Journal of Banking & Finance 40 (2014) 227–241

Contents lists available at ScienceDirect

Journal of Banking & Finance

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

Corporate tax aggression and debt ☆

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ARTICLE INFO

Article history:
Received 30 April 2013
Accepted 23 November 2013
Available online 5 December 2013

JEL classification:
G32
K34

Keywords:
Tax planning
Tax aggression
Leverage
Debt
Capital structure

ABSTRACT

We provide a tradeoff model of the capital structure that allows leverage to be a function of a firm's choice of tax aggressiveness. The model's testable implications are supported empirically. Debt use is inversely related to corporate tax aggression for most firms, and the relation is economically important. This substitution effect is especially evident for firms exhibiting high tax-shelter prediction scores. The effect attenuates for benign forms of tax avoidance and during the recent credit crisis period. For the most profitable firms, debt and tax aggression are complements. Our results extend the empirical findings of Graham and Tucker (2006).

1. Introduction

Tradeoff models hold that the ability to expense interest on debt is a first-order determinant of corporate capital structure.[2] 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 by tradeoff models, thus reducing the incentive to issue debt.[3]

Tradeoff models treat firms as "tax takers" and as such their effective tax rates are completely determined by the taxing authority. However, it is well documented that firms engage in tax planning to reduce their tax liabilities. For example, under FIN 48,[4] Merck & Co. reported an initial (first quarter 2007 10 K 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 the time Merck also was

☆ We thank the referee as well as seminar participants at Fudan University's School of Management, Peking University's HSBC Business School, the American Accounting Association Conferences held in Philadelphia, PA (April 2012) and Washington, D.C. (August 2012), the Asia-Financial Management Association Conference held in Shanghai, China (April 2013), and the European Financial Management Association Conference held in Reading, United Kingdom (June 2013). We also thank Kenneth Kopecky of Temple University for his insights regarding the model, and Gong Zhou of Fudan University, James Stekelberg of the University of Southern California, and Agnieszka Trzeciakiewicz of Hull University for their helpful comments on earlier versions of this paper. Part of this research was conducted while Tucker was on faculty at Fudan University (Shanghai, China), and he acknowledges research funding support provided by Fudan's Finance Center.

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[2] 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).

[3] 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.

[4] 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.

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http://dx.doi.org/10.1016/j.jbankfin.2013.11.035

engaged in a nearly $2 billion transfer pricing tax shelter dispute with taxing authorities in Canada. In a recent and highly publicized case, Dow Chemical lost a $1 billion lawsuit with the U.S. Department of Justice which involved a transfer pricing dispute for tax years 1993–2003.[5] The leverage ratio of Dow declined markedly after 2002.[6]

There is a large corporate tax advisory industry, the effects of which on traditional financial policy hardly have been studied. Motivated by this gap in the literature, by weak empirical support for traditional tradeoff models, and by evidence of corporate tax avoidance, we first present a two-period tradeoff model that incorporates tax planning and then empirically test the model's major predictions, including that aggressive tax planning is an inverse determinant of corporate debt utilization for a large cohort of firms, a prediction that is robustly supported by the evidence. For very highly profitable firms, the model holds that tax avoidance and debt may be complements rather than substitutes; these firms may use both tax aggression and debt to reduce their tax obligations and the empirical evidence also supports this feature of the model. Finally, the model predicts and the evidence shows that debt use is more weakly related to more benign forms of tax aggression, a result consistent with the notion that aggression must be sufficiently powerful to overcome the costs of adjusting the capital structure.

More specifically, using 1500 US publicly-traded firms for the period 2006–2011,[7] 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).[8] Our results indicate that for most firms leverage is negatively related to four measures of tax aggression and that this substitution effect appears to be economically important. This inverse relation holds after accounting for factors that reliably determine corporate debt use and when using industry-adjusted leverage ratios. 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. Further supporting our finding, we demonstrate that this relation weakens during the credit crisis of 2007–08, and our results strengthen with the removal of the crisis period from our main sample.[9] We also 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).[10] Finally, we find that for very profitable firms, tax aggression and debt use are complements.

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; by documenting 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 test of the debt substitution hypothesis; and by providing a potential solution to 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 an attenuated influence on leverage choice.

This paper proceeds as follows. In Section 2 we discuss the related literature and further describe our contributions. In Section 3 we provide our tradeoff model and its testable hypotheses. Section 4 describes our regression model while Section 5 reports our data and test results. Robustness checks are performed in Section 6, and Section 7 concludes.

2. Related literature

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 to the under-leverage puzzle. Their finding suggests that previous researchers' empirical results are biased toward finding lower leverage than predicted by 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.[11]

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.[12] 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

[5] See http://www.reuters.com/article/2013/02/27/us-usa-tax-dow-idUSBRE91Q1AL20130227.

[6] 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.

[7] The 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).

[8] We expand on these measures below. Rego and Wilson (2012) find the measures to be strongly correlated.

[9] 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. The use of the credit crisis provides us a powerful natural experiment to test (and support) our main hypothesis of tax aggression-debt substitution.

[10] Indeed, results related to cash effective tax rates are generally insignificant. Because the inverse relation between debt and tax aggression is most pronounced for tax shelter prediction, our results are consistent with Graham and Tucker (2006); the measure SHELTER is most consistent with the sample of actual shelters examined by these authors.

[11] 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.

[12] 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 whether 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).

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.[13]

Other explanations advanced to resolve the under-leverage puzzle have focused on leverage mis-measurement (Welch, 2011) and distress costs mis-measurement (Almeida and Philippon, 2007), the existence, but empirical omission, of pension contributions (Shivdasani and Stefanescu, 2012), and the omission of international tax considerations (Huizinga et al., 2008). In this paper we propose an alternative theoretical explanation unrelated to the aforementioned explanations. Specifically, we present a partial equilibrium debt tradeoff model that – through the introduction of tax planning – demonstrates the optimality of lower 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, or the fact that firms appear to have very rigid capital structures over time despite changes in their profitability as well as corporate tax regimes.[14] 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.

Our study is related to two additional papers regarding the relation between taxes and capital structure. First, our presentation and testing of a tradeoff model that incorporates the choice of leverage due to corporate tax planning is partly motivated by the empirical findings of Graham et al. (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 marginal tax rate may confound the interpretation of tax-related effects in previous studies, and provide evidence linking debt levels to tax rates, more specifically that low tax rate firms lease more and have lower debt levels than high tax rate firms. Second, MacKie-Mason (1990) notes that the reason why most studies fail to find plausible or significant tax effects on financing behavior is that firm debt/equity ratios are the cumulative result of years of separate decisions and tax shields have a negligible effect on the marginal tax rate for most firms. However, we find that aggressive tax planning is a determinant of corporate debt use.

Our paper is also 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 et al. (2009). Also, Lisowsky et al. (2013) 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% of the aggregate FIN 48 reserves in their sample. Furthermore, Gupta et al. (2011b) report that FIN 48 has arrested the trend in multistate tax aggressiveness.[15] For these reasons we use FIN 48 tax reserves as one of our five measures of tax aggression.[16] The other four measures of tax aggression examined here are discretionary book-tax differences (cf. Desai, 2003; Desai and Dharmapala, 2006; Dyreng et al., 2010), tax shelter prediction scores (cf. Frank et al., 2009; Rego and Wilson, 2012), cash effective tax rates (cf. Dyreng et al., 2010 and Rego and Wilson, 2012), and effective tax rates.[17] Rego and Wilson (2012) find that these five measures are strongly correlated, and that their principal empirical result, namely 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.[18] Finally, Frank et al. (2009) find that tax aggressiveness and financial reporting aggressiveness are directly related. The evidence reported in this study therefore suggests that leverage and financial reporting aggressiveness may be inversely related.

3. A trade-off model of the capital structure with tax planning

In this section we introduce a tradeoff model that allows corporate tax planning and capital structure choice to 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 later provide justification for why leverage choice is more likely to follow from tax planning and not vice versa.

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. Based on these estimates the firm

[13] 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 et al. (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 et al. (2012), Frischmann et al. (2008), Brown et al. (2011), Dunbar et al. (2009), Robinson and Schmidt (2008), and Gupta et al. (2011a) 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.

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

[15] 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; Dhaliwal et al., 2004). However, Cazier et al. (2012) report that FIN48 has been mostly ineffective at reducing the practice of earnings management through the use of the tax reserve account.

[16] Alexander et al. (2010) report that FIN48 reserves can be used to help quantify firms' tax reserve activities for the years prior to the advent of FIN48.

[17] See Lisowsky (2010) for using financial statement information to empirically model tax shelters.

[18] Graham and Tucker (2006) report that tax sheltering firms appear to enjoy higher credit ratings and lower credit spreads than their non-sheltering counterparts.

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 $t_h > t_l$.[19] However, selecting A will increase the 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.[20] The firm's forecasted pre-tax cash flow for the period, M, equals all inflows including ordinary and extra-ordinary gains, cash flow from investments, capital gains, etc., less all outflows including 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. The possible existence of extant loss carry forwards also could be readily accommodated. 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 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.[21] 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, i.e., the debt-induced agency cost first described by Myers (1977) and Jensen and Meckling (1976). This cost is reflected via the term $[(-a)(M)]$ where $a > 0$, i.e., a reduction in pre-tax cash flow.[22] The second is the expected cost, direct and indirect, associated with the potential for firm bankruptcy. 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.[23] At most total debt can equal total assets: $B^{\max} = TA_{t=0}$.[24]

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:

$$\begin{aligned} V_{TA} &= Z/(1+k_j) \\ &= \{(M)(1-a)(1-t_i) - B(1+r) + Br(t_i) + B(1+r) \\ &\quad - pQ\}/(1+k_j). \end{aligned} \tag{1}$$

The firm's assumed objective is to maximize its expectation of V_{TA} through its selection of tax planning and debt usage at time 0.[25] 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, that the amount exceeds the threshold, B^T, so the higher cost of capital, k_h, applies. Thus these four combinations occasion the following four firm values, respectively:

$$V_{TA} = [M(1-t_h)]/(1+k_l) \text{ [passive-no debt]}, \tag{2}$$

$$V_{TA} = [M(1-a)(1-t_h) + Br(t_h)]/(1+k_h) \text{ [passive-debt]}, \tag{3}$$

$$V_{TA} = [M(1-t_l) - pQ]/(1+k_l) \text{ [aggressive-no debt]}, \tag{4}$$

$$V_{TA} = [M(1-a)(1-t_l) + Br(t_l) - pQ]/(1+k_h) \text{ [aggressive-debt]}. \tag{5}$$

[19] 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 affected 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. 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.

[20] While in our simplified 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.

[21] 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.

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

[23] 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.

[24] While in our simple 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. 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.

[25] The classical tradeoff models of Modigliani and Miller (1958, 1963) and Miller (1977) are nested versions of equation (1). While not presented here for the sake of brevity, a comparison of our tradeoff model to those just named indicates two interesting results: First, a capital structure of all equity may still be optimal despite the ability to deduct interest expense, because aggressive tax planning can crowd-out the benefits of the interest tax shield. Second, firm capital structure may be suboptimal if tax planning is ignored. Both results may serve to help explain the under-leverage and sticky-debt puzzles, including why some firms use no debt whatsoever. Also, when analyzing our model while obviating from our assumption that firm value is strictly determined by management who maximize after-tax cash flow, and instead allowing a role played by investors and regulators when determining firm value, with possible informational differences between management and investors and regulators, we are able to show that 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. Furthermore, we are able to show that a firm may appear to be under-levered if analysts are unaware of the 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. Finally, we are able to show that if the product pQ is small there may be an "under-aggression puzzle"; firms may be insufficiently tax aggressive when seeking to maximize stakeholder value.

Simple numerical illustrations as well as simulations (available upon request) reveal that 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). However, over a wide-array of parameter values the aggressive-no debt strategy proved optimal most of the time, suggesting that aggressive tax planning combined with low leverage may be value-maximizing for a large cohort of firms. As expected, for very profitable firms (large M), the aggressive-debt strategy tended to be best, suggesting that for these firms aggressive tax planning and debt usage are complementary.

3.2. The two-period model

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, we aver 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.

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 experienced 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 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.[26,27] 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 suggest that tax planning does not follow from debt choice.[28]

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 faces two possible values of V_{TA} at time 1, depending on whether it remains all-equity or assumes some debt.[29] Respectively, we have:[30]

$$V_{TA} = M(1 - t_h)/(1 + k_l), \tag{6}$$

and

$$V_{TA} = [M(1 - a)(1 - t_h) + Br(t_h)]/(1 + k_h). \tag{7}$$

Comparing (6) to (7) 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 cost ($a > 0$) 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:

$$V_{TA} = [M(1 - t_l) - pQ]/(1 + k_l), \tag{8}$$

$$V_{TA} = [M(1 - a)(1 - t_l) + Br(t_l) - pQ]/(1 + k_h). \tag{9}$$

Comparing (8) to (9) 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 cost 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. This leads to our first testable hypothesis:

H1. Tax-aggressive firms will use less debt than their tax-passive counterparts.

To further impart this hypothesis, ignore agency cost ($a = 0$) and consider the derivative of firm value with respect to debt in Eqs. (7) and (9), respectively:

$$dV_{TA}/dB = r(t_h)/(1 + k_h) \tag{10}$$

and

$$dV_{TA}/dB = r(t_l)/(1 + k_h). \tag{11}$$

Comparing the two derivatives we see that (11) is less than (10), 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 (11) $dV_{TA}/dB = 0$, and thus there is no motive for the aggressive firm to use debt in light of debt-induced agency and bankruptcy costs.

3.3. A limit on aggression

We now 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 make M so high that the firm can exhaust every conceivable tax-aggressive strategy and still not drive its effective tax rate to zero.[31] Here, because more profitable firms are more likely to reach any aggression

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

[27] 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.

[28] We return to this topic in Section 3.4.

[29] 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.

[30] In Eq. (6), as well as (8) to follow, debt issuance is assumed to occasion a higher cost of capital.

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

limit they are more likely to engage in both tax aggression and debt use than their less profitable counterparts. Consistent with Eq. (5), the possibility that tax aggression is limited implies that for a cohort of very highly profitable firms, tax aggression and leverage may be complementary.[32] This leads to our second testable hypothesis:

H2. Tax aggression and debt use are positively related for very highly profitable firms.

3.4. The model with costly debt retirement

We now consider 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 (numerically) 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.[33] 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 rapacious tax planning measures are used. This leads to our third testable hypothesis:

H3. Any relation between debt use and tax planning is weaker (stronger) when more benign (aggressive) tax avoidance measures are undertaken.

4. Empirical model

To test the above three hypothesis empirically, we use the following regression model:

$$\begin{aligned} LEV = {} & \alpha_0 + \alpha_1 TAX\_AGGRESSION + \alpha_2 NI + \alpha_3 SALES + \alpha_4 MB \\ & + \alpha_5 DIV + \alpha_6 COLLATERAL + \alpha_7 SIZE \\ & + \alpha_7 INDUSTRY\_DUMMY + \alpha_8 YEAR\_DUMMY + \varepsilon. \end{aligned} \quad (12)$$

Our regression model includes a firm's leverage (LEV) as a dependent variable and a measure of tax aggression (TAX_AGGRESSION) as the main explanatory variable of interest. We use different proxies to measure LEV. ALEV refers to the leverage measured by the ratio of total debt over total assets; BLEV refers to the ratio of long-term debt over total assets; CLEV is defined as the ratio of total debt over the sum of total debt and equity; and IND-ADJ LEV is defined as the industry-adjusted firm leverage, calculated as the firm's total debt minus median industry leverage (2-digit SIC) multiplied by firm assets, scaled by total assets.

Table 1
Panel A: Summary statistics; Panel B: Pearson correlation coefficients.

Variable	Mean	Median	Std Dev	25th Pctl	75th Pctl
Panel A: Summary statistics					
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

	SHELTER	RESERVE	DTAX	CASH_ETR	ETR
Panel B: Pearson correlation coefficients					
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*	

Our final sample contains 4765 firm years from 2006–2011 for 1500 firms with inaugural Fin 48 reserves information. See Appendix A for variable definitions. All data are winsorized at the 1% and 99% percent levels.
Panel B reports Pearson correlation coefficients for our regression sample. There are 4765 firm-year observations from 2006 to 2011.

We also use multiple measures of TAX_AGGRESSION. 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, management focuses 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., 2012). De Waegeneare et al. (2010) report that UTB reserves are the best measure of tax aggressiveness if compliance with FIN 48 is high; 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 (RESERVE), 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

[32] Note that these very profitable firms could have used even more leverage had it not been for their aggressive tax planning.

[33] This demonstration is available upon request. To envision it, consider a profitable, initially-levered firm with a high expected tax rate and zero expected aggression penalty. From Eq. (1), this levered firm has value $V_{TA} = \{(M)(1-a)(1-t_h) - B(1+r) + Br(t_h) + B(1+r)\}/(1+k_h)$. For such an ideal candidate, aggressive tax planning would increase firm value by reducing the tax rate, thus permitting the firm to retire all of its debt and thereby eliminate agency cost ($a = 0$) and bankruptcy costs (resulting in a lower cost of capital). In this case, firm value V_{TA} is given by what we define as the firm's pure cash flow value, $M/(1+k_l)$. However, if we introduce transactions costs associated with lumpy debt retirement in Eq. (1), then the firm's incentive to retire debt is tempered and the firm may find it optimal to remain (somewhat) levered. As the costs of the retirement of lumpy debt increase (decrease), firms may require more (less) tax aggression to optimally retire debt. For instance, subtract from Eq. (1) a term "TC" which reflects the cost of lumpy debt retirement. TC 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 TC. If TC is sufficiently large, however, then this new value may be less than the value of the firm as already levered: If TC is large, then $M/(1+k_l) < \{(M)(1-a)(1-t_h) - B(1+r) + Br(t_h) + B(1+r)\}/(1+k_h) - TC$.

Table 2
Baseline regressions and alternative definitions.

Variable	(1) ALEV	(2) ALEV	(3) ALEV	(4) ALEV	(5) ALEV	(6) IND-ADJ LEV	(7) IND-ADJ LEV	(8) IND-ADJ LEV	(9) IND-ADJ LEV	(10) IND-ADJ LEV
Panel A: Baseline results										
SHELTER	−1.8936***					−1.8560***				
	(−4.14)					(−3.88)				
RESERVE		−0.6646**					−0.5433*			
		(−2.21)					(−1.79)			
DTAX			−9.5689**					−9.9892**		
			(−2.10)					(−2.14)		
CASH_ETR				−0.1835					1.0367	
				(−0.09)						(0.48)
ETR					2.8483***					3.3352***
					(3.00)					(3.49)
NI	−0.1764***	−0.1779***	−0.1727***	−0.1711***	−0.1619***	−0.1708***	−0.1702***	−0.1659***	−0.1583***	−0.1543***
	(−3.95)	(−4.02)	(−3.90)	(−3.98)	(−3.72)	(−3.47)	(−3.45)	(−3.38)	(−3.29)	(−3.19)
SALES	−0.3155***	−0.3306***	−0.3294***	−0.3288***	−0.3299***	−0.2569***	−0.2688***	−0.2667***	−0.2674***	−0.2682***
	(−7.67)	(−8.00)	(−7.96)	(−7.94)	(−7.98)	(−6.05)	(−6.26)	(−6.21)	(−6.22)	(−6.24)
MB	−0.5086	−0.8287*	−0.9153**	−0.9818**	−0.9554**	−0.0361	−0.3322	−0.4028	−0.4714	−0.4406
	(−1.10)	(−1.94)	(−2.07)	(−2.24)	(−2.17)	(−0.07)	(−0.71)	(−0.82)	(−0.96)	(−0.89)
DIV	−0.4935	−0.2088	−0.1263	−0.1193	−0.1114	−1.2963	−0.9616	−0.9087	−0.9186	−0.8871
	(−0.61)	(−0.25)	(−0.15)	(−0.14)	(−0.13)	(−1.51)	(−1.09)	(−1.03)	(−1.05)	(−1.01)
COLLATERAL	6.0385**	5.3611*	6.2660**	6.2491**	6.2165**	−4.4518**	−4.4235**	−3.6109*	−3.6892*	−3.6302*
	(2.14)	(1.86)	(2.19)	(2.18)	(2.17)	(−2.23)	(−2.18)	(−1.79)	(−1.81)	(−1.80)
SIZE	5.9321***	5.0564***	4.9329***	4.9003***	4.9346***	4.9545***	4.0004***	3.9113***	3.9038***	3.9221***
	(12.21)	(13.00)	(12.79)	(12.63)	(12.87)	(10.52)	(10.80)	(10.58)	(10.49)	(10.65)
Constant	−35.1600***	−30.1578***	−30.5960***	−30.0388***	−31.3884***	−27.9098***	−21.8841***	−22.1790***	−22.2530***	−23.3934***
	(−7.39)	(−6.86)	(−6.99)	(−6.68)	(−7.12)	(−7.65)	(−7.12)	(−7.19)	(−6.87)	(−7.47)
Industry dummy	Yes	Yes	Yes	Yes	YES	N/A	N/A	N/A	N/A	N/A
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765
Adj. *R*-squared	0.322	0.311	0.308	0.307	0.309	0.117	0.103	0.101	0.100	0.103
	(1) BLEV	(2) BLEV	(3) BLEV	(4) BLEV	(5) BLEV	(6) CLEV	(7) CLEV	(8) CLEV	(9) CLEV	(10) CLEV
Panel B: Alternative leverage definitions										
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)
Observations	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765
Adj. *R*-squared	0.324	0.309	0.307	0.306	0.309	0.325	0.312	0.313	0.312	0.315

Regression sample includes 4765 firm years from 2006 to 2011. Panel A shows our baseline results. In 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). 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 A for variable definitions. In columns (6)–(10), 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), and do not report controls for brevity. 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.

* Significance at 10% level.
** Significance at 5% level.
*** Significance at 1% levels.

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, 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) argue that a long-term cash ETR uses cash taxes paid and pre-tax income over a multi-year period. Such multi-year treatment 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.

By contrast, 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.[34] ETR's are generally computed as the ratio of total income tax expense to pre-tax book income and reflect 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 control variables include NI, SALES, MB, DIV, COLLATERAL, and SIZE. NI is net income scaled by total assets. SALES is defined as the total revenues of a firm, SIZE is the logarithm of total assets. MB is the ratio of market to book value. DIV is a dummy variable that takes the value of 1 if a firm pays a dividend, zero otherwise. COLLATERAL is the ratio of all collaterals scaled by total assets. All right-hand side variables are lagged by one year. We also include INDUSTRY_DUMMY and YEAR_DUMMY to reflect industry and year effects.

5. Data, tests, and empirical results

The sample used in this study consists of 1500 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' 10 K filings with the Securities and Exchange Commission (SEC) for fiscal tax years 2006–2011. 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 1500 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 4765 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. The *t*-stats reported in parentheses are based on heteroskedasticity-consistent standard errors that are adjusted for clustering at the firm level. All variables are winsorized at 1% and 99% to mitigate reporting errors.[35] Appendix A gives variable definitions and corresponding Compustat items used in variable construction.

Panel A of Table 1 provides descriptive statistics for variables. As shown in this panel, 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 pre-tax income, indicating that on average, firms are paying 34% tax of their pre-tax incomes.

In addition, Panel A of Table 1 provides descriptive statistics for control variables, including SIZE, MB, SALES, COLLATERAL, ROA, NI, and EBIT.[36] The mean of 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.

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 Panel B of Table 1. 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.

Table 2 reports the results of regressions on 4765 firm-year observations from 2006 to 2011, which examine the effect of tax aggressiveness on a firm's leverage level or Hypothesis 1. Table 2 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.[37] In particular, column (1) indicates that SHELTER is negatively associated with a corporate leverage level (with coefficient −1.8936 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 (−0.6646, *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 (−9.5689, *p* value less than 0.05) 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

[34] 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.

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

[36] We use the same leverage determinants/control variables found in Frank and Goyal (2009) and Graham and Tucker (2006).

[37] 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 passive (aggressive) in subsequent periods.

Table 3
Firms split by profit.

	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	2324	2324	2324	2324	2324	2323	2323	2323	2323	2323
Adj. *R*-squared	0.355	0.352	0.345	0.343	0.347	0.301	0.276	0.276	0.276	0.276

Regression sample includes 4648 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 A 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.

* Significance at 10% level.
** Significance at 5% level.
*** Significance at 1% level.

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 (2.8483, *p* value less than 0.01) indicates that 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 a firm's debt use is significantly inversely associated with the tax aggressiveness of a firm, whether measured by tax UTB reserves (RESERVE), tax shelters (SHELTER), discretionary permanent differences (DTAX), or the effective tax rate (ETR).

In addition, Table 2 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 show 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 (2009) and Graham and Tucker (2006).

Columns (6)–(10) of Panel A of Table 2 use industry-adjusted leverage (IND-ADJ LEV) as the dependent variable. 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 so far, we find that tax aggressiveness is negatively associated with a firm's leverage level, even adjusted by industry leverage levels. In particular, SHELTER, RESERVE and DTAX have significantly negative coefficients (−1.8560, −0.5433 and −9.9892, respectively), while ETR has a significantly positive coefficient (3.3352).

To further investigate the robustness of our results, Panel B of Table 2 presents regression results using alternative measures of leverage. Columns (1)–(5) use the ratio of long-term debt to total assets (BLEV) while Columns (6)–(10) uses the ratio of total debt to the sum of total debt and total equity (CLEV) as the dependent variables. All regression specifications are identical to those in our baseline models but we do not report the coefficients on control variables for brevity.

Table 4
Most profitable firms: tax aggression and debt.

Variable	(1) ALEV	(2) ALEV	(3) ALEV	(4) ALEV	(5) 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

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 A 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.

* Significance at 10% level.
** Significance at 5% level.
*** Significance at 1% level.

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 in Panel A.

We now take a moment to relate the results of Table 2 in more economic terms. Are the results economically important? To address this question we focus initially on the first coefficient estimate for SHELTER, −1.8936. An increase in SHELTER from the 25th to 75th percentile decreases leverage by 12.185%, calculated as {[regression coefficient * (75th shelter − 25th shelter)]/(75th leverage − 25th leverage) or {[−1.8936 * (2.04 − 0.41)]/(28.46 − 3.13)}. Such a reduction represents a large change in leverage (capital structure). Similar statements can be made about other measures of tax aggression in Table 2 (e.g. DTAX), as well as in subsequent tables.[38]

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 3 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 a positive coefficient for low profit firms (3.7798). However, we find a significant negative coefficient on 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.

Our tradeoff model holds that for extremely profitable firms, the relation between tax aggressiveness and debt is complementary. To test Hypothesis 2, we identified the top 10% of profitable firms. Table 4 presents regression results for these firms. 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

[38] The aforementioned 12.185% reduction represents a reduction of 1219 basis points in average leverage. This finding is consistent with Graham and Tucker (2006); they 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.

Table 5
Fixed-firm and fixed-year effects.

Variable	(1) ALEV	(2) ALEV	(3) ALEV	(4) ALEV	(5) 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)
CONSTANT	10.6184	5.7427	5.9133	4.6805	5.1254
	(1.48)	(0.82)	(0.85)	(0.65)	(0.73)
Observations	4765	4765	4765	4765	4765
Adj. *R*-squared	0.850	0.847	0.848	0.847	0.847

Regression sample includes 4765 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 A 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.

* Significance at 10% level.
** Significance at 5% level.
*** Significance at 1% level.

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.[39]

The results of our tests of Hypothesis 3 are reported throughout various tables (Panel B of Table 1, and Tables 2 and 3). As discussed in Section 4, the five measures of tax aggressions could very well represent different tax strategies, which are associated with different costs. In particular, DTAX and SHELTER have been tied to actual cases of tax sheltering (Frank et al., 2009; Wilson, 2009); therefore both variables are regarded as highly aggressive. De Waegeneare et al. (2010) report that UTB reserves are the best measure of tax aggressiveness if compliance with FIN 48 is high. Dyreng et al. (2008) and Frank et al. (2009) argue that ETR is a more appropriate measure of tax reporting aggressiveness while CASH_ETR is a more appropriate measure of tax avoidance, since CASH_ETR reflects a range of aggressive activities including more benign degrees of aggression. In addition, CASH_ETR is a longer-term measure of aggression which might avoid 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 pre-tax accrual management.

From the Pearson correlations table (Panel B of Table 1), we observe that the five measures are highly correlated, which is an indication of the validity of our measures. In particular SHELTER, DTAX and RESERVES appear to be closely related, and they reflect the strategies that are more expensive to implement and thus worth pursuing only when the expected tax savings are large. Tables 2 and 3 show that the more aggressive tax strategies (SHELTER, DTAX, RESERVES, and ETR) are better able to explain leverage since the coefficients of SHELTER, DTAX, RESERVES, and ETR are significant at the 0.05 level across various models. In contrast, across all tables, we find that the coefficient of CASH_ETR is consistently insignificant, indicating that as the most benign form of tax aggression CASH_ETR is not associated with debt use.

Our empirical results demonstrate that the most aggressive measure, SHELTER, offers the highest degree of explanatory power; it generates the highest adjusted *R*-squared in Table 2 Panel A (0.322) and Panel B (0.324),[40] followed by RESERVES, DTAX and ETR. The most benign form of tax aggression (CASH_ETR) has less explanatory power with an adjusted *R*-squared of 0.307 and 0.306 in Table 2, Panels A and B, respectively.

[39] In addition to the tests reported in Tables 1–7, 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.

[40] The variable SHELTER uses leverage in its construction (ses Appendix A 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.

Table 6
Credit crisis of 2007–2008.

	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	3127	3127	3127	3127	3127	1638	1638	1638	1638	1638
Adj. *R*-squared	0.347	0.333	0.330	0.329	0.332	0.262	0.256	0.254	0.253	0.254

Regression sample includes 4765 firm years from 2006 to 2011, split into two sub samples. The credit crisis period (2007–2008) has 1638 firm-year observations, while the remaining subsample (2006, 2009–2011) contains 3127 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 A 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.
* Significance at 10% level.
** Significance at 5% level.
*** Significance at 1% level.

6. Robustness checks

We address the potential for endogeneity by applying a fixed-firm, fixed-year model.[41] Fixed effects estimation maintains separate intercepts for each firm and for each year in order to account for unobserved relations between debt and the independent variables, and to capture effects that may change inter-temporally. From Table 5 we see that our tax-aggression-substitutes-for-leverage hypothesis holds on a within-firm basis, further validating our main hypothesis H1. This is a powerful finding as absent some other cogent 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.[42]

To further validate our findings, we use two approaches to demonstrate the sensitivity of our results. First, we examine whether the association between tax aggression and leverage is less pronounced during the crisis period than the non-crisis period. This represents a natural experiment (cf. Chen, 2010). Table 6 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 1638 firm-year observations while the remaining non-credit-crisis period contains 3127 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 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).

Second, to further test the association between tax aggressiveness and corporate debt policy we investigate any moderating effects of firm characteristics on this relation. Specifically, we examine whether larger firms or profitable firms are more sensitive to such association.[43] We identify firms that have larger assets

[41] The endogeneity issue at hand is whether tax aggressiveness reduces debt use or do low-debt firms just happen to be tax aggressive. Both tax aggressiveness and debt use are choice variables. Fixed-firm effect is based on GVKEY and fixed-year effect is based on fiscal year.

[42] Because the tax shelter prediction variable is our main focus, we repeated all of the tests found in Tables 2–7 for this variable for a longer sample period, namely beginning 2000. Recall that our initial sample was restricted to years 2006–2011, 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 2–7.

[43] 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.

Table 7
Firm characteristics.

	LARGE CHARDUM = 1 if SIZE > median					PROFITABLE CHARDUM = 1 if EBIT > 0				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variable	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV	ALEV
SHELTER	−0.3556					0.2643				
	(−0.88)					(0.20)				
SHELTER * CHARDUM	−1.9357***					−2.4119*				
	(−2.73)					(−1.91)				
RESERVE		−0.2155					−0.4829			
		(−0.53)					(−0.93)			
RESERVE* CHARDUM		−0.4849					−0.1500			
		(−1.08)					(−0.26)			
DTAX			−1.6876					−1.6102		
			(−0.29)					(−0.11)		
DTAX* CHARDUM			−22.1842**					−9.0412		
			(−2.47)					(−0.62)		
CASH_ETR				−5.8565**					9.5718**	
				(−2.44)					(2.11)	
CASH_ETR* CHARDUM				11.8633***					−9.3688**	
				(2.88)					(−2.13)	
ETR					1.1775					0.7595
					(0.98)					(0.27)
ETR* CHARDUM					3.9739**					3.1075
					(2.01)					(1.03)
CHARDUM	13.7474***	10.8122***	10.1629***	6.8053***	8.7555***	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)
SIZE						5.9841***	5.0353***	4.9035***	4.8781***	4.8961***
						(12.34)	(12.78)	(12.64)	(12.54)	(12.72)
NI	−0.1684***	−0.1654***	−0.1672***	−0.1759***	−0.1546***					
	(−3.74)	(−3.68)	(−3.77)	(−4.07)	(−3.52)					
SALES	−0.0343	−0.0986***	−0.1030***	−0.1049***	−0.1040***	−0.3117***	−0.3334***	−0.3313***	−0.3314***	−0.3308***
	(−0.88)	(−2.95)	(−3.12)	(−3.18)	(−3.15)	(−7.60)	(−8.04)	(−7.98)	(−7.98)	(−7.98)
MB	−1.3248***	−1.5327***	−1.5599***	−1.5763***	−1.6084***	−1.1426***	−1.4868***	−1.5670***	−1.6079***	−1.5670***
	(−3.03)	(−3.71)	(−3.61)	(−3.67)	(−3.72)	(−2.55)	(−3.56)	(−3.65)	(−3.72)	(−3.65)
DIV	0.4486	0.5480	0.5588	0.6019	0.6212	−0.8630	−0.5624	−0.5043	−0.4565	−0.4670
	(0.52)	(0.63)	(0.65)	(0.70)	(0.72)	(−1.06)	(−0.66)	(−0.60)	(−0.55)	(−0.56)
COLLATERAL	3.5548	3.3759	3.9774	4.1786	3.9487	5.7743**	5.3524*	6.1757**	6.1349**	6.1173**
	(1.25)	(1.16)	(1.38)	(1.45)	(1.37)	(2.03)	(1.84)	(2.14)	(2.12)	(2.12)
CONSTANT	9.3722***	7.7062***	6.7484***	8.8492***	6.6714***	−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	4765	4765	4765	4765	4765	4765	4765	4765	4765	4765
Adj. *R*-squared	0.296	0.287	0.287	0.289	0.288	0.319	0.305	0.303	0.303	0.305

Regression sample includes 4765 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 A 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.

* Significance at 10% level.
** Significance at 5% level.
*** Significance at 1% level.

(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 one when EBIT is positive). Table 7 presents regression results on larger firms or profitable firms with columns (1)–(5) representing firms with larger size 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 a significantly positive coefficient (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 on the interaction term of SHELTER and PROFIT (−2.4119), indicating that profitable firms tend to use SHELTER to adjust their debt levels.

7. Conclusion

We provide a tradeoff model of the capital structure that incorporates firm tax planning. 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. This relation is economically important. We also 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. This natural experiment further supports our main findings. Moreover, we find that larger firms or more profitable firms exhibit more sensitive substitution effects between corporate tax aggressiveness and corporate debt policy. We also show 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 (least) powerful for the most (least) rapacious measure of tax aggression.

Our analysis offers interesting paths to future research, including the following questions: Does tax planning influence other corporate financial practices, such as dividend policy? What types of firms are more likely to be subject to lower tax penalties and do these firms exhibit less debt? What types of firms are more likely to conceal their aggressive tax practices from analysts? Is there a relation between the types and costs of tax advisory services and various financial policy decisions? And what role does behavioral finance play in tax planning and, in turn, financial policy? Most important is the need to enrich the structure of our model. We expect that as this structure becomes more detailed, more precise hypotheses can be developed for empirical testing.

Appendix A

See Table A1.

Table A1
Variable definition.

Variable	Definition	Formula in compustat items
SHELTER	Shelter prediction score Wilson (2009)	BTD = (book income − taxable income)/ lagged assets
	$SHELTER = -4.30 + 6.63 \times BTD - 1.72 \times LEV + 0.66 \times SIZE + 2.26 \times ROA + 1.62 \times FOR\_INCOME + 1.56 \times R\&D$ where:	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;	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 is long-term debt divided by total assets;	LEV = data9/data6
	SIZE is the log of total assets;	SIZE = log(data6)
	ROA is pre-tax earnings divided by total assets;	ROA = data170/data6
	FOR_INCOME is pretax foreign income divided by lagged total assets;	FOR_INCOME = data273/lagged data6; 0 if missing
	R&D is divided by lagged total assets	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)], scaled by total assets at year $t-1$;	PERMDIFF = [data170 − ((data63 + data64)/ 0.35) − (data50/0.35)]/lag data6
	STR = Statutory tax rate;	STR = 0.35
	UNCON = Income (loss) reported under the equity method divided by total assets at year $t-1$;	UNCON = data55/lag data6
	MI = Income (loss) attributable to minority interest, scaled by total assets at year $t-1$;	MI = data49/lag data6
	CSTE = Current state tax expense, scaled total assets at year $t-1$;	CSTE = data173/lag data6
	ΔNOL = Change in net operating loss carry forwards, scaled by total assets at year $t-1$;	ΔNOL = data 52/lag data6
	LAGPERM = PERMDIFF in year $t-1$	
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 value	(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
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.

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