Advances in Accounting, incorporating Advances in International Accounting xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Advances in Accounting, incorporating Advances in International Accounting

journal homepage: www.elsevier.com/locate/adiac

# Corporate tax aggressiveness and the maturity structure of debt☆

Thomas R. Kubick [a,]*, G. Brandon Lockhart [b]

[a] University of Kansas, 1654 Naismith Drive, Lawrence, KS 66045-7601, United States
[b] School of Accountancy and Finance, Clemson University, Clemson, SC 29634, United States

ARTICLE INFO

*Article history:*
Received 27 October 2015
Received in revised form 20 May 2016
Accepted 20 October 2016
Available online xxxx

*JEL classifications:*
G21
G32
H26

*Keywords:*
Tax aggressiveness
Tax sheltering
Debt maturity
Leverage
Agency costs of debt

ABSTRACT

We investigate the association between tax aggressiveness and corporate debt maturity, and we find strong evidence that shorter debt maturity is more prevalent for tax aggressive firms. The results survive numerous robustness tests, including controlling for compensation-induced incentives for risk-taking, firm and CEO effects, changes regressions, and instrumental variables estimation. The results suggest that lenders view tax aggressiveness as a risky activity and therefore restrict the maturity structure of debt to provide a monitoring mechanism for debt contracts with tax-aggressive borrowers. We conclude that tax aggressiveness has a meaningful influence on debt contracting.



## 1. Introduction

The existing literature on the association between corporate tax aggressiveness and debt contracting provides mixed results. Results in Graham and Tucker (2006) and Richardson, Lanis, and Leung (2014) suggest that tax aggressive firms have, on average, lower leverage ratios by choice. However, Hasan, Hoi, Wu, and Zhang (2014) find that tax aggressiveness is associated with greater loan costs and more stringent collateral and security requirements. While it is empirically difficult to be pin down whether the negative association between tax aggressiveness and leverage is primarily driven by lender or borrower choice, it is clearer that borrowers do not prefer more costly loans with greater covenant and security requirements. We analyze the relation between tax aggressiveness and debt maturity to provide further clarity on the impact of tax aggressiveness on debt contracting, and we find consistent evidence that tax aggressive firms have debt contracts with shorter maturity.

Evidence on the economic impact of tax aggressiveness on the firm is mixed. Aggressive tax planning can provide benefits to the firm, such as cash flow savings (Mills, 1998) and relief of financial constraints (Edwards, Schwab, & Shevlin, 2016), which theoretically would result in greater firm value (Faulkender & Wang, 2006; Desai & Dharmapala, 2009). However, the value implications of the potential positives associated with tax aggressiveness depend on the risks of strategies pursued. Research has focused on the downside to tax aggressiveness such as IRS audit risk (Mills, 1998; Wilson, 2009), stock price crashes (Kim, Li, & Zhang, 2011), and negative stock returns due to the revelation of the use of illegal shelters (Hanlon & Slemrod, 2009), among others.

Because debt and equity investors have asymmetric payoff functions, they have different preferences for the risk of firm activities. Debt investors use several contracting features to moderate the firm's ability and incentives to pursue excessive risk after using debt in the firm's capital structure. While loan pricing, collateral requirements, and loan security are debt contract features the lender can use to moderate the firm's ability and incentive to pursue aggressive tax planning (Hasan et al., 2014), funding the firm's assets with short-term debt exposes the firm to “rollover risk.” Rollover risk is the potential that lenders will not renew debt financing on previous terms (or at all), and this threat can control potential conflicts of interest between equity and debt investors (Jensen & Meckling, 1976; Myers, 1977; Smith & Warner, 1979). Frequent renegotiation/re-pricing of debt – due to having shorter rather than longer-maturity debt – limits the shareholders' or managers' incentives to pursue policies that do not maximize firm value at the expense of debt investors (Childs, Mauer, & Ott, 2005). We expect that debt investors will require more frequent debt renegotiation via shorter maturity of loans to tax aggressive firms.

☆ Data availability: all data used in this study are obtained from public sources.

* Corresponding author.
*E-mail addresses:* tkubick@ku.edu (T.R. Kubick), blockha@clemson.edu (G.B. Lockhart).

http://dx.doi.org/10.1016/j.adiac.2016.10.001

We analyze the debt maturity of 10,967 U.S. firm-years over the 1993–2012 period, and find consistent evidence that tax aggressive firms have shorter maturity debt. Specifically, we estimate the effect of tax sheltering activities on the percentage of total debt that matures within three years, and find a strong and robust positive relation between tax aggressiveness and the proportion of short-term debt in the firm's capital structure. We assume that debt maturity is an important non-price loan term that is used by lenders to manage credit risk associated with tax aggressiveness. Our estimates suggest that lenders view tax aggressiveness as a risky activity and restrict the maturity structure of debt in the presence of greater tax aggressiveness.

This research contributes to literature on corporate tax aggressiveness, corporate debt maturity, and debt contracting. With respect to research on corporate tax aggressiveness, our work provides additional evidence that creditors view tax aggressive activities negatively when structuring loan contracts (Hasan et al., 2014). The results provide additional evidence that tax aggressive strategies are viewed as risky strategies by investors, consistent with results in studies of executive compensation vega (Rego & Wilson, 2012), executive compensation inside debt (Kubick, Lockhart, & Robinson, 2014), and stock price crash risk (Kim et al., 2011).

In a related study, Platikanova (in press) finds that firms with lower effective tax rates and greater reserves for uncertain tax benefits have a higher proportion of short maturity debt. However, effective tax rates are a common measure of tax *avoidance*, but not necessarily tax aggressiveness, and uncertain tax benefit reserves are subject to important limitations and weaknesses (Hanlon & Heitzman, 2010; De Simone, Robinson, & Stomberg, 2014). In contrast, we use a common measure of tax aggressiveness in all of our tests, as this measure reflects the likelihood of engaging in tax planning behaviors that are on the aggressive end of the spectrum (Hanlon & Heitzman, 2010). Our work complements the Hasan et al. (2014) analysis of the impact of tax aggressiveness on loan contracting, as the authors of that study analyze loan spreads, collateral, and covenants, but do not analyze debt maturity. Finally, our study provides indirect evidence suggesting that the lower leverage ratios among tax aggressive firms reported in Graham and Tucker (2006) and Richardson et al. (2014) are a result of lender actions instead of a choice by management to operate with lower leverage ratios. Just as we would not expect borrowers to prefer loans with greater loan spreads and more stringent collateral and security requirements (Hasan et al., 2014), we do not expect that borrowers will prefer greater levels of rollover risk and lender monitoring via short debt maturity if they are pursuing aggressive tax planning.

## 2. Background and hypothesis development

### 2.1. Debt maturity

Capital structure research has emphasized the importance of agency costs and information asymmetries for optimal leverage ratios and optimal debt maturity. Both market frictions can result in significant debt overhang and asset substitution problems, potentially affecting the firm's investment decisions (Jensen & Meckling, 1976; Myers, 1977). With risky debt outstanding, managers face an “over-hang problem” with incentives to pass-up some positive net present value projects because bondholders will gain a larger share of the project's value. Managers also face an “asset substitution problem” with incentives to accept some negative net present value projects that have a large upside return but (a more probable) lower downside return. Debt investors recognize the potential for these ex post investment distortions, and protect their positions ex ante by adjusting loan pricing, security, seniority, maturity, and other debt contract features (e.g., Jensen & Meckling, 1976; Myers, 1977; Barclay & Smith, 1995; Rajan & Zingales, 1995; Kim & Mauer, 1997; Goswami, 2000; Johnson, 2003; Gottesman & Roberts, 2004; Billett, King, & Mauer, 2006; Daniels, Ejara, & Vijayakumar, 2010).

Myers (1977) emphasizes that debt maturity can be one important solution to the agency costs of debt that result from the overhang and asset substitution problems. Essentially, the manager's incentives to depart from firm value-maximizing policies are decreased when they soon have to renegotiate existing debt. Childs et al. (2005) study the interaction of investment and financing policies in a model including agency costs of debt resulting from shareholder-bondholder conflicts over investment policy. They emphasize that frequent renegotiation/re-pricing of debt (e.g., due to shorter maturity) makes the value of the debt less sensitive to changes in firm value. Therefore, lenders have an effective tool in debt maturity to protect their investment. This interpretation of debt maturity is also modeled in Flannery (1986), Diamond (1991), discussed in Easterbrook (1984) and Rajan and Winton (1995), and is the focus of DeAngelo, DeAngelo, and Wruck (2002), among others.

### 2.2. Tax aggressiveness

Research aimed at determining whether shareholders value the tax aggressive policies of firms has yielded mixed results. On one hand, tax aggressive policies can minimize the tax burden, increasing liquidity and cash flows available to both debt and equity investors. However, because tax aggressive activities are opaque in nature, whether the associated benefits outweigh the risks is uncertain. Hanlon and Slemrod (2009) find evidence of negative stock returns upon the news release that a firm has employed tax shelters. However, Desai and Dharmapala (2009) find a positive association between firm value and tax aggressiveness if the firm has good governance characteristics. Hill, Kubick, Lockhart, and Wan (2013) find a positive association between long-window abnormal stock returns and corporate lobbying expenditures aimed at tax legislation and regulation among firms not identified as tax aggressive. Further, Rego and Wilson (2012) find a positive relation between tax aggressiveness and executive compensation vega, suggesting that managers with compensation sensitive to increases in risk (i.e., volatility of stock returns) are more tax aggressive.

Debt investors prefer more liquidity and cash flow to less, but not at the expense of excessive risk that might result in IRS penalties and other costs (e.g., management time, litigation, etc.). Edwards et al. (2016) find that tax avoidance strategies can moderate the effects of financial constraint through cash flow savings. Law and Mills (2015) analyze tone of 10-K filings and find that financially constrained firms pursue more aggressive tax planning. Research aimed at understanding the association between debt contracts and corporate tax policy has concluded that tax aggressive firms borrow less (Graham & Tucker, 2006; Richardson et al., 2014), but on more stringent and costly terms (Hasan et al., 2014). However, the interpretation of the former result is due to demand-side forces, whereas the interpretation of the latter result is due to supply-side forces. Specifically, Richardson et al. (2014) analyze the leverage ratios of tax aggressive firms and find that these firms have lower leverage ratios, especially among those firms with more outside directors on the board. The authors interpret the results from the view that the outside directors provide financial theory expertise, and thus, these firms are more equipped to understand that tax aggressive policies provide less benefit of operating with greater leverage ratios. The Hasan et al. (2014) study however, takes the opposite view in that supply-side forces result in greater costs of borrowing in the private debt markets. Specifically, they find a positive association between tax avoidance and private loan spreads, collateral, and covenant requirements. Further, the authors find that the positive association between tax avoidance and bank loan spreads is magnified for firms with greater information and agency risks, in addition to greater probability of being audited by the IRS.

Please cite this article as: Kubick, T.R., & Lockhart, G.B., Corporate tax aggressiveness and the maturity structure of debt, *Advances in Accounting, incorporating Advances in International Accounting* (2016), http://dx.doi.org/10.1016/j.adiac.2016.10.001

### 2.3. Hypothesis

Recent research provides mixed evidence on whether debtholders and shareholders prefer firms to pursue tax aggressive activities. However, one unexplored research question is whether debt investors use debt maturity to protect their position by moderating the incentive of managers to pursue risky tax policies. Debt maturing prior to the outcome of IRS audits or tax aggressive behavior can help to limit the downside risk to debt investors that can result from an increase in the tax burden after an audit, including penalties and litigation costs. This leads to our hypothesis:

**H1.** Debt maturity is negatively associated with tax aggressiveness.

## 3. Methodology

### 3.1. Sample selection

Our sample is derived from the intersection of the Compustat and Execucomp databases from 1993 through 2012. We limit our analysis to Execucomp firms, as theory and prior research suggests that we must control for executive compensation-induced incentives for risk-taking and the Execucomp database provides detailed coverage of executive compensation for S&P 1500 firms. Consistent with conventions in the capital structure literature, we limit our analysis to industrial firms with SIC codes from 2000 to 5999 (Barclay & Smith, 1995; Datta, Iskandar-Datta, & Raman, 2005; Brockman, Martin, & Unlu, 2010). We include additional control variables obtained from other sources as necessary (e.g., stock return volatility, term structure of interest rates). Our final sample contains 10,967 firm-year observations with debt in the capital structure.[1]

Table 1 presents the time and industry distributions. Panel A suggests that our sample is fairly evenly distributed across time, as we observe approximately 500–700 firms per year. Panel B presents our industry distribution using one-digit SIC codes. Although we observe a larger number of firms from the manufacturing, machinery, and electronics industries (one-digit SIC = 3), our sample has broad representation across a number of industries. Nevertheless, we control for industry at a much more refined level in our regressions (two-digit SIC).[2]

### 3.2. Measurement of short debt maturity

We follow prior literature and measure short debt maturity as the proportion of corporate debt maturing within the next three years (Barclay & Smith, 1995; Johnson, 2003; Datta et al., 2005; Brockman et al., 2010). Specifically, *Short Maturity* equals debt maturing in the next three years (Compustat DLC + DD2 + DD3) divided by total debt outstanding (Compustat DLC + DLTT).[3]

### 3.3. Measurement of corporate tax aggressiveness

We use a measure of tax sheltering likelihood as our measure of tax aggressiveness as Hanlon and Heitzman (2010), among others, contend that tax sheltering likelihood captures more aggressive forms of tax avoidance. Accordingly, we believe this is the most appropriate measure for our empirical setting as it captures the likelihood of engaging in intentional tax planning along the more aggressive end of the spectrum (Hanlon & Heitzman, 2010). Following Wilson (2009, p. 988), who empirically estimates the likelihood of engaging in a tax sheltering transaction using actual tax shelter firms, we define *SHELTER* as $-4.86 + 5.20 * BTD + 4.08|ACC| - 1.41 * LEV + 0.76 * SIZE + 3.51 * ROA + 1.72 * FI + 2.43 * R\&D$.[4] Variable definitions are consistent with definitions found in Wilson (2009). Specifically, *BTD* equals book-tax differences, *ACC* equals performance-matched pretax discretionary accruals, *LEV* equals log-term debt divided by total assets, *SIZE* equals the natural log of total assets, *ROA* equals pretax book income divided by total assets, *FI* equals one if pretax foreign income is positive, and *R&D* equals research and development expenses divided by lagged total assets. We then reverse the logit transform so that the measure represents a probability that lies between zero and one. Hence, *SHELTER* equals the likelihood of engaging in a tax sheltering transaction, and higher values of *SHELTER* reflect greater tax aggressiveness.

### 3.4. Multivariate design

We follow prior capital structure research, most notably Brockman et al. (2010), and estimate variations of the following regression:[5]

$$\begin{aligned} Short\ Maturity_{i,t} = \alpha &+ \beta_1 SHELTER_{i,t} + \beta_2 Log(CEODelta)_{i,t} \\ &+ \beta_3 Log(CEO\ Vega)_{i,t} + \beta_4 Size_{i,t} + \beta_5 Size^2{}_{i,t} \\ &+ \beta_6 Leverage_{i,t} + \beta_7 Abnormal\ Earnings_{i,t} \\ &+ \beta_8 Asset\ Maturity_{i,t} + \beta_9 CEO\ Ownership_{i,t} \\ &+ \beta_{10} Market{-}to{-}book_{i,t} + \beta_{11} MTR_{i,t} \\ &+ \beta_{12} Term\ Structure_{i,t} + \beta_{13} Stock\ Volatility_{i,t} \\ &+ \beta_{14} Rated\ Debt_{i,t} + \beta_{15} Altman's\ Z_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

*Short Maturity* is defined as the proportion of debt maturing within the next three years as described in Section 3.2. *SHETLER* is the likelihood of engaging in tax sheltering transactions as described in Section 3.3. We include a number of controls motivated by theory and prior research. First, we control for CEO option delta (*CEO delta*) and vega (*CEO Vega*) which are commonly used measures of equity incentives.[6] Brockman et al. (2010) find a negative (positive) relation between *CEO delta* (*CEO vega*) and short maturity, and Rego and Wilson (2012) establish a connection between CEO equity incentives and tax aggressiveness. We log-transform *CEO Delta* and *CEO Vega* to mitigate the influence of outliers. Similarly, the rest of our control variables are motivated by theory and prior research (see, for example, Johnson, 2003 and Brockman et al., 2010).

We control for firm size, *Size*, defined as the natural logarithm of the market value of the firm and book value of debt. Prior research suggests a negative relation between firm size and short debt maturity (Diamond, 1991; Barclay, Marx, and Smith, 2003; Johnson, 2003; Brockman et al., 2010). We also include the squared value of size in the regression to account for the nonlinearity between size and debt maturity (Brockman et al., 2010). *Leverage*, defined as total debt to market value of the firm, is included as prior research finds a negative relation between leverage and short debt maturity (Johnson, 2003), as well as leverage and tax sheltering (Graham & Tucker, 2006). *Abnormal Earnings* is included to control for the positive relation between valuable private information and short debt maturity (Flannery, 1986; Diamond, 1991, 1993; Johnson, 2003). *Asset Maturity* is included to control for the negative relation

[1] Our final sample of 10,967 firm-years is obtained after requiring non-missing values for the variables used in the analysis and performing the Belsley, Kuh, and Welsch (1980) outlier analysis by requiring the absolute values of the standardized residuals and the "DFITS" statistic to be <2.5, $2.0 * \sqrt{(k/n)}$, respectively.

[2] In untabulated tests, we confirm our primary results are robust to alternative industry definitions, such as Fama and French 49 industry classification, one-digit and three-digit SIC.

[3] In supplemental tests, we confirm our primary results are robust to defining *Short Maturity* as debt maturing within one-year, two years, four years, or five years.

[4] We also use alternative measures of *SHELTER* using other prediction models in Wilson (2009, p. 988). Specifically, we find similar results when *SHELTER* is defined as $-4.30 + 6.63 * BTD - 1.72 * LEV + 0.66 * SIZE + 2.26 * ROA + 1.62 * FI + 1.56 * R\&D$, or when *SHELTER* is defined as $-4.29 + 8.49 * BTD - 0.76 * LEV + 0.51 * SIZE + 4.59 * ROA + 1.28 * FI + 5.24 * R\&D$.

[5] All variables are defined in the Appendix.

[6] Delta (vega) is defined as the increase in the value of the CEO's option portfolio given a $1 (0.01 unit) increase in stock price (volatility). We estimate delta and vega using the "one year approximation method" in Core and Guay (2002). Theory and prior research suggests that higher delta (vega) discourages (encourages) greater risk taking (Knopf, Nam, & Thornton, 2002; Coles et al., 2006; Brockman et al., 2010; Armstrong, Larcker, Ormazabal, & Taylor, 2013).

**Table 1**
Sample composition.

Panel A: Time distribution

| Variable | N | % | Total | Total % |
|---|---|---|---|---|
| 1993 | 468 | 4.27 | 468 | 4.27 |
| 1994 | 643 | 5.86 | 1111 | 10.13 |
| 1995 | 644 | 5.87 | 1755 | 16.00 |
| 1996 | 655 | 5.97 | 2410 | 21.98 |
| 1997 | 657 | 5.99 | 3067 | 27.97 |
| 1998 | 592 | 5.40 | 3659 | 33.36 |
| 1999 | 587 | 5.35 | 4246 | 38.72 |
| 2000 | 560 | 5.11 | 4806 | 43.82 |
| 2001 | 464 | 4.23 | 5270 | 48.05 |
| 2002 | 478 | 4.36 | 5748 | 52.41 |
| 2003 | 528 | 4.81 | 6276 | 57.23 |
| 2004 | 570 | 5.20 | 6846 | 62.42 |
| 2005 | 560 | 5.11 | 7406 | 67.53 |
| 2006 | 549 | 5.01 | 7955 | 72.54 |
| 2007 | 571 | 5.21 | 8526 | 77.74 |
| 2008 | 476 | 4.34 | 9002 | 82.08 |
| 2009 | 458 | 4.18 | 9460 | 86.26 |
| 2010 | 523 | 4.77 | 9983 | 91.03 |
| 2011 | 529 | 4.82 | 10,512 | 95.85 |
| 2012 | 455 | 4.15 | 10,967 | 100.00 |

Panel B: Industry distribution

| Industry (1-digit SIC) | N | % | Total | Total % |
|---|---|---|---|---|
| 2 (food, tobacco, textiles, paper and chemicals) | 3367 | 26.52% | 3367 | 30.70% |
| 3 (manufacturing, machinery and electronics) | 4516 | 35.56% | 7883 | 71.88% |
| 4 (transportation and communications) | 789 | 6.21% | 8672 | 79.07% |
| 5 (wholesale and retail) | 2295 | 18.07% | 10,967 | 100.00% |

between long asset maturity and short debt maturity (Myers, 1977). *CEO Ownership* is included to control for the positive relation between managerial ownership and agency costs of debt (Billett, Mauer, & Zhang, 2010; Brockman et al., 2010). *Market-to-book* is included to control for the negative relation between growth opportunities and short debt maturity (Myers, 1977; Johnson, 2003). *MTR*, which is the before-financing simulated marginal tax rate of Graham (1996), is included to control for the potential preferences of longer maturity for firms with high marginal tax rates (Newberry & Novack, 1999).[7] *Term Structure* is included to control for the negative relation between an upward sloping yield curve and short debt maturity (Brick & Ravid, 1985; Johnson, 2003). *Stock Volatility* and *Rated Debt* are included as additional controls for credit quality (Johnson, 2003). Finally, we include *Altman's Z* as a measure of distress (Brockman et al., 2010). Fiscal year and industry (two-digit SIC) fixed effects are included in all regressions, and standard errors are clustered by firm (Petersen, 2009).[8]

## 4. Results

### 4.1. Descriptive statistics

Table 2 presents the descriptive statistics for our primary sample. Approximately 36.4% of outstanding corporate debt is expected to mature within three years, consistent with prior research (Johnson, 2003; Brockman et al., 2010). Mean and median tax sheltering likelihood (*SHELTER*) are also consistent with related tax research (Armstrong, Blouin, & Larcker, 2012). Mean (median) *CEO Delta* is $677,613 ($239,533), and mean (median) *CEO Vega* is $156,848 ($54,972), consistent with prior research (Coles, Daniel, & Naveen, 2006, 2014; Rego & Wilson, 2012).[9]

[7] Missing values are estimated following the procedures of Graham and Mills (2008).

[8] In untabulated robustness tests, we confirm our primary results are robust to clustering standard errors by firm and year.

[9] Rego and Wilson (2012) use slightly different terminology. Specifically, "*CEO_SLOPE*" and "*CEO_RISK_INCENT*" in their study are analogous to "*CEO Delta*" and "*CEO Vega*" in our study, respectively.

Finally, the means and medians of most of our control variables are consistent with related capital structure research (Johnson, 2003; Brockman et al., 2010). Next, we turn our attention to examining the pair-wise correlations of the variables used in our primary analyses.

### 4.2. Correlations

Table 3 reports Spearman correlation coefficients of the variables used in our primary tests. Importantly, the correlation between *Short Maturity* and *SHELTER* is positive and significant ($p$-value < 0.05),

**Table 2**
Descriptive statistics. This table reports summary statistics for the variables used in the primary analyses. The sample is comprised of 12,700 observations spanning fiscal years 1993 through 2012. All variables are defined in the Appendix.

| Variable | N | Mean | Std dev | 10th Pctl | 50th Pctl | 90th Pctl |
|---|---|---|---|---|---|---|
| $Short\ Maturity_t$ | 10,967 | 0.364 | 0.310 | 0.009 | 0.293 | 0.917 |
| $SHELTER_t$ | 10,967 | 0.833 | 0.179 | 0.538 | 0.913 | 0.989 |
| $CEO\ Delta_t$ | 10,967 | 677.613 | 1438.270 | 32.178 | 239.533 | 1549.700 |
| $CEO\ Vega_t$ | 10,967 | 156.848 | 273.225 | 0.000 | 54.972 | 422.576 |
| $Log(CEO\ Delta)_t$ | 10,967 | 5.381 | 1.692 | 3.502 | 5.483 | 7.346 |
| $Log(CEO\ Vega)_t$ | 10,967 | 3.716 | 1.960 | 0.000 | 4.025 | 6.049 |
| $Leverage_t$ | 10,967 | 0.145 | 0.109 | 0.016 | 0.125 | 0.295 |
| $Size_t$ | 10,967 | 8.093 | 1.526 | 6.284 | 7.901 | 10.258 |
| $Size * Size_t$ | 10,967 | 67.819 | 25.903 | 39.495 | 62.432 | 105.234 |
| $Abnormal\ Earnings_t$ | 10,967 | 0.008 | 0.071 | -0.034 | -0.005 | 0.055 |
| $Asset\ Maturity_t$ | 10,967 | 9.032 | 7.299 | 2.080 | 6.900 | 19.137 |
| $CEO\ Ownership_t$ | 10,967 | 0.400 | 1.725 | 0.000 | 0.000 | 1.130 |
| $Market\text{-}to\text{-}book_t$ | 10,967 | 1.937 | 0.967 | 1.100 | 1.652 | 3.109 |
| $MTR_t$ | 10,967 | 0.339 | 0.024 | 0.325 | 0.346 | 0.350 |
| $Term\ Structure_t$ | 10,967 | 1.525 | 1.130 | 0.140 | 1.570 | 3.240 |
| $Stock\ Volatility_t$ | 10,967 | 0.098 | 0.049 | 0.048 | 0.087 | 0.161 |
| $Rated\ Debt_t$ | 10,967 | 0.579 | 0.494 | 0.000 | 1.000 | 1.000 |
| $Altman's\ Z_t$ | 10,967 | 0.972 | 0.164 | 1.000 | 1.000 | 1.000 |
| $Fixed\ Assets\ Ratio_t$ | 10,967 | 0.299 | 0.191 | 0.090 | 0.253 | 0.588 |
| $ROA_t$ | 10,967 | 0.166 | 0.063 | 0.094 | 0.158 | 0.250 |
| $NOL\ dummy_t$ | 10,967 | 0.336 | 0.472 | 0.000 | 0.000 | 1.000 |
| $ITC\ dummy_t$ | 10,967 | 0.149 | 0.356 | 0.000 | 0.000 | 1.000 |

Please cite this article as: Kubick, T.R., & Lockhart, G.B., Corporate tax aggressiveness and the maturity structure of debt, *Advances in Accounting, incorporating Advances in International Accounting* (2016), http://dx.doi.org/10.1016/j.adiac.2016.10.001

**Table 3**
Correlations. This table reports Spearman correlation coefficients for selected variables of interest. Bolded coefficients denote significance at the 5% level or less using a two-sided test.

| | Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *Short Maturity$_t$* | | | | | | | | | | | | | | | |
| 2 | *SHELTER$_t$* | **0.04** | | | | | | | | | | | | | | |
| 3 | *Log(CEO Delta)$_t$* | **−0.02** | **0.41** | | | | | | | | | | | | | |
| 4 | *Log(CEO Vega)$_t$* | **−0.03** | **0.49** | **0.60** | | | | | | | | | | | | |
| 5 | *Leverage$_t$* | **−0.25** | **−0.11** | **−0.19** | **−0.03** | | | | | | | | | | | |
| 6 | *Size$_t$* | **−0.08** | **0.78** | **0.53** | **0.57** | 0.01 | | | | | | | | | | |
| 7 | *Size ∗ Size$_t$* | **−0.08** | **0.78** | **0.53** | **0.57** | 0.01 | **1.00** | | | | | | | | | |
| 8 | *Abnormal Earnings$_t$* | 0.01 | **0.04** | **−0.05** | 0.00 | **0.04** | −0.01 | −0.01 | | | | | | | | |
| 9 | *Asset Maturity$_t$* | **−0.04** | **−0.04** | **−0.10** | **−0.06** | **0.11** | **0.05** | **0.05** | 0.01 | | | | | | | |
| 10 | *CEO Ownership$_t$* | **−0.04** | **0.04** | **0.04** | **0.07** | 0.00 | 0.00 | 0.00 | **0.02** | **−0.05** | | | | | | |
| 11 | *Market-to-book$_t$* | **0.12** | **0.19** | **0.37** | **0.19** | **−0.64** | **0.24** | **0.24** | **−0.10** | **−0.08** | **−0.04** | | | | | |
| 12 | *MTR$_t$* | **−0.02** | **0.22** | **0.13** | **0.11** | 0.00 | **0.28** | **0.28** | 0.02 | **0.04** | **−0.09** | **0.11** | | | | |
| 13 | *Term Structure$_t$* | **0.03** | **0.05** | 0.02 | **0.06** | 0.00 | **0.03** | **0.03** | **−0.12** | −0.01 | **0.12** | **−0.05** | **−0.24** | | | |
| 14 | *Stock Volatility$_t$* | 0.01 | **−0.27** | **−0.15** | **−0.23** | **0.02** | **−0.35** | **−0.35** | **0.11** | **−0.12** | **0.03** | **−0.12** | **−0.14** | **−0.13** | | |
| 15 | *Rated Debt$_t$* | **−0.21** | **0.47** | **0.23** | **0.35** | **0.31** | **0.64** | **0.64** | 0.01 | **0.09** | **−0.06** | **−0.07** | **0.19** | 0.00 | **−0.21** | |
| 16 | *Altman's Z$_t$* | **0.08** | **0.03** | **0.03** | **0.03** | **−0.25** | **−0.05** | **−0.05** | **−0.03** | **−0.03** | **−0.02** | **0.19** | **0.07** | 0.01 | **−0.04** | **−0.08** |

supporting the hypothesis that lenders shorten the maturity structure of debt for firms that are more tax aggressive. Many of the remaining correlations are significant and display the correct signs. For example, *Log(CEO Delta)* is negative correlated with *Short Maturity* ($p$-value < 0.05), consistent with Brockman et al. (2010), and *Log(CEO Vega)* is positively correlated with *SHELTER*, consistent with Rego and Wilson (2012). With a few exceptions, most of the correlation coefficients are small and multicollinearity does not appear to be a significant issue.[10] Next, we test our hypothesis in a multivariate setting.

### 4.3. Pooled OLS regressions

Table 4 reports results from estimating Eq. (1) using an ordinary least squares (OLS) regression. Results support the hypothesis that lenders restrict the maturity of corporate debt in the presence of greater tax aggressiveness, as the coefficient estimate on *SHELTER* is positive and highly significant (Estimate = 0.316, $p$-value < 0.01). Notably, these results support our hypothesis after controlling for known determinants of debt maturity. Most of the coefficient estimates on our control variables display the correct signs. Specifically, the negative (Estimate = −0.005, $p$-value = 0.146) coefficient estimate on *Log(CEO Delta)* and the positive (Estimate = 0.005, $p$-value = 0.090) estimate on (*Log(CEO Vega)*) is consistent with Brockman et al. (2010) who show that lenders lengthen (shorten) debt maturity in the presence of the risk-deterring (risk-inducing) effects of delta (vega). Next, we turn our attention to various robustness tests in order to more thoroughly examine the relation between debt maturity and tax aggressiveness.

### 4.4. Firm and CEO fixed effects

Results in Table 4 support our hypothesis that lenders restrict debt maturity in the presence of greater tax aggressiveness using a pooled OLS regression. In this section, we re-estimate Eq. (1) with firm and CEO fixed effects in order to mitigate the possible influence of time-invariant, unobserved firm (e.g., firm culture, tax-related technology) and CEO (e.g., talent, ability, risk tolerance) factors that could be correlated with both debt maturity and tax aggressiveness. Table 5 reports the results from these estimations.

The regression estimates on the left report results using firm fixed effects, while the regression estimates on the right report results using CEO fixed effects. In the firm fixed effects estimation, we observe a positive and significant coefficient estimate on *SHELTER* (Estimate = 0.232, $p$-value < 0.01) suggesting that unobserved time-invariant firm factors are unlikely to be driving our results. In the CEO fixed effects specification, we continue to observe a positive coefficient estimate on *SHELTER* (Estimate = 0.232, $p$-value < 0.01) suggesting that unobserved CEO-specific factors are unlikely to account for our results. Moreover, in both instances, coefficient estimates on most of the remaining control variables are significant and properly signed, suggesting that the methodological restrictions imposed via firm and CEO fixed effects have not impeded our estimations. Overall, the results reported in Table 5 continue to support the hypothesis that lenders restrict the debt maturity of firms that exhibit greater tax aggressiveness. Next, we turn our attention to a changes regression in order to more thoroughly examine the robustness of our findings.

### 4.5. Changes regressions

In this section, we re-estimate Eq. (1) using first differences in order to further mitigate the potential effects of the endogeneity between corporate debt policy and tax policy. Table 6 reports results from this estimation. Results again support the hypothesis that lenders shorten debt maturity of firms that exhibit greater tax aggressiveness. Specifically, the positive coefficient estimate on *ΔSHELTER* (Estimate = 0.155, $p$-value = 0.001) suggests that an increase in tax sheltering likelihood

**Table 4**
OLS regressions. This table reports results from OLS regressions in which *Short Maturity$_t$* is the dependent variable. For brevity, fiscal year and industry dummies are not tabulated. Coefficients on variables of interest are bolded and italicized. All $p$-values are two-tailed, and standard errors are clustered by firm.

| Variable | Predicted signs | Estimate | $p$-Value |
|---|---|---|---|
| ***SHELTER$_t$*** | + | ***0.316*** | ***0.000*** |
| *Log(CEO Delta)$_t$* | − | −0.005 | 0.146 |
| *Log(CEO Vega)$_t$* | + | 0.005 | 0.090 |
| *Size$_t$* | − | −0.308 | 0.000 |
| *Size ∗ Size$_t$* | + | 0.017 | 0.000 |
| *Leverage$_t$* | − | −0.492 | 0.000 |
| *Abnormal Earnings$_t$* | + | 0.123 | 0.000 |
| *Asset Maturity$_t$* | − | −0.001 | 0.274 |
| *CEO Ownership$_t$* | + | −0.001 | 0.586 |
| *Market-to-book$_t$* | + | 0.020 | 0.001 |
| *MTR$_t$* | − | −0.067 | 0.680 |
| *Term Structure$_t$* | − | −0.004 | 0.671 |
| *Stock Volatility$_t$* | + | 0.057 | 0.519 |
| *Rated Debt$_t$* | − | −0.119 | 0.000 |
| *Altman's Z$_t$* | + | −0.034 | 0.043 |
| Year fixed effects? | | Included | |
| Industry fixed effects? | | Included | |
| $R^2$ | | 0.175 | |
| $N$ | | 10,967 | |

[10] One concern is the use of the squared size term in the regression. We confirm the variance inflation factors ("VIFs") of our coefficients of interest are <3, which are well below thresholds of concern (Kennedy, 2008). Further, in untabulated tests we confirm our main results are robust to the omission of the squared size term in the regression.

Please cite this article as: Kubick, T.R., & Lockhart, G.B., Corporate tax aggressiveness and the maturity structure of debt, *Advances in Accounting, incorporating Advances in International Accounting* (2016), http://dx.doi.org/10.1016/j.adiac.2016.10.001

**Table 5**
Firm and CEO fixed effects. This table reports results from CEO and firm fixed effects regressions in which *Short Maturity*$_t$ is the dependent variable. For brevity, fiscal year and firm/CEO dummies are not tabulated. Coefficients on variables of interest are bolded and italicized. All *p*-values are two-tailed.

| Variable | Predicted signs | Estimate | *p*-Value | Estimate | *p*-Value |
|---|---|---|---|---|---|
| ***SHELTER***$_t$ | + | ***0.232*** | ***0.000*** | ***0.232*** | ***0.000*** |
| *Log(CEO Delta)*$_t$ | − | 0.000 | 0.980 | −0.004 | 0.253 |
| *Log(CEO Vega)*$_t$ | + | 0.007 | 0.004 | 0.007 | 0.012 |
| *Size*$_t$ | − | −0.154 | 0.000 | −0.238 | 0.000 |
| *Size * Size*$_t$ | + | 0.007 | 0.000 | 0.011 | 0.000 |
| *Leverage*$_t$ | − | −0.581 | 0.000 | −0.562 | 0.000 |
| *Abnormal Earnings*$_t$ | + | 0.063 | 0.104 | 0.065 | 0.124 |
| *Asset Maturity*$_t$ | − | −0.001 | 0.279 | 0.000 | 0.839 |
| *CEO Ownership*$_t$ | + | 0.001 | 0.468 | 0.001 | 0.617 |
| *Market-to-book*$_t$ | + | −0.002 | 0.649 | 0.000 | 1.000 |
| *MTR*$_t$ | − | −0.036 | 0.812 | −0.082 | 0.641 |
| *Term Structure*$_t$ | − | −0.009 | 0.256 | −0.008 | 0.340 |
| *Stock Volatility*$_t$ | + | −0.010 | 0.904 | 0.084 | 0.308 |
| *Rated Debt*$_t$ | − | −0.119 | 0.000 | −0.140 | 0.000 |
| *Altman's Z*$_t$ | + | −0.056 | 0.007 | −0.065 | 0.005 |
| Year fixed effects? | | Included | | Included | |
| Industry fixed effects? | | Included | | Included | |
| Firm fixed effects? | | Included | | | |
| CEO fixed effects? | | | | Included | |
| $R^2$ | | 0.476 | | 0.582 | |
| *N* | | 10,967 | | 10,967 | |

**Table 6**
Changes (first differences) regressions. This table reports results from changes (first differences) regressions in which *Short Maturity*$_t$ is the dependent variable. For brevity, fiscal year and industry dummies are not tabulated. Coefficients on variables of interest are bolded and italicized. All *p*-values are two-tailed, and standard errors are clustered by firm.

| Variable | Predicted signs | Estimate | *p*-Value |
|---|---|---|---|
| ***ΔSHELTER***$_t$ | + | ***0.155*** | ***0.001*** |
| *ΔLog(CEO Delta)*$_t$ | − | 0.000 | 0.867 |
| *ΔLog(CEO Vega)*$_t$ | + | 0.001 | 0.774 |
| *ΔSize*$_t$ | − | −0.186 | 0.013 |
| *Δ(Size * Size)*$_t$ | + | 0.006 | 0.197 |
| *ΔLeverage*$_t$ | − | −0.555 | 0.000 |
| *ΔAbnormal Earnings*$_t$ | + | 0.052 | 0.160 |
| *ΔAsset Maturity*$_t$ | − | 0.000 | 0.804 |
| *ΔCEO Ownership*$_t$ | + | 0.002 | 0.482 |
| *ΔMarket-to-book*$_t$ | + | 0.017 | 0.064 |
| *ΔMTR*$_t$ | − | −0.038 | 0.886 |
| *ΔTerm Structure*$_t$ | − | −0.006 | 0.379 |
| *ΔStock Volatility*$_t$ | + | 0.044 | 0.616 |
| *ΔRated Debt*$_t$ | − | −0.134 | 0.000 |
| *ΔAltman's Z*$_t$ | + | −0.034 | 0.033 |
| Year fixed effects? | | Included | |
| Industry fixed effects? | | Included | |
| $R^2$ | | 0.041 | |
| *N* | | 8529 | |

is, on average, associated with an increase in the proportion of debt maturing within the next three years.[11] Similar to firm fixed effects, estimating our regression in first differences allows us to control for unobservable, time-invariant firm characteristics and thus more convincingly examine the extent to which tax aggressiveness is associated with short maturity debt.[12] Collectively, the results from firm fixed effects (Table 5) and first differences (Table 6) estimations suggest that correlated omitted firm characteristics that persist across time are not likely to be driving our results. Next, we examine if our results are robust to a two-stage least squares (2SLS) framework.

*4.6. Joint determination of debt maturity and leverage – 2SLS*

Prior research contends that leverage and debt maturity decisions are jointly endogenous (Johnson, 2003). In this section, we examine whether our results are robust to estimating leverage and debt maturity as simultaneous equations. We follow prior research (Johnson, 2003; Brockman et al., 2010) and estimate the following system of equations:

$$\begin{aligned} Leverage_{i,t} = {} & \gamma_0 + \gamma_1 Short\ Maturity_{i,t} + \gamma_2 SHELTER_{i,t} \\ & + \gamma_3 Log(CEO\ Delta)_{i,t} + \gamma_4 Log(CEO\ Vega)_{i,t} + \gamma_5 Size_{i,t} \\ & + \gamma_6 OWN_{i,t} + \gamma_7 Market{-}to{-}book_{i,t} \\ & + \gamma_8 Abnormal\ Earnings_{i,t} + \gamma_9 Stock\ Volatility_{i,t} \\ & + \gamma_{10} Fixed\ Assets\ Ratio_{i,t} + \gamma_{11} ROA_{i,t} \\ & + \gamma_{12} NOL\ dummy_{i,t} + \gamma_{13} ITC\ dummy_{i,t} + \zeta_{i,t} \end{aligned} \quad (2)$$

$$\begin{aligned} Short\ Maturity_{i,t} = {} & \varphi_0 + \varphi_1 SHELTER_{i,t} + \varphi_2 Log(CEODelta)_{i,t} \\ & + \varphi_3 Log(CEO\ Vega)_{i,t} + \varphi_4 Size_{i,t} + \varphi_5 Size^2{}_{i,t} \\ & + \varphi_6 Leverage_{i,t} + \varphi_7 Abnormal\ Earnings_{i,t} \\ & + \varphi_8 Asset\ Maturity_{i,t} + \varphi_9 CEO\ Ownership_{i,t} \\ & + \varphi_{10} Market{-}to{-}book_{i,t} + \varphi_{11} MTR_{i,t} \\ & + \varphi_{12} Term\ Structure_{i,t} + \varphi_{13} Stock\ Volatility_{i,t} \\ & + \varphi_{14} Rated\ Debt_{i,t} + \varphi_{15} Altman's\ Z_{i,t} + \eta_{i,t} \end{aligned} \quad (3)$$

Our choice of exclusion restrictions are the same as those used in Johnson (2003) and Brockman et al. (2010). Table 7 reports the results. Results continue to support the hypothesis that lenders shorten debt maturity in the presence of greater tax aggressiveness. Specifically, the positive coefficient estimate on *SHELTER* (Estimate = 0.234, *p*-value < 0.01) suggests that tax aggressiveness is on average associated with a greater proportion of debt maturing within the next three years after accounting for the simultaneity between leverage and maturity decisions. The signs and levels of significance of most of our control variables are consistent with our OLS results, as well as prior research. For brevity, we only tabulate the first stage instruments (reported near the bottom of the table). With the exception of *NOL dummy*, all instruments are significant and appropriately signed.[13] Overall, results from our 2SLS estimation confirm our earlier results and continue to support the hypothesis that lenders restrict debt maturity in the presence of greater tax aggressiveness.[14]

*4.7. Controlling for general levels of tax avoidance*

Although all of our regressions control for a firm's marginal tax rate (*MTR*), we acknowledge that this measure may not completely capture a firm's tax avoidance activity. This is potentially important, as Platikanova (in press) finds that higher levels of tax avoidance (proxied by the book and cash effective tax rate) and uncertain tax positions are associated with shorter debt maturity. In untabulated tests, we add the book and cash effective tax rate, as well as the reserve for uncertain tax positions disclosed pursuant to FIN 48, as additional controls and repeat all of our tests. In untabulated tests, we continue to find a positive and highly significant coefficient (*p*-value < 0.01) on *SHELTER* confirming that our results hold while controlling for general levels of tax avoidance.

## 5. Conclusion

We examine the relation between tax aggressiveness and corporate debt maturity, and we find strong and robust evidence that tax aggressiveness is associated with shorter debt maturity structures. The results contribute to the emerging stream of literature investigating the

[11] We note a reduction in sample size ($N = 8529$) after implementing first differences.
[12] Although we include industry fixed effects in our first differences regression, we confirm that our results hold if we exclude them. Our results also hold if we exclude our control variables and/or industry fixed effects.

[13] Brockman et al. (2010) also report a positive coefficient loading on the *NOL dummy*. One possible explanation might be that *ITC dummy* and *MTR* are picking up similar constructs. Nevertheless, we confirm our results are robust to the exclusion of this instrument.
[14] Results are also robust to estimating the system of equations using generalized methods of moments (GMM).

**Table 7**
Joint estimation of short maturity and leverage, 2SLS. This table reports results from 2SLS estimation in which *Short Maturity*$_t$ is the dependent variable of interest and *SHELTER* is the independent variable of interest. For brevity, only first stage instruments are tabulated. Coefficients on variables of interest are bolded and italicized. All *p*-values are two-tailed.

| Variable | Predicted signs | Estimate | *p*-Value |
|---|---|---|---|
| ***SHELTER***$_t$ | + | ***0.234*** | ***0.000*** |
| *Log(CEO Delta)*$_t$ | − | −0.007 | 0.002 |
| *Log(CEO Vega)*$_t$ | + | 0.005 | 0.003 |
| *Size*$_t$ | − | −0.257 | 0.000 |
| *Size ∗ Size*$_t$ | + | 0.014 | 0.000 |
| *Leverage*$_t$ | − | −1.075 | 0.000 |
| *Abnormal Earnings*$_t$ | + | 0.156 | 0.000 |
| *Asset Maturity*$_t$ | − | −0.001 | 0.009 |
| *CEO Ownership*$_t$ | + | 0.000 | 0.991 |
| *Market-to-book*$_t$ | + | −0.009 | 0.410 |
| *MTR*$_t$ | | 0.052 | 0.711 |
| *Term Structure*$_t$ | − | −0.005 | 0.579 |
| *Stock Volatility*$_t$ | + | 0.140 | 0.072 |
| *Rated Debt*$_t$ | − | −0.090 | 0.000 |
| *Altman's Z*$_t$ | + | −0.134 | 0.001 |
| *First stage instruments:* | | | |
| *Fixed Assets Ratio*$_t$ | + | 0.063 | 0.000 |
| *ROA*$_t$ | − | −0.272 | 0.000 |
| *NOL dummy*$_t$ | − | 0.008 | 0.000 |
| *ITC dummy*$_t$ | − | −0.013 | 0.000 |
| Year fixed effects? | | Included | |
| Industry fixed effects? | | Included | |
| Hansen's *J* | | 2.631 | 0.452 |
| Hausman's Test | | 7.459 | 0.006 |
| $R^2$ | | 0.154 | |
| *N* | | 10,967 | |

consequences of tax aggressiveness (Hanlon & Slemrod, 2009; Desai & Dharmapala, 2009; Kim et al., 2011; Hasan et al., 2014) by documenting that lenders appear to shorten the maturity structures of corporate debt when firms exhibit greater tax aggressiveness. Our results complement the work of Hasan et al. (2014), who show that lenders price the risk of tax aggressiveness into loan spreads, and provide evidence in favor of supply forces in the negative relationship between tax aggressiveness and leverage. We also contribute to the capital structure and debt contracting literatures by showing that corporate tax aggressiveness is negatively viewed by lenders when establishing loan terms, specifically maturity structures. As articulated in Harford, Li, and Zhao (2008), debt maturity is likely influenced by both the lender and managers, however, all else equal, managers prefer less lender monitoring to more. Thus, more frequent loan renegotiation and increased rollover risk for tax aggressive firms, due to having shorter-maturity debt, is more likely a result of lender actions and is consistent with the view of the effect of tax aggressiveness on debt contracting in Hasan et al. (2014). Finally, our results should be of general interest to auditors, policymakers, governmental agencies, academic researchers, and others interested in the implications of an aggressive corporate tax policy.

## Appendix A. Variable appendix

| Variable | Definition |
|---|---|
| A.1. Dependent variable | |
| *Short Maturity*$_t$ | Proportion of total debt maturing within the next three years (Compustat (DLC + DD2 + DD3) / (DLC + DLTT)). |
| A.2. Test variable | |
| *SHELTER*$_t$ | Probability of tax sheltering, following Wilson (2009, p. 988): $-4.86 + 5.20 * BTD + 4.08 * \lvert ACC \rvert - 1.41 * LEV + 0.76 * SIZE + 3.51 * ROA + 1.72 * FI + 2.43 * R\&D$. See Section 3.3 for additional details. |
| A.3. Control variables | |
| *CEO Delta*$_t$ | Dollar increase in the CEO's stock option portfolio given a 1% change in the underlying stock price. Computed using the Core and Guay (2002) "one-year approximation" method. Reported in thousands. |
| *CEO Vega*$_t$ | Dollar increase in the CEO's stock option portfolio given a 0.01 unit change in the underlying stock volatility. Computed using the Core and Guay (2002) "one-year approximation" method. Reported in thousands. |
| *Log(CEO Delta)*$_t$ | Natural log of *CEO Delta*. |
| *Log(CEO Vega)*$_t$ | Natural log of *CEO Vega*. |
| *Leverage*$_t$ | Total debt divided by the market value of the firm (Compustat (DLC + DLTT) / ((PRCC_F ∗ CSHPRI) + AT − SEQ). |
| *Size*$_t$ | Natural log of the market value of the firm (Compustat PRCC_F ∗ CSHPRI + AT − SEQ). |
| *Size ∗ Size*$_t$ | Square of *Size*. |
| *Abnormal Earnings*$_t$ | Change in the following year's earnings divided by market value of equity (ΔCompustat IBADJ/(PRCC_F ∗ CSHPRI). |
| *Asset Maturity*$_t$ | Weighted average maturity of property, plant, and equipment and current assets (Compustat (PPEGT/AT) ∗ (PPEGT/DP) + (ACT/AT) ∗ (ACT/COGS)). |
| *CEO Ownership*$_t$ | Percentage of shares owned by the CEO (Execucomp SHROWN_TOT_PCT). |
| *Market-to-book*$_t$ | Market-to-book value of the firm ((Compustat PRCC_F ∗ CSHPRI) + (AT − SEQ) / AT). |
| *MTR*$_t$ | Simulated before-financing marginal tax rate from John Graham. Missing values are estimated following the procedures in Graham and Mills (2008). |
| *Term Structure*$_t$ | Yield on the ten-year government note minus the six month T-bill rate. |
| *Stock Volatility*$_t$ | Standard deviation of monthly stock returns during the previous fiscal year. |
| *Rated Debt*$_t$ | Equals one if the firm has a debt rating (Compustat SPLTICRM). |
| *Altman's Z*$_t$ | Equals one if Altman's Z score is >1.81. |
| A.4. Leverage equation variables | |
| *Fixed Assets Ratio*$_t$ | Property, plant, and equipment divided by total assets (Compustat PPENT/AT). |
| *ROA*$_t$ | Return on assets (Compustat OIBDP/AT). |
| *NOL dummy*$_t$ | Equals one if the firm has a positive tax loss carryforward (Compustat TLCF). |
| *ITC dummy*$_t$ | Equals one if the firm has an investment tax credit (Compustat ITCI). |

## References

Armstrong, C., Blouin, J., & Larcker, D. (2012). The incentives for tax planning. *Journal of Accounting and Economics*, *53*, 391–411.
Armstrong, C., Larcker, D., Ormazabal, G., & Taylor, D. (2013). The relation between equity incentives and misreporting: The role of risk-taking incentives. *Journal of Financial Economics*, *109*, 327–350.
Barclay, M., & Smith, C. (1995). The maturity structure of corporate debt. *The Journal of Finance*, *50*, 609–631.
Barclay, M., Marx, L., & Smith, C. (2003). The joint determination of leverage and debt maturity. *Journal of Corporate Finance*, *9*, 149–167.
Belsley, D., Kuh, E., & Welsch, R. (1980). *Regression diagnostics: Identifying influential data and sources of collinearity*. New York: John Wiley and Sons.
Billett, M., King, D., & Mauer, D. (2006). Growth opportunities and the choice of leverage, debt maturity, and covenants. *The Journal of Finance*, *62*, 697–730.
Billett, M., Mauer, D., & Zhang, Y. (2010). Stockholder and bondholder wealth effects of CEO incentive grants. *Financial Management*, *39*, 463–487.
Brick, I., & Ravid, S. (1985). On the relevance of debt maturity structure. *The Journal of Finance*, *40*, 1423–1437.
Brockman, P., Martin, X., & Unlu, E. (2010). Executive compensation and the maturity structure of corporate debt. *The Journal of Finance*, *65*, 1123–1161.
Childs, P., Mauer, D., & Ott, S. (2005). Interactions of corporate financing and investment decisions: The effects of agency conflicts. *Journal of Financial Economics*, *76*, 667–690.
Coles, J., Daniel, N., & Naveen, L. (2006). Managerial incentives and risk-taking. *Journal of Financial Economics*, *79*, 431–468.
Coles, J., Daniel, N., & Naveen, L. (2014). Co-opted boards. *Review of Financial Studies*, *27*, 1751–1796.
Core, J., & Guay, W. (2002). Estimating the value of employee stock option portfolios and their sensitivities to price and volatility. *Journal of Accounting Research*, *40*, 613–630.
Daniels, K., Ejara, D., & Vijayakumar, J. (2010). Debt maturity, credit risk, and information asymmetry: The case of municipal bonds. *The Financial Review*, *45*, 603–626.

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

De Simone, L., Robinson, J., & Stomberg, B. (2014). Distilling the reserve for uncertain tax positions: The revealing case of black liquor. *Review of Accounting Studies*, *19*, 456–472.

DeAngelo, H., DeAngelo, L., & Wruck, K. (2002). Asset liquidity, debt covenants, and managerial discretion in financial distress: The collapse of L.A. gear. *Journal of Financial Economics*, *64*, 3–34.

Desai, M., & Dharmapala, D. (2009). Corporate tax avoidance and firm value. *The Review of Economics and Statistics*, *91*, 537–546.

Diamond, D. (1991). Debt maturity structure and liquidity risk. *Quarterly Journal of Economics*, *33*, 341–368.

Diamond, D. (1993). Seniority and maturity of debt contracts. *Journal of Financial Economics*, *33*, 341–368.

Easterbrook, F. (1984). Two agency-cost explanations of dividends. *American Economic Review*, *74*, 650–659.

Edwards, A., Schwab, C., & Shevlin, T. (2016). Financial constraints and cash tax savings. *The Accounting Review*, *91*, 859–881.

Faulkender, M., & Wang, R. (2006). Corporate financial policy and the value of cash. *The Journal of Finance*, *61*, 1957–1990.

Flannery, M. (1986). Asymmetric information and risky debt maturity choice. *The Journal of Finance*, *41*, 18–38.

Goswami, G. (2000). Asset maturity, debt covenants, and debt maturity choice. *The Financial Review*, *35*, 51–68.

Gottesman, A., & Roberts, G. (2004). Maturity and corporate loan pricing. *The Financial Review*, *39*, 55–77.

Graham, J. (1996). Debt and the marginal tax rate. *Journal of Financial Economics*, *41*, 41–73.

Graham, J., & Mills, L. (2008). Simulating marginal tax rates using tax return data. *Journal of Accounting and Economics*, *46*, 366–388.

Graham, J., & Tucker, A. (2006). Tax shelters and corporate debt policy. *Journal of Financial Economics*, *81*, 563–594.

Hanlon, M., & Heitzman, S. (2010). A review of tax research. *Journal of Accounting and Economics*, *50*, 127–178.

Hanlon, M., & Slemrod, J. (2009). What does tax aggressiveness signal? Evidence from stock price reactions to news about tax shelter involvement. *Journal of Public Economics*, *93*, 126–141.

Harford, J., Li, K., & Zhao, X. (2008). Corporate boards and the leverage and debt maturity choices. *International Journal of Corporate Governance*, *1*, 3–27.

Hasan, I., Hoi, C., Wu, Q., & Zhang, H. (2014). Beauty is in the eye of the beholder: The effect of corporate tax avoidance on the cost of bank loans. *Journal of Financial Economics*, *113*, 109–130.

Hill, M., Kubick, T., Lockhart, G. B., & Wan, H. (2013). The effectiveness and valuation of political tax minimization. *Journal of Banking & Finance*, *37*, 2836–2849.

Jensen, M., & Meckling, W. (1976). Theory of the firm: Managerial behavior, agency costs, and ownership structure. *Journal of Financial Economics*, *3*, 305–360.

Johnson, S. (2003). Debt maturity and the effects of growth opportunities and liquidity risk on leverage. *Review of Financial Studies*, *16*, 209–236.

Kennedy, P. (2008). *A guide to econometrics* (6th ed.). Blackwell publishing.

Kim, C., & Mauer, D. (1997). Securityholder taxes, corporate capital structures and the priority structure of debt. *The Financial Review*, *32*, 609–634.

Kim, J., Li, Y., & Zhang, L. (2011). Corporate tax avoidance and stock price crash risk: Firm-level analysis. *Journal of Financial Economics*, *100*, 639–662.

Knopf, J., Nam, J., & Thornton, J. (2002). The volatility and price sensitivities of managerial stock option portfolios and corporate hedging. *The Journal of Finance*, *57*, 801–812.

Kubick, T., Lockhart, G. B., & Robinson, J. (2014). *Does inside debt moderate corporate tax avoidance? Unpublished working paper*. University of Kansas, Clemson University, Texas A & M University.

Law, K., & Mills, L. (2015). Taxes and financial constraints: Evidence from linguistic cues. *Journal of Accounting Research*, *53*, 777–819.

Mills, L. (1998). Book-tax differences and Internal Revenue Service adjustments. *Journal of Accounting Research*, *36*, 343–356.

Myers, S. (1977). Determinants of corporate borrowing. *Journal of Financial Economics*, *5*, 147–175.

Newberry, K., & Novack, G. (1999). The effect of taxes on corporate debt maturity decisions: An analysis of public and private bond offerings. *The Journal of the American Taxation Association*, *21*, 1–16.

Petersen, M. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies*, *22*, 435–480.

Platikanova, P. (2016). Debt maturity and tax avoidance. *The European Accounting Review* (in press).

Rajan, R., & Winton, A. (1995). Covenants and collateral as incentives to monitor. *The Journal of Finance*, *50*, 1113–1146.

Rajan, R., & Zingales, L. (1995). What do we really know about capital structure? Some evidence from international data. *The Journal of Finance*, *50*, 1421–1460.

Rego, S., & Wilson, R. (2012). Equity risk incentives and corporate tax aggressiveness. *Journal of Accounting Research*, *50*, 775–809.

Richardson, G., Lanis, R., & Leung, S. (2014). Corporate tax aggressiveness, outside directors, and debt policy: An empirical analysis. *Journal of Corporate Finance*, *25*, 107–121.

Smith, C., & Warner, J. (1979). On financial contracting: An analysis of bond covenants. *Journal of Financial Economics*, *7*, 117–161.

Wilson, R. (2009). An examination of corporate tax shelter participants. *The Accounting Review*, *84*, 969–999.

Please cite this article as: Kubick, T.R., & Lockhart, G.B., Corporate tax aggressiveness and the maturity structure of debt, *Advances in Accounting, incorporating Advances in International Accounting* (2016), http://dx.doi.org/10.1016/j.adiac.2016.10.001