CEO traits on zero-leverage policy. These variables include chairman independence, CEO ownership, CEO age and tenure. The definition of all variables used in the analysis are given in Table 1.

[Insert Table 1 here]

4. Empirical Analysis

4.1 Descriptive and Univariate Analysis

Panel A of Table 2 provides standard descriptive statistics for the variables used in the analysis. Furthermore, in panel B, we compare the characteristics of zero-leverage (ZL) firms with non-zero leverage (NZL) firms and provide *t*-test statistics for the differences in mean values of the variables. Overall, the results indicate that the mean values of the variables for the two sub-samples are significantly different at the 1% level.[4] Notably, ZL firms significantly deviate from their target leverage levels compared to their counterparts.[5] It appears that while on average ZL firms are heavily under levered (-5.4%), NZL firms maintain their target debt ratio with the deviation of no more than 1%. We also find that ZL firms have a significantly lower probability of having a credit rating (4%) than NZL firms (about 15%).

[Insert Table 2 here]

Furthermore, the value of mispricing for ZL firms appears to be lower compared to NZL firms (56% vs 66%). Recall that the lower value of mispricing indicates a higher stock valuation. These observations hence suggest ZL firms exhibit relatively higher equity valuation, which in turn can explain the higher tendency to issue equity for this subsample of firms compared to the NZL one (13.6% vs 7.1%). Not surprisingly, the net debt issuance for ZL firms over the sample period is negative (-1.7%) while it is 1.8% for NZL firms. Taken together, initial univariate analysis suggests that the financing decisions of zero-leverage firms appear to be affected by their borrowing constraints and hence they rely more on the equity market when the market valuation is highly favourable, which is inconsistent with prior evidence on low leverage firms (Minton and Wruck 2002).

[4] These statistics are similar to those reported earlier (e.g. Bessler *et al.* 2013, Dong *et al.* 2012), and hence, for brevity, we only discuss our new variables which are not discussed in prior studies.
[5] See Table 1 for estimation of target leverage

Additionally, ZL firms have more growth opportunities (3.05 vs 1.82) and accumulate higher cash balances (0.43 vs 0.14) than NZL firms. In term of investment, the evidence suggests that ZL firms invest less than optimal, with deviation of 2% below their optimal level of investment, while NZL generally maintain their optimal level of investment (0.003).

As for the overconfidence measure, the descriptive statistics in panel A of Table 2 suggest that during the sample period 42% of managers reveal overconfidence bias. This finding is in line with the results reported by Campbell et al. (2011) who use a similar measure of overconfidence. Furthermore, in panel B about 49% of the overconfident managers are observed among the ZL firms. It is also worth mentioning that CEOs in ZL firms have a greater level of equity ownership at 4.4% compared to 2.5% for the CEOs of NZL firms. Managers in ZL firms are younger with longer tenure.

Table 3 reports yearly descriptive statistics of mispricing and financing behaviour of ZL and NZL firms during the period 1980 to 2012. The results provide interesting new insights into the financing patterns for both sub-samples. While internally generated funds (using profitability as a proxy for internal financing) seem to be higher than combined net issuance of debt and equity issuance at the start of our sample for NZL group, equity exceeds the internal funds for ZL firms in every successive year. ZL firms exhibit a positive mean value of profitability only before 1983, and in 1992. However, after 1984, firms in both samples rely more on external financing. While the equity issuance is higher for both subsamples of firms relative to debt issuance, ZL firms rely significantly more on equity to finance their needs.

[Insert Table 3 here]

Similar to previous studies (e.g. Dong *et al.* 2012), we observe that there is a strong time trend in equity valuation and equity issuance in the sample. Stock valuation is very low in the early part of the sample period and increases steadily over time, particularly between 1992 and

1999 and most notably from 2003 to 2007. Accordingly, equity issuance is exceptionally high during these periods, relative to the early part of the sample. Furthermore, we observe that ZL firms exhibit significantly higher stock valuation, relative to NZL firms, for every year except those between 1986 and 1989.

In consideration of time series swings in the market valuation and equity issuance observed in Table 3, we next construct the valuation portfolio annually in Table 4 to ensure that any effect of stock valuation we observe are cross sectional and not driven by common time series swings in market valuation. Each year, firms are grouped into five quintiles according to the extent of mispricing; Quantile 1 is the most overvalued (lower value of mis-valuation) and Quantile 5 is the most undervalued (higher value of mis-valuation) subsample.

Table 4 reports the mean value of the variables of interest and the proportion of ZL for each of the valuation quintiles. As expected, the greatest percentages of ZL firms belong to the most overvalued quintiles, 27% (Q1) and 25% (Q2), falling consistently, and rising slightly for the last quintile, 17%. The most overvalued quantile (Q1) of ZL firms, which accounts for the greatest portion of ZL firms, are those firms with higher growth opportunities and younger compared to the most undervalued quintile (Q5) of ZL.

Moreover, ZL firms appear to have significantly higher stock valuation relative to the NZL group across all valuation quintiles. Consistent with aggregate market timing, overvalued firms issue significantly more equity than undervalued firms in both ZL and NZL subsamples. However, the level of equity issuance is more apparent for the most overvalued ZL. For instance, the level of net equity issuance for the most overvalued quantile (Q1) is 30% for ZL firms and 21% for NZL firms. Moving on to the second quintile, (Q2) is associated with a dramatic fall in the level of net equity issuance, with 8% for ZL firms and 6% for NZL firms. Considering the most overvalued ZL firms (Q1) are the most active equity issuers in the sample,

it is not surprising to observe that they are the only group of ZL, which does not exhibit underinvestment. This finding potentially suggests that the level of ZL firm investment is strongly dependent on their stock valuation.

[Insert Table 4 here]

The findings in Table 4 also reveal that ZL firms deviate from their target leverage levels negatively, suggesting that zero-leverage policies are sub-optimal. However, NZL firms maintain their target leverage in all quintiles. This significant gap between target and actual leverage ratios of overvalued ZL firms supports the argument given in Warr *et al.* (2012) that equity mispricing is an important factor in determining the cost of leverage adjustment.

In order to test whether the observed capital structure of ZL is the cumulative result of a long series of past incremental financing decisions, we examine the evaluation of financial patterns in the dynamic framework around the event year (time zero), when the firm first developed a ZL policy. We require firms to have three years of data prior to and after the event year. Figure 1 provides interesting insights regarding the financial pattern of ZL policies before and after adopting this policy. It appears that, while firms on average gradually deviate from their target debt ratio for several years before adopting ZL policy, they continue to reduce this gap and lever up shortly in year +1. In contrast, several years prior to the event year, equity issuance is greater for these firms as a result of high stock valuation. It also reveals that, on average, such firms decide to lever up and cut down their equity issuance after turning to ZL policy. Overall, the evidence so far is consistent with the hypothesis that a ZL policy is the result of issuing more equity in response to a more favourable equity valuation.

4.2. Multivariate Analysis of ZL policy

Moving on to the results of the multivariate analysis, Table 5 reports the findings from the conditional logit regression analysis of the ZL decisions of firms for the entire sample. The

analysis focuses on the three hypotheses discussed earlier. Model (1) to (6) report the coefficient estimates and model (7) provide the average marginal effects of specefication (6) for the ease of interpretation. The marginal effects measure the change in the probability resulting from a one standard deviation change around the mean of a continuous explanatory variable, holding all other variables at their means. For indicator variables, we report the change in probability associated with a switch from zero to one.

[Insert Table 5 here]

In model (1), we present the results in relation to the baseline conventional leverage variables, namely tax, growth, size, firm age, excess cash, profitability, tangibility, financial distress, volatility and dividend paying dummy. We include these variables as control variables in the remaining specifications. In line with previous studies, the estimated coefficients of these variables are significant and have the expected signs.

In model (2), we incorporate the change in credit rating as a proxy for the ability of firms to access external debt financing. The estimated coefficient on the change in credit rating is negative and statistically significant, which is consistent with the conjecture that credit rating has an important impact on cost of debt and hence ZL policies. The marginal effect of credit change on the likelihood of a ZL policy reported in model (7) suggests that the likelihood of firms changing from a NZL to a ZL policy increases by 31% for a one standard deviation decrease in the proxy for debt market accessibility. This result is in support of our first hypothesis (H_1). Our finding is also in line with the findings of Kisgen (2009) who finds that firms reduce leverage following a credit rating downgrade in order to maintain their credit rating.

In models (3) and (4), we further extend our model by adding two variables to examine the impact of stock valuation on ZL policy. First, consistent with the univariate results,

mispricing appears to be a strong determinant of ZL policy, as reported in model (3). The coefficients on the mispricing variable retain their negative sign are and significant at the 1%. As reported in column (7), controlling for other firm characteristics, a one standard deviation decrease in mispricing value increases the probability of firms becoming ZL by 3%. Overall, this finding confirms our hypothesis (H_2) and in line with Alti's (2006) findings that attractive stock market prices may lead firms to substitute debt for equity issuance. In model (4), we incorporate mispricing together with the duration of overvaluation to test whether the probability of a firm having a ZL policy changes with the duration of stock overvaluation (H_3). The estimated coefficient is positive and significant at the 5 percent level. Our result is in line with Warr *et al.* (2012) showing that under-levered firms adjust more slowly toward their target when the cost of equity is low (overvalued), as managers exploit this opportunity to benefit existing shareholders by issuing more equity. Overall, this finding suggests that shifting from levered to unlevered capital structure policy can be a consequence of several attempts by managers to time the market.

We note that the mispricing proxy can be correlated with the growth prospects of firms (Q), and hence our valuation model may be criticised as this proxy could capture the effects of growth opportunities than mispricing effects. A comparison of models (1) and (3) indicates that this is not the case since the estimated coefficient of growth (Q) is greater when the mispricing variable is added to the model (0.69 vs 0.80), indicating that the growth effects are not explained by the ability of mispricing in predicting ZL. Furthermore, comparing the pseudo R^2 of models (1) and (3), given respectively as 0.116 vs 0.126, confirms that mispricing still has an incremental explanatory power after controlling for growth prospects.

In model (5), we also include a dummy variable for underinvestment to test whether ZL policy is driven by the underinvestment incentives of firms. The coefficient of underinvestment

is positive and significant at 1%. As evident in model (7), in the presence of underinvestment the probability of ZL policy increases by 5.2 percent. Moreover, the positive and significant of the coefficients on Tobin's Q in all models indicate that firms with more growth opportunities are more likely to adopt ZL policy. Taking together, our findings lend additional support to previous work on ZL (see, e.g., Dang 2013) showing that in the presence of underinvestment distortion, high growth firms avoid debt financing to alleviate the conflicts of interest between shareholders and debtholders. The estimated excess cash coefficients are consistently positive and significant, possibly suggesting that cash-rich and high growth firms try to avoid debt financing to preserve their borrowing power and maintain financial flexibility (DeAngelo and DeAngelo 2007).

4.3. Overconfident Managers and ZL Policy

In this section, we test the relationship between CEO overconfidence and zero-leverage policy.[6] Similar to other corporate finance decisions, it is possible that the decisions of CEOs to exercise their options late are determined endogenously. The behavioural literature suggests that personal bias may be influenced by age, ownership, working experience etc (Serfling 2014, Dittmar and Duchin 2015, Huang *et al.* 2016). Furthermore, since the proxy of overconfidence is an option-based measure, there might be concerns that this proxy is correlated with other omitted variables and hence the delayed decision of exercising options by CEOs might be driven by other unobserved/omitted factors. In line with this view, Cao (2009) investigates the impact of late option exercise, as a proxy for unobservable CEO overconfidence, on firm's

[6] Since overconfidence is a persistent trait, and fixed effect estimates only capture within individual differences across time, then we only examine the relation between overconfidence and ZL policy in those firms with multiple short-tenure CEOs in the sample. In other words, in order to draw a robust inference from fixed effects estimations, we need to have observations with overconfident and non-overconfident CEOs in the same firm (Malmendier and Tate 2005). Having said this, our logit model includes industry fixed effects to control for time invariant industry level determinants. We also include year fixed effects to control for any change in macroeconomic factors.

investment policy. It is shown that CEO option exercise behaviour is more likely to be related to stock mispricing and growth opportunities and cannot explain the firm's investment decisions. This finding is at odds with Malmendier and Tate (2005) who show that managerial overconfidence can account for investment distortion. In contrast, Huang *et al.* (2016) show that this proxy is robust to different estimation methods and alternative explanations. To address these concerns, we conduct an omitted variable analysis of Hausman's (1978) specification to test for the endogeneity of the overconfidence proxy by regressing our overconfidence measure on the set of firm specific characteristic used earlier in the analysis. In the regression, we also include further CEO characteristics, namely chairman independence, CEO ownership, CEO age and tenure, which could potentially influence CEO overconfidence. The results are reported in Table 6.

In conducting our analysis, we generate two new variables, namely overconfidence-residual and overconfidence-fitted. The former is the residual values and the latter is the fitted values for the overconfidence measure from model (1). Next, in model (2) we test whether the estimated coefficient of overconfidence-residual is significant, which would lead us to reject the null hypothesis that overconfidence is exogenous and substitute the fitted values of this proxy for the actual values in our models (3) to (5) in Table 6 as an instrumental variable.[7]

[Insert Table 6 here]

The Hausman test ($\chi 2 = 9.68$ and the corresponding p-value is 0.001) reveals that the overconfidence-residual's coefficient is statistically different from zero and hence we conclude that the overconfidence variable is indeed endogenous. Consistent with our hypothesis, the

[7] We cannot use an endogenous logit model because the overconfidence variable in the main regression is a binary variable. This approach is used in the finance literature to control for the endogenous binary variables (Andriosopoulos et al. 2013).

estimated coefficient of the overconfidence variable, after controlling for endogeneity problem, is positive and significant at the 1% level. This possibly suggests that overconfident CEOs are more likely to choose a zero-leverage policy. This supports Malmendier *et al.* (2011), who propose that overconfidence CEOs prefer internal financing to external financing and hence forego the tax benefits associated with debt financing. Another explanation of this finding is provided by Hackbarth's (2008) model, in which managers rely more on equity (debt) issuance as they believe these securities are more overvalued (undervalued) by the market. Overall, our evidence is contrary to the findings of Heaton (2002) and Ting et al. (2017) in which overconfident CEOs enhance pecking order preference and thus choose more debt financing.

In model (4) we exclude overconfidence from the specification and the results show that other CEO characteristics do affect capital structure decisions. In line with managerial preference explanations, zero-leverage is more more likely when CEO equity shareholdings increase. This finding is in line with Lewellen (2006), who finds that managers with greater stock ownership whose wealth is not well-diversified prefer lower leverage to reduce financial distress and bankruptcy risk. The impact of CEO ownership on zero-debt policy is also economically significant. Controlling for other factors, one standard deviation increase (0.06) of CEO Ownership leads to an increase in the probability of zero-leverage policy by 3% (1.42×0.06×0.356). In model (5), the estimated coefficient on overconfidence-fitted increases to 2.27 from 2.14 in model (3). As for the average marginal effects reported in the last column, the probability of employing a zero-leverage policy is 16% higher for a firm with an overconfident CEO compared to firms without. However, the estimated coefficient of CEO ownership turns out to be insignificant in model (5). One can therefore argue that our measure of managerial overconfidence captures the effect of managerial ownership in zero-leverage firms. A possible explanation of the delay of the exercise option might be related to the pressure

imposed by the board of directors, who require managers to hold onto a 'deeply in-the-money option' to keep incentives high when there are no debtholders to monitor them. Since CEO ownership can also be a proxy for managerial incentives, both variables in the same model may capture the incentive factor.

Finally, the coefficient of CEO age is negative and significant suggesting that as the CEO gets older, the willingness to employ a zero-leverage declines. This observation is not in line previous studies (Morin and Suarez 1983, Serfling 2014), which suggest that mature managers are more conservative and risk averse and hence they are less (more) likely to issue debt (equity) capital. The impact of tenure appears to be positive and significant only in model (4) and we cannot find any significant relation between the likelihood of zero-leverage and the indicator variable showing if CEOs served as a director during fiscal year.

5. Concluding Remarks

This study investigates the factors that are likely to determine the zero-leverage decisions of firms. In doing so, the analysis focuses on the supply side factors which prevail in the market as well as those related to managerial beliefs. The main hypotheses tested in the study concern with the impact of credit rating downgrades, mispricing in stock valuation and managerial overconfidence on zero-leverage policy.

Our analysis makes several significant contributions to the literature on the zero-leverage phenomenon. Firstly, it empirically examines the interactions between credit constraints and the borrowing ability of firms by investigating how the pricing of debt financing through credit rating can affect the zero-leverage decision. The results show that the likelihood of switching to zero-leverage increases significantly following a downgrade in credit rating. Secondly, contrary to prior research that focuses only on the impact of the availability of debt financing, this paper also incorporates the supply side conditions of equity capital in the analysis of zero-

leverage policy. The findings show that the capital structure of zero-leverage firms is the cumulative result of the past attempts by firms to issue more equity capital in response to favourable equity valuation. The results suggest that zero-leverage firms find that the benefits of issuing overvalued equity outweigh the benefits associated with debt financing. Thirdly, the current study empirically investigates how CEO overconfidence impacts the probability of zero-leverage policy. The influence of overconfident managers in determining zero-leverage policy has not been analysed in prior research. The estimated results yield strong support for the view that overconfident managers are more likely to choose a zero-leverage policy. Our results are robust to a battery of checks.

Overall, the insights provided in this paper are important in enhancing the understanding of the zero-leverage puzzle. The results clearly suggest that the supply-side factors are important in determining the choice of zero-leverage by firms. More importantly, the forces in both credit and equity markets are important, albeit the difficulty to measure the exact magnitude of each force. The analysis also advocates the inclusion of managerial biases in conjunction with the market-wide conditions in the analysis of zero-leverage policy specifically, and capital structure decisions in general.

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Table 1: Definitions of variables and Compustat Data items

Leverage	Ratio of total debt to total assets. (DLTT+DLC)/AT
Zero Leverage	Dummy variable: 1 if total debt is zero for the current year; 0 otherwise
Deviation Leverage	It measures the deviation from the target leverage, which is the difference between actual leverage and fitted leverage of the model below: $Leverage_{it} = \beta_0 + \beta_1 Leverage_{it-1} + \beta_2 Profitability_{it} + \beta_3 Tobin'sQ_{it} + \beta_4 Depreciation_{it} + \beta_5 Size_{it} + \beta_6 R\&D_{it} + \beta_7 RDD_{it} + \beta_8 IndusLev_{it} + \varepsilon_t$ where Depreciation is depreciation expenses over total assets; R&D is R&D expenses over total sales; RDD is a dummy variable which is 1 when R&D data is not available and 0 otherwise; IndusLev is the median value of industry leverage. The estimation method is dynamic fixed effects.
Credit Rating Change	The probability of having credit rating derived from the fitted value of the predictive logit model below (see Lemmon and Zender 2010) $Rating_{it} = \beta_0 + \beta_1 Tangibility_{it-1} + \beta_2 Age_{it-1} + \beta_3 Tobin's\ Q_{it-1} + \beta_4 Size_{it-1} + \beta_5 Profitability_{it-1} + \beta_6 Volatility_{it-1} + \varepsilon_t$ where Rating is a dummy variable which is 1 if the firm has debt rating and 0 otherwise. The model also includes industry dummies. We use the difference [t-(t-1)] of the estimated fitted value of this model as an indication of access to debt market.
Mispricing	It measures the degree of stock mispricing estimated as the ratio of intrinsic value of the stock (V) to the market value of stock (P). See section 3.2 for further details.
Overvaluation Duration	The numbers of years for any firms with overvalued stock.
Profitability	Ratio of earnings before interest, taxes and depreciation to total assets (EBIT+ DEP)/AT
Cash	Ratio of cash and short-term investments to total assets (CHE/AT)
Excess Cash	Dummy variable: 1 if the firm has cash balances that are higher than the industry median value (based on Fama & French's 48 industry classifications), and 0 otherwise.
Tobin's Q	Q = {Total assets (AT) – Book value equity (CEQ) + Market value equity (PRCC_F×CSHO)} / Total assets (AT)
Underinvestment	Dummy variable: 1 if the deviation from the optimal investment is negative and 0 otherwise. The deviation from the optimal investment, which is the residual value of the following regression model $New\ Investment_t = \alpha + \beta New\ Investment_{t-1} + \gamma Z_{t-1} + \varepsilon_t$ where New Investment is measured as capital expenditure (CAPX) + acquisitions (AQC) + R&D (XRD) - sale of PPE (SPPE) - depreciation & amortization (DP). The figures are scaled by total assets. Z is the vector of other investment determinants lagged by one period, i.e., leverage, growth, size, age, cash, stock returns, and contemporaneous values of industry and time fixed effects (see Richardson (2006)). The fitted value of this regression is the expected level of New Investment (i.e., Optimal Investment)
Financial Distress	Dummy variable: 1 if Z-score < 1.80, then the firm is considered as financially distressed, and 0 otherwise Altman's modified Z-score is used: 3.3×(EBIT/Total assets) + 0.99×(Sales/Total assets) + 1.4×(Retained earnings/Total assets) + 1.2×(Working Capital/Total assets)
Volatility	The standard deviation of monthly stock returns over the past 60 months
Tangibility	Ratio of fixed assets to total assets (PPENT/AT)
Size	Natural logarithm of total sales in 1980 dollars
Age	The number of years the firm has been covered in the Compustat database
Tax Benefit	Marginal corporate tax rate before interest deductions (MTRBID) from database created by Jennifer Blouin, John Core and Wayne Guay using Capital IQ Compustat data.
Dividend Payer	Dummy variable: 1 if the firm issues common dividend(DV/IBCOM), and 0 otherwise.
Net Equity Issuance	Ratio of net equity issuance to total assets (SSTK - PRSTKC)/AT.
Debt Issuance	Ratio of the change in current and long-term debt to total assets (DLC+ DLTT - l.DLC - l.DLTT)/AT.
Overconfidence	Dummy variable: 1 if Option Moneyness ((PRCC_F/PRCC_F - (OPT - UNEX - EXER-EST- VAL)/(OPT – UNEX – EXER - NUM)) -1) exceeds 67% and 0 otherwise.
CEO Ownership	The percentage of shares owned by the CEO, options excluded. (SHROWN – EXCL - OPTS/ (CSHO×1000))
CEO Age	Executive Age (1/39 = 1) (40/49 = 2) (50/59 = 3) (60/69 = 4) (70/79 = 5) (80/89 = 6) (90/99 = 7) (missing =.)
CEO Director	Executive served as a director during the fiscal year
CEO Tenure	One plus the difference between the current year and the year of appointment as CEO

Figure 1. Firm financing behaviour over time

These figures present an analysis of zero leverage firms in a dynamic framework around the event year. Event year is a dummy equal to 1 when firms first adopt a zero-leverage policy and zero otherwise. Main firm characteristics of interest are plotted before and after the event year (denoted by time 0).

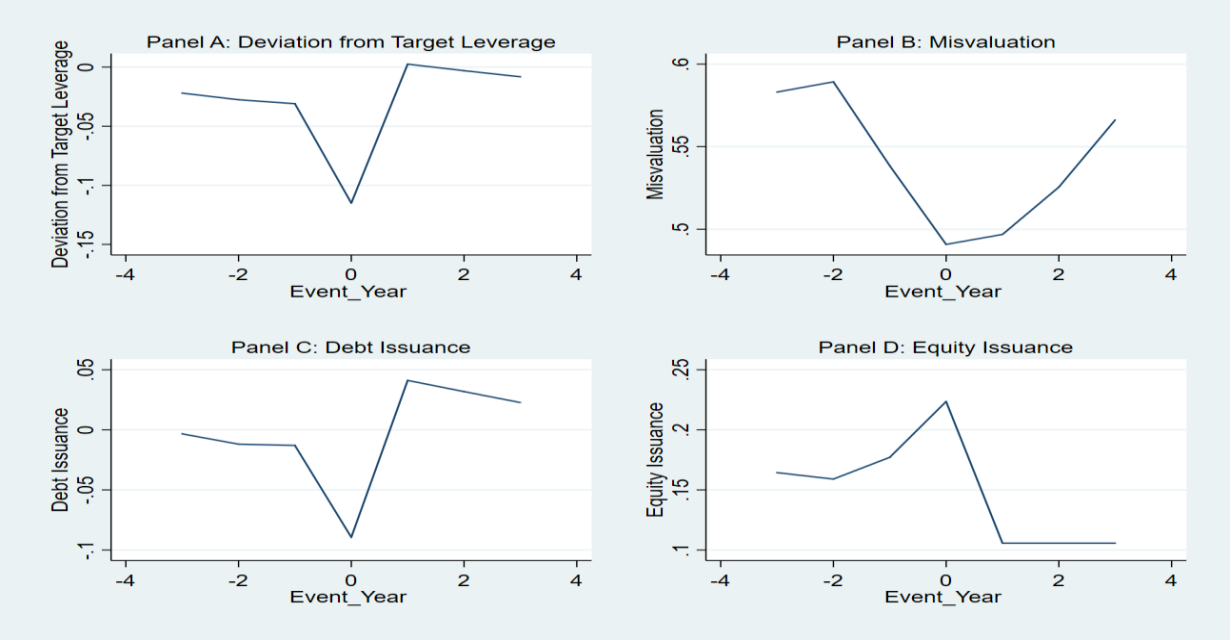

Table 2: Summary Statistics

Variable	Panel A: Full Sample				Panel B: ZL Firms vs NZL Firms		
	Mean	p50	Min	Max	Mean (ZL)	Mean (NZL)	t-stat
Leverage	0.232	0.194	0.000	1.000	0.000	0.272	208.4***
Zero Leverage	0.149	0.000	0.000	1.000			
Deviation Leverage	0.000	-0.020	-0.976	0.939	-0.054	0.009	73.7***
Credit Rating	0.133	0.024	0.000	0.999	0.040	0.149	57.2***
Credit Rating Change	0.009	0.024	-0.047	0.564	0.004	0.010	28.7***
Mispricing	0.627	0.553	0.090	3.800	0.560	0.660	18.0***
Overvaluation Duration	2.534	0.000	0.000	29.00	7.123	7.041	-3.0***
Deviation Investment	0.000	-0.011	-0.250	0.390	-0.020	0.003	24.6***
Underinvestment	0.580	1.000	0.000	1.000	0.697	0.557	-31.3***
Profitability	0.029	0.107	-1.770	0.430	-0.032	0.076	52.9***
Cash	0.185	0.084	0.000	0.950	0.431	0.142	-200.0***
Excess Cash	0.498	0.000	0.000	1.000	0.824	0.435	-136.0***
Tobin's Q	2.297	1.399	0.510	22.27	3.050	1.823	-67.3***
Financial Distress	0.531	1.000	0.000	1.000	0.529	0.475	-18.1***
Volatility	19.267	14.177	1.020	99.600	22.983	18.604	-22.7***
Tangibility	0.284	0.214	0.000	0.914	0.157	0.310	95.5***
Size	4.247	4.352	-2.92	9.880	3.416	4.901	78.7***
Age	12.218	9.000	1.000	54.000	12.177	14.898	26.7***
Tax Benefit	0.287	0.328	0.000	0.510	0.235	0.302	8.3***
Dividend Payer	0.359	0.000	0.000	1.000	0.259	0.431	48.8***
Net Equity Issuance	0.081	0.001	-0.155	0.890	0.136	0.071	-43.5***
Net Debt Issuance	0.017	0.000	-0.470	0.810	-0.017	0.018	30.1***
CEO Traits:							
Overconfidence	0.423	0.000	0.000	1.000	0.492	0.410	-8.9***
CEO Ownership	0.029	0.004	0.000	0.343	0.044	0.025	-17.3***
CEO Tenure	8.067	6.000	1.000	63.000	9.171	7.897	-9.2***
CEO Age	3.092	3.000	1.000	7.000	2.970	3.11	9.3***
CEO Director	0.970	1.000	0.000	1.000	0.968	0.977	3.4***

Notes: Panel A of this Table provides the descriptive statistics of the main variables of interest used in this study. The full sample consists of 96800 firm-year observations and CEO traits dataset consists 23,224 firm-year observations. All variables are winsorized at the upper and lower one percentile. Panel B compares the mean values of firm and CEO specific characteristics of ZL and NZL samples. ***, ** and * indicate the difference are significant at the 1%, 5% or 10% levels, respectively. The definitions of all variables are provided in Table 1

Table 3: Valuation and Security Issuance per year for *NZL*/ ZL firms

Year	ProportionZL	Mispricing	Profitability	Equity Issuance	Debt Issuance
1980	6.85	0.94/0.70	0.13/0.12	0.05/0.15	0.02/-0.01
1981	7.88	0.95/0.70	0.11/0.07	0.07/0.161	0.01/-0.01
1982	7.84	0.91/0.81	0.09/0.02	0.05/0.09	0.02/-0.00
1983	8.33	0.66/0.62	0.08/0.04	0.12/0.24	0.01/-0.01
1984	7.88	0.75/0.68	0.07/-0.01	0.07/0.16	0.02/-0.01
1985	8.34	0.68/0.66	0.05/-0.03	0.08/0.15	0.02/-0.01
1986	9.48	0.63/0.67	0.05/-0.01	0.11/0.23	0.02/-0.02
1987	9.96	0.71/0.71	0.05/-0.05	0.10/0.20	0.02/-0.01
1988	9.92	0.69/0.69	0.06/-0.05	0.06/0.12	0.01/-0.01
1989	10.17	0.66/0.72	0.06/-0.03	0.06/0.14	0.02/-0.01
1990	10.76	0.86/0.83	0.07/-0.04	0.05/0.14	0.01/-0.01
1991	11.57	0.74/0.67	0.07/-0.02	0.08/0.18	-0.01/-0.01
1992	12.34	0.66/0.61	0.07/0.03	0.09/0.20	0.00/-0.01
1993	13.63	0.55/0.53	0.07/0.00	0.11/0.19	0.00/-0.02
1994	13.80	0.58/0.52	0.06/-0.01	0.09/0.18	0.01/-0.01
1995	14.06	0.55/0.48	0.06/-0.01	0.11/0.22	0.02/-0.01
1996	14.86	0.52/0.50	0.06/-0.03	0.14/0.28	0.02/-0.01
1997	15.40	0.48/0.47	0.04/-0.03	0.11/0.18	0.03/-0.01
1998	16.15	0.62/0.58	0.02/-0.08	0.10/0.16	0.03/0.00
1999	16.25	0.67/0.52	0.00/-0.12	0.14/0.27	0.03/-0.00
2000	16.92	0.83/0.61	-0.03/-0.11	0.15/0.26	0.02/0.00
2001	18.39	0.76/0.63	-0.03/-0.16	0.08/0.14	0.00/-0.02
2002	19.59	0.84/0.78	-0.01/-0.14	0.06/0.12	0.00/-0.02
2003	20.68	0.51/0.44	0.01/-0.10	0.08/0.18	0.01/-0.02
2004	22.01	0.42/0.38	0.01/-0.11	0.12/0.22	0.02/-0.01
2005	22.60	0.44/0.36	0.03/-0.09	0.01/0.22	0.02/0.00
2006	23.00	0.41/0.35	0.02/-0.11	0.10/0.20	0.02/-0.02
2007	23.03	0.47/0.42	0.02/-0.09	0.09/0.22	0.03/-0.01
2008	22.08	0.96/0.79	0.01/-0.12	0.06/0.08	0.02/0.00
2009	23.09	0.64/0.59	0.03/-0.07	0.06/0.10	-0.01/-0.02
2010	23.40	0.57/0.49	0.04/-0.06	0.08/0.17	0.01/0.00
2011	23.79	0.69/0.54	0.03/-0.12	0.09/0.22	0.02/-0.01
2012	21.98	0.65/0.56	0.02/-0.09	0.08/0.18	0.03/-0.01

Notes. This table reports the mean values of mispricing, security issuance and profitability of ZL and NZL firms. The definitions of all variables are provided in Table 1. Proportion $_{ZL}$ is the percentage of firms with no debt.

Table 4. Characteristics of ZL and NZL Firms with Different Degrees of Mispricing

	(1)			(2)			(3)			(4)			(5)		
	ZL	NZL	t-stat	ZL	NZL	t-stat	ZL	NZL	t-stat	ZL	NZL	t-stat	ZL	NZL	t-stat
Proportion of ZL	27%			25%			16%			15%			17%		
Mispricing	0.08	0.09	4.8***	0.28	0.29	6.6***	0.47	0.48	0.71	0.74	0.75	-0.59	1.60	1.63	2.09**
Leverage	0.000	0.26	75.1***	0.00	0.23	73.9***	0.00	0.24	72.7***	0.00	0.25	76.2***	0.00	0.26	76.9***
Deviation Leverage	-0.060	0.00	27.4***	-0.05	0.00	26.3***	-0.04	0.00	26.5***	-0.04	0.00	32.2***	-0.06	0.00	36.9***
Credit Rating Change	0.00	0.08	18.1***	0.01	0.2	28.5***	0.00	0.22	27.2***	0.00	0.18	24.7***	0.00	0.11	20.0***
Tobin's Q	6.58	4.08	-36.8***	2.57	1.96	-52.8***	1.69	1.41	-43.2***	1.18	1.09	-28.7***	0.78	0.82	7.7***
Size	2.75	3.47	6.2***	4.19	5.45	4.1***	4.02	5.62	4.1***	3.81	5.3	6.1***	2.75	4.51	6.8***
Age	9.31	10.44	4.1***	11.91	15.36	5.1***	13.11	16.87	6.4***	14.29	16.59	4.8***	14.35	14.85	1.9*
Deviation Investment	0.002	0.02	5.8***	-0.02	0.01	13.3***	-0.02	0.00	14.0***	-0.03	0.00	15.8***	-0.04	-0.01	19.9***
Net Equity Issuance	0.30	0.21	-17.5***	0.08	0.06	-0.6***	0.04	0.03	5.6***	0.01	0.01	7.1***	0.01	0.01	7.9***
Debt Issuance	-0.02	0.02	19.5***	-0.01	0.02	13.5***	0.00	0.01	10.1***	0.00	0.01	7.4***	-0.01	0.00	2.4*

Notes. This table reports the mean values of selected variables for the ZL and NZL firms. Firms are grouped into quintiles based on their degree of mispricing. Group 1 is the most overvalued whereas Group 5 consists of the most undervalued firms. Proportion of ZL is the percentage of ZL firms in each quantile. We report the t statistics and p-values for the differences in mean of selected variables. *, **, and *** shows statistical significance at the 10%, 5%, and 1% level, respectively. The definitions of all variables are provided in Table 1.

Table 5. Conditional Logit Regressions for the Effects of Firm Characteristics on ZL Policy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Credit Rating Change		-2.692***				-2.437**	-0.311***
		(1.021)				(1.188)	(0.110)
Mispricing			-0.158***			-0.168***	-0.032***
			(0.036)			(0.046)	(-0.007)
Overvaluation Duration				0.026**			
				(0.011)			
Underinvestment					0.29***	0.236***	0.052***
					(0.039)	(0.047)	(-0.007)
Excess Cash	1.259***	1.251***	1.248***	1.244***	1.25***	1.240***	0.220***
	(0.049)	(0.051)	(0.053)	(0.057)	(0.050)	(0.059)	(-0.008)
Tax Benefit	1.255***	1.231***	1.248***	1.588***	1.09***	1.528***	0.129**
	(0.253)	(0.253)	(0.290)	(0.353)	(0.312)	(0.373)	(-0.063)
Financial Distress	-0.993***	-0.996***	-0.999***	-1.029***	-0.96***	-0.929***	-0.165***
	(0.054)	(0.054)	(0.061)	(0.074)	(0.067)	(0.079)	(-0.012)
Volatility	-0.004***	-0.006***	-0.004***	-0.003**	-0.004*	-0.002	0.001
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)
Size	-0.522***	-0.529***	-0.580***	-0.661***	-0.50***	-0.596***	-0.092***
	(0.021)	(0.021)	(0.025)	(0.035)	(0.027)	(0.035)	(-0.005)
Age	0.238***	0.245***	0.388***	0.380***	0.16***	0.370***	0.084***
	(0.055)	(0.056)	(0.064)	(0.118)	(0.041)	(0.128)	(-0.014)
Profitability	0.279***	0.287***	0.209**	0.226*	0.54***	0.206*	0.067***
	(0.073)	(0.073)	(0.091)	(0.125)	(0.100)	(0.125)	(-0.017)
Tobin's Q	0.069***	0.069***	0.080***	0.118***	0.05***	0.118***	0.008***
	(0.007)	(0.007)	(0.009)	(0.012)	(0.010)	(0.012)	(-0.002)
Tangibility	-5.306***	-5.310***	-5.620***	-5.708***	-4.53***	-4.728***	-0.776***
	(0.184)	(0.184)	(0.214)	(0.268)	(0.227)	(0.268)	(-0.038)
Dividends	0.273***	0.269***	0.373***	0.472***	0.34***	0.447***	0.057***
	(0.052)	(0.052)	(0.059)	(0.071)	(0.062)	(0.076)	(-0.011)
N	33,768	23,165	33,768	27,297	19,249	17,955	17,956
$\chi 2$	3506	3676	2610	3516	2694	3171	.
Pseudo R2	0.116	0.123	0.126	0.121	0.128	0.166	.

Notes: This table reports the regression results for the determinants of ZL policy. Columns 1 to 6 report the coefficient estimates and column 7 reports the average marginal effects. The marginal effects measure the change in probability resulting from a one standard deviation change around the mean of a continuous explanatory variable, holding all other variables at their means; for dummy variables, the marginal effect is the change in probability associated with a switch from 0 to 1. *, **, and *** shows statistical significance at the 10%, 5%, and 1% level, respectively. Year dummies are included in all models. The definitions of the variables are provided in Table 1.

Table 6. Managerial overconfidence and ZL policy

	(1)	(2)	(3)	(4)	(5)	(6)
Overconfidence		3.190***				
		(0.400)				
Overconfidence-Residual		-3.259***				
		(0.408)				
Overconfidence-Fitted			2.140***		2.270***	0.160***
			(0.283)		(0.416)	(0.023)
CEO Ownership	3.800***	1.530***		1.420***	0.621	0.003
	(0.365)	(0.446)		(0.441)	(0.526)	(0.028)
CEO Age	0.060**	-0.150***		-0.150***	-0.190***	-0.010***
	(0.025)	(0.039)		(0.039)	(0.039)	(0.002)
CEO Tenure	0.010***	0.020***		0.020***	0.010	0.000
	(0.003)	(0.004)		(0.004)	(0.004)	(0.000)
CEO Director	-0.460***	0.040		0.050	0.340	0.020
	(0.176)	(0.250)		(0.249)	(0.255)	(0.014)
Credit Rating Change	0.913	-0.196	-0.194	-0.201	-0.189	-0.001
	(0.601)	(1.191)	(1.191)	(1.195)	(1.195)	(0.021)
Mispricing	-0.190***	0.200**	0.198**	0.215**	0.199**	0.02**
	(0.053)	(0.078)	(0.078)	(0.079)	(0.077)	(0.005)
Underinvestment	-0.220***	0.320***	0.430***	0.330***	0.460***	0.030***
	(0.037)	(0.062)	(0.063)	(0.062)	(0.065)	(0.004)
Excess Cash	0.000	1.220***	1.210***	1.220***	1.200***	0.060***
	(0.039)	(0.064)	(0.064)	(0.064)	(0.065)	(0.004)
Tax Benefit	2.860***	0.080	-1.310**	-0.010	-1.450***	-0.080**
	(0.433)	(0.530)	(0.550)	(0.529)	(0.564)	(0.031)
Financial Distress	-0.230***	-0.710***	-0.540***	-0.710***	-0.510***	-0.030***
	(0.044)	(0.080)	(0.083)	(0.080)	(0.085)	(0.005)
Volatility	0.000	0.000	-0.000	0.000	-0.000	-0.000
	(0.003)	(0.005)	(0.005)	(0.005)	(0.006)	(0.000)
Size	0.050***	-0.710***	-0.720***	-0.710***	-0.730***	-0.040***
	(0.015)	(0.030)	(0.029)	(0.030)	(0.030)	(0.002)
Age	-0.350***	-0.070	0.110**	-0.060	0.180***	0.010***
	(0.032)	(0.050)	(0.055)	(0.050)	(0.061)	(0.003)
Profitability	0.600**	1.600***	1.250***	1.610***	1.120***	0.060***
	(0.253)	(0.306)	(0.308)	(0.306)	(0.314)	(0.017)
Tobin's Q	0.550***	0.230***	0.020	0.210***	-0.020	-0.000
	(0.034)	(0.023)	(0.027)	(0.021)	(0.035)	(0.002)
Tangibility	0.040	-2.320***	-2.360***	-2.320***	-2.340***	-0.130***
	(0.110)	(0.209)	(0.209)	(0.208)	(0.210)	(0.011)
Dividend Payer	-0.200***	0.100	0.170**	0.100	0.220***	0.010***
	(0.046)	(0.067)	(0.067)	(0.067)	(0.069)	(0.004)
Constant	-1.300***	0.250	-0.790	0.240	-0.940	
	(0.454)	(0.760)	(0.740)	(0.762)	(0.787)	
N	14,831	14,831	14,828	14,835	14,836	14,837
$\chi 2$	1304	2447	2489	2452	2492	-
Pseudo R2	0.132	0.321	0.323	0.320	0.326	-

Notes: This table reports the results of logit regressions by focusing on factors related to managerial attributes as ZL policy determinants. Model (1) reports the determinants of managerial overconfidence where Overconfidence is the dependent variable. Model (2) confirms that the Overconfidence variable is endogenous, hence the fitted value of model (1) is used as CEO overconfidence proxy in models (3) and (5) in which the dependent variable is ZL. Model (6) reports the average marginal effects that measure the change in probability resulting from a one standard deviation change around the mean of a continuous explanatory variable, holding all other variables at their means. For dummy variables, the marginal change is the change in probability associated with a switch from zero to one. The standard errors are robust to heteroscedasticity and clustered at firm level. Time and industry dummies are included in all models. *, **, and *** indicates statistical significance at the 10%, 5%, and 1% level, respectively. The definitions of all variables are provided in Table 1.