Endogenous Effective Tax Rates, Tax Aggression, and Debt

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Abstract:
A tradeoff model of the capital structure is presented wherein a firm's effective tax rate is partly endogenously determined through its choice of tax planning, in turn occasioning the prospect of a reduced optimal debt level for tax-aggressive firms. The model is supported empirically as various measures of corporate debt utilization are found to be inversely related to multiple measures of corporate tax aggression. This inverse relation is especially pronounced for the most egregious measure of tax aggressiveness – tax shelter prediction. The inverse relation between debt use and tax aggression persists after controlling reliable determinants of leverage as well as endogeneity. For highly profitable firms, tax aggression and debt use are complementary. Our results extend the empirical findings of Graham and Tucker (2006).

Keywords: *Tax aggression, leverage, debt, capital structure*

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1. Introduction

Classical tradeoff models hold that the ability to expense interest on debt is a first-order determinant of corporate capital structure.[4] As first observed by DeAngelo and Masulis (1980), however, the use of non-debt tax shields (e.g., shelters) may temper the relevancy of debt-induced interest expense when determining optimal debt use. Non-debt tax shields, which are a form of corporate tax aggression, may substitute for interest expense and thereby dilute the principal benefit associated with debt financing assumed under classical tradeoff models, thus reducing the incentive to issue debt.[5]

Classical tradeoff models treat firms as "tax takers" and as such their effective tax rates are completely exogenously determined by the taxing authority. However, it is well documented that firms engage in tax planning – often aggressively so – in order to reduce their tax liabilities. For example, under FIN 48,[6] Merck & Co. reported an initial (first quarter 2007 10K filing) liability for unrecognized tax benefits of about $5 billion. Shortly before its initial filing Merck reduced its liability for unrecognized tax benefits from $7.4 billion to about $5 billion, mainly due to a $2.3 billion settlement the company reached with the IRS in February 2007. This settlement involved an arguably illicit Bermuda-based tax sheltering special purpose vehicle. At

[4] See Graham and Leary (2011) for a review of tradeoff models of the capital structure. Tradeoff models generally have lacked strong empirical fit, e.g., profitable firms appear to use less debt than predicted (the under-leverage puzzle).

[5] See Hanlon and Heitzman (2010) for a continuum of tax avoidance activities, from benign accelerated depreciation to very aggressive shelters. Empirical evidence that non-debt tax shields temper the use of leverage includes the findings of Graham and Tucker (2006) that firms engaged in aggressive tax shelters exhibit lower leverage than their non-sheltering counterparts and that tax-sheltering firms have lower leverage during sheltering years than non-sheltering years.

[6] Financial Accounting Standard Board Interpretation No. 48 (FIN 48), *Accounting for Uncertainty in Income Taxes.* As discussed momentarily, higher levels of FIN 48 reserves may be regarded as indicative of greater corporate tax aggressiveness. A recent development related to FIN 48 is Internal Revenue Service (IRS) Announcement 2010-9 and Schedule UTP (January 2010), which proposes that firms be required to disclose a concise description of each uncertain tax position for which the taxpayer has recorded a reserve in its financial statements, and the maximum amount of potential federal tax liability associated with each position.

the time Merck also was engaged in a nearly $2 billion transfer pricing tax shelter dispute with taxing authorities in Canada.[7]

Motivated by weak empirical support for traditional tradeoff models and evidence of corporate tax avoidance, we develop a tradeoff model that incorporates tax planning, thereby making a firm's effective tax rate partly endogenously determined. We then reexamine the firm's optimal capital structure choice in light of this endogeneity. Our model illustrates that aggressive tax planning can be an inverse determinant of corporate debt utilization for a large cohort of firms. For other, highly profitable firms, the model holds that tax avoidance and debt can be complements rather than substitutes; these firms may use both tax aggression and debt to reduce their tax obligations. In addition, our model illustrates that an all-equity corner solution may be optimal despite the existence of corporate taxes with deductible interest on debt. Furthermore, our model demonstrates that under traditional tradeoff models the omission of effective tax rate endogeneity may lead to suboptimal capital structures. Our model also offers a partial solution for the under-leverage puzzle. Finally, our model shows that due to the discrete nature of debt and the cost associated with the issuance or retirement of lumpy debt, it is more likely that a firm will be incentivized to substitute aggression for debt if the form of aggressive is non-benign.

Our development of a tradeoff model that makes endogenous the choice of leverage due to corporate tax planning also is partly motivated by the empirical findings of Graham, Lemmon, and Schallheim (1998). These researchers report that corporate tax status is endogenous to the financing decision, which in turn induces a spurious relation between measures of financial policy and many commonly used tax variables. They document that the endogeneity of the

[7] See Bird and Tucker (2002), Graham and Tucker (2006), Tucker (2002), and Wilson (2009), among others, for detailed examples of firms attempting to exert control over their tax liability (tax avoidance).

marginal tax rate may confound the interpretation of tax-related effects in previous studies, and provide evidence linking debt levels to tax rates, namely that low tax rate firms lease more and have lower debt levels than high tax rate firms.

Using 1,500 U.S. publicly-traded firms for the period 2006-2011,[8] we investigate whether more tax-aggressive firms witness less leverage than their less aggressive counterparts. Specifically, we test whether various measures of corporate leverage are related to five different measures of tax aggressiveness: FIN 48 tax reserves (RESERVE), discretionary book-tax differences (DTAX), tax shelter prediction scores (SHELTER), cash effective tax rates (CASH_ETR), and effective tax rate (ETR).[9] Our results indicate that overall, for firms in our sample, leverage is negatively related to each measure of tax aggression. This inverse relation holds after accounting for factors that reliably determine corporate debt use. The relation also holds after controlling endogeneity, using industry-adjusted leverage ratios, and during the credit crisis of 2007-08 (albeit weaker).[10] Our tests also indicate that more tax aggressive firms have lower leverage than their less aggressive counterparts for 2009 through 2011.[11] Inter-temporally, firms decrease (increase) their use of debt as their degree of tax aggressiveness increases (decreases), and thus the inverse relation between leverage and tax aggression also is evidenced on a within-firm basis. Finally, we find that the relation between debt use and aggression is most (least) pronounced for the strongest (weakest) measure of aggressiveness (tax shelter prediction scores and cash effective tax rates, respectively).[12]

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[8] This sample period is dictated by the availability of FIN 48 tax reserves. However, as reported herein, the inverse relation between debt use and tax shelter prediction (our main aggression variable of interest) holds for a longer sample period (beginning 2000).
[9] We expand on these measures below. Rego and Wilson (2012) find the measures to be strongly correlated.
[10] Indeed, results are robust with respect to a variety of alternative specifications, including two-stage least squares, fixed effects models, and alternative variables definitions.
[11] The relation between leverage and tax aggression – like the relation between leverage and any of its traditional explanatory variables – is expected to be attenuated during the credit crisis period.
[12] Indeed, results related to cash effective tax rates are generally insignificant.

The main focus of this research is on the relation between debt use and the most egregious form of tax aggression – tax shelter prediction – because it is this measure of aggression that is most consistent with, i.e., comparable to, the sample of actual shelters found in Graham and Tucker (2006). Because the inverse relation between debt and tax aggression is most pronounced for tax shelter prediction, our results are consistent with Graham and Tucker. This finding is also consistent with the notion that more benign forms of aggression are simply not large enough to justify altering a firm's leverage in light of the lumpy nature of debt outstanding as well as the costs associated with changing capital structure. Put another way, if outstanding debt was more or less continuous in nature, and low-cost to alter, benign aggression presumably would occasion marginal reductions in debt. However, debt tends to be more discrete, implying that only larger, more aggressive tax avoidance strategies will incentivize a firm to engage in costly debt retirement. The tax shelters found in Graham and Tucker (2006) are very large, on average representing over nine percent of total assets.

Our research is related to the literatures on capital structure, tax aggression, and accounting aggression. While we detail how our research relates to each of these bodies of literature below, we note here that we contribute to the literature by explicitly incorporating tax planning into the capital structure decision process, thus making the effective tax rate endogenously determined; by revealing that the traditional interest tax shield may be a weaker determinant of debt use than previously thought; by demonstrating empirically that aggressive tax planning can lead to reduced leverage; by providing a comprehensive test of the debt substitution hypothesis; and by providing a potential solution for the under-leverage puzzle. Perhaps our most important contributions are that we extend the results of Graham and Tucker

(2006) to a much larger and more contemporary universe of firms, and we find that more benign forms of tax aggression have a less material impact on leverage choice.

In section 2 we discuss the related literature. In section 3 we provide a tradeoff model of the capital structure that incorporates the prospect of aggressive tax planning and its consequences for the effective tax rate faced by the firm. Section 4 presents the data, tests, and empirical results. A conclusion is presented in section 5.

2. Literature review

Graham and Leary (2011) provide a comprehensive review of the empirical evidence regarding tradeoff models of the capital structure. Overall, tradeoff models have shown a disappointing fit to the data. A particularly troubling lack of fit is the under-leverage puzzle – a phenomenon first noted by Miller (1977) and Graham (2000) wherein profitable firms appear to be paying too much in taxes due to their underutilization of debt and, thus, the interest tax shield, in light of the expected costs of bankruptcy. The finding of Graham and Tucker (2006) that tax shelters appear to substitute for corporate debt utilization provides one compelling solution for the under-leverage puzzle. Their finding suggests that previous researchers' empirical results are biased toward finding lower leverage than predicted by classical tradeoff models of the capital structure, because these researchers utilize data sources that omit off-balance sheet debt substitutes, i.e., tax shelters. Once shelters are accommodated, firms may not be under-leveraged.[13]

[13] Ironically, Graham and Tucker's finding may give rise to another puzzle, namely why do not firms utilize more tax shelters in order to obviate paying taxes altogether? Desai and Dharmapala (2006) call this anomaly the "under-sheltering puzzle" and argue that entrenched managers may not be incentivized to pursue sheltering activities. Thus, Desai et al view the foregoing of tax shelters as a form of agency cost. See Rego and Wilson (2012) for a related discussion.

While Graham and Tucker's sample of actual tax shelters is unique, it is, unfortunately, small and dated, thereby making their inferences about the relation between leverage and shelters tentative.[14] In addition, because their examination focuses on tax shelters Graham and Tucker's findings necessarily cannot be generalized to other (presumably less bold) forms of tax aggression. By using a large and recent sample that includes several measures of tax aggression, this research provides additional evidence on the relation between leverage and tax aggression. Consistent with Graham and Tucker (2006), we find that more aggressive firms exhibit lower leverage. Thus, our results provide additional evidence resolving the under-leverage puzzle.[15]

Other explanations advanced to resolve the under-leverage puzzle have focused on leverage mis-measurement (Welch 2011) and distress costs mis-measurement (Almeida and Phillipon 2007), the existence, but empirical omission, of pension contributions (Shivdasani and Stefanescu 2012), and the omission of international tax considerations (Huizinga, Laeven, and Nicodeme 2008). In this paper we propose an alternative theoretical explanation unrelated to the aforementioned explanations. More specifically, we present a partial equilibrium debt tradeoff model that – through the introduction of tax planning – demonstrates the optimality of lower

[14] We emphasize that there is no controversy regarding Graham and Tucker's results. However, they caution that inferences based on their sample may not be relevant for other firms due to the limitations of their sample size, the large sizes of the shelters examined, and other considerations, including the age of their shelters. Most of their shelters were shut down long ago by the government. Some of their shelters date back twenty-five years or more. Shelters like the contingent payment installment sale deals sponsored by Merrill Lynch, which make up a large portion of their sample, were closed down years ago by various changes to the tax code, e.g. eliminating Internal Revenue Code (IRC) Temporary Regulation 453, which was the key element of the IRC needed to manufacture the paper capital losses in the Merrill-sponsored deals. For these reasons it is difficult to determine if Graham and Tucker's conclusions about the influence of sheltering on capital structure hold today or are a relic of the past. Similar concerns presumably apply to the proprietary tax sheltering sample of Wilson (2009).

[15] One of our measures of tax aggression is FIN 48 tax reserves. Some researchers contend that such reserves reflect tax shelters. See, for example, Blouin, Gleason, Mills, and Sikes (2007, 2010) for a detailed discussion of FIN 48 including how tax reserves are likely reflective of tax shelters. To the extent that reserves are indicative of actual sheltering, our results may be viewed as complementing those of Graham and Tucker (2006). Not all researchers agree that tax reserves are a good proxy for tax aggression. See Robinson, Stomberg, and Simone (2012), Frischmann, Shelvin and Wilson (2008), Brown, Drake and Martin (2011), Dunbar, Phillips and Plesko (2009), Robinson and Schmidt (2008), and Gupta, Laux and Lynch (2011) for other papers that use or discuss some aspect of the FIN 48 balance and why it may or may not adequately reflect aggressive tax planning. We return to this subject momentarily.

leverage for a large cohort of firms. Empirical results are generally consistent with this alternative explanation.

Additional evidence of the lack of fit of classical tradeoff models is the sticky-debt puzzle – the fact that firms appear to have very rigid capital structures over time despite changes in their profitability as well as corporate tax regimes.[16] Such rigidity suggests that corporate the interest tax shield may not be a first-order determinant of debt use and, thus, capital structure choice. It stands to reason that the lower the use of debt in the capital structure, the more likely it is that the variability of debt use will be low. Thus, to the extent that our model provides an explanation for the under-leverage puzzle, it may also offer insight regarding the sticky-debt phenomenon.

Besides tradeoff models of the capital structure, our paper is closely related to the literature on corporate tax aggression. Rego and Wilson (2012) report that the factors identified as predictive of actual tax sheltering (using the public sample of Graham and Tucker (2006) and the proprietary sample of Wilson (2009)) tend to be the same as the factors associated with higher FIN 48 tax reserves. In addition, these factors are many of the same ones found in the unrecognized tax benefit (UTB) prediction model of Cazier, Rego, Tian, and Wilson (2009). Also, Lisowsky, Robinson and Schmidt (2011) report that tax reserves are a suitable summary measure for predicting tax shelters, using out-of-sample data, and furthermore that the tax benefits of tax shelters account for up to 48 percent of the aggregate FIN 48 reserves in their sample. Furthermore, Gupta, Mills and Towery (2011) report that FIN 48 has arrested the trend

[16] See Fama and French (2002), Welch (2004), and Baker and Wurgler (2002). Lemmon, Roberts, and Zender (2008) find that the capital structures of mature firms are remarkably similar to their capital structures at the time of their initial public offerings.

in multistate tax aggressiveness.[17] For these reasons we use FIN 48 tax reserves as one of our (five) measures of tax aggression.[18]

The other four measures of tax aggression examined here are discretionary book-tax differences (cf. Desai 2003, Desai et al 2006, and Dyreng, Hanlon, and Maydew 2010), tax shelter prediction scores (cf. Frank, Lynch, and Rego 2009 and Rego and Wilson 2012), which is our focal measure, cash effective tax rates (cf. Dyreng et al 2010 and Rego and Wilson 2012), and effective tax rates.[19] Rego and Wilson (2012) find that these five measures are strongly correlated, and that their principal empirical result – that tax aggressiveness is positively related to high-Vega executive compensation – is robust with respect to all measures employed.

Our findings relate to other research including Wilson (2009) who reports that higher tax reserves appear to increase future shareholder wealth for well-governed firms. An interesting question is why? The results reported here offer one possible explanation, namely that higher tax reserves are a proxy variable for reduced firm leverage, which traditional financial theory as well as a large body of empirical evidence suggests may be value enhancing for shareholders.[20] Finally, Frank, Lynch, and Rego (2009) find that tax aggressiveness and financial reporting aggressiveness are directly related. The evidence reported here therefore suggests that leverage and financial reporting aggressiveness may be inversely related.

[17] Another possible motive for the adoption of FIN 48 is the better detection of abusive earnings management (targeting and smoothing) through the use of the tax reserve account (cf. Blouin and Tuna 2007 and Dhaliwal, Gleason, and Mills 2004). However, Cazier, Rego, Tian, and Wilson (2010) report that FIN48 has been mostly ineffective at reducing the practice of earnings management through the use of the tax reserve account.
[18] Alexander, Ettredge, Stone, and Sun (2010) report that FIN48 reserves can be used to help quantify firms' tax reserve activities for the years prior to the advent of FIN48.
[19] See Lisowsky (2010) for using financial statement information to empirically model tax shelters.
[20] Graham and Tucker (2006) report that tax sheltering firms appear to enjoy higher credit ratings and lower credit spreads than their non-sheltering counterparts.

3. An endogenous effective tax rate model of the capital structure

In this section we introduce a tradeoff model illustrating that corporate tax planning and capital structure choice may be interdependent when optimizing firm value. Initially we use a one-period framework wherein the tax planning and capital structure choices are made simultaneously. To permit the choices to be made sequentially, we thereafter move to a two-period framework. Inferences from the model do not change if we allow the first decision to be tax planning or debt choice, initially suggesting that the model be estimated while allowing the two choices to be determined simultaneously. However, we provide justification for why leverage choice is more likely to follow from tax planning and not vice versa. Thus our empirical tests treat leverage (tax planning) as the dependent (independent) variable.

3.1. One-period model with four tax planning-debt use combinations

We begin with a one-period set up in which a firm generates estimates of a set of seven variables (a, M, r, t_i, k_j, p, Q), each defined momentarily, at time 0.[21] Based on these estimates the firm optimizes the expected after-tax cash flow to its stock and bond holders by simultaneously choosing its tax plan and capital structure. The firm selects one of two tax planning programs, aggressive (A) or passive (P). If A, the firm hopes to achieve a lower effective tax rate, t_l; if P, the effective tax rate is $t_h > t_l$.[22] However, selecting A will increase the

[21] We consider a two-period set up momentarily.

[22] The expected effective tax rate is the amount of expected taxes paid divided by expected pre-tax cash flow, M. A lower expected effective tax rate is equivalent to paying less to the taxing authority, resulting in a greater expected residual cash flow for the firm's stakeholders. In practice aggressive tax planning may reduce the amount of taxable income reported by the firm, thus subjecting it to a lower tax rate from a rate schedule established by the taxing authority. This "schedule rate" is not the firm's effective rate. Through tax planning the expected effective rate may be partly endogenously determined by the firm – not the schedule rate. Aggressive tax planning does not change M; it may only change the amount of taxes paid to the taxing authority on M or, equivalently, the expected effective tax rate. We model the optimization of the anticipated residual cash flow available to firm stakeholders after taxes are paid. Maximizing this residual cash flow is identical to the dual of minimizing the amount of tax paid or, equivalently, minimizing the future effective rate. In our model, M is strictly positive; an expectation of negative future cash flow would imply that the firm would not exist in the first place, i.e., it would be bankrupted at time 0.

probability (from zero to p) of having to pay a tax penalty, Q. Because p is the probability of penalty, 1 – p represents the aggressive firm's forecast of the lower effective tax rate applying.[23] The firm's forecasted pre-tax cash flow for the period, M, equals all inflows (ordinary and extra-ordinary gains, cash flow from investments, capital gains, etc) less all outflows (ordinary and extra-ordinary operating expenses, capital losses, etc). Because our focus is on aggressive tax planning strategies we ignore (for modeling purposes) all benign non-cash expenses such as accelerated depreciation and amortization; these items could be readily included in our set up. Thus the only tax shields are the interest expense on any debt issued and any uncommon non-debt tax shields occasioned by the aggressive program (e.g., transfer-pricing shelters). We assume that there are no transactions costs associated with tax planning; this assumption could be relaxed.

At time 0 the firm also selects one of two possible capital structures, all-equity (no leverage) or some degree of debt financing (leverage). In our set up the use of leverage reduces the amount of equity needed to finance the firm's current total assets ($TA_{t=0}$), thus leaving total asset size intact.[24] Any debt would exhibit face value B, a one-period maturity, and a coupon rate of r. This coupon rate is the par rate, i.e., the rate that ensures that the debt sells for par (face value) at its inception. We initially assume that there are no transactions costs associated with debt issuance (or retirement), as well as the retirement of equity. Issuing debt will occasion two non-interest costs: The first is the expected cost associated with the potentially negative aspects of debt on the firm's ability to generate cash flow due to management-creditor conflicts and the

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An inverse relation between leverage and tax aggression can obtain for firms with negative current earnings; the very existence of such a firm implies – by definition – that it anticipates positive future cash flow.

[23] While in our initial set up the firm selects between one of just two tax planning strategies, in reality the firm presumably would have the ability to select from a wide spectrum of strategies. We return to this matter later.

[24] This assumption allows us to obviate from the contaminating valuation issues associated with using the proceeds from debt issuance to engage in real investment activity. We also assume that there are no signaling effects from a debt-for-equity swap.

like. This cost is reflected via the term [(-a)(M)] where a > 0, i.e., a reduction in pre-tax cash flow.[25] The second is the expected cost associated with the potential for firm bankruptcy, i.e., the "outside option" shareholders have to transfer firm ownership to creditors, leaving equity valueless. To reflect bankruptcy risk in our set up we allow for two possible costs of capital for the firm: A lower cost of capital, k_l, under the all-equity structure or when little leverage is used, and a higher cost, k_h, when a threshold amount of debt, B^T, is exceeded.[26] At most total debt can equal total assets: $B^{max} = TA_{t=0}$.[27]

Let V_{TA}, V_E, and V_B represent the value of the firm's total assets (TA), equity (E), and debt (B), respectively. By the balance sheet constraint, $V_{TA} = V_E + V_B$. Let Z represent the cash flow available to stock and bond holders for the period. Thus we have:

$$(1)\ V_{TA} = Z/(1 + k_j) = \{(M)(1 - a)(1 - t_i) - B(1 + r) + Br(t_i) + B(1 + r) - pQ\}/(1 + k_j).$$

The firm's objective is to maximize its expectation of V_{TA} through its selection of tax planning and debt usage at time 0. Before examining this objective, however, we first compare our set up to the classical tradeoff models of Modigliani and Miller (1958, 1963) and Miller (1977), and therefore others of the same ilk. Under these seminal models an economy having no frictions (in particular, no taxes and no bankruptcy costs) occasions capital structure irrelevancy, i.e., equity

[25] In reality, the variable a will be much closer to zero than to, say, one.

[26] In traditional tradeoff models the firm's cost of capital is initially reduced as debt is first employed, because of the interest tax shield on debt. Eventually the additional use of debt occasions too much bankruptcy risk, and the firm's cost of capital increases. Empirically, however, it appears that there is a range of debt use within which the cost of capital is essentially flat; the cost of capital schedule is u-shaped (rather than v-shaped) with respect to leverage. Because we have a binary debt choice in our initial set up (rather than a more or less continuous debt schedule), we use a discrete, threshold amount of debt, B^T, below (above) which debt use results in a lower (higher) cost of capital, in the traditional tradeoff sense. Keep in mind that in our set up the traditional interest tax shield is potentially displaced through the use of aggressive tax planning.

[27] While in our initial set up the firm selects between one of just two capital structures, in reality the firm presumably would have the ability to select from a wide spectrum of capital structures. We return to this matter later. In the event of an all-debt capital structure, the firm's cost of capital will be equivalent to its after-tax cost of debt.

and debt are perfect substitutes. Upon the introduction of bankruptcy costs the optimal capital structure is all-equity financing (a corner solution). With no bankruptcy costs but with taxes where interest can be expensed the optimal capital structure is all-debt financing (a corner solution). With both bankruptcy costs and taxes where interest can be expensed the optimal capital structure is a mixture of equity and debt (an interior solution).[28] We will demonstrate that upon the introduction of non-debt tax shields this optimal mix may contain less debt for a large cohort of firms.

To make an apples-to-apples comparison we initially eliminate from our model the ability of firms to engage in tax planning, which in turn implies that pQ = 0. After all, in M&M the effective tax rate paid by the firm is completely exogenously determined. Eliminating tax planning, if there are no corporate taxes and no agency and bankruptcy costs in our model we have:[29]

(2) $V_{TA} = M/(1 + k_l)$.

In other words, firm value is invariant to the use of debt ($dV_{TA}/dB = 0$) so capital structure irrelevancy obtains. This is consistent with M&M. By introducing debt with agency and bankruptcy costs (but not taxes) firm value is reduced:[30]

(3) $V_{TA} = [(M)(1 – a)]/(1 + k_h) < M/(1 + k_l)$.

Thus firm value is optimized when there is no debt in the capital structure (a corner solution):

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[28] Hereafter, we refer to these results as the “M&M findings”.
[29] Because there are no bankruptcy costs, the lower cost of capital, k_l, applies in equation (2), as well as in equations (5) and (6) to follow. We refer to equation (2) as the firm’s “pure cash flow value”.
[30] In equation (3) it first appears that either k_l or k_h may apply; the lower cost of capital seems to apply if the amount of debt issued is less than the threshold, B^T. However, $B^T = 0$ here because there is no tax advantage to debt utilization. Thus k_h is the appropriate discount factor.

(4) $dV_{TA}/dB = (-aM)/(1 + k_h) < 0$.

This result is also consistent with M&M. By introducing debt with corporate taxes where interest can be expensed (but no agency and bankruptcy costs) firm value is increased as debt use increases:

(5) $V_{TA} = [(M)(1 - t_i) + Brt_i]/(1 + k_l) > M(1 - t_l)/(1 + k_l)$,

And

(6) $dV_{TA}/dB = rt_i/(1 + k_l) > 0$.

Thus, consistent with M&M the optimal capital structure is all-debt financing (a corner solution). Finally, introduce both agency costs and bankruptcy risk, and taxes with deductible interest, so equation (1) applies but where $pQ = 0$. Consistent with M&M, an interior solution, i.e., an optimal amount of both equity and debt financing, obtains. At first, substituting some debt for equity (in a previously all-equity firm) will occasion the benefit of the interest tax shield but without too much of the concomitantly growing agency and bankruptcy costs, i.e., $a > 0$ and the potentially deleterious effect of a higher cost of capital, k_h, if $B > B^T$. Eventually, however, adding debt will reduce firm value due to these traditional factors. From (1):

(7) $dV_{TA}/dB = [(aM)(t_i - 1) + rt_i]/(1 + k_j)$.

The sign of dV_{TA}/dB is ambiguous.[31] Just as in M&M, firms will utilize debt until the marginal benefit of the interest tax shield equals the marginal cost of the debt-induced agency and bankruptcy costs.

[31] Recall that debt use may increase the cost of capital from k_l to k_h.

In contrast to the M&M findings, however, the debt level at which this equality obtains may be less in our set up once we re-introduce tax planning. By being tax aggressive the firm may reduce its effective tax rate, thus diluting the benefit derived from the interest tax shield of the classical tradeoff model and providing less incentive to utilize debt in the capital structure, especially if the expected penalty pQ is small.[32] Consider the derivative of firm value with respect to debt when tax planning is re-introduced:

(8) $dV_{TA}/dB = [(aM)(t_i - 1) + rt_i - pQ]/(1 + k_j)$.

Comparing equations (7) and (8) we see that (8) may be lower (less positive or more negative – either of which implies less incentive to use debt), if the applicable effective tax rate in (8) is t_l while that in (7) is t_h.[33] For example, suppose that aggressive tax planning reduces the firm's anticipated effective tax rate to zero. Here the sign of (8) is unambiguously negative [$dV_{TA}/dB = (-aM - pQ)/(1 + k_j) < 0$], implying that the optimal capital structure is all-equity. Thus we revert to an all-equity corner solution despite the existence of corporate taxes with deductible interest on debt. And because aggressive tax planning may displace the interest tax shield for some firms, the under-leverage puzzle (as well as the sticky-debt puzzle) may not be so, well, puzzling. Consistent with the finding of Graham and Tucker (2006) that tax-sheltering firms tend to exhibit less financial leverage, by making the firm's effective tax rate partly endogenously determined

[32] Of course, we could reciprocally state that using less (more) debt may compel the firm to be more (less) tax aggressive.

[33] Moreover, less debt use may occasion a lower cost of capital, which would reinforce the prospect that (8) < (7). Obviate for a moment from our assumption that firm value is strictly determined by management who maximize after-tax cash flow, and allow a role played by investors and regulators when determining firm value, with possible informational differences between management and investors and regulators. Then the marketplace may view the firm as less risky (more valuable) if the risk introduced by aggressive tax planning is regarded as less than the risk associated with more financial leverage. This raises the prospect that firms may conceal their aggressive tax planning strategies in order to fool investors as well as the taxing authorities.

our set up suggests that some tax-aggressive firms may have optimal capital structures composed of little or no debt.[34]

Another way to appreciate this insight is to consider an initially levered firm facing a high expected effective tax rate and low anticipated penalty.[35] From equation (1), aggressive tax planning should increase firm value. Indeed, consider the ideal prospect that aggressive tax planning reduces the expected effective tax rate to zero with a zero expected penalty. Such a firm can eliminate agency and bankruptcy costs, and possibly lower its cost of capital, by retiring all of its debt. Here equation (1) reduces to equation (2), i.e., the firm's pure cash flow value.[36]

We now return to our optimization problem. There are four possible combinations of tax planning and capital structure in our set up: (1) passive-no debt; (2) passive-debt; (3) aggressive-no debt; and (4) aggressive-debt. If debt is issued then we assume (for simplicity and without loss of generality) the amount exceeds the threshold, B^T, so the higher cost of capital, k_h, applies. These four combinations occasion the following four firm values, respectively:

(9) $V_{TA} = V(P,0) = [M(1 - t_h)]/(1 + k_l)$,

(10) $V_{TA} = V(P,B) = [M(1 - a)(1 - t_h) + Br(t_h)]/(1 + k_h)$,

[34] Indeed, if pQ is small there may be an "under-aggression puzzle". Again, we also could conclude that firms using low (high) leverage may have optimal tax planning strategies that are more (less) aggressive.
[35] We return to the idea of an initially levered firm momentarily (section 3.5), in order to discuss the relation between the degree of tax aggression and leverage use in light of the lumpy nature of already outstanding debt and a cost associated with its retirement. That is, we introduce a costly debt adjustment tradeoff model.
[36] This observation raises the following research question: What type of firm is likely to expect a small penalty, pQ? Such a firm is more likely to be tax aggressive, ceteris paribus. While we do not address this question here, we aver that such a firm is more likely to exhibit greater expenditures for tax accounting and tax counseling (both internal and external), is more likely to be too big to fail, and is more likely to be quasi-governmental (e.g., strategic entities like firms in the military industrial complex).

(11) $V_{TA} = V(A,0) = [M(1 - t_l) - pQ]/(1 + k_l)$,

(12) $V_{TA} = V(A,B) = [M(1 - a)(1 - t_l) + Br(t_l) - pQ]/(1 + k_h)$.

Firm value may be highest under any one of these four combinations, depending on the variable estimates (a, M, r, t_i, k_j, p, Q).

Begin with a simple numerical example in which a tax-passive, all-equity firm estimates the following parameter values at time 0: M = 100, r = 0.079, $k_l = 0.078$, $k_h = 0.080$, $t_l = 0.05$, $t_h = 0.25$, a = 0.005, p = 0.50, and Q = 25. If the firm issues debt the amount will be B = 50, allowing the firm to reduce its equity outstanding.[37] Should the firm issue the debt? Should it engage in aggressive tax planning? From equations (9) through (12): V(P,0) = 69.5733; V(P,B) = 70.0116; V(A,0)* = 76.5306; and V(A,B) = 76.1319. Thus the firm should remain all-equity and undertake aggressive tax planning, V(A,0)*.[38] Notice that such a firm may appear to be under-levered if analysts are unaware of the now aggressive nature of the firm's tax planning, because analysts – if they assume the firm is passive – view the firm as more valuable when levered: V(P,B) > V(P,0).[39] Thus this simple example helps to illuminate how the under-leverage puzzle may be resolved in our set up; while the aggressive, all-equity firm may appear to be under-levered, it is in fact optimally levered – at least prospectively. Also notice that under traditional tradeoff models, where the effective tax rate is completely exogenously determined

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[37] As discussed momentarily, the seemingly arbitrary choice of B = 50 is irrelevant here. The optimal tax planning-debt use combination will be the same regardless of any feasible amount of debt issuance under consideration by the firm. See footnote 38.

[38] Given the parameter values in this example the issuance of any feasible amount of debt ($0 < B < TA_{t=0}$) will produce a firm value of less than V(A,0)* = 79.3269. Thus the optimal strategy is V(A,0)* and the amount of debt issuance is zero. For this firm $TA_{t=0}$ equals the current value of the equity under the passive tax plan, i.e., V(P,0).

[39] Here we momentarily deviate from the assumption that firm value is strictly determined by management seeking to maximize after-tax cash flow and raise, albeit in an informal way, the prospect that investors partly determine firm value and may operate under a different information set than that of management.

(so there is no tax planning or, equivalently, all firms are assumed passive), firm value will be lower under the all-equity capital structure than if debt is issued (assuming $t_h = 0.25$ still applies): V(P,0) < V(P,B) when the tax rate is 25%. In other words, if the two aggressive tax planning possibilities are eliminated then the firm should issue debt in this example. Thus in traditional tradeoff models the omission of effective tax rate endogeneity can lead to suboptimal capital structures.

Consider a second example where $t_l = 0.15$, $p = 0.05$, and all other parameter values remain the same. From equations (9) through (12) we have: V(P,0) = 69.5733; V(P,B) = 70.0116; V(A,0) = 77.6902; and V(A,B)* = 77.7014. Hence this firm should engage in aggressive tax planning and debt issuance. Thus for some firms tax aggression and leverage may be complementary.[40]

Indeed, depending on the firm (its forecasts) any one of the four tax planning-capital structure combinations may be optimal. To demonstrate this further, we engage in the following simulation analysis: We assume that M is uniformly distributed between 10 and 200; a is uniformly distributed between 0.001 and 0.01; p is uniformly distributed between 0.05 and 1; Q is uniformly distributed between 5 and 100; t_l is uniformly distributed between 0.05 and 0.25; t_h is uniformly distributed between 0.26 and 0.60; r is uniformly distributed between 0.02 and 0.12; k_l is uniformly distributed between 0.02 and 0.07; and k_h is uniformly distributed between 0.07 and 0.12. Using the RAND(x) function from EXCEL's Toolkit, we randomly draw 10,000 combinations of these nine uniformly-distributed variables and, for each combination, compute

[40] Here the firm will maximize its value by issuing as much debt as possible: $B^* = B^{max}$. This example illustrates how some firms may use both tax aggression and the traditional interest tax shield on debt to minimize their expected effective tax rates. It may be the case that the sample firms of Rego and Wilson (2012) are of this ilk. We return to this issue momentarily, by limiting the amount of aggression possible and therefore the extent to which the expected effective tax rate can be reduced.

firm value under each of the four tax planning-leverage combinations: V(P,0), V(P,B), V(A,0), and V(A,B). We identify the optimal tax plan-leverage combination for each of the 10,000 variable combinations, ensuring that the condition $0 < B^* < B^{max}$ is satisfied. The results of this simulation indicate that V(P,0) is optimal 29.34% of the time; V(P,B) is optimal 17.40%; V(A,0) is optimal 52.77%; and V(A,B) is optimal 0.54%. This simple exercise suggests that capital structure choice may be impacted when the expected effective tax rate is allowed to be partly endogenously determined. It also suggests that optimal debt use may be lower for a larger proportion of firms than what is suggested by traditional tradeoff models of the capital structure; the strategy V(A,0) is the majority strategy in this simulation.[41]

3.2. A two-period set up

Because firm choices are made at time 0, optimal tax planning and debt use are simultaneously determined in our previous one-period set up. However, our view is that the more likely process is such that the debt choice follows from tax planning, assuming that the two decisions are in fact related in a causal way. In other words, the causality is such that tax planning influences debt use and not vice versa. In this subsection we analyze a two-period framework in which the first decision is tax planning and the second decision is debt use.

Strongly supporting the perspective that debt choice follows from tax planning is the empirical finding of Graham and Tucker (2006) that tax-sheltering firms use less (more) leverage during shelter (no-shelter) periods. Also, tax-sheltering firms in their sample witnessed leverage levels in the post-shelter period that quickly returned to their higher pre-shelter period levels. Also, non-sheltering firms exhibited comparatively stable debt levels. Furthermore, the shelters

[41] Once again, we may alternatively conclude that optimal tax planning is influenced by debt choice.

of Graham and Tucker are occasioned by real economic activity on the part of the firm, especially asset divestitures that trigger substantial capital gains; firms engineered paper losses in order to offset these gains for tax purposes. It seems unreasonable to contend that such activity is motivated by debt choice.[42,43] Collectively, the evidence provided by Graham and Tucker (2006) suggests that debt use follows from tax planning and not vice versa, at least for aggressive sheltering.

Further supporting the notion that debt use likely follows from tax planning is the likelihood that tax planning is a relatively less costly process than changing firm capital structure. Except for large tax shelters, which can occasion millions of dollars of fees paid by a firm (cf. Tucker 2002), tax planning is generally conducted by personnel employed by the firm (a sunk cost) and the firm's various consulting advisors (relationship services). Such low costs accommodate some variability in tax planning from year to year, particularly for more benign forms of tax aggression. On the other hand, debt issuance and retirement are relatively costly processes. These high costs strongly suggest that tax planning does not follow from debt choice.[44]

We now introduce a two-period framework in which the tax planning decision is first made followed by the choice of debt use. If the firm elects passive tax planning at time 0, then it

[42] In other words, the chain of events is such that divestitures lead to gains which lead to shelters (tax planning) which allow for reductions in leverage, and not such that debt reductions lead to divestitures that lead to gains which lead to shelters. Debt reductions likely do not occasion divestitures.

[43] In their attempt to better understand why some firms are more tax aggressive than others, Rego and Wilson (2012) report that tax aggressive firms tend to have greater leverage. Previous researchers have reported a similar finding. As discussed and evidenced by Rego and Wilson, the high-Vega nature of top executive compensation provides an explanation for why some firms are more tax aggressive. High-Vega compensation design rationally occasions all sorts of risky (but positive expected net-present-value) corporate behavior, including tax aggression, financial leverage, intense research and development, and the like. We do not regard the finding of Rego and Wilson as conflicting with the findings presented here. Simply put, we are investigating different issues. However, we opine that any causality is more likely to be such that tax aggression affects leverage choice and not vice versa. In other words, our prior is that leverage is the dependent variable. Our empirical tests control for endogeneity.

[44] We return to this topic in section 3.5.

faces two possible values of V_{TA} at time 1, depending on whether it remains all-equity or assumes some debt.[45] Respectively, we have:[46]

(13) $V_{TA} = M(1 – t_h)/(1 + k_l)$,

And

(14) $V_{TA} = [M(1 – a)(1 – t_h) + Br(t_h)]/(1 + k_h)$.

Comparing (13) and (14) we see that the passive firm is more likely to use debt financing if the expected benefit derived from the interest tax shield is greater than the added agency costs ($a > 0$) and higher cost of capital (k_h). This tradeoff represents that found in the traditional capital structure model.

If the firm elects tax aggression at time 0, its two possible values at time 1 (under all-equity and leverage, respectively) are:

(15) $V_{TA} = [M(1 – t_l) – pQ]/(1 + k_l)$

(16) $V_{TA} = [M(1 – a)(1 – t_l) + Br(t_l) – pQ]/(1 + k_h)$.

Comparing (15) and (16) we see that – like the passive firm – the aggressive firm is more likely to use debt financing if the associated interest tax shield is greater than the debt-induced agency costs and higher cost of capital. However, because the firm is aggressive the benefit derived from the interest tax shield is expected to be lower for this firm than for the passive firm: $Br(t_l) < Br(t_h)$. Thus, the aggressive firm is less likely to use debt, ceteris paribus.

[45] The length of the time increment from time 0 to time 1 can be nearly instantaneous here, suggesting that in the empirical tests that follow, which use yearly data, leverage and tax aggression can be measured contemporaneously or with a lag. We return to this subject momentarily. Also, we assume that the tax planning choice conveys no information to the market.
[46] In equation (14), as well as (16) to follow, debt issuance is assumed to occasion a higher cost of capital.

To impart this result further, ignore agency costs (a = 0) and consider the derivative of firm value with respect to debt in equations (14) and (16), respectively:

(17) $dV_{TA}/dB = r(t_h)/(1 + k_h)$

And

(18) $dV_{TA}/dB = r(t_l)/(1 + k_h)$.

Comparing the two derivatives we see that (18) is less than (17), implying that the aggressive (passive) firm has less (more) incentive to issue debt. Indeed, if tax aggression is sufficient to reduce the effective tax rate to zero, then by (18) $dV_{TA}/dB = 0$, and thus there is no motive for the aggressive firm to use debt (especially in light of debt-induced agency and bankruptcy costs).

3.3. A limit on aggression

We now briefly address the possibility that the firm faces a limit on how aggressive its tax planning can be and the consequences for its capital structure choice. One way to introduce such a limit is to model the expected penalty as a discontinuous function so that beyond some aggression threshold pQ jumps to a draconian amount – perhaps high enough to bankrupt the firm and/or subject firm management to personal liability, either civil or even criminal.[47] In this event very highly profitable companies may hit the penalty-induced limit before achieving a zero tax liability. Another way to introduce such a limit is to make expected pre-tax cash flow (M) so high that, simply put, the firm can exhaust every conceivable tax-aggressive strategy and still not drive its effective tax rate to zero. Either way, because more profitable firms are more likely to reach any aggression limit they are more likely to engage in both tax aggression and debt use

[47] This suggests that tax aggression may be related to management-specific factors, such as the age of the Chief Executive Officer. See Armstrong, Blouin, and Larcker (2012) for a related topic.

than their less profitable counterparts. Consistent with equation (12), the very real possibility that tax aggression is limited implies that for a cohort of very highly profitable firms, tax aggression and leverage may be complementary. However, these very profitable firms could have used even more leverage had it not been for their aggressive tax planning.

3.4. Allowing for more choices and uncertainty

It is possible to extend our framework to accommodate more tax planning and debt level choices. For instance, here we reexamine our initial one-period set up but where the firm can now select from a continuum of tax planning and debt utilization combinations. Here the firm maximizes the expected after-tax cash flow to its stakeholders by simultaneously selecting an effective tax rate t, where t is an element from 0 to 1, and a level of debt B, where B is an element from 0 to B^{max}. Selecting t is tantamount to selecting a level of tax aggression, with very aggressive (passive) planning represented by a lower (higher) value of t.

To accommodate this revised set up we allow for both r and a to be increasing functions of B; for both p and Q to be inverse functions of t; and for k to be a u-shaped function of B. More specifically:

(19) $r = r_0 + b_1(B)$,

(20) $a = a_0 + b_2(B)$,

(21) $p = p_0 + (b_3/t)$,

(22) $Q = Q_0 + (b_4/t)$,

(23) $k = (B - b_5)^2 + b_6$,

Where b_i, i = 1 to 6, are all positive.[48]

Substituting these expressions into equation (1) yields the revised formula for firm value:

(24) $V_{TA} = \{(M)(1 - (a_0 + b_2(B))(1 - t) - B(1 + (r_0 + b_1(B))) + B(r_0 + b_1(B))(t) +$

$B(1 + (r_0 + b_1(B))) - (p_0 + (b_3/t))(Q_0 + (b_4/t))\}/(1 + ((B - b_5)^2 + b_6))$.

The firm's revised objective function is to maximize V_{TA} in equation (24), over (t*, B*), subject to the aforementioned constraints on the values of t and B. The firm can efficiently accomplish this optimization numerically, albeit an analytic solution may be available. This exercise expands the tax planning-capital structure opportunity set available to the firm and should lead to a more optimal solution.

We now note that if we would allow, say, M to be stochastic, we would introduce uncertainty into the firm's tax planning and capital structure choices. While the introduction of uncertainty would make such choices more nebulous and potentially sub-optimal, we opine that it would not change the major qualitative findings of our model – especially that tax aggression can influence debt usage by lowering the expected effective tax rate component of the traditional interest expense, or, equivalently, that tax planning makes the firm's anticipated effective tax rate

[48] The firm would require estimates of the b_i at time 0. In equation (23), k is a u-shaped function of B having lower and upper asymptotes that can be adjusted to make u flatter or more v-shaped. The minimum occurs at (b_5, b_6).

partly endogenously determined. Moreover, we aver that this finding is preserved if we morph to a continuous-time, inter-temporal framework.

3.5. Regarding the discrete nature of debt and the cost of debt retirement

We now return to the scenario of an already levered firm, and introduce a cost associated with changing firm leverage. In other words, we now treat our model as if it were a costly debt adjustment framework. If we assume that debt outstanding is discrete (lumpy) in nature (which is a consequence of the transactions costs – broadly defined so as to include such items as underwriting fees – associated with debt use), and that there is a cost associated with debt retirement, then it is trivial to demonstrate that tax aggression must be sufficiently intense to incentivize the firm to engage in the costly retirement of discrete debt, i.e., to alter its capital structure.[49] Hence our model predicts that more benign forms of tax aggression may be insufficient in size to meaningfully influence debt utilization (capital structure) in light of the existence of debt-related transactions costs. As such, we hypothesize that any relation between tax aggression and debt use is more likely to be evidenced when more egregious tax aggression measures (such as high tax shelter prediction scores) are employed.

[49] This demonstration is available upon request. To envision it, consider an initially levered firm with a high expected tax rate and low expected aggression penalty. As illustrated earlier, for such an ideal candidate, aggressive tax planning can increase firm value (under equation 1) by reducing the tax rate, thus permitting the firm to retire all of its debt and thereby eliminate agency costs (a = 0) and bankruptcy costs (as reflected in a lower cost of capital). Here firm value is given by what we previously defined as the firm's pure cash flow value. However, if we introduce transactions costs associated with lumpy debt retirement in equation (1), then the firm's incentive to retire debt is tempered and the firm will find it optimal to remain (somewhat) levered. As the costs of the retirement of lumpy debt increase (decrease), firms will require more (less) aggression to optimally retire debt. For instance, subtract from equation (1) a term "C" which reflects the cost of lumpy debt retirement. C is already present-valued and adjusted for any ability to expense debt retirement cost. For our ideal firm the new firm value is the pure cash flow value less C. If C is sufficiently large, then this new value may be less than the value of the firm as already levered.

4. Data, tests, and empirical results

The sample used in this study consists of 1,500 U.S. firms: the Standard and Poor's 500, the Standard and Poor's 400, and the 600 largest publicly-traded companies not included in these two indices. The tax reserve data (UTB's) are hand collected from these firms' 10K filings with the Securities and Exchange Commission (SEC) for fiscal tax years 2006-2010. UTB data are now available from Compustat, but there is a large number of missing observations for this item. To stay consistent with UTB studies to date, we choose to adhere to the 1,500 firms. We use UTB data from Compustat if available, and supplement this source with our hand-collected data when it is missing. All other firm characteristics are from the Compustat database. The final sample consists of 4,765 firm-year observations and covers years 2006-2011. We exclude firms in the financial industry and firms with missing observations on the variables in the regression model. All variables are winsorized at 1% and 99% to mitigate reporting errors.[50] The appendix gives variable definitions and corresponding Compustat items used in variable construction.

The literature to date has developed a number of proposed measures of corporate tax avoidance, including tax reserves (e.g., Dyreng et al 2008; Frank et al 2009). Some measures of tax avoidance assume that managers focus on the total income tax expense in the income statement (e.g., the effective tax rate and discretionary book-tax differences), while the cash effective tax rate (Dyreng et al 2008) assumes that, in the long run, managers focus on the amount of cash taxes paid to taxing authorities. Since the measures emphasize different aspects of tax aggressiveness, they are known to produce inconsistent results in some contexts (e.g., Armstrong et al 2012; Robinson et al 2010). De Waegenaere, Sansing, and Wielhouwer (2010) report that UTB's are the best measure of tax aggressiveness if compliance with FIN 48 is high;

[50] We include firms that have negative earnings and negatives taxes paid. Earnings are winsorized too.

if compliance is low, it is the worst measure and cash taxes paid is the best measure. For robustness and completeness we include five common measures. In addition to our tax reserve measure (UTB's), we invoke four common proxies for tax aggressiveness or tax avoidance found in the literature. We test our hypotheses using these different measures because no single measure perfectly captures the degree to which firms engage in aggressive tax planning. In addition, we hypothesize that some measures capture relatively more aggressive behavior and therefore the relation between leverage and aggression may be more pronounced for such measures. Specifically we use discretionary permanent differences (DTAX), a tax-shelter prediction score (SHELTER, as computed in Wilson 2009), the five-year cash effective tax rate (CASH_ETR), and the effective tax rate (ETR) (Frank et al 2009). DTAX and SHELTER have been significantly tied to actual cases of tax sheltering (Frank et al 2009; Wilson 2009). CASH_ETR captures a range of tax planning activities and is widely used in the tax literature; thus we aver that its inclusion should provide insights regarding the consistency of our results across several measures of tax risk. Because CASH_ETR reflects a range of aggressive activities, including more benign degrees of aggression, and is a longer-term measure of aggression, we anticipate that any relation between leverage and aggression will be less (more) pronounced for CASH_ETR (the other measures). In particular, Dyreng et al. (2008) and Frank et al (2009) argue that ETR is a more appropriate measure of tax reporting aggressiveness whereas CASH_ETR is a more appropriate measure of tax avoidance[51]. In addition, ETR's are generally computed as the ratio of total income tax expense to pre-tax book income and reflect

[51] As indicated in Frank et al (2009)'s footnote 3, long-term CASH_ETR uses cash taxes paid and pre-tax income over a multi-year period. Cash taxes paid avoids the problems associated with using current tax expense as a measure of corporate tax burden, and the multi-year period smoothes out estimated tax payments and pretax accrual management. Therefore, this measure reflects tax avoidance rather than tax aggressiveness, where tax avoidance includes a broad array of activities that would not be considered tax aggressive, including firm and industry characteristics.

permanent book-tax differences and other statutory adjustments (hereafter, permanent differences) included in the rate reconciliation schedule of a firm's income tax footnote. Therefore, the ETR's reflect the results of tax aggressiveness. If firms engage more tax aggressiveness activities, then their ETR's will be lower. Therefore, we consider ETR as another measure of tax aggressiveness and we expect that there is a positive relation between ETR and corporate leverage levels. Our empirical results demonstrate that the most aggressive measure, SHELTER, offers the highest degree of explanatory power.[52]

Table 1 provides descriptive statistics for variables. As shown in table 1, on average, the leverage level of a sample corporation, measured as the ratio of total debt to total assets, is about 20% of the average assets (ALEV), while the average ratio of long-term debt to total assets (BLEV) is about 17.38% of the average assets. The average industry-adjusted leverage level (IND-ADJ LEV) is 1.79%. On average, firms' UTB reserves are about 1.18% of their average assets while the average cash effective tax rate (CASH_ETR) is 24%, indicating that for a given firm the total cash tax paid is about 24% of the pre-tax income. Mean (median) of SHELTER equals approximately 1.27% (1.11%) of average assets. The mean (median) of DTAX is 0.00 (0.00), as DTAX is a measure that captures discretionary permanent differences. The mean (median) of ETR is 34% of the pre-tax income, indicating that on average, firms are paying 34% tax of their pre-tax incomes.

In addition, table 1 provides descriptive statistics for control variables, including SIZE, MB, SALES, COLLATERAL, ROA, NI, EBIT, RESEARCH and SELLING.[53] The mean of

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[52] The variable SHELTER uses leverage in its construction (see the Appendix for variables definitions). Since leverage enters SHELTER in a direct way (the coefficient on leverage is positive in the construction), SHELTER should be biased toward finding a direct relations between leverage and tax aggression. Our finding of an inverse relation between leverage and SHELTER is even more compelling in light of this bias.

[53] We use the same leverage determinants/control variables found in Frank and Goyal (2004) and Graham and Tucker (2006).

SIZE is 7.65. On average, firms have market values about 1.94 times over their book values. The average ROA is about 10%, while the average NI (EBIT) is about 6.76% (11.83%) of the total assets. Lastly, the mean of a firm's R& D expenditure (RESEARCH) is 4.13% of its sales.

---Insert Table 1 Here--

Various studies in the field document that different measures of tax avoidance are highly correlated. We observe this to be the case in our sample, as demonstrated by the Pearson's correlations shown in table 2. Measures of tax aggressiveness SHELTER, RESERVE and DTAX are significantly and positively correlated with one another, while CASH_ETR and ETR are significantly and negatively correlated with these measures since a lower tax rate corresponds to more tax aggressiveness. In addition, we find that CASH_ETR and ETR are significantly and positively correlated with each other. Unconditionally, SHELTER is the one measure of tax aggressiveness that shows the most significant correlation with other measures and, as we will see, conditionally it also appears to best capture tax aggressiveness.

---Insert Table 2 Here---

Table 3 reports the results of regressions on 4,765 firm-year observations from 2006 to 2011, which examine the effect of tax aggressiveness on a firm's leverage level. Table 3 presents the coefficients from the regression when the corporation's debt level (total debt divided by total assets) is the dependent variable (ALEV). The results of the full sample analysis indicate that the tax aggressiveness of a firm is negatively associated with the corporate debt level, as indicated by the significant coefficients on SHELTER, RESERVE and DTAX.[54] In particular,

[54] Because data are yearly, we initially use, and only report results from tests involving, contemporaneous measures of leverage and tax aggression; control variables are lagged. However, results obtained when lagging tax aggression variables are qualitatively similar. Our investigations suggest that while tax aggression on a within firm basis exhibits some variability from year to year, firms that tend to be tax passive (aggressive) in one period are also

column (1) indicates that SHELTER is negatively associated with a corporate leverage level (with coefficient -1.9876 and p value less than 0.001). Column (2) substitutes SHELTER with RESERVE, a measure of the UTB level of a corporation, and the results are consistent. The significant negative coefficient of RESERVE (-0.6409, p value less than 0.05) indicates that corporate UTB levels are indeed negatively associated with a corporation's debt level. In column (3) we use a proxy that captures discretionary permanent differences (DTAX) to examine the effect of tax aggressiveness on a firm's debt policy. We find a significant negative association between DTAX and a firm's leverage level（-9.8510，p value less than 0.10） which indicates that when a firm engages in less tax planning its debt level increases. Column (4) presents the regression results of CASH_ETR and ALEV; as shown, we are unable to find a significant association between the cash effective tax rate (which we regard as capturing relatively more benign types of aggression) and corporate leverage levels. As stated in the previous section, CASH_ETR actually measures the tax avoidance of a firm. Therefore, it is understandable that no significant result is found between CASH_ETR and ALEV. Column (5) presents the regression results of ETR and ALEV. A significant positive coefficient (3.2854, p value less than 0.01) indicates that when there is a positive relation between a firm's effective tax rate and overall debt level. This result implies that when a firm has a higher level of effective tax rate, it tends to increase debt levels to use interest expense to offset the tax expenses. Overall, we find strong evidence that the tax aggressiveness of a firm – as measured by tax UTB reserves (RESERVE), tax shelters (SHELTER) discretionary permanent differences (DTAX), and effective tax rate (ETR) – is significantly inversely associated with a firm's debt use.

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passive (aggressive) in subsequent periods.

In addition, table 3 presents the results of regression models accommodating control variables. We find that debt levels of firms are negatively associated with firm performance as measured by NI and SALES. This finding indicates that when a firm performs better it is able to decrease its debt level by using self-generated profit. In addition, we find that a firm's debt policy is positively associated with collaterals of a firm, since firms with higher levels of collaterals find it easier to access outside financing. Furthermore, we find that firms' debt levels are negatively associated with the growth opportunities of a firm, measured by the market to book ratio (MB). This result implies that firms experiencing a growth stage are less likely to finance with debt than equity. Moreover, we find a positive coefficient on SIZE, which indicates that larger firms have higher leverage levels. These results are broadly consistent with those of Frank and Goyal (2004) and Graham and Tucker (2006).

Table 3, columns (6) to (10) use a different model that includes both industry and year dummies to control for industry and year effect, respectively. Similar results are found, again indicating that tax aggressiveness is negatively associated with corporate leverage. Especially, we find that leverage levels are negatively associated with SHELTER, RESERVE, and DTAX, and positively associated with ETR.

---Insert Table 3 Here---

We now take a moment to relate the results of table 3 in more economic terms. Are the results economically important? To address this question we focus initially on the first coefficient estimate for SHELTER, -1.9876. Recall that the average value of SHELTER is 1.32 for our sample (table 1), and that the average leverage (ALEV) is 18.58 for our sample (table 1). Thus the estimated coefficient indicates that a firm having a SHELTER score of twice that of the average firm will have leverage that is about 14% lower when compared to the average firm:

[(1.32)(-1.9876)]/(18.58). Such a reduction represents a large change in leverage (capital structure).[55] Similar statements can be made about other measures of tax aggression in table 3 (e.g. DTAX), as well as in subsequent tables.[56]

To further investigate the robustness of our results, table 4 presents regression results that use alternative measures of leverage. Panel A uses industry-adjusted leverage (IND-ADJ LEV) as the dependent variable while panel B uses the ratio of long-term debt to total assets (BLEV) (columns 1 to 5) and the ratio of total debt to the sum of total debt and total equity (CLEV) as the dependent variables (columns 6 to 10). Industry-adjusted leverage level is calculated as the difference between actual leverage level of a firm and the expected leverage level, estimated by using the median industry leverage (2-digits SIC) multiplied by firm assets, scaled by total assets multiplied by 100. Similar to our baseline regression results that are presented in table 3, we find that tax aggressiveness is negatively associated with a firm's leverage level, even adjusted by industry leverage levels (table 4, panel A). In particular, SHELTER, RESERVE and DTAX have significantly negative coefficients (-1.9485, -0.6386 and -9.6871, respectively), while ETR has significantly positive coefficient (3.0101).

Table 4, panel B also presents regression results on the impact of tax aggressiveness on additional leverage measures of a firm. We again find that tax aggressiveness, measured by SHELTER, RESERVE and DTAX, is negatively associated with a firm's debt policy and ETR is positively with a firm's debt policy, measured as the ratio of long-term debt to total assets (BLEV) and the ratio of total debt to the sum of total debt and total equity (CLEV). The sign and significance levels of control variables are similar to those of table 3.

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[55] A doubling of SHELTER (i.e., a change of 1.32) is not an extreme change as the standard deviation of SHELTER is 1.40 (table 1).

[56] The aforementioned 14% reduction represents a change of about 262 basis points in average leverage. Graham and Tucker (2006) report that for firms caught in engaging in very large, illicit shelters, the average leverage reduction occasioned by those shelters was about 1000 basis points.

---Insert Table 4 Here---

Table 5 presents regression results that utilize the two-stage-least-square (2SLS) method to test for potential endogeneity. Using selling, general and administrative expenditure (SELLING) and R&D expense (RESEARCH) as instruments to predict aggressiveness, we find that our regression results of tax aggressiveness on a firm's corporate debt policy remain strong.[57] In particular, un-tabulated results indicate that the F-test of the Instrumental Variable (IV) is significant while the Hansen J Statistic is insignificant, indicating that the IV's are valid as they are orthogonal to leverage. Similarly, we find statistically significant negative coefficients of SHELTER and RESERVE (-16.029, -4.422 respectively, with p values less than 0.001 level), which indicates that after controlling for other determinants of corporate debt policy our predicted values remain significant in explaining leverage. This finding is consistent with the results of the baseline regression models in table 3.

---Insert Table 5 Here---

To alternatively address potential endogeneity, we also apply a fixed-firm, fixed-year model.[58] Fixed effects estimation maintains separate intercepts for each firm and for each year in order to account for unobserved relationships between debt and the independent variables, and to capture effects that may change inter-temporally. From table 6 we see that our tax-aggression-substitutes-for-leverage hypothesis holds on a within-firm basis, further validating our hypothesis and earlier findings. This is a powerful finding as absent some other cogent

[57] Previous researchers (cf. Cazier et al 2009) report that high R&D spending (a proxy for the presence of overseas subsidiaries and the use of transfer pricing tax shelters) and high general and administrative spending (a proxy for tax consulting expenditures) are reliable determinants of tax avoidance. First-stage results of the instrument variables are available upon request.

[58] Fixed-firm effect is based on GVKEY and fixed-year effect is based on fiscal year.

explanation for why within-firm leverage should change over time for our sample of firms, the finding indicates that leverage is sensitive to firm tax planning over time.[59]

---Insert Table 6 Here---

To further examine the impact of tax aggressiveness on a firm's debt policy, we investigate such association when firms experience crisis. Table 7 shows regression results when we split firm year observations into the credit crisis period (2007-2008) and the non-credit-crisis period (2006, 2009-2011). The credit crisis period has 1,638 firm-year observations while the remaining non-credit-crisis period contains 3,127 firm-year observations. The dependent variable is leverage as measured by ALEV. Once again we find that the tax aggressiveness of a firm is associated with its debt policy. But, as anticipated, such association is less sensitive in the crisis period than that in non-crisis period. In particular, we find that SHELTER, RESERVE, DTAX and ETR are all significant in the non-crisis period (coefficients of -2.0632, -0.7172, -11.2065, and 3.1383, respectively), while only the most aggressive measure (SHELTER) is significant in the crisis period (coefficient of -1.4940, p value less than 0.001).

---Insert Table 7 Here---

To further test the association between tax aggressiveness and corporate debt policy, we investigate whether larger firms or profitable firms are more sensitive to such association.[60] We identify firms that have larger assets (large dummy equals one when SIZE is larger than the median of the total assets of all samples) or firms that have positive profits (Profit dummy equals

[59] Because the tax shelter prediction variable is our main focus, we repeated all of the tests found in tables 3-6 for this variable for a longer sample period, namely beginning 2000. (Recall that our initial sample was restricted to years 2006-2010, due to the availability/onset of FIN 48 reserves.) Results for tax shelter prediction for this longer sample period (available upon request) are qualitatively consistent with those reported in tables 3-6.

[60] These investigations represent cross-sectional tests. Larger firms are expected to have more opportunities to be tax aggressive; for instance, tax shelters like transfer pricing are presumably only available to large, multinational companies.

one when EBIT is positive). Table 8 presents regression results on larger firms or profitable firms with columns 1-5 representing firms with size over the sample and columns 6-10 representing more profitable firms. We find that tax aggressive proxies, measured by the interactions between SHELTER and Large and between DTAX and Large, have significantly negative coefficients (-1.9357 and -22.1842, respectively), while the interaction between ETR and Large has significantly positive coefficients (3.9739) These results are likely due to large firms having the expertise to execute the tax aggression-debt substitution and an elaborate company structure to support such activity (with more accounts allowing for more flexibility). Similarly, we find a significant negative coefficient of the interaction term of SHELTER and Profit (-2.4119), indicating that profitable firms tend to use SHELTER to adjust their debt levels.

---Insert Table 8 Here---

To further test the association between tax aggressiveness and corporate debt policy for profitable firms, we investigate whether low or high profitable firms are more sensitive to such association. We identified firms with positive EBIT and divide them into two groups: LOW profit firms as below median EBIT profit and HIGH profit firms as above median EBIT profit. Table 9 presents regression results on low or high profitable firms with columns 1-5 representing low profit firms and columns 6-10 representing high profitable firms. We find that tax aggressive proxies, measured by SHELTER, RESERVE and DTAX, have significantly negative coefficients for low profit firms (-1.6980, -1.1926, and -17.996, respectively), while ETR has positive coefficient for low profit firms (3.7798). However, we find a significant negative coefficient of SHELTER (-2.7568), but failed to document significant negative coefficients for RESERVE and DTAX. Such findings indicate that the debt substitute hypothesis holds strongly for low profit firms.

---Insert Table 9 Here---

The theoretical model holds that for extremely profitable firms, the relation between tax aggressiveness and debt is complementary. To test, we identified the top 10% of profitable firms. Table 10 presents regression results for these firms (columns 1-5). We find that tax aggressive proxies, measured by SHELTER, RESERVE, and DTAX, have different significant directions. In particular, we find that SHELTER still exhibits a negative coefficient (-3.2658), but RESERVE and DTAX exhibit positive coefficients (1.6668 and 27.1138). A potential reason for the negative coefficient on SHELTER and positive coefficients on RESERVE and DTAX is that sheltering activities are more difficult to execute and have potentially higher legal costs, while the reserve related activities and discretionary permanent difference are relatively easy to execute with lower legal cost. Overall, our evidence supports the hypothesis that for highly profitable firms the relation between tax aggression and debt can be complementary.

---Insert Table 10 Here---

4.1. Cross-sectional investigation

In addition to the tests reported in tables 1-10, we engaged in cross-sectional tests investigating whether firms with higher borrowing costs/greater distress risk (as indicated by lower credit ratings for their long-term debt) were more likely to substitute tax aggression for debt. These firms also are more likely to have higher bankruptcy costs and equity holder-bondholder conflicts. However, the cross-sectional results were insignificant. A possible reason for this finding is that firms with greater distress risk are probably not in need of tax aggression, because they have little if any profits to shelter.

5. Conclusion

Firms may engage in aggressive tax planning to minimize their future tax burden and therefore increase future cash flow available to stakeholders. If firms are successful at reducing their tax burden then it stands to reason that they may have less incentive to finance with risky debt because the interest tax shield occasioned by debt financing is less valuable to such firms. Put another way, aggressive and successful tax planning can change the calculus of the traditional interest expense and thus optimal debt component of the capital structure. The traditional interest expense can change from a first-order determinant to a lower-order determinant of capital structure. We provide a tradeoff model of the capital structure that explicitly incorporates tax planning and therefore makes a firm's anticipated effective tax rate partly endogenously determined. The main inference from the model is that many firms may optimally use less debt than previously predicted by traditional tradeoff models. Empirical tests robustly support this hypothesis. Various measures of corporate tax aggressiveness are found to be a reliable determinant of leverage for firms in our sample. In particular, we find that corporate tax aggression as measured by a prediction score of a firm's sheltering activity (SHELTER), corporate UTB's (RESERVE), a measure of discretionary permanent difference (DTAX), and a measure of corporation effective tax rate (ETR), are all statistically negatively associated with corporate debt levels, using different leverage measures (actual leverage levels and industry-adjusted leverage levels). This inverse relation appears to be economically important. Furthermore, we find that the association between corporate tax aggressiveness and corporate debt policy is more pronounced in the non-credit-crisis period than in the credit crisis period. Moreover, we find that larger (or profitable) firms exhibit more sensitive substitution effects between corporate tax aggressiveness and corporate debt policy. In addition, we find that for very highly profitable firms, the relation between tax aggressiveness and corporate debt levels can be direct. Finally, we find that the inverse association between leverage and tax aggression is most powerful for the most aggressive measure of tax aggression (SHELTER).

We believe that our model is the first tradeoff model to explicitly incorporate tax planning in the capital structure decision and furthermore that we provide the first rigorous test of the debt-substitution hypothesis originally posited by DeAngelo and Masulis (1980). Our model demonstrates that, remarkably, an all-equity corner solution may be optimal despite the existence of interest deductibility. It also demonstrates that traditional tradeoff models, which fail to accommodate tax planning, can lead to suboptimal capital structures. Our findings suggest that many firms may not be under-levered and therefore provide a potential explanation for the under-leverage puzzle. Our results expand those of Graham and Tucker (2006). Finally, our analysis offers interesting paths to future research including what types of firms are more likely to be subject to lower tax penalties and what types of firms are more likely to conceal their aggressive practices from analysts.

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Appendix: Variable Definition

Variable	Definition	Formula in Compustat items
SHELTER	Shelter prediction score Wilson (2009) *SHELTER* = -4.30 + 6.63 × *BTD* - 1.72 × *LEV* + 0.66 × *SIZE* + 2.26 × *ROA* +1.62 × *FOR_INCOME* +1.56 × *R&D* where: BTD is book income less taxable income scaled by lagged total assets. Book income is pre-tax income. Taxable income is calculated by grossing up the sum of the current federal tax expense and the current foreign tax expense and subtracting the change in NOL carryforward. If the current federal tax expense is missing, then total current tax expense is calculated by subtracting deferred taxes, state income taxes and other income taxes from total income taxes ; LEV is long-term debt divided by total assets; SIZE is the log of total assets; ROA is pre-tax earnings divided by total assets; FOR_INCOME is pretax foreign income divided by lagged total assets; R&D is divided by lagged total assets.	BTD= (book income- taxable income)/lagged assets where : book income=data 170 taxable income=((data63+data64)/0.35)- data52 if data 63 is missing, it is equal to data16-data50-data173-data211; data 50, data 173, data211 set to 0 if missing data 52 set to 0 if missing LEV=data9/data6 SIZE= log(data6) ROA=data170/data6 FOR_ INCOME= data273/lagged data6; 0 if missing R&D=data46/lagged data 6
RESERVE	FIN 48 (uncertain tax benefits)/ta*100	TXTUBEND/data6*100; when missing use hand-collected data to supplement
CASH_ETR	The five-year sum of cash taxes paid ending in year t divided by the five-year sum of pre-tax income minus special items.	∑data317 /(∑data170-∑data17)
DTAX	Residual from following equation estimated by year and 2-digit SIC code: $PERMDIFF_{it} = \alpha_0 + \alpha_1 INTANGit + \alpha_2\ UNCON_{it} + \alpha_3\ MI_{it} + \alpha_4 CSTE_{it} + \alpha_5 NOL_{it} + \alpha_6\ LAGPERM_{it} + \varepsilon_{it}$ where: PERMDIFF = Total book-tax differences– temporary book-tax differences =[{PI – [(TXFED + TXFO) / STR]} – (TXDI /STR)],	PERMDIFF=[data170-((data63+data64)/0.35)-

	scaled by total assets at year *t- 1*; STR = Statutory tax rate; UNCON= Income (loss) reported under the equity method divided by total assets at year t- 1; MI = Income (loss) attributable to minority interest, scaled by total assets at year t- 1; CSTE = Current state tax expense, scaled total assets at year t- 1; ΔNOL = Change in net operating loss carry forwards, scaled by total assets at year t- 1; LAGPERM =PERMDIFF in year t-1.	(data50/0.35)]/lag data6 STR=0.35 UNCON=data55/lag data6 MI=data49/lag data6 CSTE=data173/lag data6 ΔNOL=data 52/lag data6
ETR	Total tax expense divided by pre-tax income except if total tax expense and pre-tax income are negative or missing then ETR is set to missing and if total tax expense is positive and pre-tax income is negative then ETR=1; ETR is also limited to between -1 and 1;	(data 16)/ data170
ALEV	Total debt/ta*100	(data9+data34)/data6*100
BLEV	Long-term debt/ta*100	(data9)/data6*100
CLEV	Total debt/(Total debt+equity)*100	(data9+data34)/ (data9+data34+data60)*100
IND-ADJ LEV	Firm debt minus median industry leverage(2-digit SIC) multiplied by firm asset, scaled by total assets *100	((data9+data34)-(data6*(medianlev/100)))/data6*100
SALES	Total Revenues	data12/1000
SIZE	Log(total assets)	log (data6)
MB	Market to book	(data6-data60+(data25*data199))/data6
DIV	Dividend Dummy=1 if firm pays dividends	=1 if data201>0; 0 otherwise
COLLATERAL	Collateral/ta*100	(data8+data3)/data6*100; missing data for data8 or data3 is replace by 0
R&D	R&D expenses/sales*100	data46/data12*100; 0 if data is missing
SELLING	Selling and administrative expenses/sales*100	data189/data12*100; 0 if data is missing

EBIT	Earnings before Interest and taxes/ta*100	data178/data6*100
NI	Net incomes/ta*100	data172/data6*100

*Firm-fixed effect based on GVKEY.

Table 1 Summary Statistics

Our final sample contains 4,765 firm years from 2006-2011 for 1,500 firms with inaugural Fin 48 reserves information. See appendix for variable definitions. All data are winsorized at the 1% and 99% percent levels.

Variable	Mean	Median	Std Dev	25th Pctl	75th Pctl
ALEV	18.58	17.15	16.05	3.13	28.46
BLEV	16.13	14.47	14.89	0.60	25.35
CLEV	27.25	25.56	23.39	4.44	41.52
IND-ADJ LEV	1.90	0.00	15.10	-9.24	9.92
SHELTER	1.32	1.14	1.40	0.41	2.04
RESERVE	1.31	0.79	1.59	0.32	1.70
DTAX	0.00	0.00	0.05	-0.01	0.01
CASH_ETR	0.27	0.26	0.18	0.18	0.33
ETR	0.34	0.34	0.25	0.26	0.38
SIZE	7.65	7.49	1.51	6.55	8.64
MB	1.94	1.63	1.03	1.27	2.27
SALES	7.23	1.77	19.29	0.70	5.14
COLLATERAL	0.36	0.32	0.23	0.17	0.50
ROA	0.10	0.09	0.09	0.05	0.15
NI	6.76	6.52	7.53	3.68	10.10
EBIT	11.83	10.68	7.63	7.18	15.46
RESEARCH	4.13	0.38	6.98	0.00	5.26
SELLING	24.10	22.00	16.20	11.33	33.97

Table 2 Pearson Correlation Coefficients

The following table reports Pearson correlation coefficients for our regression sample. There are 4,765 firm-year observations from 2006 to 2011

	SHELTER	RESERVE	DTAX	CASH_ETR	ETR
SHELTER	1	0.18674	0.28007	-0.12813	-0.25985
		<.0001	*<.0001*	*<.0001*	*<.0001*
RESERVE	0.18674	1	0.02471	-0.02572	-0.0177
	<.0001		*0.0881*	*0.0759*	*0.2218*
DTAX	0.28007	0.02471	1	-0.11048	-0.51507
	<.0001	*0.0881*		*<.0001*	*<.0001*
CASH_ETR	-0.12813	-0.02572	-0.11048	1	0.13797
	<.0001	*0.0759*	*<.0001*		*<.0001*
ETR	-0.25985	-0.0177	-0.51507	0.13797	1
	<.0001	*0.2218*	*<.0001*	*<.0001*	

Table 3 Baseline Regressions

Regression sample includes 4,765 firm years from 2006 to 2011. The dependent variable is leverage as measured by ALEV, equal to long-term debt plus debt in current liabilities all over total assets*100. All right hand side variables are lagged by one year except for tax aggressiveness measures. We use various measures of tax aggressiveness, including a shelter prediction score by Wilson (2009) (SHELTER), FIN 48 tax reserves (RESERVE), the discretionary permanent book-tax difference (DTAX), the cash effective tax rate (CASH_ETR) and the effective tax rate (ETR). We control for other factors known to reliably explain leverage use, including net income, revenue, market to book, dividend, collateral, and firm size. See appendix for variable definitions. In the first five columns we control for industry but do not control for time trend while the last five columns include both industry and year dummies. All variables are winsorized at the 1% and 99% levels. All regressions include industry and year dummies. The t-stats reported in parentheses are based on heteroskedasticity-consistent standard errors that are adjusted for clustering at the firm level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLE	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV
SHELTER	-1.9876***					-1.8936***				
	(-4.38)					(-4.14)				
RESERVE		-0.6409**					-0.6646**			
		(-2.16)					(-2.21)			
DTAX			-9.8510**					-9.5689**		
			(-2.17)					(-2.10)		
CASH_ETR				-0.2942					-0.1835	
				(-0.14)					(-0.09)	
ETR					3.2854***					2.8483***
					(3.48)					(3.00)
NI	-0.1635***	-0.1621***	-0.1572***	-0.1561***	-0.1460***	-0.1764***	-0.1779***	-0.1727***	-0.1711***	-0.1619***
	(-3.68)	(-3.68)	(-3.57)	(-3.65)	(-3.38)	(-3.95)	(-4.02)	(-3.90)	(-3.98)	(-3.72)
SALES	-0.3160***	-0.3310***	-0.3301***	-0.3295***	-0.3309***	-0.3155***	-0.3306***	-0.3294***	-0.3288***	-0.3299***
	(-7.67)	(-8.00)	(-7.96)	(-7.94)	(-7.99)	(-7.67)	(-8.00)	(-7.96)	(-7.94)	(-7.98)
MB	-0.3355	-0.6531	-0.7389*	-0.8051*	-0.7820*	-0.5086	-0.8287*	-0.9153**	-0.9818**	-0.9554**
	(-0.76)	(-1.60)	(-1.75)	(-1.91)	(-1.86)	(-1.10)	(-1.94)	(-2.07)	(-2.24)	(-2.17)
DIV	-0.5242	-0.2236	-0.1435	-0.1347	-0.1254	-0.4935	-0.2088	-0.1263	-0.1193	-0.1114
	(-0.65)	(-0.27)	(-0.17)	(-0.16)	(-0.15)	(-0.61)	(-0.25)	(-0.15)	(-0.14)	(-0.13)
COLLATERAL	6.2583**	5.7500**	6.5990**	6.5901**	6.5167**	6.0385**	5.3611*	6.2660**	6.2491**	6.2165**
	(2.23)	(2.00)	(2.31)	(2.30)	(2.28)	(2.14)	(1.86)	(2.19)	(2.18)	(2.17)

SIZE	5.9996***	5.0610***	4.9473***	4.9121***	4.9528***	5.9321***	5.0564***	4.9329***	4.9003***	4.9346***
	(12.37)	(13.00)	(12.82)	(12.65)	(12.92)	(12.21)	(13.00)	(12.79)	(12.63)	(12.87)
Constant	-36.9031***	-31.8802***	-32.2395***	-31.6541***	-33.1870***	-35.1600***	-30.1578***	-30.5960***	-30.0388***	-31.3884***
	(-8.10)	(-7.57)	(-7.67)	(-7.28)	(-7.86)	(-7.39)	(-6.86)	(-6.99)	(-6.68)	(-7.12)
Industry Dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year Dummy	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Observations	4,765	4,765	4,765	4,765	4,765	4,765	4,765	4,765	4,765	4,765
Adj. R-squared	0.319	0.305	0.303	0.302	0.305	0.322	0.311	0.308	0.307	0.309

Table 4 Alternative Measures of Leverage

Regression sample includes 4,765 firm years from 2006 to 2011. In Panel A, the dependent variable is industry adjusted leverage (IND-ADJ LEV) which is equal to firm debt minus median industry leverage(2-digit SIC) multiplied by firm asset, scaled by total assets*100. In Panel B, we use alternate measures of debt: longer-term debt to asset (BLEV) and total debt to market value (CLEV). All right hand side variables are lagged by one year except for tax aggressiveness measures. We use various measures of tax aggressiveness, including a shelter prediction score by Wilson (2009) (SHELTER), FIN 48 tax reserves (RESERVE), the discretionary permanent book-tax difference (DTAX), the cash effective tax rate (CASH_ETR), and the effective tax rate (ETR). We control for other factors known to reliably explain leverage use, including net income, revenue, market to book, dividend, collateral, and firm size. See appendix for variable definitions. All variables are winsorized at the 1% and 99% levels. All regressions include industry and year dummies. The t-stats reported in parentheses are based on heteroskedasticity-consistent standard errors that are adjusted for clustering at the firm level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Panel A Industry-Adjusted Leverage

	(1)	(2)	(3)	(4)	(5)
VARIABLE	IND-ADJ LEV	IND-ADJ LEV	IND-ADJ LEV	IND-ADJ LEV	IND-ADJ LEV
SHELTER	-1.9485***				
	(-3.93)				
RESERVE		-0.6386**			
		(-2.07)			
DTAX			-9.6871**		
			(-2.09)		
CASH_ETR				-0.2663	
				(-0.12)	
ETR					3.0101***
					(3.13)
NI	-0.1820***	-0.1831***	-0.1781***	-0.1770***	-0.1669***
	(-3.77)	(-3.80)	(-3.71)	(-3.80)	(-3.53)
SALES	-0.3202***	-0.3355***	-0.3344***	-0.3338***	-0.3350***
	(-7.58)	(-7.91)	(-7.87)	(-7.86)	(-7.90)
MB	-0.3239	-0.6637	-0.7435	-0.8106	-0.7830
	(-0.60)	(-1.35)	(-1.46)	(-1.60)	(-1.54)
DIV	-0.5308	-0.2320	-0.1529	-0.1446	-0.1373
	(-0.63)	(-0.26)	(-0.17)	(-0.17)	(-0.16)
COLLATERAL	6.2824**	5.6449*	6.5160**	6.5041**	6.4650**
	(2.18)	(1.92)	(2.23)	(2.21)	(2.21)
SIZE	5.9839***	5.0724***	4.9553***	4.9212***	4.9584***
	(11.77)	(12.81)	(12.61)	(12.44)	(12.69)
Constant	-46.6641***	-41.5126***	-41.9595***	-41.3711***	-42.8192***
	(-9.12)	(-8.91)	(-9.05)	(-8.67)	(-9.15)
Industry Dummy	YES	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES	YES
Observations	4,765	4,765	4,765	4,765	4,765
Adj. R-squared	0.177	0.163	0.160	0.159	0.161

Panel B Additional Alternative Leverage Definitions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLE	BLEV	BLEV	BLEV	BLEV	BLEV	CLEV	CLEV	CLEV	CLEV	CLEV
SHELTER	-1.9339***					-2.6189***				
	(-4.86)					(-4.19)				
RESERVE		-0.5853**					-0.3595			
		(-2.19)					(-0.67)			
DTAX			-10.2644***					-17.7429***		
			(-2.59)					(-2.74)		
CASH_ETR				-0.9476					-0.0397	
				(-0.50)					(-0.01)	
ETR					3.0343***					5.2235***
					(3.45)					(3.84)
NI	-0.1377***	-0.1382***	-0.1340***	-0.1362***	-0.1225***	-0.2915***	-0.2870***	-0.2874***	-0.2830***	-0.2676***
	(-3.69)	(-3.83)	(-3.71)	(-3.85)	(-3.48)	(-4.41)	(-4.30)	(-4.40)	(-4.37)	(-4.16)
SALES	-0.3075***	-0.3226***	-0.3217***	-0.3206***	-0.3223***	-0.3388***	-0.3582***	-0.3581***	-0.3573***	-0.3592***
	(-8.85)	(-9.23)	(-9.20)	(-9.17)	(-9.24)	(-5.61)	(-5.86)	(-5.84)	(-5.84)	(-5.85)
MB	-0.5766	-0.9251**	-0.9884***	-1.0569***	-1.0317***	-0.0522	-0.6245	-0.5830	-0.7076	-0.6580
	(-1.47)	(-2.51)	(-2.61)	(-2.80)	(-2.73)	(-0.07)	(-0.94)	(-0.82)	(-1.01)	(-0.93)
DIV	-0.7607	-0.4578	-0.3859	-0.3669	-0.3700	0.1685	0.6352	0.6744	0.6827	0.7019
	(-1.01)	(-0.59)	(-0.50)	(-0.48)	(-0.48)	(0.14)	(0.50)	(0.55)	(0.55)	(0.57)
COLLATERAL	6.8061***	6.2375**	7.0400***	7.0699***	6.9871***	10.0840***	9.8850**	10.4121***	10.3616***	10.3209***
	(2.58)	(2.32)	(2.62)	(2.63)	(2.61)	(2.58)	(2.48)	(2.63)	(2.61)	(2.61)
SIZE	5.5237***	4.6078***	4.5048***	4.4593***	4.5064***	8.7315***	7.3911***	7.3638***	7.3075***	7.3662***
	(13.18)	(13.30)	(13.19)	(12.94)	(13.25)	(12.63)	(13.20)	(13.15)	(12.93)	(13.23)
Constant	-33.3981***	-28.2804***	-28.7627***	-27.9379***	-29.6030***	-57.0827***	-50.1110***	-51.0069***	-50.0647***	-52.4498***
	(-8.08)	(-7.25)	(-7.43)	(-7.01)	(-7.58)	(-8.00)	(-7.57)	(-7.69)	(-7.33)	(-7.85)
Industry Dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	4,765	4,765	4,765	4,765	4,765	4,765	4,765	4,765	4,765	4,765
Adj. R-squared	0.324	0.309	0.307	0.306	0.309	0.325	0.312	0.313	0.312	0.315

Table 5 2SLS Regression of Leverage and Tax Aggressiveness

Regression sample includes 4,765 firm years from 2006 to 2011. We first use two instrumental variables: selling general and administrative expense (SELLING) and R&D expense (RESEARCH) to predict each tax aggressiveness measure. The F-test of the IV's was significant, and the Hansen J Statistic was insignificant, indicating that the IV's are valid as they are orthogonal to leverage. We then use the predicted values and other determinants (same as in baseline model) of debt to explain firm leverage (ALEV). We use various measures of tax aggressiveness, including a shelter prediction score by Wilson (2009) (SHELTER), FIN 48 tax reserves (RESERVE), the discretionary permanent book-tax difference (DTAX), the cash effective tax rate (CASH_ETR), and the effective tax rate (ETR). See appendix for variable definitions. All variables are winsorized at the 1% and 99% levels. All regressions include industry and year dummies. The t-stats reported in parentheses are based on heteroskedasticity-consistent standard errors that are adjusted for clustering at the firm level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)
VARIABLE	ALEV	ALEV	ALEV	ALEV	ALEV
SHELTER	-16.029**				
	(-2.12)				
RESERVE		-4.422***			
		(-3.35)			
DTAX			429.253*		
			(1.94)		
CASH_ETR				-122.350*	
				(-1.70)	
ETR					-89.370**
					(-2.01)
NI	-0.223**	-0.222***	-0.058	-0.800**	-0.429***
	(-2.49)	(-4.86)	(-0.52)	(-2.35)	(-2.82)
SALES	-0.215***	-0.340***	-0.310***	-0.248***	-0.298***
	(-2.83)	(-7.43)	(-6.02)	(-3.13)	(-5.06)
MB	3.030	0.041	-4.001**	-0.500	-1.834**
	(1.49)	(0.07)	(-2.37)	(-0.63)	(-2.38)
DIV	-3.266**	-0.699	0.064	1.756	-0.460
	(-1.99)	(-0.77)	(0.06)	(0.96)	(-0.38)
COLLATERAL	4.554	0.407	4.954	14.067**	6.891*
	(1.30)	(0.12)	(1.34)	(2.11)	(1.68)
SIZE	13.615***	5.924***	3.555***	3.191***	3.908***
	(3.21)	(11.09)	(4.00)	(2.58)	(4.92)
Industry Dummy	YES	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES	YES
Observations	4,765	4,765	4,765	4,765	4,765

Table 6 Fixed-firm and Fixed-year Effects

Regression sample includes 4,765 firm years from 2006 to 2011. Firm-fixed effect is based on gvkey and fixed-year effect is based on fiscal year. The dependent variable is leverage as measured by ALEV, equal to long-term debt plus debt in current liabilities all over total assets*100. All right hand side variables are lagged by one year except for tax aggressiveness measures. We use various measures of tax aggressiveness, including a shelter prediction score by Wilson (2009) (SHELTER), FIN 48 tax reserves (RESERVE), the discretionary permanent book-tax difference (DTAX), the cash effective tax rate (CASH_ETR), and the effective tax rate (ETR). We control for other factors known to reliably explain leverage use, including net income, revenue, market to book, dividend, collateral, and firm size. See appendix for variable definitions. All variables are winsorized at the 1% and 99% levels. The t-stats reported in parentheses are based on heteroskedasticity-consistent standard errors that are adjusted for clustering at the firm level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)
VARIABLE	ALEV	ALEV	ALEV	ALEV	ALEV
SHELTER	-1.2832***				
	(-4.00)				
RESERVE		-0.3140			
		(-1.39)			
DTAX			-8.7624***		
			(-2.75)		
CASH_ETR				0.4504	
				(0.30)	
ETR					1.3680**
					(2.03)
NI	-0.0973***	-0.0969***	-0.1032***	-0.0931***	-0.0941***
	(-3.13)	(-2.99)	(-3.09)	(-2.94)	(-2.95)
SALES	-0.0291	-0.0685	-0.0574	-0.0661	-0.0645
	(-0.33)	(-0.76)	(-0.63)	(-0.74)	(-0.72)
MB	-0.3158	-0.5710*	-0.4828	-0.5426	-0.5249
	(-0.91)	(-1.71)	(-1.45)	(-1.61)	(-1.57)
DIV	0.9073	0.8037	0.8491	0.8401	0.7475
	(1.09)	(0.94)	(1.00)	(0.99)	(0.88)
COLLATERAL	5.3841	5.4360	5.7313	5.4724	5.6094
	(1.40)	(1.43)	(1.50)	(1.43)	(1.47)
SIZE	1.0751	1.6948*	1.5654*	1.7442*	1.6306*
	(1.18)	(1.90)	(1.77)	(1.92)	(1.83)
_Ifyear_2007	1.1582***	1.0663**	1.0867***	1.0769***	1.1014***
	(2.84)	(2.57)	(2.63)	(2.59)	(2.67)
_Ifyear_2008	2.0070***	2.0652***	2.1140***	2.0444***	2.0109***
	(4.21)	(4.28)	(4.38)	(4.16)	(4.15)
_Ifyear_2009	-0.3689	-0.6697	-0.5993	-0.6492	-0.6151
	(-0.72)	(-1.25)	(-1.13)	(-1.20)	(-1.16)
_Ifyear_2010	-0.2948	-0.9452*	-0.8338	-0.8831	-0.7945
	(-0.56)	(-1.69)	(-1.53)	(-1.58)	(-1.46)
_Ifyear_2011	0.9716	0.2391	0.4041	0.3090	0.3987
	(1.63)	(0.39)	(0.67)	(0.51)	(0.66)

Constant	10.6184	5.7427	5.9133	4.6805	5.1254
	(1.48)	(0.82)	(0.85)	(0.65)	(0.73)
Observations	4,765	4,765	4,765	4,765	4,765
Adj. R-squared	0.850	0.847	0.848	0.847	0.847

Table 7 Credit Crisis of 2007-2008

Regression sample includes 4,765 firm years from 2006 to 2011, split into two sub samples. The credit crisis period (2007-2008) has 1,638 firm-year observations, while the remaining subsample (2006, 2009-2011) contains 3,127 firm-year observations. The dependent variable is leverage as measured by ALEV, equal to long-term debt plus debt in current liabilities all over total assets*100. All right hand side variables are lagged by one year except for tax aggressiveness measures. We use various measures of tax aggressiveness, including a shelter prediction score by Wilson (2009) (SHELTER), FIN 48 tax reserves (RESERVE), the discretionary permanent book-tax difference (DTAX), the cash effective tax rate (CASH_ETR), and the effective tax rate (ETR). We control for other factors known to reliably explain leverage use, including net income, revenue, market to book, dividend, collateral, and firm size. See appendix for variable definitions. All variables are winsorized at the 1% and 99% levels. All regressions include industry and year dummies. The t-stats reported in parentheses are based on heteroskedasticity-consistent standard errors that are adjusted for clustering at the firm level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	2006, 2009-2011					2007-2008				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLE	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV
SHELTER	-2.0632***					-1.4940**				
	(-4.95)					(-2.27)				
RESERVE		-0.7172**					-0.5702			
		(-2.32)					(-1.63)			
DTAX			-11.2065**					-6.8121		
			(-2.22)					(-0.84)		
CASH_ETR				0.0882					-0.6016	
				(0.04)					(-0.17)	
ETR					3.1383***					1.9950
					(2.68)					(1.17)
NI	-0.1728***	-0.1664***	-0.1599***	-0.1560***	-0.1498***	-0.2083**	-0.2295***	-0.2286***	-0.2320***	-0.2155**
	(-3.74)	(-3.68)	(-3.57)	(-3.53)	(-3.39)	(-2.54)	(-2.76)	(-2.67)	(-2.71)	(-2.53)
SALES	-0.3190***	-0.3327***	-0.3342***	-0.3331***	-0.3343***	-0.3152***	-0.3332***	-0.3272***	-0.3273***	-0.3281***
	(-8.22)	(-8.55)	(-8.61)	(-8.59)	(-8.63)	(-6.14)	(-6.48)	(-6.30)	(-6.29)	(-6.31)
MB	-0.4951	-0.8765**	-0.9848**	-1.0471**	-1.0268**	-0.5523	-0.7360	-0.7926	-0.8469	-0.8374
	(-1.07)	(-1.98)	(-2.19)	(-2.32)	(-2.28)	(-0.93)	(-1.38)	(-1.40)	(-1.55)	(-1.52)
DIV	-0.6492	-0.3102	-0.2625	-0.2287	-0.2380	-0.0963	0.1086	0.2468	0.2287	0.2412
	(-0.81)	(-0.37)	(-0.32)	(-0.28)	(-0.29)	(-0.09)	(0.10)	(0.24)	(0.22)	(0.23)
COLLATERAL	7.4709**	6.9510**	7.8633***	7.8792***	7.8201***	2.7215	1.7773	2.6712	2.6582	2.6284
	(2.56)	(2.31)	(2.64)	(2.64)	(2.62)	(0.81)	(0.53)	(0.80)	(0.79)	(0.79)

SIZE	6.2523***	5.2877***	5.1795***	5.1377***	5.1737***	5.2820***	4.6138***	4.4653***	4.4458***	4.4745***
	(13.82)	(13.79)	(13.65)	(13.47)	(13.70)	(8.13)	(9.85)	(9.67)	(9.56)	(9.73)
Constant	-37.7004***	-31.9930***	-32.5105***	-32.0008***	-33.3668***	-30.1062***	-26.7097***	-27.0000***	-26.4566***	-27.4747***
	(-8.39)	(-7.47)	(-7.66)	(-7.34)	(-7.78)	(-5.10)	(-5.11)	(-5.11)	(-4.92)	(-5.15)
Industry Dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	3,127	3,127	3,127	3,127	3,127	1,638	1,638	1,638	1,638	1,638
Adj. R-squared	0.347	0.333	0.330	0.329	0.332	0.262	0.256	0.254	0.253	0.254

Table 8 Firm Characteristics

Regression sample includes 4,765 firm years from 2006 to 2011. In this table we examine whether the tax-aggression-substitutes-for-leverage hypothesis holds more true for larger firms, as defined by those with firm size over the sample (Columns 1-5) and more profitable firms, as defined by those with positive EBIT (Columns 6-10). We use a dummy in each case and create interaction terms (aggression*dummy) to see the incremental effects. The dependent variable is leverage as measured by ALEV, equal to long-term debt plus debt in current liabilities all over total assets*100. All right hand side variables are lagged by one year except for tax aggressiveness measures. We use various measures of tax aggressiveness, including a shelter prediction score by Wilson (2009) (SHELTER), FIN 48 tax reserves (RESERVE), the discretionary permanent book-tax difference (DTAX), the cash effective tax rate (CASH_ETR), and the effective tax rate (ETR). We control for other factors known to reliably explain leverage use, including net income, revenue, market to book, dividend, collateral, and firm size. See appendix for variable definitions. All variables are winsorized at the 1% and 99% levels. All regressions include industry and year dummies. The t-stats reported in parentheses are based on heteroskedasticity-consistent standard errors that are adjusted for clustering at the firm level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Large dummy=1 if SIZE>median						Profit dummy=1 if EBIT>0					
	(1)	(2)	(3)	(4)	(5)		(6)	(7)	(8)	(9)	(10)
	ALEV	ALEV	ALEV	ALEV	ALEV		ALEV	ALEV	ALEV	ALEV	ALEV
SHELTER	-0.3556					SHELTER	0.2643				
	(-0.88)						(0.20)				
SHELTER * Large	-1.9357***					SHELTER *Prof	-2.4119*				
	(-2.73)						(-1.91)				
RESERVE		-0.2155				RESERVE		-0.4829			
		(-0.53)						(-0.93)			
RESERVE* Large		-0.4849				RESERVE*Large		-0.1500			
		(-1.08)						(-0.26)			
DTAX			-1.6876			DTAX			-1.6102		
			(-0.29)						(-0.11)		
DTAX*Large			-22.1842**			DTAX*Prof			-9.0412		
			(-2.47)						(-0.62)		
CASH_ETR				-5.8565**		CASH_ETR				9.5718**	
				(-2.44)						(2.11)	
CASH_ETR*Large				11.8633***		CASH_ETR*Prof				-9.3688**	
				(2.88)						(-2.13)	
ETR					1.1775	ETR					0.7595
					(0.98)						(0.27)
ETR*Large					3.9739**	ETR*PROF					3.1075

					(2.01)						(1.03)
Large	13.7474***	10.8122***	10.1629***	6.8053***	8.7555***	PROFITABLE	2.0589	0.0060	0.4273	6.3449**	-0.3456
	(10.12)	(9.75)	(10.97)	(4.85)	(8.42)		(1.16)	(0.00)	(0.20)	(2.37)	(-0.13)
NI	-0.1684***	-0.1654***	-0.1672***	-0.1759***	-0.1546***	SALES	-0.3117***	-0.3334***	-0.3313***	-0.3314***	-0.3308***
	(-3.74)	(-3.68)	(-3.77)	(-4.07)	(-3.52)		(-7.60)	(-8.04)	(-7.98)	(-7.98)	(-7.98)
SALES	-0.0343	-0.0986***	-0.1030***	-0.1049***	-0.1040***	MB	-1.1426**	-1.4868***	-1.5670***	-1.6079***	-1.5670***
	(-0.88)	(-2.95)	(-3.12)	(-3.18)	(-3.15)		(-2.55)	(-3.56)	(-3.65)	(-3.72)	(-3.65)
MB	-1.3248***	-1.5327***	-1.5599***	-1.5763***	-1.6084***	DIV	-0.8630	-0.5624	-0.5043	-0.4565	-0.4670
	(-3.03)	(-3.71)	(-3.61)	(-3.67)	(-3.72)		(-1.06)	(-0.66)	(-0.60)	(-0.55)	(-0.56)
DIV	0.4486	0.5480	0.5588	0.6019	0.6212	COLLATERAL	5.7743**	5.3524*	6.1757**	6.1349**	6.1173**
	(0.52)	(0.63)	(0.65)	(0.70)	(0.72)		(2.03)	(1.84)	(2.14)	(2.12)	(2.12)
COLLATERAL	3.5548	3.3759	3.9774	4.1786	3.9487	SIZE	5.9841***	5.0353***	4.9035***	4.8781***	4.8961***
	(1.25)	(1.16)	(1.38)	(1.45)	(1.37)		(12.34)	(12.78)	(12.64)	(12.54)	(12.72)
CONSTANT	9.3722***	7.7062***	6.7484***	8.8492***	6.6714***	CONSTANT	-36.1511***	-29.2734***	-29.9329***	-35.5019***	-30.2397***
	(4.15)	(2.95)	(2.95)	(3.68)	(2.88)		(-7.31)	(-6.16)	(-6.47)	(-7.12)	(-6.40)
Observations	4,765	4,765	4,765	4,765	4,765	Observations	4,765	4,765	4,765	4,765	4,765
Adj. R-squared	0.296	0.287	0.287	0.289	0.288	Adj. R-squared	0.319	0.305	0.303	0.303	0.305

Table 9 Profit Firm: Tax Aggression and Debt

Regression sample includes 4,648 firm years from 2006 to 2011. In this table we examine whether the tax-aggression-substitutes-for-leverage hypothesis holds true for more profitable firms. We identified firms with positive EBIT and divide them into two groups: Low profit firms as below Median EBIT profit (Columns 1-5) and High profit firms (Columns 6-10). The dependent variable is leverage as measured by ALEV, equal to long-term debt plus debt in current liabilities all over total assets*100. All right hand side variables are lagged by one year except for tax aggressiveness measures. We use various measures of tax aggressiveness, including a shelter prediction score by Wilson (2009) (SHELTER), FIN 48 tax reserves (RESERVE), the discretionary permanent book-tax difference (DTAX), the cash effective tax rate (CASH_ETR), and the effective tax rate (ETR) to explain leverage. We control for other factors known to reliably explain leverage use, including net income, revenue, market to book, dividend, collateral, and firm size. See appendix for variable definitions. All variables are winsorized at the 1% and 99% levels. All regressions include industry and year dummies. The t-stats reported in parentheses are based on heteroskedasticity-consistent standard errors that are adjusted for clustering at the firm level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	LOW profit(below median EBIT)					HIGH profit(above median EBIT)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLE	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV
SHELTER	-1.6980***					-2.7568***				
	(-3.65)					(-3.39)				
RESERVE		-1.1926***					-0.1757			
		(-3.80)					(-0.39)			
DTAX			-17.9968***					-5.7879		
			(-3.33)					(-0.67)		
CASH_ETR				-0.7822					-1.4398	
				(-0.36)					(-0.31)	
ETR					3.7798***					3.7882
					(3.57)					(1.10)
NI	-0.2106***	-0.2031***	-0.2065***	-0.1935***	-0.1879***	-0.0493	-0.0562	-0.0602	-0.0558	-0.0582
	(-3.98)	(-3.91)	(-3.95)	(-3.67)	(-3.68)	(-0.86)	(-0.96)	(-1.00)	(-0.95)	(-0.98)
SALES	-0.3458***	-0.3552***	-0.3606***	-0.3587***	-0.3580***	-0.2480***	-0.2712***	-0.2685***	-0.2681***	-0.2688***
	(-7.38)	(-7.66)	(-7.71)	(-7.68)	(-7.71)	(-4.30)	(-4.55)	(-4.47)	(-4.44)	(-4.48)
MB	-0.8102	-1.1803*	-1.1499*	-1.3632**	-1.1412*	-0.6092	-1.0068**	-1.0250**	-1.0510**	-1.0436**
	(-1.13)	(-1.73)	(-1.67)	(-2.01)	(-1.68)	(-1.07)	(-2.08)	(-2.02)	(-2.06)	(-2.05)
DIV	-2.5761**	-2.3524**	-2.2297**	-2.2004**	-2.1544**	1.5917	2.0775*	2.0857*	2.1492**	2.0905*
	(-2.39)	(-2.18)	(-2.07)	(-2.04)	(-2.01)	(1.54)	(1.85)	(1.89)	(1.98)	(1.91)
COLLATERAL	7.4782*	6.2590	7.5256*	7.5112*	7.5430*	2.9547	3.2137	3.4701	3.5586	3.2882

	(1.91)	(1.59)	(1.89)	(1.88)	(1.90)	(0.83)	(0.89)	(0.96)	(0.98)	(0.91)
SIZE	5.9400***	5.2003***	5.0777***	5.0243***	5.0463***	5.7162***	4.2806***	4.2242***	4.1977***	4.2357***
	(10.03)	(9.65)	(9.72)	(9.56)	(9.77)	(7.18)	(8.20)	(8.23)	(8.08)	(8.23)
Constant	-30.1172***	-23.6666***	-25.4989***	-24.4601***	-26.8951***	-33.5946***	-27.3268***	-27.2290***	-26.7462***	-28.3692***
	(-4.88)	(-3.95)	(-4.29)	(-4.04)	(-4.56)	(-4.69)	(-4.68)	(-4.58)	(-4.31)	(-4.57)
Industry Dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	2,324	2,324	2,324	2,324	2,324	2,323	2,323	2,323	2,323	2,323
Adj. R-squared	0.355	0.352	0.345	0.343	0.347	0.301	0.276	0.276	0.276	0.276

Table 10 Most Profitable Firms: Tax Aggression and Debt

Regression sample includes 466 firm years from 2006 to 2011. In this table we examine whether the tax-aggression-substitutes-for-leverage hypothesis holds true for most profitable firms. We identified firms that belong to top 10% of the profitable firms (Columns 1-5). The dependent variable is leverage as measured by ALEV, equal to long-term debt plus debt in current liabilities all over total assets*100. All right hand side variables are lagged by one year except for tax aggressiveness measures. We use various measures of tax aggressiveness, including a shelter prediction score by Wilson (2009) (SHELTER), FIN 48 tax reserves (RESERVE), the discretionary permanent book-tax difference (DTAX), the cash effective tax rate (CASH_ETR), and the effective tax rate (ETR) to explain leverage. We control for other factors known to reliably explain leverage use, including net income, revenue, market to book, dividend, collateral, and firm size. See appendix for variable definitions. All variables are winsorized at the 1% and 99% levels. All regressions include industry and year dummies. The t-stats reported in parentheses are based on heteroskedasticity-consistent standard errors that are adjusted for clustering at the firm level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)	(4)	(5)
VARIABLE	ALEV	ALEV	ALEV	ALEV	ALEV
SHELTER	-3.2658**				
	(-2.56)				
RESERVE		1.6668*			
		(1.93)			
DTAX			27.1138**		
			(2.06)		
CASH_ETR				12.4953	
				(0.97)	
ETR					-3.7931
					(-0.57)
NI	-0.0202	-0.0649	0.0213	-0.0241	-0.0136
	(-0.25)	(-0.79)	(0.24)	(-0.31)	(-0.16)
SALES	-0.6512***	-0.6513***	-0.7174***	-0.7228***	-0.7004***
	(-4.32)	(-4.38)	(-4.11)	(-4.19)	(-4.07)
MB	0.8991	0.5865	0.6442	0.6769	0.7462
	(1.14)	(0.75)	(0.82)	(0.84)	(0.92)
DIV	3.3526	5.9934**	5.1533*	4.5641	4.9713*
	(1.30)	(1.99)	(1.78)	(1.60)	(1.70)
COLLATERAL	-1.7784	1.7147	1.4180	-0.1183	0.8457
	(-0.22)	(0.21)	(0.17)	(-0.01)	(0.10)
SIZE	8.5799***	5.5835***	6.7532***	6.9763***	6.7300***

	(4.90)	(4.31)	(4.84)	(4.71)	(4.77)
Constant	-52.6092***	-41.0077***	-47.7078***	-54.6851***	-46.6196***
	(-3.55)	(-2.82)	(-3.29)	(-2.98)	(-3.12)
Industry Dummy	YES	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES	YES
Observations	466	466	466	466	466
Adj. R-squared	0.336	0.324	0.301	0.298	0.295