**Corporate Tax Aggressiveness, Outside Directors, and Corporate Debt Policy:**

**An Empirical Analysis**

**Abstract**

This study examines the influence of corporate tax aggressiveness on corporate debt policy (the debt-substitution effect), the impact of outside directors on debt, and the influence of outside directors on the debt-substitution effect. Based on a sample of 6,967 firm-year observations over the 2001–2010 period, we find that tax aggressiveness is negatively correlated with debt. We also observe that the proportion of outside directors on the board has a negative correlation with debt, and that outside directors magnify the debt-substitution effect. Finally, we obtain similar results based on the analysis of firms’ debt issuance decisions.

*JEL classification:*G3; H2.

*Keywords:* Corporate tax aggressiveness; debt policy; outside directors; corporate governance.

1. **Introduction**

The question of what determines a firm’s debt policy or capital structure has received a great deal of research attention over the years. Modigliani and Miller (1958) show that in a frictionless capital market, a value-maximizing firm is indifferent between debt and equity financing. Yet, Myers (1984) suggests that corporate debt policy is determined by the benefits and costs of debt financing, including the tax benefits of borrowing, the costs of bankruptcy or financial distress, and the cost of debt. Moreover, the view that capital structure decisions are impacted by agency cost considerations has also gained credence within the corporate finance literature (e.g. Grossman and Hart, 1982; Jensen, 1986; Harris and Raviv, 1988; Stultz, 1988; Harris and Raviv, 1991; Rajan and Winton, 1995). Hence, taxes and agency costs are considered to be important factors in a firm’s capital structure decision, so corporate tax aggressiveness[[1]](#footnote-1) and corporate governance mechanisms that monitor management are likely to affect corporate debt policy.

DeAngelo and Masulis (1980) theorize that non-debt tax shields, such as depreciation deductions and investment tax credits, serve as substitutes for debt (interest) deductions, as they reduce the tax advantage of, and thus the demand for debt. Specifically, they claim that every firm has an optimal amount of total tax deductions, so that when a firm uses more non-debt tax shields it has lower debt levels (the so-called debt-substitution effect). Early research on the determinants of capital structure choice reports inconsistent results on the debt-substitution effect (e.g. Bradley et al., 1984; Titman and Wessels, 1988). However, the findings of several later studies suggest that non-debt tax shields can serve as substitutes for debt deductions (e.g. MacKie-Mason, 1990; Dhaliwal et al., 1992; Trezevant, 1992). In more recent research that investigates tax sheltering, Graham and Tucker (2006) consider a sample of tax aggressive and non-tax aggressive firms. They observe that tax preferred activities related to tax shelters (non-debt shield deductions) are a substitute for debt tax shields (interest deductions). Thus, Graham and Tucker (2006) find that tax-aggressive firms use less debt on average than their non-tax-aggressive counterparts. We extend Graham and Tucker’s (2006) research by analyzing whether tax aggressiveness is negatively correlated with debt in a broad sample of firms.

Additionally, research by Grossman and Hart (1982) and Jensen (1986) conjectures that corporate debt has an important role to play in monitoring management and thus in reducing agency costs. Later research by Friend and Lang (1988), Mehran (1992), Bathala et al. (1994), Grier and Zychowicz (1994), Berger et al. (1997) and Harford et al. (2008) extends this view by examining the interplay between debt and other management monitoring mechanisms (such as the board of directors and institutional investors). These later studies generally find that there is a correlation between debt and other management monitoring mechanisms. However, the nature of this correlation is not clear with several studies finding that debt has a “complementary” relationship with other monitoring mechanisms (e.g. Friend and Lang, 1988; Mehran, 1992; Berger et al., 1997), whereas other studies are indicating a “substitutive” relationship between the two (e.g. Bathala et al., 1994; Berger et al., 1997).[[2]](#footnote-2) Employing a large sample of firms, we reconsider the issue about the role that debt plays as a management monitoring mechanism by examining whether debt has either a complementary (positive) or a substitutive (negative) correlation with the proportion of outside directors on the board, which is arguably one of the most effective management monitoring devices (Fama and Jensen, 1983; Hermalin and Weisbach, 1988; Rosenstein and Wyatt, 1990; Byrd and Hickman, 1992; Xie et al., 2003).[[3]](#footnote-3)

Finally, and more importantly, this study also investigates whether the proportion of outside directors on the board magnifies the debt-substitution effect. We specifically test the influence of outside directors on the debt-substitution effect because, apart from monitoring, outside directors also have a significant advisory role to play in the firm and are thus likely to be in a better position to make superior decisions about the optimal debt and capital structure mix of the firm (Fama and Jensen, 1983; Anderson and Reeb, 2004; Dahya and McConnell, 2005; Adams and Ferreira 2007; Coles et al., 2008; Armstrong et al., 2010). In fact, prior research indicates that outside directors provide valuable expert advice to management about key corporate decisions (e.g. Dalton et al., 1998; Hermalin and Weisbach, 1988; Agrawal and Knoeber, 1996; Hillman and Dalziel, 2003; Fich, 2005). Outside directors also contribute to a skilled and knowledgeable board as they are normally experienced professionals (e.g. reputable CEOs and executives, successful entrepreneurs, and university academics) that have broad expertise in several areas (e.g. business strategy, finance, and operations) (Fich, 2005; Linck et al., 2008). Thus, boards with a greater representation of outside directors are expected to make optimal financial structure decisions that maximize stockholder wealth. Indeed, as tax aggressiveness intensifies, firms with a greater representation of outside directors on their boards should better understand the tradeoffs between the costs and benefits of debt and non-debt tax shields.

Based on a sample of 6,967 firm-year observations over the 2001–2010 period, we find that corporate tax aggressiveness is negatively correlated with corporate debt. We also observe that the proportion of outside directors on the board has a negative correlation with debt, and that outside directors magnify the debt-substitution effect. Finally, we obtain comparable results based on analysis of firms’ debt issuance decisions.

This study contributes to the literature in several ways. First, this study extends prior research by Graham and Tucker (2006) by examining whether the proportion of outside directors on the board magnifies the debt-substitution effect. Our results consistently show that the proportion of outside directors on the board magnifies the negative correlation between corporate tax aggressiveness and debt. To the best of our knowledge, this study is the first to empirically document this correlation. Second, this study also investigates whether debt has either a complementary (positive) or a substitutive (negative) correlation with the proportion of outside directors on the board as the results of prior research in this area are mixed and inconclusive (e.g. Friend and Lang, 1988; Mehran, 1992; Bathala et al., 1994; Grier and Zychowicz, 1994; Berger et al., 1997; Harford et al., 2008). Unlike prior research, we employ a large sample of 6,967 firm-year observations to consider the correlation between the proportion of outside directors on the board and debt. Our results constantly indicate that the proportion of outside directors on the board has a negative impact on debt (substitutive), consistent with the idea that managers are likely to choose a restrictive capital structure (higher leverage) to bond themselves and establish a reputation with the capital markets in the absence of other management monitoring mechanisms (Harford et al., 2008). Finally, this study also tests the debt-substitution effect in a broad-based sample of approximately 697 firms, on average, over the 2001–2010 period (6,967 firm-years). This is a substantially larger and more representative sample than the Graham and Tucker (2006) sample, which extends the generalizability of their results.

The remainder of the paper is organized as follows. Section 2 provides the relevant theory and develops our hypotheses. Section 3 describes the sample, presents the descriptive statistics, and outlines our research method. Section 4 reports the results, and Section 5 concludes the paper.

1. **Theory and hypotheses development**

*2.1. Corporate tax aggressiveness and debt substitution*

Based on the theory of DeAngelo and Masulis (1980) that every firm has an optimal amount of total deductions, if a firm uses additional non-debt tax shields it will use fewer debt deductions (the debt-substitution effect). Thus, non-debt tax shields (e.g. depreciation deductions and investment tax credits) serve as substitutes for debt (interest) deductions.

Preliminary research on the debt-substitution effect failed to generate results consistent with the DeAngelo and Masulis (1980) prediction. For example, Bradley et al. (1984) conducted one of the earliest studies of non-debt tax shields and debt use but, in contrast to the aforementioned theory, found a positive correlation between the two. A later study by Titman and Wessels (1988) also found no evidence of non-debt tax shields’ effect on debt ratios. However, these researchers admit that it is questionable whether their measurement model captured the relevant aspects of the attributes suggested by DeAngelo and Masulis (1980).[[4]](#footnote-4)

Several studies, however, do provide some evidence to suggest that non-debt tax shields are an appropriate substitute for debt deductions. For instance, both MacKie-Mason (1990) and Dhaliwal et al. (1992) find a significant correlation between tax shields and the marginal tax rate and show that the latter does influence financing decisions. Particularly notable is these studies’ identification of an interaction between non-debt tax shields and a variable that identifies firms that are close to tax exhaustion, at which point the substitution between non-debt and debt tax shields becomes prominent. MacKie-Mason (1990) and Dhaliwal et al. (1992) find that tax-exhausted firms substitute away from debt tax shields when non-debt tax shields become more prevalent, a finding confirmed by Trezevant (1992).[[5]](#footnote-5)

Graham and Tucker (2006) also investigate the correlation between non-debt tax shields and debt levels using a sample of 44 tax-aggressive firms that had been issued a notice of deficiency by the IRS during the 1975–2000 period. Comparing these firms with a matched sample of non-tax-aggressive firms (based on size and industry classification) that had not been implicated by the IRS, they show that tax-preferred activities related to tax aggressiveness (non-debt tax shield deductions)[[6]](#footnote-6) can serve as a substitute for debt tax shield (interest) deductions, as originally envisaged by DeAngelo and Masulis (1980). On average, the tax-aggressive firms in Graham and Tucker’s (2006) sample made less use of debt than the control firms. The debt-to-asset ratios of the tax-aggressive firms were also found to be more than five percentage points lower than those of their non-tax-aggressive counterparts. Overall, Graham and Tucker’s (2006) results are consistent with the idea that tax-aggressive firms use non-debt tax shield deductions as a substitute for the interest deductions related to the use of debt.

Despite the major contribution of Graham and Tucker’s (2006) study to the issue of the substitution effect between tax aggressiveness and debt policy, the authors themselves question the generalizability of their results, owing to their small sample size and the nature of the firms involved; specifically, they examined 44 firms that had been identified by the IRS as involved in tax aggressiveness. Our study builds on Graham and Tucker (2006) and other research in this area (e.g. MacKie-Mason, 1990; Dhaliwal et al., 1992; Trezevant, 1992) by examining the impact of the substitution effect between tax aggressiveness and debt policy in a broad-based sample of firms. Overall, we expect that firms with a higher level of tax aggressiveness (more non-debt tax shields) are more likely to use less debt to reduce the risk of losing the tax benefits of interest deductions. Accordingly, this study tests the following hypothesis:

**H1:** All else being equal, corporate tax aggressiveness is negatively correlated with corporate debt.

*2.2. Outside directors and corporate debt*

The role of corporate debt, employed as a management monitoring mechanism and thereby reducing agency costs, is an important topic in the corporate finance literature. Grossman and Hart (1982) is one of the earliest studies that examines the role of debt in reducing agency costs. They suggest that the issue of debt changes management incentives so that their behavior becomes more consistent with that of shareholders. By issuing debt, firm management bonds itself to act in the shareholders’ interest because discretionary funds reduce and managers face greater overview from the financial markets as the threat of financial default increases (Grossman and Hart, 1982). In a more detailed discussion, Jensen (1986) presents the “control hypothesis” of debt creation. He claims that debt allows managers to effectively bond their promise to pay out future cash flows, which in turn, reduces the agency costs of free cash flows by reducing the cash flows available to managers for discretionary spending. Moreover, debt also forces managers to liquidate inefficient operations (Harris and Raviv, 1990). The role of debt in lowering the agency problem between managers and shareholders has been confirmed in other research (e.g. Harris and Raviv, 1988; Stultz, 1988; Harris and Raviv, 1991; Rajan and Winton, 1995). However, prior research is not clear about the correlation between debt as a management monitoring mechanism and other management monitoring mechanisms, such as the board of directors, institutional investors and blockholders. More specifically, prior literature offers competing views on the correlation. The two competing views concern a “complementary” (positive) relationship or a “substitutive” (negative) relationship between debt and other management monitoring mechanisms. Of specific interest here are outside directors as demonstrated effective monitors of management (Fama and Jensen, 1983; Hermalin and Weisbach, 1988; Rosenstein and Wyatt, 1990; Byrd and Hickman, 1992; Xie et al., 2003; Anderson and Reeb, 2004; Dahya and McConnell, 2005).

According to Harford et al. (2008), it is possible that debt and other management monitoring mechanisms are substitutive if managers choose a restrictive capital structure (higher leverage) to bond themselves and establish a reputation with the capital markets in the absence of strong governance. Conversely, if restrictive capital structures are the result of strong boards imposing constraints on managers, then capital structure and board strength are complementary (Harford et al., 2008). Friend and Lang (1988) was one of the earliest studies to test this hypothesis. They found that where firms have large non-managerial investors, their debt levels are significantly higher compared to those without a principal shareholder. This research suggests a complementary relationship between the existence of a large blockholder which can improve monitoring and reduce agency costs and the level of debt. Mehran (1992) examines executive incentive plans, corporate control and capital structure. He finds that where firms have more investment bankers on the board of directors, they have larger long-term debt ratios, and there is a positive correlation between the percentage of individual investors’ stock ownership and the firm’s leverage ratio, supporting the argument that major shareholders are also effective monitors. Consistent with the findings of Friend and Lang (1988), these results are indicative of a complementary relationship between board and blockholder monitoring, and leverage. Berger et al. (1997) also investigate cross-sectional correlations between corporate governance variables and debt levels. They observe that debt is lower when the CEO has a long tenure in office, has weak stock and compensation incentives, and does not face strong monitoring from the board or major stockholders. Berger et al. (1997) claim that their findings are consistent with entrenched CEOs pursuing less-levered capital structures, and thus the complementary view holds. With respect to outside directors the expectation is that they would choose to effectively monitor management by preferring more debt to impose a more constrained capital structure on the firm.

Alternatively, several other studies indicate a substitutive relationship between debt and other management monitoring mechanisms. Bathala et al. (1994) claim that, based on the substitutability argument, it is possible that as attendant monitoring increases, firms may find it optimal to utilize lower levels of debt to control agency conflicts in the firm. They find that increased monitoring via institutional ownership is negatively correlated with the level of debt financing, which is consistent with the substitutive relationship. As per Grier and Zychowicz (1994), the monitoring engendered by active institutional ownership, and the potential for large shareholders to exert disciplinary pressures on management via the corporate governance process, are also functions attributable to debt. Thus, to the extent that the disciplinary pressures of active institutional ownership and debt financing are substitutes, they expect that higher levels of institutional ownership is correlated with less debt. Grier and Zychowicz (1994) find that when institutional ownership is prevalent, firms are characterized by lower levels of debt, which is consistent with the substitutive relationship. Finally, while a fairly recent paper by Harford et al. (2008) posits a complementary correlation between a board monitoring index and debt, their results are mixed. They find that board monitoring (measured by an index) is not significantly correlated with debt. However, they do find that greater director power is the only separate item in their board monitoring index which is positively correlated with debt. However, this is offset by the negative correlation between incentive alignment (i.e. another item in their board monitoring index) and debt, thereby suggesting a substitutive relationship. The substitutive view indicates that with the presence of outside directors management may have a decreased demand for debt, as monitoring mechanism, given the existence of a well established and effective monitoring mechanism such as outside directors.

Overall, the evidence presented above is mixed and inconclusive as to whether debt as a management monitoring mechanism is complementary or substitutive for other monitoring mechanisms. In fact, none of the abovementioned research has employed outside directors, arguably one of the most effective management monitoring mechanisms, to test the correlation between debt and other management monitoring devices. We thus expect that the proportion of outside director membership on the board will impact debt levels either positively (complementary) or negatively (substitutive). It is possible that with the presence of outside directors, there is a preference to increase debt, to compliment effective monitoring, and at the same time to reduce debt as it is substituted because outside directors are already effective monitors. However, it is more probable that one will dominate the other. Accordingly, unless an effect exactly cancels out the other on aggregate, we expect a correlation between the proportion of outside directors and debt (non-directional hypothesis):

**H2:** All else being equal, there is an correlation between the proportion of outside directors on the board of directors and corporate debt.

*2.3. Debt-substitution effect and outside directors*

Issues related to a firm’s optimal capital structure, as determined by the trade-off between the tax advantages of debt and the costs of debt such as bankruptcy costs, agency costs of debt (i.e. conflicts of interests between shareholders and bondholders lead to higher debt costs), and the loss of non-debt tax shields, present various challenges and problems for senior managers (Bradley et al., 1984). As tax aggressiveness increases, more non-debt tax shields are used; thus the tax advantage of debt is reduced, while the bankruptcy and agency costs of debt are unlikely to change. Tax aggressiveness thus reduces the tax advantage of debt and demand for debt, so the challenge for senior management is to then lower debt levels. In its advisory role, we expect that boards with more outside directors should provide senior management with better advice in relation to the debt-substitution effect.

Besides monitoring, the board of directors has the important role of advising senior management of the firm (Mace, 1986; Finkelstein and Mooney, 2003; Adams and Ferreira 2007; Armstrong et al., 2010). According to Adams and Ferreira (2007), the provision of advice to management is among the top-five functions of boards of directors. Moreover, as an advisor, the board is unrestricted in its approach, so the board uses the knowledge-base of its directors to counsel management about the firm’s strategic direction (Adams and Ferreira, 2007). More specifically, Coles et al. (2008) found that directors serve different functions: non-management directors (outsiders) monitor top management and explicitly advise them on business strategy.

Outside directors are likely to be in a better position to make superior corporate decisions, including decisions about the optimal debt and capital structure mix of a firm. Prior research suggests that outside directors improve the quality of corporate decisions by providing independent and unbiased expert advice and counsel to the board (e.g. Fama and Jensen, 1983; Anderson and Reeb, 2004; Dahya and McConnell, 2005). In addition to the outside directors’ important role as monitors to protect the interests of shareholders of the firm, prior research indicates that outside directors provide valuable expert advice to management about major corporate decisions, such as mergers and acquisitions, capital structure, or strategic decisions. For instance, Dalton et al. (1998; 1999) argue that outside directors are more likely to offer better advice to CEOs. Hermalin and Weisbach (1988) also recognize that CEOs may choose outside directors who will give superior advice and counsel, and can bring valuable experience and expertise to the board. Pfeffer and Salancik (1978) and Hillman and Dalziel (2003) also claim that outside directors provide the firm with the resources essential for firm survival and long-term success. Agrawal and Knoeber (1996) show that the proportion of outsiders with political expertise on the board is related to the firm’s need for political advice, and Fich (2005) finds that CEOs from other firms are required as directors because of their ability to provide expert advice.

Additionally, outside directors contribute to a skilled and knowledgeable board given that they are typically experienced professionals (e.g. reputable CEOs and executives, successful entrepreneurs, and university academics) that have broad expertise in a number of important areas, including business strategy, finance, and operations (Fich, 2005; Linck et al., 2008). Thus, corporate boards with a greater representation of outside directors are expected to make optimal financial structure decisions that maximize stockholder wealth. As tax aggressiveness intensifies, firms with a greater representation of outside directors on their boards should better understand the tradeoff between the costs and benefits of debt and non-debt tax shields. This reasoning suggests that the debt-substitution effect is magnified in firms with a greater representation of outside directors on the board. Accordingly, this study tests the following hypothesis:

**H3:** All else being equal, the negative correlation between corporate tax aggressiveness and corporate debt is magnified for firms with a higher proportion of outside directors on their boards.

**3. Data and methodology**

*3.1. Data*

Our sample was collected from the Corporate Library, Compustat,the Investor Responsibility Research Center, and Audit Analytics databases. It consists of an unbalanced panel of 6,967 firm-year observations (around 697 firms) over the 2001–2010 period. Financial firms and regulated utility firms were excluded from the sample because the government regulations they face are likely to affect their corporate debt and tax aggressiveness measures, thus rendering them different from the other firms in the sample.

Table 1 reports the sample industry distribution according to the two-digit Global Industry Classification Standard (GICS) codes. Although the sample includes a greater proportion of firms in such industry categories as information technology (22.35%), consumer discretionary (21.67%), and consumer staples (20.41%) as expected, the firms are relatively evenly distributed across industries, indicating that there is no significant degree of industry bias.

**[Insert Table 1 about here]**

 The dependent variable is corporate debt (DEBT). Consistent with Byoun (2008), we measure corporate debt by book debt (BDEBT) and market debt (MDEBT). Specifically, BDEBT is measured as total debt (short-term debt plus long-term debt) divided by total assets (Graham and Tucker, 2006), and MDEBT is measured as total debt divided by the sum of the market value of equity and total debt (Rajan and Zingales, 1995).

The study’s independent variables of interest are corporate tax aggressiveness (TAG) and outside directors (OUTDIR). TAG is our key independent variable, and we use several proxy measures for it, including the book-tax gap (BTG), to improve the robustness of our results.[[7]](#footnote-7) The BTG is considered an effective measure of tax aggressiveness because large differences between accounting (book) income and taxable income are typical among firms that exhibit significant tax-aggressive behavior (Mills et al., 1998; Manzon and Plesko, 2002; Desai and Dharmapala, 2006; Frank et al., 2009; Wilson, 2009; Lisowsky, 2010; Rego and Wilson, 2012). Firms can structure transactions to generate large temporary or permanent differences between accounting and taxable income.[[8]](#footnote-8) Thus, our first measure of tax aggressiveness (BTG1) involves the assessment of the raw BTG, which captures tax strategies that lead to both temporary and permanent differences. In line with Manzon and Plesko (2002), BTG1 is computed as pre-tax accounting income less taxable income divided by total assets, with taxable income calculated as income tax expense divided by the corporate statutory tax rate of 35%. Our second measure of tax aggressiveness (BTG2) is calculated as the BTG residual, following Desai and Dharmapala (2006).[[9]](#footnote-9) We adjust the BTG in the same way that they do to control for earnings management strategies that may be responsible for the BTG, that is, the BTG component attributable to earnings management (via income-changing discretionary accruals) is removed to leave a residual value that is inferred to capture tax aggressiveness. Finally, our third measure of tax aggressiveness (BTG3) is computed as the BTG residual, following Frank et al. (2009).[[10]](#footnote-10) We estimate BTG3 as the residual of a regression of permanent discretionary book-tax differences on several non-tax-planning determinants, including state tax expenses, a change in net operating losses, and minority interest (Frank et al., 2009). Conceptually, BTG3 encapsulates tax-aggressive activities that are on the more aggressive end of the spectrum and that directly affect net income through a reduction in total income tax expense (McGuire et al., 2012). In terms of OUTDIR, we follow Beasley (1996), Bhojraj and Sengupta (2003), and Uzun et al. (2004), and measure it as the proportion of board members who are non-employee directors of the firm.

We also include several control variables in our regression models, based on the corporate debt model advanced by Byoun (2008): industry median debt ratio (MED), operating income (OI), market-to-book ratio of assets (MB), log of total assets (LnA), depreciation and amortization (DEP), fixed assets (FA), R&D expenditures (RND), a dummy variable for missing R&D expenditures (D\_RND), common stock dividends (DIV), and Altman’s Z-score (AZ) modified by MacKie-Mason (1990).

MED is measured as the industry median debt ratio based on the two-digit GICS codes. Frank and Goyal (2004, 2009) argue that industry median leverage is a key determinant of a firm’s leverage ratio that can act as a proxy for such factors as intangibility, regulation, stock variance, uniqueness, and the purchasing managers’ sentiment index. OI is measured as operating income divided by total assets. A firm with greater earnings may prefer to operate with either a lower or higher degree of leverage (Byoun, 2008). A lower degree of leverage may result from higher retained earnings mechanically reducing leverage, or from the firm limiting leverage to protect the franchise responsible for producing those high earnings, whereas a higher degree of leverage may reflect the firm’s ability to meet debt payments out of its earnings cash flow (Byoun, 2008). MB is measured as the market value of assets (MVA) divided by total assets, where MVA equals total assets minus total equity minus balance sheet-deferred taxes and investment tax credit plus the market value of common equity plus the preferred stock liquidating value (replaced by the preferred stock redemption value when missing). A higher MBis a sign of more attractive future growth options, which firms tend to protect by limiting their leverage (Adam and Goyal, 2008; Byoun, 2008). LnA is measured as the log of total assets, which proxies for firm size. Larger firms tend to have more leverage (possibly because they are more transparent) and less asset volatility, or are able to sell sufficiently large debt issues such that the fixed costs of public borrowing are not prohibitive (Byoun, 2008). DEP is measured as depreciation and amortization divided by total assets. Firms with more depreciation expenses have less need for the interest deductions correlated with debt financing (Dhaliwal et al., 1992; Trezevant, 1992). FA is measured as fixed assets divided by total assets. Firms operating with greater tangible assets have greater debt capacity (Harris and Raviv, 1991). RND is measured as R&D expenditures divided by net sales. RNDis a proxy for future expected investment, and also serves as an additional proxy for non-debt tax shields (Fama and French, 2002; Byoun, 2008). We set missing values to zero. D\_RND is a dummy variable, coded as 1 for firms with missing RND, and 0 otherwise (Byoun, 2008). DIV is measured as common stock dividends divided by total assets, and is included to control for the possible trade-off between debt and dividends in reducing the agency costs of free cash flow (Fama and French, 2002). AZ is Altman’s *Z*-score modified by MacKie-Mason (1990). It measures the ex ante probability of financial distress, and is calculated as 3.3EBITplus sales plus 1.4retained earnings plus 1.2working capital divided by total assets. Firms use less debt when the expected cost of financial distress is high (Graham, 1996, 2000). The variable definitions are summarized in Table 2.

**[Insert Table 2 about here]**

Table 3 reports the descriptive statistics for the variables used in our analysis. The mean (median) of BDEBT is 0.326 (0.198), whereas the mean (median) of MDEBT is 0.188 (0.146) which is lower, as expected. The means (medians) of BTG1, BTG2 and BTG3 are 0.097 (0.032), 0.008 (0.004) and 0.003 (0.002), respectively, which suggests that pre-tax accounting income is higher than taxable income for our BTG measures of tax aggressiveness. The mean (median) of OUTDIR is 0.816 (0.857). Finally, the means (medians) of the control variables are also summarized in Table 3.

**[Insert Table 3 about here]**

*3.2. Methodology*

To test the corporate tax aggressiveness and debt substitution hypothesis (H1), we estimate the following fixed-effects model (FEM), which controls for firm- and time-specific effects:[[11]](#footnote-11)

 DEBTit = α0 + β1TAGit + β2MEDit + β3OIit + β4MBit + β5LnAit + β6DEPit + β7FAit

 + β8RNDit + β9D\_RNDit + β10DIVit + β11AZit + εit, (1)

where DEBT = the firm’s debt measures (BDEBT and MDEBT); TAG = the firm’s tax aggressiveness measures (BTG1, BTG2 and BTG3); MED = the industry median debt ratio based on the two-digit GICS codes; OI = operating income divided by total assets; MB = the market-to-book ratio of assets; LnA = the log of total assets; DEP = depreciation and amortization divided by total assets; FA = fixed assets divided by total assets; RND = R&D expenditures divided by net sales; D\_RND = a dummy variable, coded as 1 for firms with missing RND, and otherwise 0; DIV = common stock dividends divided by total assets; AZ = Altman’s Z-score modified by MacKie-Mason (1990); and ε = the error term.

To test the outside directors and corporate debt hypothesis (H2), and the debt-substitution effect and outside directors hypothesis (H3), we estimate the following FEM, which also controls for firm- and time-specific effects:

 DEBTit = α0 + β1TAGit + β2OUTDIRit + β3OUTDIR\*TAGit + β4MEDit + β5OIit

 + β6MBit + β7LnAit + β8DEPit + β9FAit + β10RNDit + β11D\_RNDit

+ β12DIVit + β13AZit + εit, (2)

where OUTDIR = the proportion of board members who are non-employee directors; and OUTDIR\*TAG = an interaction term computed by multiplying OUTDIR by TAG (BTG1, BTG2, or BTG3).

**4. Results**

The regression results for corporate tax aggressiveness and debt substitution (H1) are reported first, followed by those for outside directors and corporate debt (H2), and the debt-substitution effect and outside directors (H3).[[12]](#footnote-12)

*4.1. Corporate tax aggressiveness and debt substitution*

Table 4 reports the regression results for H1’s prediction that tax aggressiveness is negatively correlated with debt (proxied by DDEBT and MDEBT). In line with this prediction, the regression coefficient for tax aggressiveness (proxied by BTG1, BTG2 and BTG3) is negative and significantly correlated with debt (*p* < 0.05 or better) across all regression model specifications, thus H1 is supported: the higher the level of tax aggressiveness, the lower the level of firm debt. These results, which are based on a large sample of firms and multiple measures of tax aggressiveness, are consistent with Graham and Tucker’s (2006) findings, thus providing strong evidence of the debt-substitution effect. For the control variables, we find that the regression coefficients for MED, LnA and FA are positive and significantly correlated with debt (*p* < 0.10 or better), and those for MB and RND are negative and significantly correlated with debt (*p* < 0.10 or better), across all regression model specifications, whereas those for OI, DEP, D\_RND and DIV are negative and significantly correlated with debt (*p* < 0.10 or better) across several of the specifications. The regression coefficient for AZ is not significant.

**[Insert Table 4 about here]**

*4.2. Outside directors and corporate debt, and the debt-substitution effect and outside directors*

Our next set of regression results, which are reported in Table 5, concern H2’s prediction that there is an correlation between the proportion of outside directors on the board and debt, and H3’s prediction that the negative correlation between tax aggressiveness and debt is magnified for firms with a higher proportion of outside directors on their boards. The regression coefficient for OUTDIR is significantly negatively correlated with debt (*p* < 0.05 or better) across all regression model specifications, providing support for H2. Our results for OUTDIR are thus consistent with prior research by Bathala et al. (1994) and Grier and Zychowicz (1994), showing a strong “substitution effect” between debt and outside directors (i.e. other management monitoring mechanisms). The regression coefficient for the interaction term between outside directors and tax aggressiveness (OUTDIR\*TAG [i.e. OUTDIR\*BTG1, OUTDIR\*BTG2 and OUTDIR\*BTG3]) is negative and significantly correlated with debt (*p* < 0.10 or better) across all regression model specifications, so H3 is supported: the negative correlation between tax aggressiveness and debt is indeed magnified for firms with a higher proportion of outside directors on their boards. The regression coefficient for tax aggressiveness (BTG1, BTG2 and BTG3) is also significantly negatively correlated with debt (*p* < 0.05 or better) across all regression model specifications, which is consistent with Graham and Tucker’s (2006) findings. As with the tests of H1, across all model specifications, the regression coefficients for MED, LnA and FA are positive and significantly correlated with debt (*p* < 0.10 or better), whereas those for MB and RND are negative and significantly correlated with debt (*p* < 0.10 or better). The regression coefficients for OI, DEP, D\_RND and DIV are negative and significantly correlated with debt (*p* < 0.10 or better) across some of the regression model specifications, and the regression coefficient for AZ is insignificant.

 **[Insert Table 5 about here]**

According to prior research, it is possible to divide non-employee directors into two groups: (1) independent directors, and (2) gray directors (Hermalin and Weisbach, 1988; Beasley, 1996; Uzun et al., 2004). Both are outside directors, but the former have no affiliation with the firm other than serving on the board, while the latter have some non-board affiliation, thus potentially violating the spirit of board independence (Beasley, 1996). They may be affiliated with management due to family relations, through serving as a consultant or supplier to the firm, or acting as an outside legal adviser, or they may be a retired former executive (Beasley, 1996). We thus perform additional analysis by replacing the proportion of board members who are non-employee directors (OUTDIR) in our regression model with the proportion of those who are either independent directors (OUTDIR\_IND) or gray directors (OUTDIR\_GRY) to test the prediction in H2. The interaction terms OUTDIR\_IND\*TAG and OUTDIR\_GRY\*TAG are also included in the regression model to test the prediction in H3. These additional results are presented in Table 6.

The regression coefficient for OUTDIR\_IND is significantly negatively correlated with debt (*p* < 0.05 or better) across all regression model specifications, thus H2 is supported by the results. We also find that the regression coefficient for OUTDIR\_GRY is significantly negatively correlated with debt (*p* < 0.10 or better) across all regression model specifications, so H2 is again supported. In fact, Table 6 shows that the results for H2 are slightly stronger for independent directors (as opposed to gray directors) who have no affiliation with the firm other than serving on the board. The regression coefficient for the interaction term between independent directors and tax aggressiveness (OUTDIR\_IND\*TAG) is negative and significantly correlated with debt (*p* < 0.05 or better) across all of the regression model specifications (i.e. OUTDIR\_IND\*BTG1, OUTDIR\_ING\*BTG2 and OUTDIR\_IND\*BTG3). Moreover, the regression coefficient for the interaction term between gray directors and tax aggressiveness (OUTDIR\_GRY\*TAG) is negative and significantly correlated with debt (*p* < 0.10 or better) across several of the regression model specifications (i.e. OUTDIR\_GRY\*BTG2 and OUTDIR\_GRY\*BTG3). Overall, these results provide support for H3. But, they are slightly stronger for independent directors rather than gray directors, indicating that independent directors are truly outsiders, which is consistent with the extant literature. Table 6 also shows the regression coefficients for TAG (BTG1, BTG2 and BTG3) to be negative and significantly correlated with debt (*p* < 0.01) across all of the regression model specifications. The results for the control variables differ slightly from those in Table 5. Although the regression coefficients for MED, LnA and FA remain positive and significantly correlated, and those for MB and RND negative and significantly correlated, with debt (all at *p* < 0.10 or better) across all regression model specifications, and those for DEP and DIV negative and significantly correlated (*p* < 0.10 or better) across several specifications, the regression coefficients for OI and D\_RND are no longer significant. Finally, the regression coefficient for AZ remains not significant.

**[Insert Table 6 about here]**

*4.3. Additional analysis*

We also perform additional analysis of firms’ incremental (0, 1) debt issuance decisions for two important reasons. First, by focusing on the numerator of the debt ratio, we circumvent the possibility that denominator effects drive our empirical results (Graham and Tucker, 2006). If tax aggressiveness generates deductions that serve as substitutes for interest deductions, then we would expect to find that tax-aggressive firms issue less debt. Second, the debt issuance decision also represents a potential solution to any endogeneity problem of tax aggressiveness (Mackie-Mason, 1990).[[13]](#footnote-13) As per Mackie-Mason (1990), we measure debt issuance (DEBTISSUE) with a dummy variable, coded as 1 if the firm issues debt over the period from t–1 to t = 0, and 0 otherwise. Moreover, given that our dependent variable is binary, we use fixed-effects logistic regression analysis in this part of the study.[[14]](#footnote-14) The results are presented in Table 7.

The regression coefficient for tax aggressiveness (BTG1, BTG2 and BTG3) remains negative and significantly correlated with debt (*p* < 0.01) across all regression model specifications, which provides further support for H1 of tax aggressiveness and debt substitution. In terms of the control variables, we find that the regression coefficients for MED, LnA and FA also remain positive and significantly correlated with debt (*p* < 0.05 or better), and those for OI and DEP are negative and significantly correlated with debt (*p* < 0.10 or better), across all regression model specifications. The regression coefficients for RND and D\_RND are still negative and significantly correlated with debt (*p* < 0.05 or better) across some of the regression model specifications, whereas those for MB, DIV, and AZ are insignificant.

H2, concerning outside directors and debt, is further supported by our results. Specifically, the regression coefficient for OUTDIR is significantly negatively correlated with debt (p < 0.05) across all regression model specifications. In terms of H3 (i.e. the debt-substitution effect and outside directors), this hypothesis also gains further support from these additional analyses, with the regression coefficient for the interaction term between outside directors and tax aggressiveness (OUTDIR\*TAG [i.e. OUTDIR\*BTG1, OUTDIR\*BTG2 and OUTDIR\*BTG3]) remaining negative and significantly correlated with debt (*p* < 0.05 or better) across all regression model specifications. The regression coefficient for tax aggressiveness is also negative and significantly correlated with debt across all regression model specifications (*p* < 0.01). Turning to the control variables, we again find the regression coefficients for MED, LnA and FA to be positive and significantly correlated with debt (*p* < 0.05 or better), and those for OI and DEP to be negative and significantly correlated (*p* < 0.10 or better), across all regression model specifications. In these analyses, the regression coefficients for MB, RND and D\_RND have a significantly negative correlation with debt (*p* < 0.10 or better) across several of the specifications, and those for DIV and AZ are not significant.

Overall, the results of our tests of the correlations between tax aggressiveness and debt substitution (H1), outside directors and corporate debt (H2), and the debt-substitution effect and outside directors (H3) based on firms’ debt issuance decisions, are comparable to the main results reported in Tables 4 and 5 of this paper.

**[Insert Table 7 about here]**

**5. Conclusion**

This study examines the influence of corporate tax aggressiveness on debt policy (the debt-substitution effect), the impact of outside directors on debt, and the influence of outside directors on the debt-substitution effect. Our results show that tax aggressiveness is negatively correlated with debt, thereby providing support for the debt-substitution hypothesis put forward by DeAngelo and Masulis (1980). Our findings also indicate that that the proportion of outside directors on the board has a negative impact on debt (substitutive), suggesting that it is likely that managers choose a restrictive capital structure (higher leverage) to bond themselves and establish a reputation with the capital markets in the absence of other management monitoring mechanisms (Harford et al., 2008). We also find that the proportion of outside directors on the board of directors magnifies the debt-substitution effect. Finally, additional analysis based on firms’ debt issuance decisions produces similar results.

Our study contributes to a better understanding of the correlation between corporate taxes and firms’ debt policies. Perhaps of even greater importance is that this study significantly improves upon and extends the notable work of Graham and Tucker (2006) by drawing on agency theory to investigate whether outside directors magnify the debt-substitution effect in a broad sample of firms.

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**Appendix A. Description of the Desai and Dharmapala (2006) method for calculating the BTG residual**

Applying the Desai and Dharmapala (2006) methodology, taxable income is calculated as TIjt = accounting income tax expense divided by the corporate statutory tax rate of 35%. The BTG is calculated by subtracting TI from pre-tax accounting income (AI): BTGjt = AIjt – TIjt. The BTG is scaled by the beginning of period total assets. The sample is not restricted to firms with positive BTG because those firms with TI > AI can and do use carry-forward tax losses to reduce tax payable. Total accruals (TA) were calculated for each firm in each year using the measure of total accruals developed by Healy (1985).

Total accruals are considered to measure the earnings management component of BTG.

TAit = EBEIit – (CFOit – EIDOit) (3)

where:

|  |  |  |
| --- | --- | --- |
| TAit | = | total accruals for firm *i* in year *t*; |
| EBEIit | = | income before extraordinary items for firm *i* in year *t*; |
| CFOit | = | cash flows from operations for firm *i* in year *t*; and |
| EIDOit | = | extraordinary items and discontinued operations from the statement of cash flows for firm *i* in year *t*. |

The following ordinary least squares (OLS) regression is performed to account for the component of BTG attributable to earnings management:

BTGit = β1TAit + μit + εjt (4)

where:

|  |  |  |
| --- | --- | --- |
| BTGit | = | the book-tax gap scaled by beginning year assets for firm *i* in year *t*; |
| TAit | = | total accruals scaled by beginning of year assets for firm *i* in year *t*; |
| μit | = | residual for firm *i* in year *t*; and |
| εit | = | error term for firm *i* in year *t*. |

The residual value of BTG is considered to reflect tax aggressiveness activity (TA): TAit = μit + εit.

**Appendix B. Description of the Frank et al. (2009) method for calculating the BTG residual**

Applying the methodology developed by Frank et al. (2009), we compute the BTG residual according to the following OLS regression equation:

PERMDIFFit = α0 + INTANGit + UNCONit + MIit + CSTEit + ∆NOLit + LAGPERMit  + εit (5)

where:

|  |  |  |
| --- | --- | --- |
| PERMDIFFit | = | total book-tax differences less temporary book-tax differences for firm *i* in year *t* = {BIit – [(CFTEit + CFORit)/CSTRit]} – (DTEit/CSTRit); |
| BIit | = | pre-tax book income for firm *i* in year *t*; |
| CFTEit | = | current federal tax expense for firm *i* in year *t*; |
| CFORit | = | current foreign tax expense for firm *i* in year *t*; |
| DTEit | = | deferred tax expense for firm *i* in year *t*; |
| CSTRit | = | corporate statutory tax rate of 35% for firm *i* in year *t*; |
| INTANGit | = | goodwill and other intangibles for firm *i* in year *t*; |
| UNCONit | = | income (loss) reported under the equity method for firm *i* in year *t*; |
| MIit | = | income (loss) attributable to minority interest for firm *i* in year *t*; |
| CSTEit | = | current state income tax expense for firm *i* in year *t*; |
| ∆NOLit | = | change in net operating loss carryforwards for firm *i* in year *t*; |
| LAGPERMit | = | one-year lagged PERMDIFF for firm *i* in year *t*; and  |
| εit | = | the error term for firm *i* in year *t*. |

The residual value of PERMDIFFit is considered to reflect tax aggressiveness activity (TA): TAit = εit.

**Table 1**

Sample industry distribution. This table reports the distribution of our sample firms according to industry classification, which is based on two-digit GICS codes, where 10 is energy, 15 is materials, 20 is industrials, 25 is consumer discretionary, 30 is consumer staples, 35 is health care, 45 is information technology, and 50 is telecommunication services.

|  |  |  |
| --- | --- | --- |
| Industry description (two-digit GICS codes) | No. of firm-years | Relative frequency (%) |
| Energy | 424 | 6.09 |
| Materials | 695 | 9.98 |
| Industrials | 1,510 | 21.67 |
| Consumer discretionary | 1,422 | 20.41 |
| Consumer staples | 520 | 7.46 |
| Health care | 774 | 11.11 |
| Information technology | 1,557 | 22.35 |
| Telecommunication services | 65 | 0.93 |
| Total | 6,967 | 100 |

**Table 2**

Variable definitions.

|  |  |
| --- | --- |
| Variable | Definition |
| BDEBT | Total debt (short-term debt plus long-term debt) divided by total assets. |
| MDEBT | Total debt divided by the sum of the market value of equity and total debt. |
| BTG1 | Pre-tax accounting income less taxable income (where taxable income is computed as income tax expense divided by the statutory corporate tax rate of 35%) using the method developed by Manzon and Plesko (2002). |
| BTG2 | Book-tax gap residual calculated employing the method developed by Desai and Dharmapala (2006). |
| BTG3 | Book-tax gap residual computed using the method developed by Frank et al. (2009). |
| OUTDIR | The proportion of board members who are non-employee directors. |
| MED | Industry median debt ratio based on two-digit GICS codes. |
| OI | Operating income divided by total assets. |
| MB | Market-to-book ratio of assets. |
| LnA | Log of total assets. |
| DEP | Depreciation and amortization divided by total assets. |
| FA | Fixed assets divided by total assets. |
| RND | R&D expenditures divided by net sales. |
| D\_RND | Dummy variable, coded as 1 for firms with missing RND, and 0 otherwise. |
| DIV | Common stock dividends divided by total assets. |
| AZ | Altman’s Z-score modified by MacKie-Mason (1990). |

**Table 3**

Descriptive statistics. Variable definitions are reported in Table 2. N = 6,967 for all variables.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable | Mean | Std. Dev. | Minimum | Median | Maximum |
| BDEBT | 0.326 | 0.895 | 0.000 | 0.198 | 0.750 |
| MDEBT | 0.188 | 0.183 | 0.000 | 0.146 | 0.776 |
| BTG1 | 0.097 | 0.739 | –0.635 | 0.032 | 0.223 |
| BTG2 | 0.008 | 0.109 | –0.279 | 0.004 | 0.255 |
| BTG3 | 0.003 | 0.007 | –0.005 | 0.002 | 0.008 |
| OUTDIR | 0.816 | 0.109 | 0.000 | 0.857 | 1.000 |
| MED | 0.214 | 0.047 | 0.000 | 0.219 | 0.346 |
| OI | 0.046 | 0.754 | –0.611 | 0.058 | 0.329 |
| MB | 2.011 | 2.226 | 0.362 | 1.306 | 6.101 |
| LnA | 7.666 | 1.705 | 3.176 | 7.600 | 13.590 |
| DEP | 0.044 | 0.099 | 0.005 | 0.037 | 0.139 |
| FA | 0.536 | 0.541 | 0.026 | 0.445 | 0.955 |
| RND | 0.058 | 0.667 | 0.000 | 0.000 | 0.537 |
| D\_RND | 0.353 | 0.397 | 0.000 | 0.000 | 1.000 |
| DIV | 0.024 | 0.069 | 0.000 | 0.005 | 0.105 |
| AZ | 1.889 | 1.450 | –1.300 | 1.507 | 5.560 |

**Table 4**

Multivariate regression analysis of corporate tax aggressiveness and the debt-substitution effect (H1). This table shows the regression results between tax aggressiveness and debt-substitution. The dependent variable is total debt (short-term debt plus long-term debt) divided by total assets (BDEBT) or total debt divided by the sum of the market value of equity and total debt (MDEBT). The independent variable is tax aggressiveness (TAG) which is measured as pre-tax accounting income less taxable income (where taxable income is computed as income tax expense divided by the statutory corporate tax rate of 35%) using the method developed by Manzon and Plesko (2002) (BTG1), the book-tax gap residual is calculated using the method developed by Desai and Dharmapala (2006) (BTG2), and the book-tax gap residual is computed using the method developed by Frank et al. (2009) (BTG3). Other variables are defined in Table 2. Coefficient estimates with the *t*-statistics are reported in parentheses. The *t*-statistics are computed using the fixed-effects model, controlling for firm-specific and time-specific effects, and standard errors are corrected based on one-way clustering by firm (e.g. Peterson, 2009). The statistical significance of the estimates is denoted with asterisks: \*\*\*, \*\* and \* correspond to 1%, 5% and 10% levels of significance, respectively. The *p*–values are one-tailed for directional hypotheses and two-tailed otherwise.

|  |  |  |
| --- | --- | --- |
|  | BDEBT | MDEBT |
| Variable | FEM1 | FEM2 | FEM3 | FEM4 | FEM5 | FEM6 |
| Intercept | 0.197(2.45)\*\* | 0.117(2.49)\*\* | 0.124(2.44)\*\* | 0.114(2.41)\*\* | 0.152(2.41)\*\* | 0.137(2.38)\*\* |
| BTG1 | –0.471(–2.03)\*\* |  |  | –0.539(–5.64)\*\*\* |  |  |
| BTG2 |  | –0.454(–1.99)\*\* |  |  | –0.313(–4.37)\*\*\* |  |
| BTG3 |  |  | –0.460(–2.06)\*\* |  |  | –0.301(–2.13)\*\* |
| MED | 0.865(2.03)\*\* | 0.885(1.99)\*\* | 0.341(2.24)\*\* | 0.845(2.90)\*\*\* | 0.614(2.25)\*\* | 0.686(2.15)\*\* |
| OI | –0.152(–1.76) | –0.285(–0.67) | –0.076(–0.96) | –0.140(–2.05)\* | –0.025(–2.01)\* | –0.001(–0.61) |
| MB | –0.428(–.2.20)\*\* | –0.427(–2.21)\*\* | –0.431(–2.26)\*\* | –0.401(–2.04)\*\* | –0.403(–2.20)\*\* | –0.302(–2.28)\*\* |
| LnA | 0.171(2.47)\*\* | 0.192(2.63)\*\* | 0.141(2.41)\*\* | 0.176(5.75)\*\*\* | 0.022(4.16)\*\*\* | 0.019(4.27)\*\*\* |
| DEP | –0.104(–1.72)\* | –0.191(–1.73)\* | –0.156(–0.49) | –0.135(–1.76)\* | –0.165(–2.67)\*\*\* | –0.007(–0.32) |
| FA | 0.690(1.61)\* | 0.879(2.02)\*\* | 0.624(2.31)\*\* | 0.713(2.94)\*\*\* | 0.654(3.03)\*\*\* | 0.432(2.83)\*\*\* |
| RND | –0.142(–2.04)\*\* | –0.111(–1.69)\* | –0.028(–3.57)\*\*\* | –0.049(–2.50)\*\*\* | –0.050(–2.38)\*\*\* | –0.010(–3.27)\*\*\* |
| D\_RND | –0.067(–0.67) | –0.141(–2.04)\* | –0.018(–0.56) | –0.004(–0.24) | –0.024(–0.33) | –0.026(–0.27) |
| DIV | –0.815(–0.77) | –0.932(–0.92) | –0.626(–0.53) | –0.004(–0.58) | –0.029(–0.82) | –0.013(–1.72)\* |
| AZ | –0.001(–1.15) | –0.001(–1.12) | –0.001(–0.89) | –0.001(–1.31) | –0.001(–1.41) | –0.001(–1.19) |
|  |  |  |  |  |  |  |
| N | 6,967 | 6,967 | 6,967 | 6,967 | 6,967 | 6,967 |
| Adjusted R2 (%) | 54.35% | 50.34% | 37.25% | 33.25% | 33.46% | 33.93% |

**Table 5**

Multivariate regression analysis of outside directors and corporate debt (H2), and the debt-substitution effect and outside directors (H3). This table reports the regression results between outside directors and debt, and the debt-substitution effect and outside directors. The dependent variable is total debt (short-term debt plus long-term debt) divided by total assets (BDEBT) or total debt divided by the sum of the market value of equity and total debt (MDEBT). The independent variables are: tax aggressiveness (TAG) which is measured as pre-tax accounting income less taxable income (where taxable income is computed as income tax expense divided by the statutory corporate tax rate of 35%) using the method developed by Manzon and Plesko (2002) (BTG1), the book-tax gap residual is calculated using the method developed by Desai and Dharmapala (2006) (BTG2), and the book-tax gap residual is computed using the method developed by Frank et al. (2009) (BTG3); and outside directors (OUTDIR), which is measured as the proportion of board members who are non-employee directors. An interaction term between OUTDIR and TAG (OUTDIR\*BTG1, OUTDIR\*BTG2 and OUTDIR\*BTG3) is also included in the regression model. Other variables are defined in Table 2. Coefficient estimates with the *t*-statistics are reported in parentheses. The *t*-statistics are computed using the fixed-effects model, controlling for firm-specific and time-specific effects, and standard errors are corrected based on one-way clustering by firm (e.g. Peterson, 2009). The statistical significance of the estimates is denoted with asterisks: \*\*\*, \*\* and \* correspond to 1%, 5% and 10% levels of significance, respectively. The *p*–values are one-tailed for directional hypotheses and two-tailed otherwise.

|  |  |  |
| --- | --- | --- |
|  | BDEBT | MDEBT |
| Variable | FEM1 | FEM2 | FEM3 | FEM4 | FEM5 | FEM6 |
| Intercept | 0.164(2.40)\*\* | 0.155(2.09)\* | 0.210(2.23)\*\* | 0.156(2.71)\*\* | 0.223(2.44)\*\* | 0.217(2.40)\*\* |
| BTG1 | –0.458(–1.94)\*\* |  |  | –0.589(–5.91)\*\*\* |  |  |
| BTG2 |  | –0.402(–2.26)\*\* |  |  | –0.304(–4.15)\*\*\* |  |
| BTG3 |  |  | –0.460(–2.02)\*\* |  |  | –0.301(–4.01)\*\*\* |
| OUTDIR | –0.497(–2.08)\*\* | –0.663(–2.01)\*\* | –0.479(–3.01)\*\*\* | –0.068(–5.39)\*\*\* | –0.096(–5.01)\*\*\* | –0.112(–5.15)\*\*\* |
| OUTDIR\*BTG1 | –0.784(–3.48)\*\*\* |  |  | –0.043(–3.65)\*\*\* |  |  |
| OUTDIR\*BTG2 |  | –0.712(–2.25)\*\* |  |  | –0.101(–2.38)\*\* |  |
| OUTDIR\*BTG3 |  |  | –0.706(–2.08)\* |  |  | –0.134(–2.47)\*\* |
| MED | 0.302(3.72)\*\*\* | 0.813(1.97)\*\* | 0.312(2.20)\*\* | 0.836(2.89)\*\*\* | 0.618(2.35)\*\* | 0.680(2.87)\*\*\* |
| OI | –0.126(–1.05) | –0.289(–0.68) | –0.077(–0.97) | –0.126(–1.88)\* | –0.024(–1.23) | –0.001(–0.58) |
| MB | –0.470(–2.30)\*\* | –0.427(–2.22)\*\* | –0.428(–2.25)\*\* | –0.401(–1.90)\*\* | –0.402(–2.05)\*\* | –0.301(–1.99)\*\* |
| LnA | 0.174(2.16)\*\* | 0.197(2.58)\*\* | 0.147(2.01)\*\* | 0.161(5.29)\*\*\* | 0.021(3.22)\*\*\* | 0.017(4.50)\*\*\* |
| DEP | –0.178(–2.08)\*\* | –0.193(–1.72)\* | –0.144(–0.50) | –0.124(–1.31) | –0.142(–2.02)\*\* | –0.003(–0.12) |
| FA | 0.619(1.71)\* | 0.927(2.18)\*\* | 0.665(2.28)\*\* | 0.716(2.88)\*\*\* | 0.627(3.26)\*\*\* | 0.413(2.93)\*\*\* |
| RND | –0.075(–1.73)\* | –0.090(–1.62)\* | –0.028(–3.43)\*\*\* | –0.038(–2.03)\*\* | –0.051(–2.24)\*\* | –0.010(–3.26)\*\*\* |
| D\_RND | –0.064(–0.28) | –0.152(–1.97)\* | –0.011(–0.39) | –0.011(–0.30) | –0.026(–0.83) | –0.030(–0.46) |
| DIV | –0.859(–0.72) | –0.962(–0.96) | –0.629(–0.55) | –0.005(–0.47) | –0.028(–0.92) | –0.012(–1.68)\* |
| AZ | –0.001(–0.75) | –0.001(–1.11) | –0.001(–0.62) | –0.001(–1.21) | –0.001(–1.23) | –0.001(–1.24) |
|  |  |  |  |  |  |  |
| N | 6,967 | 6,967 | 6,967 | 6,967 | 6,967 | 6,967 |
| Adjusted R2 (%) | 56.54% | 54.46% | 37.41% | 33.75% | 35.91% | 34.25% |

**Table 6**

Multivariate regression analysis of independent/gray outside directors and corporate debt (H2), and the debt-substitution effect and independent/gray outside directors (H3). This table reports the regression results between independent/gray outside directors and debt, and the debt-substitution effect and independent/gray outside directors. The dependent variable is total debt (short-term debt plus long-term debt) divided by total assets (BDEBT), or total debt divided by the sum of the market value of equity and total debt (MDEBT). The independent variables are: tax aggressiveness (TAG) which is measured as pre-tax accounting income less taxable income (where taxable income is computed as income tax expense divided by the statutory corporate tax rate of 35%) using the method developed by Manzon and Plesko (2002) (BTG1), the book-tax gap residual calculated using the method developed by Desai and Dharmapala (2006) (BTG2), and the book-tax gap residual computed using the method developed by Frank et al. (2009) (BTG3); outside directors – independent (OUTDIR\_IND), which is measured as the proportion of board members who are independent directors, and outside directors – gray (OUTDIR\_GRY), which is measured as the proportion of board members who are gray directors. Interaction terms between OUTDIR\_IND and TAG (OUTDIR\_IND\*BTG1, OUTDIR\_IND\*BTG2 and OUTDIR\_IND\*BTG3), and OUTDIR\_GRY and TAG (OUTDIR\_GRY\*BTG1, OUTDIR\_GRY\*BTG2 and OUTDIR\_GRY\*BTG3) are also included in the regression model. Other variables are defined in Table 2. Coefficient estimates with the *t*-statistics are reported in parentheses. The *t*-statistics are computed using the fixed-effects model, controlling for firm-specific and time-specific effects, and standard errors are corrected based on one-way clustering by firm (e.g. Peterson, 2009). The statistical significance of the estimates is denoted with asterisks: \*\*\*, \*\* and \* correspond to 1%, 5% and 10% levels of significance, respectively. The *p*–values are one-tailed for directional hypotheses and two-tailed otherwise.

|  |  |  |
| --- | --- | --- |
|  | BDEBT | MDEBT |
| Variables | FEM1 | FEM2 | FEM3 | FEM4 | FEM5 | FEM6 |
| Intercept | 0.937(2.72)\*\* | 0.105(2.57)\*\* | 0.151(2.24)\*\* | 0.140(2.85)\*\*\* | 0.146(2.83)\*\*\* | 0.166(2.39)\*\* |
| BTG1 | –0.465(–3.18)\*\*\* |  |  | –0.522(–5.54)\*\*\* |  |  |
| BTG2 |  | –0.370(–2.90)\*\*\* |  |  | –0.312(–3.09)\*\*\* |  |
| BTG3 |  |  | –0.410(–3.31)\*\*\* |  |  | –0.302(–3.06)\*\*\* |
| OUTDIR\_IND | –0.803(–2.50)\*\*\* | –0.633(–2.21)\*\* | –0.409(–3.10)\*\*\* | –0.032(–2.25)\*\* | –0.044(–2.10)\*\* | –0.037(–2.31)\*\* |
| OUTDIR\_GRY | –0.254(–1.88)\*\* | –0.132(–2.08)\*\* | –0.197(–1.96)\*\* | –0.017(–1.73)\* | –0.024(–1.86)\*\* | –0.021(–1.97)\*\* |
| OUTDIR\_IND\*BTG1 | –0.583(–2.26)\*\* |  |  | –0.946(–3.41)\*\*\* |  |  |
| OUTDIR\_GRY\*BTG1 | –0.261(–0.17) |  |  | –0.112(–0.15) |  |  |
| OUTDIR\_IND\*BTG2 |  | –0.216(–3.37)\*\*\* |  |  | –0.375(–2.71)\*\*\* |  |
| OUTDIR\_GRY\*BTG2 |  | –0.171(–2.01)\*\* |  |  | –0.134(–1.72)\* |  |
| OUTDIR\_IND \*BTG3 |  |  | –0.527(–3.13)\*\*\* |  |  | –0.017(–2.60)\*\* |
| OUTDIR\_GRY\*BTG3 |  |  | –0.197(–2.04)\*\* |  |  | –0.005(–2.01)\*\* |
| MED | 0.332(2.05)\*\* | 0.829(1.92)\*\* | 0.343(2.21)\*\* | 0.832(2.53)\*\*\* | 0.612(2.74)\*\*\* | 0.667(2.60)\*\* |
| OI | –0.118(–0.77) | –0.286(–0.67) | –0.075(–0.95) | –0.943(–1.66) | –0.002(–1.35) | –0.001(–0.57) |
| MB | –0.430(–2.21)\*\* | –0.428(–2.21)\*\* | –0.344(–2.22)\*\* | –0.403(–1.92)\*\* | –0.401(–2.58)\*\* | –0.301(–1.96)\*\* |
| LnA | 0.203(2.70)\*\* | 0.190(2.64)\*\* | 0.142(2.01)\*\* | 0.122(4.32)\*\*\* | 0.021(3.62)\*\*\* | 0.020(4.82)\*\*\* |
| DEP | –0.198(–2.37)\*\* | –0.144(–1.46)\* | –0.156(–0.41) | –0.137(–1.20) | –0.070(–3.31)\*\*\* | –0.001(–0.04) |
| FA | 0.729(1.82)\* | 0.955(2.23)\*\* | 0.624(2.21)\*\* | 0.715(3.40)\*\*\* | 0.672(3.70)\*\*\* | 0.459(3.24)\*\*\* |
| RND | –0.138(–2.36)\*\* | –0.096(–1.73)\* | –0.030(–3.07)\*\*\* | –0.005(–1.71)\* | –0.008(–2.20)\*\* | –0.008(–4.45)\*\*\* |
| D\_RND | –0.071(–0.69) | –0.118(–1.02) | –0.024(–0.58) | –0.048(–1.06) | –0.023(–0.11) | –0.027(–0.43) |
| DIV | –0.393(–0.78) | –0.989(–0.96) | –0.624(–0.53) | –0.010(–0.93) | –0.030(–0.45) | –0.014(–1.84)\* |
| AZ | –0.001(–1.15) | –0.001(–1.18) | –0.001(–0.60) | –0.001(–1.04) | –0.001(–1.07) | –0.001(–1.06) |
|  |  |  |  |  |  |  |
| N | 6,967 | 6,967 | 6,967 | 6,967 | 6,967 | 6,967 |
| Adjusted R2 (%) | 54.47% | 54.50% | 37.33% | 34.85% | 33.67% | 32.77% |

**Table 7**

Multivariate logistic regression analysis of the debt issuance decision (H1, H2 and H3). This table reports the regression results of the debt issuance decision. The dependent variable is a dummy variable that takes a value of 1 if the firm issues debt over the period from t–1 to t = 0, and 0 otherwise (DEBTISSUE). The independent variables are: tax aggressiveness (TAG) which is measured as pre-tax accounting income less taxable income (where taxable income is computed as income tax expense divided by the statutory corporate tax rate of 35%) using the method developed by Manzon and Plesko (2002) (BTG1), the book-tax gap residual is calculated using the method developed by Desai and Dharmapala (2006) (BTG2), and the book-tax gap residual is computed using the method developed by Frank et al. (2009) (BTG3); and outside directors (OUTDIR), which is measured as the proportion of board members who are non-employee directors. An interaction term between OUTDIR and TAG (OUTDIR\*BTG1, OUTDIR\*BTG2 and OUTDIR\*BTG3) is also included in the regression model. Other variables are defined in Table 2. Coefficient estimates with the *t*-statistics are reported in parentheses. The *t*-statistics are computed using the fixed-effects logistic regression model, controlling for firm-specific and time-specific effects, and standard errors are corrected based on one-way clustering by firm (e.g. Peterson, 2009). The statistical significance of the estimates is denoted with asterisks: \*\*\*, \*\* and \* correspond to 1%, 5% and 10% levels of significance, respectively. The *p*–values are one-tailed for directional hypotheses and two-tailed otherwise.

|  |  |
| --- | --- |
|  | DEBTISSUE |
|  |  Tax Aggressiveness and Debt-substitution (H1) | Outside Directors and Corporate Debt (H2), and the Debt-substitution Effect and Outside Directors (H3) |
| Variables | FEM1 | FEM2 | FEM3 | FEM4 | FEM5 | FEM6 |
| Intercept | 0.178(4.08)\*\*\* | 0.244(4.32)\*\*\* | 0.338(4.28)\*\*\* | 0.192(4.29)\*\*\* | 0.177(4.67)\*\*\* | 0.305(4.02)\*\*\* |
| BTG1 | –1.737(–4.40)\*\*\* |  |  | –1.049(–3.22)\*\*\* |  |  |
| BTG2 |  | –2.219(–5.12)\*\*\* |  |  | –2.288(–4.04)\*\*\* |  |
| BTG3 |  |  | –1.151(–4.24)\*\*\* |  |  | –1.017(–4.04)\*\*\* |
| OUTDIR |  |  |  | –0.117(–2.08)\*\* | –0.118(–2.05)\*\* | –0.067(–1.98)\*\* |
| OUTDIR\*BTG1 |  |  |  | –1.113(–2.73)\*\*\* |  |  |
| OUTDIR\*BTG2 |  |  |  |  | –2.371(–2.85)\*\*\* |  |
| OUTDIR\*BTG3 |  |  |  |  |  | –2.223(–2.01)\*\* |
| MED | 3.165(4.44)\*\*\* | 2.434(3.40)\*\*\* | 2.754(3.62)\*\*\* | 2.983(4.15)\*\*\* | 2.502(3.49)\*\*\* | 2.778(3.65)\*\*\* |
| OI | –1.695(–4.29)\*\*\* | –1.077(–2.12)\*\* | –1.044(–1.51)\* | –1.887(–2.70)\*\*\* | –1.082(–2.26)\*\* | –1.044(–1.69)\* |
| MB | –0.002(–0.19) | –0.016(–0.71) | –0.021(–0.60) | –0.027(–1.68)\*\* | –0.019(–0.81) | –0.020(–0.57) |
| LnA | 0.249(3.69)\*\*\* | 0.276(4.92)\*\*\* | 0.244(4.74)\*\*\* | 0.255(3.28)\*\*\* | 0.278(4.66)\*\*\* | 0.246(4.43)\*\*\* |
| DEP | –2.190(–2.59)\*\*\* | –1.396(–2.20)\*\* | –2.225(–1.78)\*\* | –2.572(–1.86)\*\* | –1.278(–2.09)\*\* | –2.307(–1.93)\*\* |
| FA | 0.117(2.10)\*\* | 0.269(2.63)\*\*\* | 0.202(1.73)\*\* | 0.159(2.08)\*\* | 0.263(2.58)\*\*\* | 0.208(1.78)\*\* |
| RND | –0.060(–1.98)\*\* | –0.010(–0.27) | –0.109(–2.12)\*\* | –0.156(–1.80)\*\* | –0.013(–0.37) | –0.109(–2.12)\*\* |
| D\_RND | –0.149(–2.62)\*\*\* | –0.089(–1.58) | –0.146(–2.45)\*\* | –0.106(–1.87)\* | –0.083(–1.46) | –0.143(–2.36)\*\* |
| DIV | –0.034(–0.47) | –0.241(–1.19) | –0.010(–0.09) | –0.072(–0.21) | –0.265(–1.01) | –0.006(–0.06) |
| AZ | –0.001(–0.49) | –0.001(–0.38) | –0.001(–0.28) | –0.001(–0.13) | –0.001(–0.63) | –0.001(–0.43) |
|  |  |  |  |  |  |  |
| N | 6,967 | 6,967 | 6,967 | 6,967 | 6,967 | 6,967 |
| Pseudo R2 (%) | 4.12% | 4.53% | 3.88% | 4.13% | 4.56% | 3.91% |

1. We define corporate tax aggressiveness broadly in this paper as the downward management of taxable income through tax-planning activities. It thus encompasses both legal and illegal tax-planning activities and those that may fall into the gray area (Frank et al., 2009; Chen et al., 2010). Although we use the term “tax aggressiveness” throughout this paper, it can be used interchangeably with tax avoidance, tax management and tax shelters. [↑](#footnote-ref-1)
2. More specifically, higher debt levels eventuate in the absence of other monitoring mechanisms, such as outside directors and institutional investors. [↑](#footnote-ref-2)
3. In recent years, there has been increasing demand by regulators and investors to call for mandating a greater representation of outside directors on corporate boards. The passage of the *Sarbanes-Oxley (SOX) Act* in 2002 requires outside directors to play a more important role in firm governance to protect the interests of stockholders. The SOX also triggered modifications in the New York Stock Exchange’s (NYSE) listing regulations in 2003, which required the appointment of outside directors on boards. A presumption under such movement is that boards with more outside directors will lead to better board monitoring and decisions (Dahya and McConnell, 2005). [↑](#footnote-ref-3)
4. Moreover, Dammon and Senbet (1988) claim that one problem in using non-debt tax shields to explain debt policy is that they are positively correlated with profitability and investment. Thus, if profitable firms (i.e. those with a high corporate tax rate) invest heavily and also borrow to finance their investments, the result may be a positive correlation between debt and non-debt tax shields that overwhelms the tax substitution effect between them. [↑](#footnote-ref-4)
5. Specifically, Trezevant (1992) finds that the firms most likely to suffer tax exhaustion decreased their debt use the most following the liberalization of tax laws induced by the *Economic Recovery Tax Act of 1981*, which increased their use of non-debt tax shields. [↑](#footnote-ref-5)
6. The non-debt tax shield deductions (i.e. tax shelter deductions) that Graham and Tucker (2006) identify in their sample of 44 tax shelter cases involve lease-in/lease-out transactions (3 or 7% of cases), transfer pricing (15 or 35% of cases), corporate-owned life insurance (11 or 26% of cases), cross-border dividend capture (2 or 5% of cases), contingent-payment installment sales (5 or 12% of cases), liquidation/recontribution (1 or 2% of cases), offshore intellectual property havens (1 or 2% of cases), and contested liability acceleration strategies (5 or 11% of cases). We refer readers to Graham and Tucker (2006) for a full description of these non-debt tax shield deductions. [↑](#footnote-ref-6)
7. We also considered proxy measures of tax aggressiveness based on effective tax rates (ETRs). However, research by Frank et al. (2009), Wilson (2009) and Lisowsky (2010) find ETRs to be imprecise measures of actual corporate tax aggressiveness relative to BTG measures. Hence, we restrict ourselves to BTG measures in this study. [↑](#footnote-ref-7)
8. For instance, depreciation expenses generate temporary book-tax differences, whereas R&D expenditures produce permanent book-tax differences. [↑](#footnote-ref-8)
9. A detailed description of the method developed by Desai and Dharmapala (2006) to calculate the BTG residual is provided in Appendix A. [↑](#footnote-ref-9)
10. A detailed description of the method advanced by Frank et al. (2009) to compute the permanent BTG residual is reported in Appendix B. [↑](#footnote-ref-10)
11. Standard errors are corrected based on one-way clustering by firm as per Peterson (2009) for all of the regression models estimated in this study. [↑](#footnote-ref-11)
12. We also compute variance inflation factors (VIFs) when estimating our regression models to test for signs of multicollinearity between the explanatory variables. We find no VIFs exceeding five, so multicollinearity is not an issue in this study (e.g. Hair et al., 2006). [↑](#footnote-ref-12)
13. Mackie-Mason (1990) suggests using the incremental debt issuance (0, 1) decision as a possible solution to any endogeneity problem. Debt levels (e.g. debt ratios) are the result of various historical decisions by the firm, and thus could mask the correlation between corporate taxes and current-period financing choices. Detecting tax effects with the incremental approach requires only that the firm make the appropriate debt-equity choice at the time of security issuance, taking into account its current position, not necessarily that the firm rebalance to its optimal debt-equity ratio with each issuance, as is implied in many debt-level studies. [↑](#footnote-ref-13)
14. Standard errors are corrected based on one-way clustering by firm as per Peterson (2009) for all of the logistic regression models estimated in this section of the paper. [↑](#footnote-ref-14)