A Review of Taxes and Corporate Finance

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A Review of Taxes and Corporate Finance

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Abstract

This paper reviews domestic and multinational corporate tax research. For each topic, the theoretical arguments explaining how taxes can affect corporate decision-making and firm value are reviewed, followed by a summary of the related empirical evidence and a discussion of unresolved issues. Tax research generally supports the hypothesis that high-tax rate firms pursue policies that provide tax benefits. Many issues remain unresolved, however, including understanding whether tax effects are of first-order importance, why firms do not pursue tax benefits more aggressively, and whether corporate actions are affected by investor-level taxes.

Contents

Modigliani and Miller (1985) and Miller and Modigliani (1961) demonstrate that corporate financial decisions are irrelevant in a perfect, frictionless world. During the past 45 years, research has focused on whether financial decisions become relevant if capital markets are not perfect. This paper reviews the literature that investigates the consequences of allowing taxation, with emphasis on how taxes can affect corporate policies and firm value.[1] This role is potentially very important, given the sizable tax rates that many corporations and individuals face (see Fig. 1).

Modigliani and Miller (MM) argue that corporate financial policies do not add value in equilibrium, and therefore firm value equals the present value of operating cash flows. Once imperfections are introduced, however, corporate financial policies can affect firm value, and firms should pursue a given policy until the marginal benefit of doing so equals the marginal cost. A common theme in tax research involves expressing how various tax rules and regulations affect the marginal benefit of corporate actions. For example, when tax rules allow interest deductibility, a \$1 interest deduction provides tax savings of \$1x$\tau_C(.)$. $\tau_C(.)$ measures corporate marginal tax benefits and is a function of statutory tax rates, nondebt tax shields, the probability of experiencing a loss, international tax rules about dividend imputation and interest allocation, organizational form, and various other tax rules. A common theme that runs throughout this paper is the demonstration of how various tax rules affect the $\tau_C(.)$ benefit function, and therefore how they affect corporate incentives and decisions. A second but less common theme in tax research is related to how market imperfections affect costs. Given that this chapter reviews tax research, I emphasize research that describes how taxes affect costs and benefits – and only briefly discuss the influence of nontax factors.

There are multiple avenues for taxes to affect corporate decisions. Taxes can affect capital structure decisions (both domestic (Section 1)

[1] The interested reader can find excellent reviews of how taxes affect household investment decisions (Poterba, 2001) and the current state of tax research from the perspective of accountants (Shackelford and Shevlin, 2001) and public economists (Auerbach, 2002). Articles reviewing how nontax factors such as agency and informational imperfections affect corporate financial decisions can be found in the other chapters of this handbook.

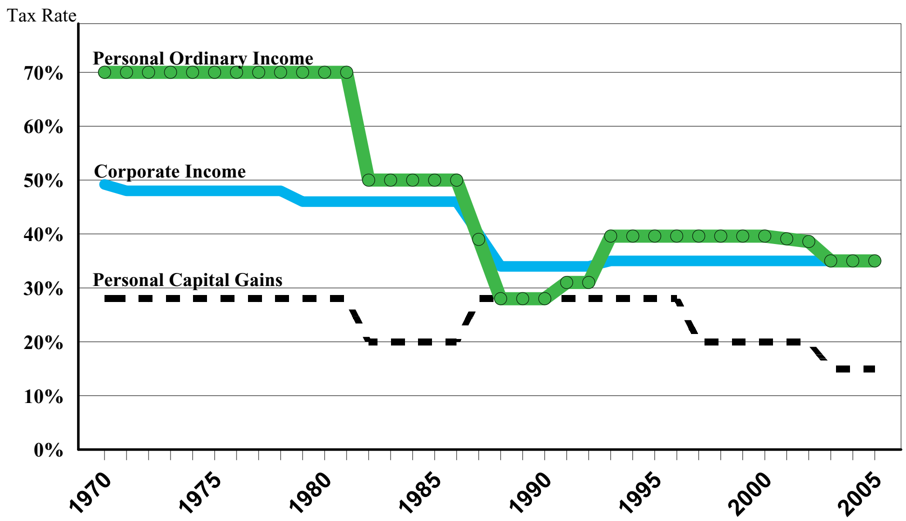

Fig. 1 Corporate and Personal Income Tax Rates
The highest tax bracket statutory rates are shown for individuals and C corporations. The corporate capital gains tax rate (not shown) was equal to the corporate income tax rate every rate after 1987. In May 2003 President Bush signed into law a reduction in the top personal income tax rate to 35%. This same law reduced top personal tax rates on capital gains and dividends to 15%. Source for pre-2003 numbers: Commerce Clearing House, annual publications.

and multinational (Section 2)), organizational form and restructurings (Section 3), payout policy (Section 4), compensation policy (Section 5),risk management (Section 6), and the use of tax shelters (Section 7). For each of these areas, the sections that follow provide a theoretical framework describing how taxes might affect corporate decisions, empirical predictions based on the theory, and summaries of the related empirical evidence. This approach is intended to highlight important questions about how taxes affect corporate decisions, and to summarize and critique the answers that have been thus far provided. Each section concludes with a discussion of unanswered questions and possible avenues for future research. Overall, substantial progress has been made investigating if and how taxes affect corporate financial decisions – but much work remains to be done. Section 8 concludes and proposes directions for future research.

1

Taxes and Capital Structure – U.S. Tax System

1.1 Theory and empirical predictions

This section reviews capital structure research related to the "classical" tax system found in the United States. (Section 2 reviews multinational and imputation tax systems.) The key features of the classical system are that corporate income is taxed at a rate τ_C, interest is deductible and so is paid out of income before taxes, and equity payout is not deductible but is paid from the residual remaining after corporate taxation. In this tax system, interest, dividends, and capital gains income are taxed upon receipt by investors (at tax rates τ_P, τ_{div}=τ_P, and τ_G, respectively). Most of the research assumes that equity is the marginal source of funds and that dividends are paid according to a fixed payout policy.[1] To narrow the discussion, I assume that regulations or transactions costs prevent investors from following the tax-avoidance schemes implied by Miller and Scholes (1978), in which investors borrow via insurance or other tax-free vehicles to avoid personal tax on interest or dividend income.

[1] This assumption implies that retained earnings are not "trapped equity" that is implicitly taxed at the dividend tax rate, even while still retained. See Auerbach (2002) for more on the trapped equity or "new" view.

In this framework, the after-personal-tax value to investors of a corporation paying \$1 of interest is \$1$(1-\tau_P)$. In contrast, if that capital were instead returned as equity income, it would be subject to taxation at both the corporate and personal level, and the investor would receive \$1$(1-\tau_C)(1-\tau_E)$. The equity tax rate, τ_E, is often modeled as a blended dividend and capital gains tax rate.[2] The net tax advantage of \$1 of debt payout, relative to \$1 of equity payout, is

$$(1-\tau_P)-(1-\tau_C)(1-\tau_E). \tag{1.1}$$

If expression (1.1) is positive, debt interest is the tax-favored way to return capital to investors, once both corporate and individual taxation are considered. In this case, to maximize firm value, there is a tax incentive to issue debt instead of equity.

Eq. (1.1) captures the benefit of a firm paying \$1 as debt interest in the current period, relative to paying \$1 as equity income. If a firm has \$D of debt with coupon rate r_D, the net benefit of using debt rather than equity is

$$[(1-\tau_P)-(1-\tau_C)(1-\tau_E)]r_D D. \tag{1.2}$$

Given this expression, the value of a firm with debt can be written as

$$\begin{aligned} \mathit{Value}_{\text{with debt}} = {} & \mathit{Value}_{\text{no debt}} \\ & + PV[(1-\tau_P)-(1-\tau_C)(1-\tau_E)]r_D D \end{aligned} \tag{1.3}$$

where the PV term measures the present value of all current and future interest deductions. Note that eq. (1.3) implicitly assumes that using debt adds tax benefits but has no other effect on incentives, operations or value.[3]

MM (1958) is the seminal capital structure paper. If capital markets are perfect, τ_C, τ_P and τ_E all equal zero, and it does not matter whether the firm finances with debt or equity (i.e.,

[2] In mid-2003 the tax rate on both dividends and capital gains were reduced to 15% for individual investors, thereby simplifying and greatly reducing the level of equity taxation relative to historic levels.

[3] There are other approaches to modeling the tax benefits of debt that do not fit directly into this general framework. For example, Goldstein et al. (2001) develop a dynamic contingent-claims model in which firms can restructure debt. They estimate that the tax benefits of debt should equal between eight and nine percent of firm value. See Goldstein et al. for references to other contingent-claims models.

$Value_{\text{with debt}} = Value_{\text{no debt}}$). That is, the value of the firm equals the value of equity plus the value of debt – but total value is not affected by the proportions of debt and equity. I use this implication as the null throughout the capital structure discussion.

Null hypotheses

- Firms do not have optimal tax-driven capital structures.
- The value of a firm with debt is equal to the value of an identical firm without debt (i.e., there is no net tax advantage to debt).

In their "correction article," MM (1963) consider corporate income taxation but continue to assume that τ_P and τ_E equal zero. In this case, the second term in eq. (1.3) collapses to PV[$\tau_C r_D$D]: Because interest is deductible, paying \$$r_D$D of interest saves $\tau_C r_D$D in taxes each period relative to returning capital as equity. MM (1963) assume that interest deductions are as risky as the debt that generates them and should be discounted by r_D.[4] With perpetual debt, MM (1963) argue that the value of a firm with debt financing is

$$V_{\text{with debt}} = V_{\text{no debt}} + \frac{\tau_C r_D D}{r_D} = V_{\text{no debt}} + \tau_C D, \tag{1.4}$$

where the τ_CD term represents the tax advantage of debt. Note that eq. (1.4) contains a term that captures the tax benefit of using debt (τ_CD) but no offsetting cost of debt term. Eq. (1.4) has two strong implications. First, corporations should finance with 100% debt because the marginal benefit of debt is τ_C, which is often assumed to be a positive constant. Second, if τ_C is constant, firm value increases (linearly) with D due to tax benefits.

[4] The assumption that debt should be discounted at r_D is controversial because it requires the amount of debt to remain fixed. Miles and Ezzell (1985) demonstrate that if the dollar amount of debt is not fixed but instead is set to maintain a target debt-equity ratio, then interest deductions have equity risk and should be discounted with the return on assets, r_A, rather than r_D. (Miles and Ezzell, 1985 allow first period financing to be fixed, which requires adjusting the discount factor by $(1 + r_A)/(1 + r_D)$). In contrast, Grinblatt and Titman (2002) argue that firms often pay down debt when things are going well and stock returns are high, and do not alter debt when returns are low. Such behavior can produce a low or negative beta for debt and hence a low discount rate for the tax benefits of debt. In either the Miles and Ezzell or Grinblatt and Titman case, however, the value of a levered firm still equals the value of the unlevered firm plus a "coefficient times debt" term – the discounting controversy only affects the coefficient.

The first implication was recognized as extreme, so researchers developed models that relax the MM (1958) assumptions and consider costs of debt. In the early models, firms trade-off the tax benefits of debt with costs. The first cost proposed in the literature was the cost of bankruptcy, or more generally, costs of financial distress. Kraus and Litzenberger (1973) show in a state-preference framework that firms should trade-off bankruptcy costs with the tax benefits of debt to arrive at an optimal capital structure that involves less than 100% debt. Scott (1976) shows the same with continuous variables. The bankruptcy cost solution does not appear empirically to ex ante offset the benefits of debt.[5] Therefore other papers have proposed non-bankruptcy costs that could be traded off against the tax benefits of debt. For example, Jensen and Meckling (1976) introduce agency costs of equity and leverage-related deadweight costs.[6] Myers (1977) introduces underinvestment costs that can result from too much "debt overhang."

Regardless of the type of cost, the basic trade-off implications remain similar to those in MM (1963): 1) the incentive to finance with debt increases with the corporate tax rate, and 2) firm value increases with the use of debt (up to the point where the marginal cost equals the marginal benefit of debt). Note also that in these models, different firms can have different optimal debt ratios depending on the relative costs and benefits of debt (i.e., depending on differing firm characteristics).

Prediction 1 All else constant, for taxable firms, value increases with the use of debt because of tax benefits (up to the point where the marginal cost equals the marginal benefit of debt).

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[5] Warner (1977) shows that direct costs of bankruptcy average no more than 5.3% ex post in railroad bankruptcies. More recently, Andrade and Kaplan (1998) show that the ex post costs of distress brought about by financing choice amount to 20% of firm value for a group of industrial firms. Miller (1977) notes that firms choose optimal debt policy by considering ex ante costs of distress, so ex ante costs are measured by multiplying the costs mentioned above need by the conditional probability of distress. Miller points out that ex ante costs of financial distress appear to be very small compared to the apparently large tax benefits of debt.

[6] Parrino and Weisbach (1999) use simulations to conclude that the agency costs of debt are too small to offset the tax benefits, and Esty (1998) empirically examines the effects of agency costs on capital structure in the banking industry.

Prediction 2 Corporations have a tax incentive to finance with debt that increases with the corporate marginal tax rate. All else equal, this implies that firms have differing optimal debt ratios if their tax rates differ.

Prediction 1 is based directly on eq. (1.4), while Prediction 2 is based on the first derivative of eq. (1.4) with respect to D.

Miller (1977) argues that personal taxes can eliminate the "100% debt" implication, without the need for bankruptcy or agency costs. (Farrar and Selwyn, 1967 took first steps in this direction.) Miller's argument is that the marginal costs of debt and equity, net of the effects of personal and corporate taxes, should be equal in equilibrium, so firms are indifferent between the two financing sources. In essence, the corporate tax savings from debt is offset by the personal tax disadvantage to investors from holding debt, relative to holding equity. All else equal (including risk), this personal tax disadvantage causes investors to demand higher pretax returns on debt, relative to equity returns. From the firm's perspective, paying this higher pretax return wipes out the tax advantage of using debt financing.

Fig. 1.1 illustrates Miller's point. The horizontal line in Panel A depicts the supply curve for debt; the line is horizontal because Miller assumes that the benefit of debt for all firms equals a fixed constant τ_C. The demand for debt curve is initially horizontal at zero, representing demand by tax-free investors, but eventually slopes upward because the return on debt must increase to attract investors with higher personal income tax rates. By making the simplifying assumption that $\tau_E = 0$, Miller's equilibrium is reached when the marginal investor with $\tau_P^* = \tau_C$ is attracted to purchase debt. In this equilibrium, the entire surplus (the area between the supply and demand curves) accrues to investors subject to personal tax rates less than τ_P^*.

There are several implications from Miller's (1977) analysis. The first two are new:

Prediction 3 High personal taxes on interest income (relative to personal taxes on equity income) are negatively related to the corporate use of debt.

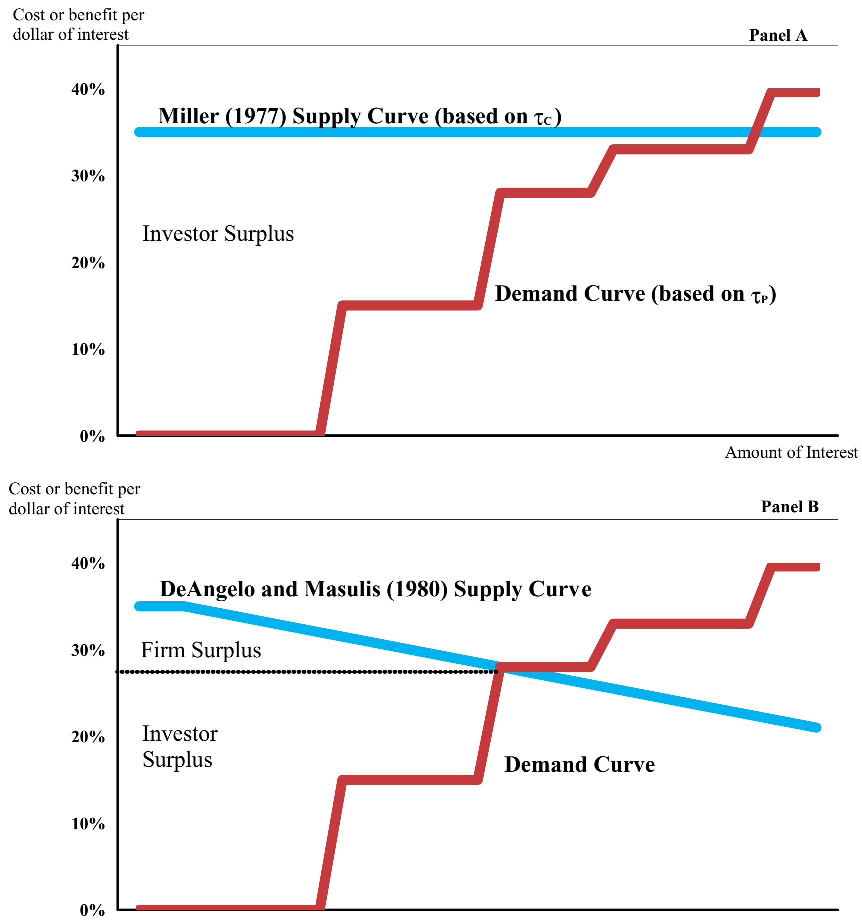

Fig. 1.1 Equilibrium Supply and Demand Curves for Corporate Debt
The supply curve depicts the expected tax rate (and therefore the tax benefit of a dollar of interest) for firms that issue debt. The demand curve shows the tax rate (and therefore the tax cost of a dollar of interest) for investors who purchase debt. The tax rates for the marginal supplier and marginal investor are determined by the intersection of the two curves. In the Miller Equilibrium (panel A), all firms have the same tax rate in every state, so the supply curve is flat. The demand curve slopes upward because tax-free investors are the initial purchasers of corporate bonds, followed by low-tax-rate investors, and eventually followed by high-tax-rate-investors. All investors with tax rate less than the marginal investor's (i.e., investors with tax rates of 33% or less in Panel A) enjoy "investor surplus" in the form of an after-tax return on debt higher than their reservation return. In Panel B, the supply curve is downward sloping because firms differ in the probability of full utilization of interest deductions (or have varying amounts of nondebt tax shields), and therefore have differing benefits of interest deductibility. Firms with tax rates higher than that for the marginal supplier of date (i.e., firms with tax rates greater than 28% in Panel B) enjoy "firm surplus" because the benefit of interest deductibility is larger than the personal tax cost implicit in the debt interest rate.

Prediction 4 The aggregate supply of debt is affected by relative corporate and personal taxes.

The other implications are consistent with the null hypotheses stated above: 1) there is no net tax advantage to debt at the corporate level (once one accounts for the higher debt yields that investors demand because of the relatively high personal taxes associated with receiving interest), 2) though taxes affect the aggregate supply of debt in equilibrium, they do not affect the optimal capital structure for any particular firm (i.e., it does not matter which particular firms issue debt, as long as aggregate supply equals aggregate demand), and 3) using debt does not increase firm value.

A general version of Miller's argument (that does not assume $\tau_E = 0$) can be expressed in terms of eq. (1.3). Once personal taxes are introduced into this framework, the appropriate discount rate is measured after-personal income taxes to capture the (after-personal-tax) opportunity cost of investing in debt. In this case, the value of a firm using perpetual debt is:[7]

$$V_{\text{with debt}} = V_{\text{no debt}} + \frac{[(1-\tau_P) - (1-\tau_C)(1-\tau_E)]r_D D}{(1-\tau_P)r_D}$$
$$= V_{\text{no debt}} + \left[1 - \frac{(1-\tau_C)(1-\tau_E)}{(1-\tau_P)}\right] D. \qquad (1.5)$$

If the investor-level tax on interest income (τ_P) is large relative to tax rates on corporate and equity income (τ_C and τ_E), the net tax advantage of debt can be zero or even negative. Note that eq. (1.5) is identical to eq. (1.4) if there are no personal taxes, or if $\tau_P = \tau_E$.

One way that eq. (1.5) can be an equilibrium expression is for the right-most term in eq. (1.5) to equal zero in equilibrium (e.g., $(1 - \tau_P) = (1 - \tau_C)(1 - \tau_E)$), in which case the implications from Miller (1977) are unchanged. Alternatively, the tax benefit term in eq. (1.5) can be positive and a separate cost term can be introduced in the spirit

[7] See Sick (1990), Taggart (1991), or Benninga and Sarig (1997) for derivation of expressions like eq. (1.5) under various discounting assumptions. These expressions are of the form $V_{\text{with debt}} = V_{\text{no debt}}$ + coefficient*D, with the coefficient an increasing (decreasing) function of corporate (personal income) tax rates.

of the trade-off models; in this case, the corporate incentive to issue debt and firm value both increase with $[1 - (1 - \tau_C)(1 - \tau_E)/(1 - \tau_P)]$ and firm-specific optimal debt ratios can exist. The bracketed expression specifies the degree to which personal taxes (Prediction 3) offset the corporate incentive to use debt (Prediction 2). Recall that τ_P and τ_E are personal tax rates for the marginal investor(s), and therefore are difficult to pin down empirically (more on this in Section 1.4).

DeAngelo and Masulis (1980; hereafter DM) broaden Miller's (1977) model and put the focus on the marginal tax benefit of debt, represented above by τ_C. DM argue that $\tau_C(.)$ is not constant and always equal to the statutory rate. Instead, $\tau_C(.)$ is a function that decreases in nondebt tax shields (e.g., depreciation and investment tax credits) because nondebt tax shields (NDTS) crowd out the tax benefit of interest. Further, Kim (1989) highlights that firms do not always benefit fully from incremental interest deductions, for example when taxable income is negative. This implies that $\tau_C(.)$ is a decreasing function of a firm's debt usage because existing interest deductions reduce the tax benefit of incremental interest.

Modeling $\tau_C(.)$ as a function has important implications because the supply of debt function can become downward sloping (see Panel B in Fig. 1.1). This implies that there is a corporate advantage to using debt, as measured by the "firm surplus" of issuing debt (the area above the dotted line but below the supply curve in Panel B). Moreover, high-tax-rate firms supply debt (i.e., are on the portion of the supply curve to the left of its intersection with demand), which implies that there can exist tax-driven firm-specific optimal debt ratios (as in Prediction 2), and that the tax benefits of debt add value for high-tax-rate firms (as in Prediction 1). The DeAngelo and Masulis (1980) approach leads to the following prediction, which expands Prediction 2:

Prediction 2' All else equal, to the extent that they reduce $\tau_C(.)$, nondebt tax shields and/or interest deductions from already-existing debt reduce the tax incentive to use debt. Similarly, the tax incentive to use debt decreases with the probability that a firm will experience nontaxable states of the world.

1.2 Empirical evidence on whether the tax advantage of debt increases firm value

Prediction 1 indicates that the tax benefits of debt add τ_CD (eq. (1.4)) or $[1-(1-\tau_C)(1-\tau_E)/(1-\tau_P)]D$ (eq. (1.5)) to firm value. If $\tau_C =$ 40% and the debt ratio is 35%, eq. (1.4) indicates that the contribution of taxes to firm value is about 14% ($0.14 = \tau_C$ x debt-to-value). This tax benefit would be offset by costs and other factors that reduce the corporate tax benefit of interest deductibility, such as personal taxes, nontax costs of debt, and the possibility that interest deductions are not fully valued in every state of the world. This section reviews empirical research that attempts to quantify the net tax benefits of debt. The first group of papers studies market reactions to exchange offers, which should net out the various costs and benefits of debt. The remainder of the section reviews recent analyses based on large-sample regressions and concludes by examining explicit benefit functions for interest deductions.

1.2.1 Exchange offers

To investigate whether the tax benefits of debt increase firm value (Prediction 1), Masulis (1980) examines exchange offers made during the 1960s and 1970s. Because one security is issued and another simultaneously retired in an exchange offer, Masulis argues that exchanges hold investment policy relatively constant and are primarily changes in capital structure. Masulis' tax hypothesis is that leverage-increasing (−decreasing) exchange offers increase (decrease) firm value because they increase (decrease) tax deductions. Note that Masulis implicitly assumes that firms are underlevered. In reality, for a company already at its optimum, a movement in either direction (i.e., increasing or decreasing debt) would decrease firm value.

Masulis (1980) finds evidence consistent with his predictions: leverage-increasing exchange offers increase equity value by 7.6%, and leverage-decreasing transactions decrease value by 5.4%. Moreover, the exchange offers with the largest increases in tax deductions (debt-for-common and debt-for-preferred) have the largest positive stock price reactions (9.8% and 4.7%, respectively). Using a similar sample, Masulis (1983) regresses stock returns on the change in debt in exchange offers and finds a debt coefficient of approximately 0.40 (which is statistically indistinguishable from the top statutory corporate tax rate during that era). This is consistent with tax deductions increasing firm value as in eq. (1.4) (and also consistent with some alternative hypotheses discussed below) but it is surprising because such a large coefficient implies near-zero personal tax and non-tax costs to debt. That is, the debt coefficient in Masulis (1983) measures the average benefit of debt (averaged across firms and averaged over the incremental net benefit of each dollar of debt for a given firm) *net of the costs*. An average net benefit of 0.40 requires that the costs are much smaller than the benefits for most dollars of debt. For the post-exchange offer capital structure to satisfy the $\mathrm{MB} = \mathrm{MC}$ equilibrium condition, the benefit or cost curves (or both) must be very steeply sloped near their intersection.

Myers (1984) and Cornett and Travlos (1989) argue that Masulis' (1980) hypothesis is problematic. If firms optimize, they should only adjust capital structure to move towards an optimal debt ratio, whether that involves increasing debt or equity. In other words, increasing debt will not always add to firm value, even if interest reduces tax liabilities. Graham et al. (1999) point out that if a firm starts at its optimal capital structure, it will only perform an exchange offer if something moves the firm out of equilibrium. They derive conditions under which stock-price-maximizing exchanges are unrelated to marginal tax rates because market reactions aggregate tax and non-tax informational aspects of capital structure changes. Therefore, nontax reactions might explain Masulis' (1980) results. As described next, several papers have found evidence of non-tax factors affecting exchange offer market reactions. It is important to note that these post-Masulis papers do not prove that the tax interpretation is wrong – but they do offer alternative interpretations.

First, some papers find evidence of positive (negative) stock reactions to leverage-increasing (leverage-decreasing) events that are unrelated to tax deductions: Asquith and Mullins (1986), Masulis and Korwar (1986), and Mikkelson and Partch (1986) find negative stock price reactions to straight equity issuance, and Pinegar and Lease

(1986) find positive stock price reactions to preferred-for-common exchanges. Second, Mikkelson and Partch (1986) and Eckbo (1986) find that straight debt issuance (without equity retirement) produces a stock price reaction that is indistinguishable from zero. Third, some papers find that exchange offers convey non-tax information that affects security prices, perhaps due to asymmetric information problems along the lines suggested by Myers and Majluf (1984) or due to signaling (Ross, 1977 and Leland and Pyle, 1977). For example, Shah (1994) correlates exchange offers with information about reduced future cash flows (for leverage-decreasing offers) and decreased risk (for leverage-increasing offers). Finally, Cornett and Travlos (1989) provide evidence that weakens Masulis' (1983) conclusions. Cornett and Travlos regress event stock returns on the change in debt and two variables that control for information effects (the ex-post change in inside ownership and ex-post abnormal earnings). They find the coefficient on the change in debt variable is insignificant while the coefficients on the other variables are significant, which implies that the positive stock price reaction is related to positive information conveyed by the exchange.[8] Cornett and Travlos conclude that equity-for-debt exchanges convey information about the future – but find no evidence of increased value due to tax benefits.

Two recent papers examine the exchange of traditional preferred stock for monthly income preferred stock (MIPS). These two securities differ primarily in terms of their tax characteristics, so any market reaction should have minimal non-tax explanations. MIPS interest is tax deductible for corporations (like debt interest) and preferred dividends are not. On the investor side, corporate investors enjoy a 70% dividends received deduction (DRD) for preferred dividends but recipients of MIPS interest receive no parallel deduction.[9] When issuing MIPS to retire preferred, corporations gain the tax benefit of interest

[8] Cornett and Travlos do not report whether they get a significant positive tax coefficient (like Masulis, 1983 did) when they exclude the information variables. Therefore, their results could be driven by their using a different sample than used by Masulis.

[9] A 70% DRD means that a corporation that owns another firm's stock only pays tax on 30% of the dividends received. Note that evidence in Erickson and Maydew (1998) implies that corporations are the marginal investor in preferred stock (see footnote 28).

deductibility but experience two costs: underwriting costs, and possibly an increased coupon due to the personal tax penalty (because investors are fully taxed on MIPS interest in contrast to corporate investors receiving the DRD on preferred dividends). Engel and Maydew (1999) compare MIPS yields to preferred yields and conclude that the tax benefit of MIPS are approximately \$0.28 per dollar of face value, net of the aforementioned costs. Irvine and Rosenfeld (2000) use abnormal announcement returns to estimate the value at \$0.26. Given that MIPS and preferred are nearly identical in all legal and informational respects, these studies provide straight-forward evidence of the positive contribution of taxes to firm value, net of underwriting and personal tax costs. Nayar (2005) finds that when the IRS denied (restored) interest deductibility for LYONS, an instrument similar to MIPS, firm value fell (increased) in recognition of the loss (gain) of interest tax deductions.

1.2.2 Cross-sectional regressions

Fama and French (1998; hereafter FF) attempt to estimate eq. (1.4) and Prediction 1 directly, by regressing V_L on debt interest, dividends, and a proxy for V_U. They argue that a positive coefficient on interest is evidence of positive tax benefits of debt. FF measure V_L as the excess of market value over book assets. They proxy V_U with a collection of control variables including current earnings, assets, and R&D spending, as well as future changes in these same variables. (All the variables in the regression are deflated by assets.) If these control variables adequately proxy for V_U, the regression coefficient on interest will measure the tax benefit of debt (which is hypothesized to be positive). The main difficulty with this approach is that if the control variables measure V_U with error, the regression coefficients can be biased. FF perform a series of regressions on a broad cross-section of firms, using both level-form and first-difference specifications. In all cases, the coefficient on interest is either insignificant or negative. Fama and French interpret their results as being inconsistent with debt tax benefits having a first-order effect on firm value. Instead, they argue that interest provides information about earnings that is not otherwise captured by their controls for V_U. In other words9 V_U is measured with error, which results in the interest coefficient picking up a negative valuation effect related to financial distress or some other cost.

Kemsley and Nissim (2002) attempt to circumvent this measurement problem. They perform a switch of variables, moving the earnings variable (which they assume proxies V_U with error) to the left-hand side of the regression and V_L to the right-side. Their regression tests the relation $V_U = V_L - \text{coeff} * \text{D}$.

When Kemsley and Nissim regress EBIT on V_L and debt, the debt coefficient is negative, which they interpret as evidence that debt contributes to firm value. The coefficient also changes through time in proportional to changes in statutory tax rates. In my opinion, the Kemsley and Nissim analysis should be interpreted carefully. First, their regression specification can be interpreted as measuring the effect of debt on earnings just as well as it can be interpreted as a switch-of-variables that fixes a measurement error problem in Fama and French (1998). Second, the debt coefficient has the correct sign for the full sample only in a nonlinear specification in which all the right-hand side variables are interacted with a crude measure of the discount rate. Finally, the coefficient that measures the net benefit of debt has an absolute value of 0.40. While consistent with Masulis (1983), such a large coefficient implies near-zero average debt costs and a near-zero effect of personal taxes.

1.2.3 Marginal benefit functions

Using a different approach, Graham (2000, 2001) simulates interest deduction benefit functions and uses them to estimate the tax-reducing value of each incremental dollar of interest expense. For a given level of interest deductions, Graham essentially integrates over possible states of the world (i.e., both taxable and nontaxable states) to determine a firm's expected τ_C, which specifies the expected tax benefit of an incremental dollar of interest deduction. Marginal tax benefits of debt decline as more debt is added because the probability increases with each incremental dollar of interest that the next dollar will not be fully valued in every state of the world. Using simulation methods (described more fully in Section 1.3.2) and various levels of interest deductions, Graham maps out firm-specific interest benefit functions analogous to the supply of debt curve in Panel B of Fig. 1.1.

By integrating under these benefit functions, Graham (2000) estimates that the tax benefit of debt equals approximately 9–10% of firm value during 1980–1994 (ignoring all costs), and Graham (2006) finds that the tax benefit of debt is 7.8%, 9.8%, 9.1%, 9.5%, and 7.7% of firm value in 1995–1999, respectively (see Table 1.1). The fact that these figures are less than the 14% estimated (at the beginning of Section 1) with the back of the envelope "τ_CD" calculation reflects the reduced value of interest deductions in some states of the world. When personal taxes are considered, the tax benefit of debt falls to 7–8% of firm value during 1980–1994 (i.e., this is Graham's estimate of the "firm surplus" in Panel B of Fig. 1.1).

Graham also estimates the "money left on the table" that firms could obtain if they levered up to the point where their last dollar of interest deduction is valued at the full statutory tax rate (i.e., the "kink," which is the point just before incremental tax benefits begin to decline).[10] Graham (2006) updates the money left on the table calculations in Graham (2000, his Figure 1.1). If all firms lever up to operate at the kink in their benefit functions, they could add 10.5% to firm value over the 1995–1999 period (see Table 1.1). This number can be interpreted either as a measure of the value loss due to conservative corporate debt policy, or as a lower bound for the difficult-to-measure costs of debt that would occur if a company were to lever up to its kink. In the former interpretation, these estimates imply that large tax benefits of debt appear to go unexploited, and that large, profitable firms (which would seem to face the lowest costs of debt) are the most conservative in their use of debt.[11] In general, these implications are hard

[10] For example, if during 1995–1999 all firms levered up to just before the point of declining benefit, simulations performed for this paper indicate that the average company would have total tax benefits of debt of around 18% of firm value. That is, by levering up, the typical firm could add interest deductions with tax benefit equal to 10% of firm value, above and beyond their current level of tax benefits.

[11] McDonald (2004) argues that the prevalence of writing puts or purchasing calls on their own shares is also evidence that many firms pass up potential interest deductions. For example, writing a put (which involves implicit borrowing) can be replicated by explicitly borrowing today to purchase a share on the open market and repaying the loan in the future. The cash flows are identical in these two strategies but the latter results in the

Table 1.1 Annual calculations of the mean benefits of debt and degree of debt conservatism

Before-financing MTR is the mean Graham (1996a) simulated corporate marginal tax rate based on earnings before interest deductions, and *after-financing MTR* is the same based on earnings after interest deductions. *Kink* is the multiple by which interest payments could increase without a firm experiencing reduced marginal benefit on incremental deductions (i.e., the amount of interest at the point at which a firm's marginal benefit function becomes downward sloping, divided by actual interest expense) as in Graham (2000). The *tax benefit of debt* is the reduction in corporate and state tax liabilities occurring because interest expense is tax deductible, expressed as a percentage of firm value. *Money left on the table* is the additional tax benefit that could be obtained, ignoring all costs, if firms with kink greater than one increased their interest deductions in proportion with kink.

	Before-financing MTR	After-financing MTR	Kink	Tax benefit of debt	Money left on table
1980	0.415	0.324	3.10	10.1	27.7
1981	0.413	0.319	2.98	11.4	28.6
1982	0.397	0.286	2.69	11.0	23.2
1983	0.388	0.282	2.68	10.7	22.5
1984	0.380	0.275	2.75	10.9	21.6
1985	0.366	0.255	2.51	11.1	21.8
1986	0.356	0.241	2.39	11.6	20.5
1987	0.296	0.198	2.35	10.7	19.5
1988	0.259	0.172	2.30	9.9	16.7
1989	0.258	0.169	2.24	10.6	15.8
1990	0.258	0.164	2.08	10.7	15.3
1991	0.257	0.160	1.99	9.6	11.7
1992	0.258	0.165	2.07	8.7	9.7
1993	0.236	0.175	1.71	7.7	8.0
1994	0.249	0.183	1.94	7.3	8.5
1995	0.260	0.207	1.99	7.8	9.8
1996	0.261	0.185	2.05	9.8	12.2
1997	0.261	0.188	2.08	9.1	10.9
1998	0.252	0.165	2.00	9.5	10.7
1999	0.252	0.170	1.90	7.7	8.9

for a trade-off model to explain. Graham (2000), Lemmon and Zender (2001) and Minton and Wruck (2001) try to identify nontax costs that are large enough in a trade-off sense that perhaps these firms are not in fact underlevered.

To sum up, a fair amount of research has found evidence consistent with tax benefits adding to firm value. However, some of this evidence is ambiguous because non-tax explanations or econometric issues cloud

firm receiving a tax deduction. The fact that many firms write puts is consistent with them passing up interest tax deductions.

interpretation. Additional research in three specific areas would be helpful. First, we need more market-based research along the lines of the MIPs exchanges, where tax effects are isolated from information and other factors and therefore the interpretation is fairly unambiguous. Second, additional cross-sectional regression research that investigates the market value of the tax benefits of debt would be helpful in terms of clarifying or confirming the interpretation of existing cross-sectional regression analysis. Finally, if the tax benefits of debt do in fact add to firm value, an important unanswered question is why firms do not use more debt, especially large, profitable firms.[12] We need to better understand whether this implies that some firms are not optimizing, or whether there are costs and other influences that have not been adequately modeled in previous research.

Regarding this last point, several papers discussed later in this review address Graham's (2000) use of public financial statement (i.e., Compustat). If there are sufficient "off balance sheet" deductions, not available to a Compustat researcher, then debt interest deductions might be less valuable than implied in Graham (2000), and correspondingly firms might not be as underlevered either. Graham et al. (2004) consider stock option deductions, Stefanascu defined benefit pension obligations, and Graham and Tucker (2006) tax shelters, and all three papers find that this would reduce the apparent underleveage relative to that measured with Compustat. However, Graham and Mills (2006) use tax return data and find that even when all deductions are considered, including those not publically available, the degree of underleverage remains large. Some papers (e.g., Hennessey and Whited, 2005 respond that dynamic considerations could lead to firms preserving debt capacity, and therefore small debt ratios not being suboptimal. Almeida and Phillipon (2005) argue that present value of distress might be larger than previously mentioned (due to the wrong discount rate being use previously), thereby justifying small debt ratios. Berk et al. (2006) show that the loss of human capital adds to the costs of barnkruptcy, and therefore argue that bankrupcy costs might be of

[12] Shyum-Sunder and Myers (1999), Lemmon and Zender (2002), Leary and Roberts (2005, 2006), and related papers investigate whether the trade-off model is the correct model of capital structure, which has implications towards interpreting these results.

the same order of magnitude as tax benefits. Even these arguments, however, do not fully explain the cross-sectional puzzle from Graham (2000) that firms that would appear to have the lowest costs of debt also have the highest unexploited benefits (that is, marginal benefit appears to exceed marginal cost). More research is needed to address this issue.

1.3 Empirical evidence on whether corporate taxes affect debt vs. equity policy

Trade-off models imply that firms should issue debt as long as the marginal benefit of doing so (measured by τ_C) is larger than the marginal cost. $\tau_C(.)$ is a decreasing function of nondebt tax shields, existing debt tax shields, and the probability of experiencing losses, so the incentive to use debt declines with these three factors (Prediction 2'). In general, high-tax rate firms should use more debt than low-tax rate firms (Prediction 2). The papers reviewed in this section generally use reduced-form cross-sectional or panel regressions to test these predictions – and ignore personal taxes altogether. For expositional reasons, I start with tests of Prediction 2'.

1.3.1 Nondebt tax shields, profitability, and the use of debt

Bradley et al. (1984) perform one of the early regression tests for tax effects along the lines suggested by DeAngelo and Masulis (1980). Bradley et al. regress firm-specific debt-to-value ratios on nondebt tax shields (as measured by depreciation plus investment tax credits), R&D expense, the time-series volatility of EBITDA, and industry dummies. The tax hypothesis is that nondebt tax shields are negatively related to debt usage because they substitute for interest deductions (Prediction 2'). However, Bradley et al. find that debt is positively related to nondebt tax shields, opposite the tax prediction. This surprising finding, and others like it, prompted Stewart Myers (1984) to state in his presidential address to the American Finance Association, (p. 588) "I know of no study clearly demonstrating that a firm's tax status has predictable, material effects on its debt policy. I think the wait for such a study will be protracted."

One problem with using nondebt tax shields, in the form of depreciation and investment tax credits, to explain debt policy is that nondebt tax shields are positively correlated with profitability and investment. If profitable (i.e., high-tax rate) firms invest heavily and also borrow to fund this investment, this can induce a positive relation between debt and nondebt tax shields and overwhelm the tax substitution between interest and nondebt tax shields (Dammon and Senbet, 1988, Dotan and Ravid, 1985). Another issue is that nondebt tax shields (as well as existing interest deductions or the probability of experiencing losses) should only affect debt decisions to the extent that they affect a firm's marginal tax rate. Only for modestly profitable firms is it likely that nondebt tax shields have impact sufficient to affect the marginal tax rate and therefore debt policy.[13]

MacKie-Mason (1990) and Dhaliwal et al. (1992) address these issues by interacting NDTS with a variable that identifies firms near "tax exhaustion," at which point the substitution between nondebt tax shields and interest is most important. Both papers find that tax-exhausted firms substitute away from debt when nondebt tax shields are high.[14] Even though these papers find a negative relation between the interacted NDTS variable and debt usage, this solution is not ideal. For one thing, the definition of tax exhaustion is ad hoc. Moreover, Graham (1996a) shows that the interacted NDTS variable has low power to detect tax effects and that depreciation and investment tax credits (the traditional components of nondebt tax shields) have a very small empirical effect on the marginal tax rate. Ideally, researchers should capture the effects (if any) of nondebt tax shields, existing interest, and the probability of experiencing losses directly in the estimated

[13] The marginal tax rate for unprofitable firms will be close to zero whether or not the firm has NDTS. The tax rate for highly profitable firms will be near the top statutory rate, unless a firm has a very large amount of NDTS.

[14] Ekman (1995) finds the same for Swedish firms, as do Barthody and Mateus (2005) for Portuguese companies. Trezevant (1992) finds that Compustat PST firms most likely to be tax-exhausted decreased debt usage the most following the 1981 liberalization of tax laws that increased nondebt tax shields.

marginal tax rate, rather than including these factors as stand-alone variables.

A similar issue exists with respect to using profitability as a measure of tax status. Profitable firms usually have high tax rates and therefore some papers argue that the tax hypothesis implies they should use more debt. Empirically, however, the use of debt declines with profitability, which is often interpreted as evidence against the tax hypothesis (e.g., Myers, 1993). My view is that profitability should only affect the tax incentive to use debt to the extent that it affects the corporate marginal tax rate[15]; therefore, when testing for tax effects, the effects (if any) of profitability should be captured directly in the estimated MTR. Researchers would then interpret a stand-alone profitability variable as a control for potential nontax influences.

1.3.2 Directly estimating the marginal tax rate

One of the problems that led to Myers' capital structure puzzle is related to properly quantifying corporate tax rates and incentives. For example, many studies use static MTRs that ignore important dynamic features of the tax code related to net operating losses carryback and carryforwards, investment tax credits and other nondebt tax shields, and the alternative minimum tax. Static MTRs miss the fact that a company might be profitable today but expect to experience losses in the near future. This firm might erroneously be assigned a high current-period tax rate even though its true economic tax rate is low.[16] Conversely, an unprofitable firm might have a large current economic marginal tax rate if it is expected to soon become and remain profitable (because extra income earned today increases taxes paid in the future: an extra dollar of income today reduces losses that could be carried forward to delay future tax payments, thereby increasing present value tax liabilities).

[15] Keep in mind that a marginal tax rate is bound between zero and the top statutory rate while profitability is not bounded, which can introduce difficulties into interpreting profitability as a proxy for the tax rate.

[16] Scholes and Wolfson (1992) define the *economic marginal tax rate* as the present value of current and future taxes owed on an extra dollar of income earned today, which accounts for the probability that taxes paid today will be refunded in the near future.

Shevlin (1987, 1990) uses simulation techniques to capture the dynamic features of the tax code related to net operating loss carrybacks and carryforwards.[17] The first step in simulating an MTR for a given firm-year involves calculating the historic mean and variance of the change in taxable income for each firm. The second step uses this historic information to forecast future income for each firm. These forecasts can be generated with random draws from a normal distribution, with mean and variance equal to that gathered in the first step; therefore, many different forecasts of the future can be generated for each firm. The third step calculates the present value tax liability along each of the income paths generated in the second step, accounting for the tax-loss carryback and carryforward features of the tax code. The fourth step adds \$1 to current year income and recalculates the present value tax liability along each path. The incremental tax liability calculated in the fourth step, minus that calculated in the third step, is the present value tax liability from earning an extra dollar today; in other words, the economic MTR. A separate marginal tax rate is calculated along each of the forecasted income paths to capture the different tax situations a firm might experience in different future scenarios. The idea is to mimic the different planning scenarios that a manager might consider. The fifth step averages across the MTRs from the different scenarios to calculate the expected economic marginal tax rate for a given firm-year. Note that these five steps produce the expected marginal tax rate for a single firm-year. The steps are replicated for each firm for each year, to produce a panel of firm-year MTRs. The marginal tax rates in this panel vary across firms and can also vary through time for a given firm. The end result is greater cross-sectional variation in corporate tax rates (and hence tax incentives) than implied by statutory rates.

One difficulty with simulated tax rates is that they require a time-series of firm-specific data. A second difficulty is that simulated tax rates are usually calculated using financial statement data, even though it would be preferable to use tax return data. Graham and Mills (2006)

[17] Auerbach and Poterba (1987) and Altshuler and Auerbach (1990) simulate tax rates using first-order Markov probabilities that weight the probability of transition between taxable and nontaxable states.

address both these problems by comparing several financial statement tax rates to simulated tax return tax rates. They find that the simulated financial statement tax rates are the best proxy for tax return tax rates, followed by a financial statement-based statutory tax rate.[18]

Note that by construction the simulated tax rates capture the influence of profitability on the corporate marginal tax rate. Graham (1996a) extends the simulation approach to directly capture the effects of nondebt tax shields, investment tax credits, and the alternative minimum tax. Using the simulated corporate marginal tax rates, Graham (1996a) documents a positive relation between tax rates and changes in debt ratios (consistent with Prediction 2), as do Graham et al. (1998) and Graham (1999) for debt levels. Since that time, numerous other studies have also used simulated tax rates to document tax effects in corporate financial decisions. These results help to resolve Myers' (1984) capital structure puzzle; when tax rates are properly measured, it is possible to link tax status with corporate debt policy.

1.3.3 Endogeneity of corporate tax status

Even if measured with a very precise technique, tax rates are endogenous to debt policy, which can have important effects on tax research. If a company issues debt, it reduces taxable income, which in turn can reduce its tax rate. The more debt issued, the greater the reduction in the marginal tax rate. Therefore, if one regresses debt ratios on marginal tax rates, the endogeneity of corporate tax status can impose a negative bias on the tax coefficient. This could explain the negative tax coefficient detected in some specifications (e.g., Hovakimian et al., 2001 and Barclay and Smith, 1995b). Note that endogeneity can affect

[18] Previous research by Graham (1996b) shows that an easy-to-calculate trichotomous variable (equal to the top statutory rate if a firm has neither negative taxable income nor NOL carryforwards, equal to one-half the statutory rate if it has one but not the other, and equal to zero if it has both) is a reasonable replacement for the simulated rate. Plesko (2003) compares financial-statement-based simulated rates for 586 firms to a static tax variable calculated using actual tax return data. He finds that simulated rates (based on financial statements) are highly correlated with tax variables based on tax return data. Plesko's evidence implies that the simulated tax rates are a robust measure of corporate tax status. Graham (1996b) suffers from the first difficulty mentioned in the text, Plesko by the second.

all sorts of tax variables, including those based on NOLs or that use an average tax rate (i.e., taxes paid/taxable income).

There are two solutions to the endogeneity problem. MacKie-Mason (1990) proposed the first solution by looking at (0,1) debt versus equity issuance decisions (rather than the debt level) in his influential examination of 1,747 issuances from 1977–1987. Debt levels (such as debt ratios) are the culmination of many historical decisions, which may obscure whether taxes influence current-period financing choice. Detecting tax effects in the incremental approach only requires that a firm make the appropriate debt-equity choice at the time of security issuance, given its current position, and not necessarily that the firm rebalance to its optimal debt-equity ratio with each issuance (as is implicit in many debt level studies). To avoid the endogenous effect of debt decisions on the marginal tax rate, MacKie-Mason uses the lagged marginal tax rate to explain current-period financing choice.[19] He finds a positive relation between debt issuance and tax rates. Graham (1996a) follows a similar approach and examines the relation between changes in the debt ratio and lagged simulated MTRs. He finds positive tax effects for a large sample of Compustat firms.[20]

If taxes exert a positive influence on each incremental financing decision, then the sum of these incremental decisions should show up in an analysis of current debt levels – if one could fix the endogenous negative effect on tax rates induced by cumulative debt usage.[21] The second

[19] Wang (2000) argues that firms do not consider the level of the marginal tax rate when making incremental decisions but rather consider how far the marginal tax rate is from the "optimal MTR." Holding the level of the tax rate constant, Wang shows that companies with tax rates above the optimum are those that use the most debt (an action which should endogenously reduce the marginal tax rate and move it closer to the optimum, essentially reducing MB until it equals MC). The difficulty with this approach is that Wang's "optimal MTR" is ad hoc and based on the probability of bankruptcy (as measured by Altman's Z-score).

[20] A number of other papers corroborate these results. For example, Shum (1996) finds similar evidence for Canadian firms. Alworth and Arachi (2000) show that lagged after-financing simulated tax rates are positively related to changes in debt for Italian firms. Henderson (2001) finds that changes in total liabilities and changes in long-term debt are both positively related to simulated tax rates in a sample of U.S. banks. Schulman et al. (1996) find that debt levels are positively correlated to tax rates in Canada and New Zealand.

[21] Dittmar (2002) studies corporate spin-offs, which potentially allows her to avoid the endogeneity problem by observing capital structures that are not the end result of a

approach to fixing the endogeneity problem is to measure tax rates "but for" financing decisions. Graham et al. (1998) measure tax rates before financing (i.e., based on income before interest is deducted). They find a positive relation between debt-to-value and (endogeneity-corrected) but-for tax rates. (They also find a "spurious" negative correlation in an experiment that uses an endogenously affected after-financing tax rate.)

Examining changes in debt answers the question "are incremental decisions affected by tax status?" An alternative approach is to ask "if tax rates exogenously change, how will a firm alter debt usage?" The Tax Reform Act of 1986 greatly reduced corporate marginal tax rates (see Fig. 1), which in isolation implies a reduction in the corporate use of debt. Givoly et al. (1992) find that firms with high tax rates prior to tax reform (firms that therefore probably experienced the largest drop in their tax rate) reduce debt the most after tax reform. This finding is somewhat surprising because their corporate marginal tax rate suffers from the negative endogeneity bias described above. Moreover, personal taxes are not modeled directly, even though they fell by more than corporate tax rates after the 1986 tax reform.[22] In a paper that examines international evidence during the same time period, Rajan and Zingales (1995) provide weak international evidence that taxes affect debt decisions.

1.3.4 Time-series and small firm evidence of tax effects

The empirical evidence described thus far confirms cross-sectionally that firms with high tax rates use more debt than those with low tax rates. Presumably, there should also be time-series tax effects. For example, if a firm starts public life with a low tax rate, one would expect increased debt usage if the tax rate increases as the firm matures. I am not aware of any study that documents tax-related time-series effects in debt usage. For example, Graham (1999) uses panel data to document

long history of accumulated debt policy decisions. However, it is still the case that past decisions can influence the parent's and/or spun-off unit's new capital structure. Dittmar does not find evidence that corporate tax rates affect spin-off debt ratios.

[22] Givoly et al. (1992) include lagged dividend yield in their specification to control for personal tax effects, which might allow their tax variable to isolate corporate tax effects. Personal tax effects are examined more fully in Section 1.4.

that cross-sectional variation in tax status affects debt usage but he finds no evidence that time-series variation does.

By studying capital structure decisions among newly formed firms, one might be able to avoid long-lasting effects of past financing decisions. For example, Baker and Wurgler (2002) show that today's market-to-book ratio and debt-equity issuance decisions continue to affect firm's debt ratios for ten or more years. Esty et al. (2000) describe various start-up financing issues including selecting a target debt ratio, as well as how market conditions and collateralization affect the sequence of initial financing choices.

Lemmon et al. (2006) show that firms retain close to their original debt ratios decades after first going public, even as tax status changes. Pittman and Klassen (2001) examine capital structure in the years following IPO. They perform annual (i.e., years since IPO) cross-sectional regressions and find evidence that taxes have a positive effect on the use of debt in the early years of a firm's public life – but this relation wanes as the firm ages. Pittman and Klassen attribute this waning to an increase in refinancing transactions costs as firms age. Note that their evidence is not time-series in terms of firms altering capital structure as tax rates change through time, though they do link debt policy to firm age. Pittman and Klassen also find that firms use relatively more NDTS as they age.

Almost all capital structure papers study Compustat companies. Ayers et al. (2001) instead examine small companies with less than 500 employees that participated in the 1993 Federal Reserve National Survey of Small Business Finances. 2,600 firms meet the Ayers et al. data requirements. The authors regress interest expense divided by pre-interest pre-NDTS income on various variables including tax expense divided by pre-interest income. They find a positive coefficient on the tax variable in both their outside and inside debt regressions (i.e., interest owed to non-owners and owners, respectively). It is difficult to compare their results to Compusat-based research because Ayers et al. use a different dependent variable than most studies, and they delete firms with a negative value for the dependent variable (which raises statistical issues).

To summarize Section 1.3, once issues related to measuring debt policy and tax rates are addressed, researchers have supplied evidence in response to Myers' (1984) challenge to show that corporate debt usage is positively affected by tax rates. These results are consistent with survey evidence that interest tax deductibility is an important factor affecting debt policy decisions (ranking below only maintaining financial flexibility, credit ratings, and earnings volatility), and is especially important for large industrial firms (Graham and Harvey, 2001). Notwithstanding these empirical results, Myers is still not entirely convinced (Myers et al., 1998); he argues that tax incentives are of "third order" importance in the hierarchy of corporate decisions. It would be helpful for future research to investigate whether the tax effects on debt versus equity choice are economically important, and if they are not, determine why not.

Several other challenges remain. First, none of the papers cited above provide time-series evidence that firm-specific changes in tax status affect debt policy. It would be quite helpful to examine whether a firm changes its debt policy as it matures and presumably its tax status changes. Second, Fama and French (2001) point out that with few exceptions the panel data examinations do not use statistical techniques that account for cross-correlation in residuals, and therefore many papers do not allow for proper determination of statistical significance for the tax coefficients. Therefore, it is not clear if all of the tax effects documented above are robustly significant. Finally, most papers ignore the tax cost of receiving interest income from the investor's perspective, an issue to which I now turn.

1.4 Empirical evidence on whether personal taxes affect corporate debt vs. equity policy

Miller (1977) identifies a puzzle: the benefits of debt seem large relative to expected costs, and yet many firms do not use much debt. Miller proposes that the personal tax cost of interest income (relative to the personal tax cost of equity) is large enough at the margin to completely offset the corporate tax advantage of debt. The Miller Equilibrium is difficult to test empirically for several reasons, not the least of which is that the identity and tax-status of the marginal investor(s) between debt and equity are unknown. Anecdotally, we can note that the tax rate on interest income (τ_P) was large relative to tax rates on corporate and equity income (τ_C and τ_E) when Miller wrote his paper, so the Miller Equilibrium was plausible. However, the statutory tax rates shown in Fig.1 imply that expression (1) has been positive since 1981, so the strict form of the Miller Equilibrium is less plausible in the last two decades.[23]

From the corporate perspective, the relatively high investor-level taxation of interest leads to a "personal tax penalty" for debt: investors demand a higher risk-adjusted return on debt than on equity. By rearranging Equation (1.1), the net tax advantage of debt can be represented as

$$\tau_C - [\tau_P - (1 - \tau_C)\tau_E], \tag{1.6}$$

where τ_C is the corporate income tax rate, τ_E is the personal tax rate on equity income, and τ_P is the personal tax rate on interest income. The bracketed term in Eq. (1.6) accounts for the personal tax penalty: $\tau_P - (1 - \tau_C)\tau_E$.

To quantify the effect of personal taxes in expression (5), Gordon and MacKie-Mason (1990) and others implicitly assume that investors form clienteles based on firm-specific dividend payout ratios, and therefore that τ_E is a weighted combination of the tax rates on dividend payout and capital gains income: $\tau_E = (payout)\tau_{div} + (1 - payout)\tau_{\text{cap gains}}$. This and related papers use historic averages to estimate dividend payout and measure τ_{div} as equaling τ_P, where τ_P is implicitly estimated using the difference between the yield on taxable and tax-free government bonds. $\tau_{\text{cap gains}}$ is often assumed to equal a fraction of the statutory capital gains tax rate (to capture the benefit of reduced effective tax rates due to deferral of equity taxation and omission of equity tax at death).[24]

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[23] If the statutory tax rates depicted in Fig. 1 are not representative of the tax rates applicable to the marginal investor(s), or if capital gains tax rates are effectively reduced through deferral and/or elimination at death, then the Miller Equilibrium is technically possible even in recent years.

[24] Green and Hollifield (2003) simulate an economy to investigate the degree to which capital gains deferral reduces the effective tax rate on equity income (and therefore, from the company's perspective, increases the personal tax penalty for debt relative to equity). Green and Hollifield find that the ability to defer taxation reduces the implicit tax on capital gains by about 60%. If they were to factor in deferral at death and the lower

Given these assumptions, Gordon and MacKie-Mason (1990) estimate that the tax advantage of debt, net of the personal tax penalty, increased following the Tax Reform Act of 1986. Recall that Miller (1977) implies that the aggregate supply of debt is determined by relative corporate and personal tax rates. Gordon and MacKie-Mason document that aggregate corporate debt ratios increased slightly in response to tax reform (consistent with Prediction 4). This is the only research of which I am aware that investigates this aggregate prediction. Note that Gordon and MacKie-Mason focus on a single point in time, while the Miller Equilibrium has implications for any point in time. Also note that if the marginal investor is taxable at rates like those reflected in Fig. 1, then the 2003 reduction in dividend and capital gains tax rates to $\tau_{div} = \tau_P = 15\%$ should reduce the aggregate amount of debt used in the U.S. economy.

Graham (1999) tests similar predictions using firm-specific data. He finds that the net tax advantage of the first dollar of interest averaged between 140 and 650 basis points between 1980 and 1994.[25] He finds that the firms for which the net advantage is largest use the most debt in virtually every year. Graham also separately identifies a positive (negative) relation between the corporate tax rate (personal tax penalty) and debt usage. These results are consistent with Predictions 2 and 3. In contrast, while Dhaliwal et al. (2005) find evidence that interest deductibility reduces the cost of capital (consistent with Prediction 2),

tax rate on capital gains relative to the rate on dividends and interest, it would reduce the implicit tax rate on capital gains even further. (On the other hand, their calculations ignore the high turnover frequently observed for common stocks and mutual funds, which increases the effective tax rate on equity.) Overall, their evidence suggests that there is a measurable personal tax disadvantage to debt but it does not appear large enough to offset the corporate tax benefits of debt. However, Green and Hollifield find that when coupled with fairly small costs of bankruptcy (e.g., realized bankruptcy costs equal to 3% of pretax firm value), the personal tax penalty is sufficient to offset the corporate tax advantage to debt at the margin and lead to interior optimal debt ratios.

[25] I update Graham's (1999) annual tax regressions from his Table 5.1, Panel B. The tax variable is the tax advantage of debt net of personal taxes, as expressed in Eq. (1.5), with the personal tax penalty based on firm-specific dividend payout ratios. The dependent variable is debt-to-value. The estimated tax coefficients for 1995–1999 are 0.072, 0.046, 0.103, 0.135, 0.191, respectively, indicating that debt ratios are positively related to net tax incentives. All the tax coefficients are significant at a 1% level, except in 1996 when the p-value is 0.026.

they do not find evidence that personal taxes affect the cost of capital (lack of evidence relative to Prediction 3).

Campello (2001) assumes that a given firm's debt *and* equity are held by a particular clientele of investors (with the clienteles based on investor tax rates). He investigates the capital structure response to the large reduction in personal taxes (relative to the smaller reduction in corporate tax rates) after the Tax Reform Act of 1986. Campello finds that zero-dividend firms (which presumably have high-tax-rate investors and therefore experienced the largest reduction in the personal tax penalty) increased debt ratios in response to tax reform, while high-dividend payout firms (which presumably have low-tax-rate investors and therefore experienced a small reduction in the personal tax penalty) reduced debt usage relative to peer firms.

1.4.1 Market-based evidence on how personal taxes affect security returns

While consistent with personal taxes affecting corporate financing decisions in the manner suggested by Prediction 3, the papers cited above are not closely tied to market-based evidence about the tax characteristics of the marginal investor between debt and equity. Instead, these papers assume that dividend clienteles exist, and also make assumptions about the personal tax characteristics of these clienteles based on a firm's payout policy. For example, these papers implicitly assume that there is a certain marginal investor who owns both equity and debt *and* (to estimate τ_P) that this same investor sets prices between taxable and tax-free bonds. The truth is that we know very little about the identity or tax-status of the marginal investor(s) between any two sets of securities, and deducing this information is difficult.

For example, assume that munis yield 7%, Treasuries 10%, and equities 8% (and assume that this equity return has been adjusted to make its risk equivalent to the risk of munis and Treasuries). In a Gordon/MacKie-Mason/Graham type of equilibrium, $r_{\text{muni}} = r_{\text{Treasury}}(1 - \tau_P) = r_{\text{equity}}(1 - \tau_{\text{equity}}) = 7\%$, which implies that τ_P=30% and $\tau_{\text{equity}} = 12.5\%$. This in turn implies that a large portion of equity returns are expected to come from capital gains (because

τ_{equity} is so much lower than τ_P). However, things are rarely so simple. First, it is difficult to determine the risk-adjusted equity return.[26] Second, if there are frictions or transactions costs limiting arbitrage between pairs of markets (or if risk adjustments are not perfect), one could observe, say, munis yielding 7%, Treasuries 10%, and equities 12%. In this case, it is not clear which pair of securities should be used to deduce τ_P. If Treasuries and equities are used, the implicit τ_P could be negative. For example, assume that dividend payout is 15%, that $\tau_{\text{effective cap gains}} = 5\%$, and that τ_{equity} is modeled as a weighted average between dividends and retained earnings: $\tau_{\text{equity}} = 0.15(1 - \tau_{\text{div}}) + 0.85(1 - \tau_{\text{effective cap gains}})$, where $\tau_{\text{div}} = \tau_P$. To ensure that $r_{\text{Treasury}}(1 - \tau_P) = r_{\text{equity}}(1 - \tau_{\text{equity}})$, in this example $\tau_P = -30\%$; clearly, market frictions drive relative returns in this example, so the usual approach can not be used to deduce the personal tax characteristics of the marginal investor(s).

Williams (2000) points out that when there are more than two assets, different pairs of assets can be arbitraged by different investors, so prices might reflect a mixture of tax characteristics. It is difficult to know which assets are directly benchmarked to each other by the marginal investor(s) and which are "indirectly arbitraged," and it is even difficult to know whether capital gains or income tax rates are priced into security returns.

It would be helpful if future research could quantify the relative importance of personal taxes on security prices, with an eye towards feedback into capital structure decisions. One area where there has been a fair amount of research along these lines involves determining the investor tax rate implicit between municipals and taxable government bonds. Poterba (1989) finds that the yield difference between high-grade one-year munis and government bonds approximates the top statutory personal tax rate, implying that the marginal investor

[26] Gordon and MacKie-Mason (1990) and Graham (1999) avoid the issue of adjusting the equity return. Instead, they assume that τ_{div} equals the τ_P implicit between munis and Treasuries, that $\tau_{\text{effective cap gains}} = 0.25\text{x } \tau_{\text{statutory capital gains}}$, and weight these two pieces by the portion of earnings returned as dividends and retained, respectively, to deduce τ_{equity}. It would be informative if future research could calibrate this approach to market-driven estimates of τ_{equity}.

between these two securities is a highly taxed individual. However, even this experiment is not without difficulty. First, returns on long-term munis and taxables imply a tax rate for the marginal investor that is approximately half that implied by the short-term securities. Chalmers (1998) shows that this holds even when the muni interest payments are prefunded by T-bonds held in "defeasement," and therefore differences in risk between munis and T-bonds do not explain this conundrum. Green (1993) proposes that taxable bonds might not be "fully taxable" because a portion of their return can come from capital gains (especially for long-term bonds) and also because to some degree the interest income can be offset by investment interest deductions. Mankiw and Poterba (1996) suggest that munis might be benchmarked to equities by one clientele of investors and taxable bonds might be benchmarked to equities by another clientele. In this case, munis and taxables might not be directly benchmarked to each other, which could explain the unusual implicit tax rate that is sometimes observed between the two securities.

As an example of trying to link the effects of personal taxes to capital structure issues, consider the implications from Engel and Maydew (1999) and Irvine and Rosenfeld (2000) about the personal tax penalty.[27] Assume that corporations are the marginal investors in preferred stock but not in debt.[28] Given the similarity of the securities,

[27] Recall that these authors investigate MIPS for preferred exchanges. These two securities are similar in most respects, except that MIPS interest is tax deductible for issuing corporations and preferred dividends are not. On the investor side, corporate investors can take the 70% dividends received deduction (DRD) for preferred dividends but recipients of MIPS interest receive no parallel deduction.

[28] Erickson and Maydew (1998) provide evidence that corporations are the marginal investors in preferred stock, though they do not precisely identify the numeric value of the marginal investor's tax rate. They study the market reaction to the announced (but never implemented) change in the dividends received deduction (DRD). The DRD allows corporations to deduct a portion of the dividends they receive from other corporations to attenuate "triple taxation" of equity income. Individual investors do not receive the DRD. When the Treasury made a surprise announcement in December, 1995 that they were planning to reduce the deduction from 70% to 50%, the typical preferred stock experienced a statistically significant −1% abnormal return, while there was no reaction among common stocks. This implies that corporations are the marginal investors (i.e., price-setters) in preferred stocks but not in common stocks. One advantage of the Erickson and Maydew study is that they are able to control for risk when examining abnormal returns because they compare a security to itself before and after the exogenous

in equilibrium we expect their after-investor-tax returns to be equal, within transactions cost bounds: $r_{\text{preferred}}(1-\tau_{\text{DRD}}) = r_{\text{MIPS}}(1-\tau_P)$. Plugging in $r_{\text{preferred}} = 8.14\%$ and $r_{\text{MIPS}} = 8.37\%$ from Engel et al.'s Table 5.1, and assuming that the marginal corporate investor is taxed at 35% so that $\tau_{\text{DRD}} = 10.5\%$, we can back out the personal tax rate associated with interest income: $0.0814(1-0.105) = 0.0837(1-\tau_P)$ implies that $\tau_P = 13\%$. If I ignore the 30 basis point "yield premium" on MIPS imputed by Engel et al. and use $r_{\text{MIPS}} = 8.67\%$, $\tau_P = 16\%$.

To the extent that results based on MIPS interest carry over to debt interest, finding $\tau_P = 16\%$ for the marginal debt investor is intriguing. First note that the mean after-financing corporate tax rate in 1993–1999 is approximately 18% (see Table 1.1), which is a rough estimate of the tax benefit of the *last* dollar of interest deduction (ignoring all costs). If we make Miller's (1977) assumptions that $\tau_E = 0$ and that all firms face the same 18% marginal benefit of debt, then τ_P should equal 18% (i.e., MC should equal MB), quite close to the $\tau_P = 16\%$ MIPS estimate. As argued by Green and Hollifield (2003), it would only take fairly small costs of bankruptcy to equalize the costs and benefits of debt, creating an environment conducive to an equilibrium with internal optimal debt ratios. However, τ_E is most likely not zero for the marginal investor in equities. (Green and Hollifield argue that deferral reduces effective τ_E to about half its statutory level.) Another issue is that the estimated MIPS costs and benefits are average, not marginal. Even if the marginal costs and benefits are equal in an equilibrium like that depicted in Figure 1.1a, there is a firm surplus/benefit to using debt. Therefore, even if personal tax costs are large enough at the margin to equal marginal benefits, there appear to be tax-driven preferred

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announcement. The authors are unable to precisely deduce the tax rate of the marginal (corporate) investor, however, because they can not pinpoint the probability assigned by the market that the Treasury would actually implement the proposal.

While Erickson and Maydew (1998) find no evidence that corporations are the marginal investors in common stocks, Geisler (1999) shows that common stock holdings by insurance companies vary positively with the allocation of the dividends received deduction among insurance companies. (The allocation of DRD can vary across insurance companies for regulatory reasons.) Geisler's evidence is consistent with clienteles: insurance companies respond to tax incentives to hold common stocks when their tax rate is low (i.e., when their DRD allocation is high).

capital structures for some firms – presumably the incremental benefit would be near $0.35 per dollar for high-tax-rate firms, while the personal tax cost is only half that amount. Only if the nontax costs of debt are large for these high-tax rate firms could a Miller-type equilibrium hold, in which the benefits of debt are zero for all firms in equilibrium.

In sum, the implicit personal tax costs estimated here suggest that at the margin the tax costs and tax benefits might be of similar magnitude. However, they do not explain cross-sectionally why some inframarginal firms (with large tax benefits of interest) do not use more debt. More on this in Section 1.4. One other place where there has been a fair amount of success (though not unambiguously so) in deducing marginal investor tax characteristics is related to ex-day dividend returns. I defer this discussion to Section 3, where I explore how taxes affect corporate dividend policy.

In the most general sense, any research that shows that personal tax rates affect security returns sheds light on Miller's (1977) claims. Using the CAPM-with-taxes specification, Auerbach (1983) finds evidence that tax-related preferences result in clienteles of investors that purchase stocks based on firm-specific dividend-price ratios. Constantinides (1983) and Dammon et al. (2001) investigate how favorable capital gains taxation affects investment and consumption choices. Seida and Wempe (2000) show that individual investors accelerated recognizing capital gains (and delayed losses) in anticipation of the increase in capital gains tax rates associated with the 1986 tax act. See Poterba (2001) for a review of articles related to how personal taxation affects the timing and value of asset sales and purchases.

Tax capitalization Another group of papers investigates tax capitalization. These papers argue that personal taxes are capitalized into share prices via retained earnings. This in turn affects the relative tax advantage to debt because retained earnings are assumed to be the marginal source of funding. Harris and Kemsley (1999), Collins and Kemsley (2000), and related papers assume that all earnings are eventually paid out as taxable dividends (and none via repurchases or liquidating dividends), which is consistent with the "new view" of the effects of dividend taxation.[29] They argue that (nearly) full dividend taxation is impounded into share prices and therefore, there is no incremental personal tax penalty when a firm pays a dividend. Therefore, personal taxes are large on interest income and small on equity income, and the personal tax penalty to debt financing is large.

Harris and Kemsley (1999) regress stock price on variables including retained earnings, and they infer that retained earnings are penalized at a dividend tax rate of approximately 47%. Collins and Kemsley (2000) argue that reinvesting current earnings leads to investor capital gains taxation when shares are sold, on top of the already impounded dividend taxation. This implies that there is no personal tax penalty to dividend payments (it is already impounded into share prices and therefore paying a dividend does not lead to further valuation effects). In fact, this leads to the counterintuitive argument that paying dividends leads to a reduction in future capital gains payments and therefore, *dividend payments are tax advantageous*. This implication only holds if arbitrage by tax-free investors is restricted to the point that personal investors are the marginal price-setters in stocks. Collins and Kemsley find empirical evidence that they interpret as being consistent with their hypotheses. An untested implication of their argument is that there should be a large value gain in deals that result in firms returning capital to investors in any form other than taxable dividends (such as mergers). Research into this area could be informative.

Rather than dividend taxes, an alternative argument is that capital gains taxes on future earnings are impounded into share prices. Consider a shareholder in a nondividend-paying firm and assume that the firm is expected to pay dividends at some point in the distant future. If the market expects that low-tax investors are likely to be the dominant owners of this company when the dividend payments are initiated, the only (future) tax that current investors face is capital gains. In support of this argument, Lang and Shackelford (2000) show that upon announcement that capital gains tax rates were going to decline,

[29] See Auerbach (2002) for cites. The "new view" or "trapped equity" assumptions are in contrast to the assumptions I made at the beginning of Section 1 that "equity is the marginal source of funds" and that "dividends are paid out according to a fixed payout policy."

stock prices increased most among firms for which capital gains are most important (i.e., firms with the lowest dividend yield). This is opposite the reaction predicted by lock-in models like Klein (2001), in which returns fall when capital gains rates fall, for firms with substantial accrued retained earnings, because the required return declines along with the tax rate. Dai et al. (2006) find evidence of a capitalization effect after announcement that the Taxpayer Relief Act of 1997 would reduce capital gains tax rates, and evidence of a lock-in effect when the act became effective. See Shackelford and Shevlin (2001) for further discussion of the tax capitalization literature.

Overall, the tax status of the marginal investor and therefore the empirical magnitude of the personal tax penalty is an open empirical question. This is an important issue. For one thing, failing to control for personal tax considerations can result in an omitted variable bias. For example, personal tax considerations could cause clientele behavior that is correlated with dividend-payout ratios. In a regression that omits personal tax considerations, the dividend-payout coefficient might erroneously be interpreted as supporting a nontax hypothesis. As another example, business students are often taught that the tax advantage of debt is captured by τ_CD (see eq. (1.4)), which ignores personal tax effects. If it can be demonstrated that personal tax effects are not particularly important, this simplified view of the world might be justified. In contrast, if investor taxes affect security returns in important ways, more care needs to be taken in modeling these effects in corporate finance research. Investigations of personal tax effects face several challenges, not the least of which is that risk-differences between securities must be properly controlled to allow one to deduce implicit tax rates from market return data.

1.5 Beyond debt vs. equity

Leasing The discussion thus far has considered the debt versus equity choice; however, it can be extended to leasing arrangements. In certain circumstances, a high-tax rate firm can have a tax incentive to borrow to purchase an asset, even if it allows another firm to lease and use the asset. With true leases (as defined by the IRS) the lessor purchases an asset, and deducts depreciation and (if it borrows to buy) interest from taxable income. The lessee, in turn, obtains use of the asset but can not deduct interest or depreciation. The depreciation effect therefore encourages low-tax rate firms to lease assets from high-tax-rate lessors. This occurs because the lessee effectively "sells" the depreciation (and associated tax deduction) to the lessor, who values it more highly (assuming that the lessee has a lower tax rate than the lessor). This incentive for low-tax rate firms to lease is magnified when depreciation is accelerated, relative to straight line depreciation. Further, the alternative minimum tax (AMT) system can provide an additional incentive for a lessee to lease, in order to remove some depreciation from its books and stay out of AMT status altogether.

There are other tax effects that can reinforce or offset the incentive for low tax rate firms to lease. Lessors with relatively large tax rates receive a relatively large tax benefit of debt, which provides an additional incentive (to borrow to) buy an asset and lease it to the lessee. Moreover, tax incentives provided by investment tax credits (which have existed at various times but are not currently on the books in the U.S.) associated with asset purchsaes are also relatively beneficial to high tax-rate lessors. In contrast, the relatively high taxes that the lessor must pay on lease income provide a tax disincentive for firms with high tax rates to be lessors (and similarly the relatively small tax benefit that a low tax rate firm obtains from deducting lease expense works against the incentive for low tax rate firms to lease rather than buy). The traditional argument is that low tax rate firms have a tax incentive to lease from high tax rate lessors, though this implication is only true for some combinations of tax rules (e.g., depreciation rules, range of corporate tax rates, existence of investment tax credits or AMT) and leasing arrangements (e.g., structure of lease payments). See Smith and Wakeman (1985) for details on how nontax effects can also influence the leasing decision.

Prediction 5 All else equal, the traditional argument is that low tax-rate firms should lease assets from high-tax rate lessors, though this implication is conditional on specifics of the tax code and leasing contract.

There are several complications associated with investigating whether firms lease in response to tax incentives. First, because leasing expense is tax deductible, leasing endogenously reduces a lessee's effective tax rate, which can bias an experiment in favor of detecting tax effects. Likewise, lessor tax rates could be endogenously increased from the effects of lease income. Second, financial statement definitions of leasing are not one-to-one with IRS definitions, making it difficult to use Compustat data to test Prediction 5. Using endogenously-affected tax variables, Barclay and Smith (1995b) and Sharpe and Nguyen (1995) find that low-tax-rate firms use relatively many capital leases. However, capital leases do not meet the IRS definition of true leases (instead they are likely a mixture of true leases and conditional sales contracts, the latter of which are treated like debt so the lessee deducts interest and depreciation), and therefore the documented negative relation between capital leases and taxes is hard to interpret because it might be spurious.

Graham et al. (1998) address the first issue by measuring tax incentives "but-for financing decisions," i.e., calculating tax rates using income before debt interest and the implicit interest portion of lease payments are deducted. They address the second issue by focusing on operating leases, which are defined in a manner similar to the IRS definition of true leases. Graham et al. (1998) find that the use of operating leases is negatively related to before-financing tax rates, consistent with Prediction 5, and that capital leases are unrelated to before-financing tax rates. Graham et al. also show that erroneously using an after-financing tax rate would double the magnitude of the negative tax coefficient for operating leases, and spuriously assign a negative tax coefficient to capital lease usage.

Eades and Marston (2001) find that lessors tend to be high-tax rate firms (consistent with Prediction 5). Finally, O'Malley (1996) finds no evidence that firms systematically lease in response to tax incentives imposed by the AMT. We need research investigating whether the tax benefit of leasing adds to firm value. The jury is also still out on whether debt and leasing are substitutes for the lessee (as they might be in a DeAngelo and Masulis, 1980 sense because both lead to tax deductions).

Pensions Black (1980) assumes that pension plans and the overall company are a single economic entity that should have an integrated financing and investment strategy. Due to interest tax deductions, the cost of corporate borrowing is the after-tax cost of debt. Because they are tax-free entities, defined benefit pension plans (DBs) earn the before-tax rate of interest on bond holdings. Therefore, Black suggests that DBs should increase (decrease) bond (equity) holdings, while the rest of the firm should do the reverse. This action should not increase firm risk because the increase in corporate debt offerings is offset by the increase in bonds held in the pension plan. In a M&M (1963) world, the net effect is that the company earns τ_C times the amount of bonds held, as in Eq. (1.4). Tepper (1981) argues that there can be a tax advantage to the strategy of corporate borrowing and DBs investing in bonds, even in a Miller (1977) world. In this case, the benefit occurs when the DB is an inframarginal investor in bonds, thereby earning the "extra" return necessary to compensate individual investors for the personal tax penalty associated with interest income (i.e., DBs capture some of the investor surplus depicted in Figure 1.1). The Tepper incentive for DBs to hold bonds increases with the difference between personal tax rates on interest and equity income.

Prediction 6 Defined benefit pension plans have an incentive to hold bonds (equity) that increases (decreases) in the corporate tax rate, while the rest of the firm has the reverse incentive.

Frank (2002) finds evidence consistent with the Black (1980) case: she finds that DB bond holdings increase with a simulated corporate marginal tax rate. She does not find evidence consistent with the Tepper argument. In a less direct test of the same incentives, Thomas (1988) finds time-series evidence that firms decrease DB contributions when their tax rate is falling, and cross-sectional evidence that high-tax firms have larger DB funding levels.

Clinch and Shibano (1996) study pension reversions, which occur when a firm terminates an overfunded pension, settles its liabilities, and reverts the excess assets to the firm, all in one year. The reverted assets are taxable in the reversion year. Clinch and Shibano find that firms with the largest tax benefit of reverting do so, and also that firms time reversion decisions to occur in years with particularly large tax benefits. One nice thing about the Clinch and Shibano experiment is that their tax variable equals the tax consequence of reverting relative to the tax consequence associated with the next best alternative (e.g., amortizing the excess assets over several years).[30]

Stefanescu (2006) studies whether defined pension obligations, which are akin to off-balance sheet debt, displace the use of balance sheet debt along the lines of suggested in DeAngelo and Masulis (1980). Pension contributions to DB plans are tax deductible and therefore are a form of nondebt tax shield that might substitute for interest deductions (Section 1.1). Stefanescu finds that considering pension deductions increases the overall measure of the tax benefits of debt by nearly one half, and reduces the Graham (2000) kink measure of debt conservatism by nearly one-third. She also concludes that one dollar of pension obligation reduces debt on the balance sheet by \$0.36.

Debt maturity In the spirit of Modigliani and Miller (1985), Lewis (1990) derives an irrelevance null hypothesis for debt maturity. If corporate taxes are the only market imperfection, Lewis shows that the optimal firm-specific debt policy (i.e., optimal level of promised interest payments) can be achieved by various combinations of short- and long-term debt. This implies that firm value is unaffected by debt maturity structure and that capital market imperfections beyond corporate taxes, like costs to restructuring debt or underinvestment, are needed for debt maturity to matter.

Rather than modeling the simultaneous choice of debt level and maturity structure as in Lewis (1990), Brick and Ravid (1985) assume

[30] Chaplinsky and Niehaus (1990) describe the potential tax benefits of Employee Stock Ownership Plans, a form of defined contribution benefit plan. ESOPs offer deferred compensation to employees and a deductible expense to employers. ESOPs are designed to allow firms to borrow to purchase own-company stock on employees' behalf, which provides an interest deduction to the firm. Moreover, half of the interest income received by the lenders is tax-free. Shackelford (1991) finds that lenders keep only 20–30% of the tax benefit associated with this interest, with the remainder being passed along to the ESOP in the form of a lower interest rate on the loan. In late 1989, tax rules changed to restrict the interest exclusion to loans where the ESOP own more than 50% of the stock, which effectively killed the interest exclusion except for a few very unusual cases.

that firms choose debt level before debt maturity. If the expectations theory of interest rates holds, firms pay the same present value of interest in the long run regardless of debt maturity; however, issuing long-term debt accelerates interest payments, thus maximizing the present value of the interest tax shield. Brick and Ravid (1985) use this logic to argue that debt maturity should increase with the slope in the yield curve.

Prediction 7 Debt maturity increases in the slope of the yield curve.

Most empirical evidence does not support this prediction. Barclay and Smith (1995a) and Stohs and Mauer (1996) include a stand-alone yield curve variable that is either insignificant or has the wrong sign. Guedes and Opler (1996) argue that the slope of the yield curve should only affect firms with a positive tax rate, and therefore interact the yield curve variable with the corporate marginal tax rate. Neither Guedes and Opler (using a crude measure of the corporate tax rate), nor Harwood and Manzon (2000, using a simulated corporate tax rate) find a significant coefficient on the yield curve variable. The one exception is Newberry and Novack (1999), who use a dummy variable equal to one during 1992 and 1993 (when the term premium was relatively high) and equal to zero for all other years 1987–1995. Newberry and Novack find a positive coefficient on the yield curve dummy in their public debt regression but not in their private debt analysis.

Kane et al. (1985) determine optimal debt maturity in a model that trades off corporate tax benefits with personal tax, bankruptcy, and flotation costs. The implications of their model are that debt maturity decreases with the corporate MTR and increases with the personal tax rate: long maturity implies less frequent recapitalization and relatively low transactions costs, so long-term debt can be desireable even if the net tax benefit is low. Maturity also decreases with the volatility of firm value because volatile firms are more likely to restructure debt.

Prediction 8 Debt maturity decreases with the corporate MTR and the volatility of firm value and increases with the personal tax rate.

Stohs and Mauer (1996) find support for the latter prediction: volatile firms generally use shorter term debt. The evidence is weaker related to the tax rate prediction. Stohs and Mauer find that debt maturity decreases with corporate tax rates – but their MTR variable is very crude (equal to income tax expense divided by pretax income when this ratio is between zero and one, and equal to zero otherwise). Guedes and Opler (1996) find a negative coefficient on a tax expense divided by assets variable but the wrong sign on an NOL-based tax variable. Finally, Harwood and Manzon (2000) and Newberry and Novack (1999) find a positive relation between a simulated tax variable and debt maturity, opposite the Kane et al. prediction.[31] A positive coefficient makes sense if large simulated MTRs identify firms that use long-term debt cause they are relatively likely to be able to deduct interest in current and future periods.

Finally, debt maturity can affect the tax-timing option for firms to opportunely retire debt (e.g., Emery et al., 1988). If the corporate tax function is convex, the expected present value tax benefit of short-term debt declines with interest rate volatility, while the tax deductions with long-term debt are fixed. Therefore, long-term debt is preferred when interest rates are volatile. Long-term debt also increases the value of the timing option for investors to tax-trade securities (Kim et al., 1995) because option value increases with security maturity and long-term bond prices are more sensitive to changes in interest rates.

Prediction 9 Debt maturity increases with interest rate volatility.

Kim et al. (1995) find that debt maturity increases with interest rate volatility but Guedes and Opler (1996) do not. Nor do Guedes

[31] Harwood and Manzon's variable equals the Graham (1996a) simulated tax rate divided by the top statutory tax rate. This variable has a large value for firms that do not currently have NOLs and that do not expect to experience a loss in the near future. Harwood and Manzon predict a positive relation between this tax variable and debt maturity. They argue that firms with large values for the tax variable are likely to fully utilize tax deductions in the future, and therefore lock into long-term debt now. In new analysis for this chapter, I perform a more direct test on the hypothesis that uncertainty about future tax-paying status reduces the use of long-term debt. I use the standard deviation of the simulated marginal tax rate to measure uncertainty about tax-paying status, with the standard deviation calculated across the simulated scenarios for any given firm-year. I do not find any relation between debt maturity and uncertainty about tax-paying status.

and Opler find significance for a second variable that interacts interest rate volatility with a corporate MTR variable.

The evidence linking tax incentives to debt maturity is mixed. One thing that makes it difficult to draw general conclusions is that debt maturity is defined differently in various papers. Barclay and Smith (1995a) use a dependent variable measuring the portion of outstanding debt that matures in four or more years, Guedes and Opler (1996) use the log of the term to maturity for new debt issues, Stohs and Mauer (1996) use the book value weighted-average of the maturity of a firm's outstanding debt, Newberry and Novack use the same for new issues, and Harwood and Manzon (2000) use the portion of outstanding debt that is long-term. Another issue that might affect inference about tax variables is the apparently nonlinear relation between debt maturity and nontax influences (Guedes and Opler, 1996). Unless the nonlinearity of the overall specification is properly controlled, it might adversely affect the ability to detect tax effects. Finally, the yield curve was never inverted during the periods studied by most of these papers, so the tests of Brick and Ravid (1985) focus on the steepness of the yield curve, rather than the sign.

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