Taxes and Financing Decisions

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Abstract

We argue that trade-off theory's simple distinction between debt and 'equity' is fundamentally incomplete because firms have three, not two, distinct sources of funds: debt, internal equity, and external equity. Internal equity (retained earnings) is generally less costly than external equity for tax reasons, and may even be cheaper than debt. It follows that, without any information problems or adjustment costs, optimal leverage is a function of internal cashflows, debt ratios can wander around without a specific target, and a firm's cost of capital depends on its mix of internal and external finance, not just its mix of debt and equity. The trade-off between debt, retained earnings, and external equity depends critically on the tax basis of investors' shares relative to current price. We estimate how the trade off varies cross-sectionally and through time for a large sample of U.S. firms.

1. Introduction

The finance literature has long offered a simple model of how taxes affect financing decisions, familiar to generations of MBA students. Debt has tax advantages at the corporate level because interest payments reduce the firm's taxable income while dividends and share repurchases do not. Unless personal taxes negate this advantage, interest 'tax shields' give corporations – that is, shareholders – a powerful incentive to increase leverage.

The trade-off theory of capital structure is largely built upon the tax benefits of debt. In its simplest form, trade-off theory says that firms balance the tax benefits of debt against the costs of financial distress. (Leverage might also affect agency conflicts among stockholders, bondholders, and managers.) Tax effects dominate at low leverage, while distress costs dominate at high leverage. The firm has an optimal, or target, debt ratio at which the incremental value of tax shields from a small change in leverage exactly offsets the incremental distress costs. This notion of a target debt ratio, determined by firm characteristics like profitability and asset risk, is the central focus of most empirical tests (see, e.g., Shyam-Sunder and Myers, 1999; Fama and French, 2002; Leary and Roberts, 2004).

This paper re-considers the tax effects of financing decisions in a simple yet, in important respects, realistic model of taxation. Our main thesis is that, under general conditions, the tax costs of internal equity (retained earnings) are less than the tax costs of external equity, and in principle may be zero or negative. As a result, optimal leverage will depend on internal cashflows, debt ratios can wander around without a specific target (much like in the pecking-order theory of Myers, 1984), and firms with excess cash may not have a tax incentive to lever up. Further, the firm's cost of capital depends on its mix of internal and external finance, not just its mix of debt and equity. These predictions are all contrary to the way trade-off theory is generally interpreted.

Our results follow from a simple observation whose importance for capital structure seems largely unappreciated: when a firm distributes cash to shareholders, using either dividends or repurchases, the payout triggers personal taxes that could otherwise be delayed. Thus, using internal cash for investment, rather than paying it out to equityholders, has a tax advantage – the deferral of personal taxes – that partially offsets the double-taxation costs of equity. An immediate implication is that internal equity is less costly than external equity for tax reasons (i.e., both types of equity are subject to double taxation, but only internal equity has the offsetting deferral effect).[1]

[1] This observation isn't new, but our results differ in important respects from related arguments in the literature. We discuss the literature below.

The tax-deferral benefit of retained earnings is well known, of course, but is typically discussed in the context of payout policy, not capital structure. In a sense, our paper merges the two literatures: In the capital structure literature, research focuses on the double-taxation costs of equity and generally ignores the fact that distributions to shareholders (i.e., steps taken to reduce equity) accelerate personal taxes. The opposite is true in the payout literature, which focuses on the tax-deferral benefit of retained earnings but tends to ignore the double-taxation costs. We combine the two effects to evaluate the overall tax costs, or benefits, of internal equity.

Our formal model quantifies these ideas when firms use either dividends or repurchases to distribute cash. The general rule is that internal equity is less costly than external equity whenever distributions trigger personal taxes, and, in principle, this effect can be large enough to completely offset the double-taxation costs of equity (i.e., retained earnings may be better than debt financing). With dividends, the tax advantage of internal equity depends on dividend and capital gains tax rates, τ_{dv} and τ_{cg}, as well as the fraction α of capital gains that are realized and taxed each period. Intuitively, α determines how much tax can be delayed if the firm decides to retain earnings: if α is zero, personal taxes are fully deferred if the firm doesn't pay dividends; if α is one, personal taxes must be paid, via either dividend or capital gains taxes, regardless of the firm's payout decision. We show that internal equity is less costly than external equity as long as $\alpha\tau_{cg} < \tau_{dv}$. If α is sufficiently small, internal equity may even be cheaper than debt – that is, internal equity may have *negative* tax costs, even if tax rates are such that firms would never want to raise external equity.

With repurchases, the tax advantage of internal over external equity depends on the tax basis on investors' shares relative to the current price, a ratio we denote as β (endogenous in the model). Intuitively, β determines how much tax is triggered by a share repurchase since it determines how much of the price represents capital gains. If β is small, retaining cash inside the firm has a large tax deferral benefit; internal equity is much less costly than external equity and, if β is sufficiently small, retained earnings can even be better be better than debt. The cost of internal equity rises as β gets larger, and internal equity becomes equivalent to external equity if β equals one.

We explore the implications of these results for capital structure, payout policy, and the cost of capital. The main implications for capital structure are noted above: the tax advantage of internal over external equity implies that optimal leverage is a function of internal cashflows and that firms have less incentive to lever up than typically assumed (we show, in particular, that the trade-off between debt and retained earnings depends on the capital gains tax rate, not the dividend tax rate, regardless of how the firm distributes cash). The tax advantage of internal equity also implies that a firm's cost of capital depends on its mix of internal and external finance, not just its mix of debt and equity. The implication is that firms' investment decisions, like their capital structures, should depend on past profitability and cashflows (see, also, Fazzari, Hubbard, and Petersen, 1988).

An important contribution of the paper is to show that subtle, often unstated, tax assumptions play a key role in many capital structure theories. For example, Miller (1977) observes that, with personal taxes, equity is preferred to debt if the after-tax return to shareholders on a dollar of corporate profits, $(1 - \tau_c)(1 - \tau_e)$, is greater than the after-tax return to debtholders, $(1 - \tau_i)$ [τ_c, τ_i, and τ_e refer to the corporate tax rate and the personal tax rates on interest and equity income]. In his analysis, Miller doesn't differentiate between internal and external equity, an assumption we show is valid only if $\alpha = 1$ and the capital gains tax rate equals the dividend tax rate. The first condition, $\alpha = 1$, is equivalent to assuming that capital gains are taxed on an 'accrual' basis.

Our analysis also relates to the growing literature on dynamic trade-off theory. This literature typically focuses on the transaction costs associated with changing a firm's capital structure, not the distinction between internal and external equity (e.g., Fischer, Heinkel, and Zechner, 1989; Leland, 1998; Goldstein, Ju, and Leland, 2001; Stebulaev, 2004). An important exception is Hennessy and Whited (2004), who observe that substituting debt for internal cash has different tax consequences than substituting debt for external equity, similar to the observation made here. A key difference is that Hennessy and Whited do not account for capital gains taxes (shareholders pay tax only when they receive a cash distribution from the firm). We show that their assumptions, in effect, maximize the tax advantage of internal over external equity, which is a key source of dynamics in their model. Indeed, the difference between their results and Miller (1977) is less that one is dynamic and the other static, but that the models implicitly make different assumptions about taxes.

Our paper is perhaps closest to the public economics literature on dividend taxes. Like us, King (1974), Auerbach (1979), and Bradford (1981) observe that retained earnings may be less costly than new equity for tax reasons. We generalize their results to account for share repurchases and realization-based capital gains taxes. In addition, Auerbach (1979) and Poterba and Summers (1985) discuss the so-called 'trapped equity' view of dividends, which says that payout policy is irrelevant even with corporate and personal taxes (in our language, the tax costs of internal equity are zero). We show that the trapped equity view is precarious, holding only if tax rates are 'just right.' In fact, given the tax-on-accrual assumption standard in this literature, internal equity has zero tax costs only if a Miller-like equilibrium holds, that is, only if $(1 - \tau_c)(1 - \tau_{cg}) = (1 - \tau_i)$, where τ_{cg} is the capital gains tax rate.

Finally, our paper relates to Green and Hollifield (2003). Like us, they study how investors' ability to defer capital gains affects the cost of equity, and some of their results overlap with ideas in our paper. The main difference is that they focus on valuation and the tax advantage of repurchases over dividends, while we focus on the firms' incentive to retain cash, the tax advantage of internal over external equity, and the dynamics of capital structure through time.

The remainder of the paper is organized as follows. Section 2 presents a formal model of the tax costs of debt, retained earnings, and external equity. Section 3 discusses the literature and Section 4 explores the implications for corporate behavior. Section 5 estimates the tax costs of equity for a large sample of U.S. corporations. Section 6 concludes.

2. Tax effects of financing decisions

This section formalizes our arguments in a simple two-period model. (The model can be extended to many periods; the crucial feature is that we have at least one intermediate date.) We incorporate realistic tax assumptions, allowing the tax rates on dividends, capital gains, and interest income to differ and recognizing that capital gains aren't taxed until they are realized. Since our goal is to study the tax consequences of financing decisions, not to develop a complete model of financing choice, we ignore information asymmetries, agency conflicts, and distress costs. Thus, the model is in the spirit of Modigliani and Miller (1963), Miller (1977), and Auerbach (1979).

Our main results concern the tax costs of internal equity and the dynamics of capital structure through time. To make the ideas as transparent as possible, we start with a one-period model in which the firm relies on external finance, and proceed to the two-period model in which the firm has internally-generated earnings to reinvest in the second period.

2.1. One period

The firm has an opportunity to invest I today in a project that pays $I + P_1$, pre-tax, in one period. The payoff can be random, but, to rule out bankruptcy, we assume that the rate of return is always more than the riskless rate r (the connection to bankruptcy will be clear in a moment). Investors are risk neutral, and both investors and the firm can invest in the riskless asset.

The firm initially has no cash but can sell debt and equity in competitive markets. We assume that any cash raised must be invested inside the firm – that is, the firm can't pay the cash immediately to shareholders, leaving an empty shell. From this, and the fact that $P_1 > I\, r$, debt is riskless because the firm always has enough cash to repay debtholders.

Interest paid by the firm is tax deductible but dividends and repurchases are not. The corporate tax rate is denoted τ_c and the personal tax rates on interest, dividends, and realized capital gains are denoted τ_i, τ_{dv}, and τ_{cg}, respectively. With only one period, the firm is assumed to be liquidated at date 1, so all capital gains are necessarily realized. The portion of a liquidating dividend that represents capital repayment is exempt from personal taxes (consistent with the actual tax code).

In this model, it's clear that capital structure conforms to the traditional debt-and-taxes story. Formally, suppose the firm raises debt and equity of D_0 and S_0, with $D_0 + S_0 \geq I$. Excess cash, $C_0 = D_0 + S_0 - I$, is invested in the riskless asset, so net income for the period is $(P_1 + C_0\, r - D_0\, r)\,(1 - \tau_c)$. After paying debtholders, the firm has cash at date 1 of

$$C_1 = I + P_1\,(1 - \tau_c) + (C_0 - D_0)\,[1 + r\,(1 - \tau_c)]. \tag{1}$$

The last term in (1) implies that raising an extra dollar of debt to hold as cash has no effect on after-tax income or cashflows, an observation we will return to later. Substituting for C_0 yields

$$C_1 = (P_1 - I\,r)\,(1 - \tau_c) + S_0\,[1 + r\,(1 - \tau_c)]. \tag{2}$$

This equation says that every dollar of equity raises the firm's cash holdings at date 1 by $1 + r\,(1 - \tau_c)$. The first term, which we denote as π_1, is the firm's after-tax income if it is entirely debt financed. The firm distributes C_1 as either a dividend or a repurchase, and the portion that represents capital repayment, S_0, is tax exempt in both cases. After personal taxes, shareholders receive

$$CF_1 = \pi_1\,(1 - \tau_e) + S_0\,[1 + r\,(1 - \tau_c)(1 - \tau_e)], \tag{3}$$

where τ_e denotes either τ_{dv} or τ_{cg} depending on whether dividends or repurchases are used. We assume throughout the paper that $\tau_{cg} \leq \tau_{dv}$, so repurchases are preferred. Equity is valuable if it yields a higher after-tax payoff than investors can receive from holding the riskfree asset, $1 + r\,(1 - \tau_i)$. Thus, the value of equity financing relative to debt is

$$\text{Net value of } S_0 \text{ at date 1} = S_0\, r\,[(1 - \tau_c)(1 - \tau_{cg}) - (1 - \tau_i)], \tag{4}$$

assuming the firm disburses cash through a share repurchase (otherwise substitute τ_{dv} for τ_{cg}). These results are all quite standard.

2.2. Two periods

Our novel results come from adding a second period to the model (dates are numbered 0, 1, and 2). The first period remains the same, but now the firm has the option either to pay cash to shareholders at date 1 or retain it until date 2. For simplicity, we assume the firm's only investment opportunity at date 1 is the

Table 1. The firm's cashflows

Date 0	Issue debt D_0 and equity S_0. Invest I in the project. Hold cash $C_0 = D_0 + S_0 - I \geq 0$.
Date 1	Net income: $NI_1 = [P_1 + C_0\, r - D_0\, r]\,(1 - \tau_c)$ Cash on arrival, after taxes and debt: $C_1 = \pi_1 + S_0\,[1 + r\,(1 - \tau_c]$, where $\pi_1 = (P_1 - I\, r)\,(1 - \tau_c)$ Cash distribution δ_1 Issue debt D_1 and equity S_1 Cash on exit: $C_1' = C_1 + S_1 + D_1 - \delta_1 \geq 0$
Date 2	Cash, after taxes and debt: $C_2 = [C_1' - D_1]\,[1 + r\,(1 - \tau_c)]$

riskfree asset; giving the firm a positive-NPV investment, like the project in the first period, only adds an additional term to some of the expressions.

The firm can again sell debt and equity in competitive financial markets at dates 0 and 1. We assume for convenience that debt is short term and, to prevent the possibility of bankruptcy, dividends at date 1 must be paid before any new debt is issued (again, this prevents the firm from issuing debt and immediately paying the proceeds to shareholders).

The tax treatment of dividends, repurchases, and capital gains becomes more important now that we have multiple periods. Our assumptions attempt to match actual tax policy. In particular, we assume that dividends are fully taxable but that repurchases are taxed only on the portion that represents capital gains. Investors also pay capital gains tax on any remaining shares when they are sold, which means that we have to make an assumption about trading behavior at date 1. A fully worked out model of trading is obviously beyond the scope of the paper (tax incentives would imply zero trading). Our way of handling the issue is to assume simply that investors trade an exogenous fraction α of their shares at date 1, which thus represents the fraction of capital gains that are realized. We study how the results change as α varies between zero and one.

Table 1 summarizes the firm's cashflows. The first period remains exactly the same: net income is $NI_1 = (P_1 + C_0\, r - D_0\, r)\,(1 - \tau_c)$ and cash on arrival to date 1, after repaying debt but before any other transactions, is given by C_1 in eq. (2). At date 1, the firm pays dividends or makes a share repurchase of $\delta_1 \leq C_1$ and issues new debt and equity of D_1 and S_1. Cash on exit from date 1 is therefore $C_1' = C_1 + D_1 + S_1 - \delta_1$, which grows to

$$C_2 = (C_1' - D_1)\,[1 + r\,(1 - \tau_c)] \tag{5}$$

at date 2, after taxes and debt payments. As we saw earlier, selling an extra dollar of debt to hold as cash has no effect on the firm's net income or cashflows. This observation gives our first result:

Proposition 1. *Issuing debt to invest in the riskfree asset (i.e., to hold as cash) has no effect on shareholder value, regardless of tax rates.*

Proposition 1 is fairly obvious and, we suspect, not really new (though we can't cite a specific reference). We highlight it for two main reasons. First, we believe it clarifies the connection between debt and taxes: the right way to think about leverage is not that debt *per se* creates value, via interest tax shields, but that equity potentially destroys value, via double taxation. Second, Proposition 1 simplifies our subsequent analysis of equity financing: we can consider transactions between shareholders and the firm without worrying about where the cash goes to or comes from. For example, the value of a dividend is the same regardless of whether the firm draws down cash or increases borrowing, and it is the dividend payment per se that affects value, not the possible debt transaction.

Equity financing

We now turn to equity financing at date 1. In the following, cash carried forward from the first to the second period is referred to as 'internal equity' while new equity raised is 'external equity.' The ordering of transactions affects the algebra, so we need to be more precise about timing in the model. We assume that any cash payout at date 1 occurs *before* new equity is raised and that capital gains taxes at date 1 are assessed *before* new equity is raised. These assumptions imply that external equity financing doesn't affect capital gains taxes at date 1, simplifying the algebra.[2] Also, we initially assume that all cash distributions are made via share repurchases – which are optimal from a tax standpoint – deferring for the moment our analysis of dividends.

With these assumptions, external equity at date 1 has the same tax costs as external equity in the one-period model. Substituting for C_1' in eq. (5), the firm's cash at date 2 equals

$$C_2 = (C_1 + S_1 - \delta_1)\,[1 + r\,(1 - \tau_c)]. \tag{6}$$

An extra dollar of external equity at date 1, S_1, raises the firm's cash holdings at date 2 by $1 + r\,(1 - \tau_c)$. If earnings are paid out through a share repurchase, this increases the after-tax cashflows to shareholders by $S_1\,[1 + r\,(1 - \tau_c)(1 - \tau_{cg})]$, since the distribution is taxed only on the portion that represents capital gains. As before, the tax costs depend on whether the return is higher or lower than the return from investing directly in the riskless asset, $1 + r\,(1 - \tau_i)$.

[2] To clarify, suppose that equity financing is costly from a tax standpoint. Then any equity raised leads to an immediate capital loss, reducing taxes today but raising taxes later. We ignore this effect but, as discussed later, it is minor and does not significantly affect any results.

Proposition 2. *When the firm uses repurchases, the tax benefit of external equity at date 1, or equivalently, the net present value of a new equity issue, equals*

$$PV(S_1) = S_1 \frac{r}{1+r(1-\tau_i)} [(1-\tau_c)(1-\tau_{cg})-(1-\tau_i)] \ . \tag{7}$$

As mentioned above, Proposition 2 assumes that capital gains taxes at date 1 are assessed prior to the equity issue. The present value of S_1 would be attenuated slightly towards zero if we allowed the value impact of S_1 to feed immediately into capital gains.[3] The key fact, however, is that the tax cost of external equity still depends on whether equity taxes, $(1 - \tau_c)(1 - \tau_{cg})$, are higher or lower than debt taxes, $(1 - \tau_i)$, just as in the one-period model.

The results so far match standard trade-off theory. The key differences arise when we consider internal equity; indeed, trade-off theory doesn't even distinguish internal from external equity except when issuance costs are large (see, e.g., Fischer, Heinkel, and Zechner, 1989). We believe the easiest way to understand the results is to compare the extreme cases when the firm either distributes all of its cash at date 1 or retains all of it until date 2. Also, because external financing at date 1 doesn't affect the value of internal equity, we drop terms associated with S_1 below.

The firm arrives at date 1 with cash C_1. If the firm chooses to distribute the cash via a share repurchase, equityholders receive

$$CF_{1,\text{ repurchase}} = C_1 - \tau_{cg} (C_1 - S_0). \tag{8}$$

The second term reflects the fact that taxes are paid only on capital gains, $C_1 - S_0$. Shareholders get no cash at date 2 in this scenario because the firm completely liquidates at date 1.

Alternatively, if the firm decides to retain all of its cash, shareholders don't receive a distribution at date 1 but owe capital gains taxes of

$$CF_{1,\text{ retain}} = -\alpha\, \tau_{cg} (V_1 - S_0), \tag{9}$$

where V_1 is the equity value at date 1 before new equity is issued, derived below, and α represents the fraction of capital gains that are realized and taxed. The tax basis of the shares is originally S_0 at date 0, but after trading it becomes:

$$TB_1 = (1 - \alpha) S_0 + \alpha V_1. \tag{10}$$

[3] Eq. (7) would become

$$PV(S_1) = S_1 \frac{r(1-\alpha\tau_{cg})}{1+r(1-\tau_i)-\alpha\tau_{cg}} [(1-\tau_c)(1-\tau_{cg})-(1-\tau_i)] \ .$$

The derivation of this equation closely parellels the algebra below for internal equity.

By date 2, the firm's cash grows to $C_2 = C_1 [1 + r(1 - \tau_c)]$. After personal taxes, shareholders receive

$$CF_{2,\,retain} = C_2 - \tau_{cg}(C_2 - TB_1). \tag{11}$$

Eq. (11) parellels eq. (8); it simply says that shareholders pay taxes only on the portion of the payout that represents new capital gains. To determine V_1, we assume that equity is valued at date 1 from the perspective of current shareholders given the firm's payout decision. V_1 is therefore equal to the present value of $CF_{2,retain}$. In truth, V_1 isn't precisely pinned down because, with unrealized capital gains, existing shareholders view the firm differently than would a new investor. The exact value isn't critical to the results – it has only a second-order effect – and the assumption that V_1 equals the present value of eq. (11) seems reasonable. Thus, V_1 is given by

$$V_1 = \frac{C_2(1-\tau_{cg})}{1+r(1-\tau_i)} + \frac{\tau_{cg}TB_1}{1+r(1-\tau_i)}. \tag{12}$$

Define β as TB_1 / V_1, the ratio of the tax basis to price at date 1. Substituting for $TB_1 = \beta V_1$ and $C_2 = C_1 [1 + r(1 - \tau_c)]$, and solving for V_1, yields

$$V_1 = C_1(1-\tau_{cg})\frac{1+r(1-\tau_c)}{1+r(1-\tau_i)-\beta\tau_{cg}}. \tag{13}$$

Together, eqs. (8) – (13) say that, if the firm retains all of its cash at date 1, shareholders receive no immediate dividends, pay capital gains taxes of $\alpha\,\tau_{cg}(V_1 - S_0)$ at date 1, and retain a claim worth V_1. Alternatively, shareholders could simply receive an immediate after-tax payout of $C_1(1 - \tau_{cg}) + \tau_{cg}S_0$. The tax benefit of internal equity is the difference between the present value of these two alternatives, which gives the following result.

Proposition 3. *The tax benefit of internal equity at date 1, or equivalently the present value of retained cash vis-à-vis a share repurchase, equals*

$$PV(RE_1) = RE_1\frac{r(1-\tau_{cg})}{1+r(1-\tau_i)-\beta\tau_{cg}}[(1-\tau_c)(1-\beta\tau_{cg})-(1-\tau_i)], \tag{14}$$

where RE_1 is retained equity (equal to C_1 if cash is fully retained) and β is the ratio of the tax basis of equity to current value at date 1.

Proposition 3 is one of our key results. It says that the tax costs of internal equity depend not only on personal and corporate tax rates, as in traditional trade-off theory, but also on the tax basis of investors' shares relative to current price, $\beta = TB_1 / V_1$. Intuitively, β determines how much additional tax is triggered by a share repurchase. If β is low, a share repurchase accelerates the realization of large capital gains which can otherwise be deferred, so retaining equity in the firm has a substantial tax benefit – the deferral of personal taxes – that helps offset the tax costs of equity. Indeed, comparing Propositions 2 and 3, it's clear that internal equity is always less costly than external equity if $\beta < 1$ and, if β is sufficiently low, can actually have tax benefits (positive NPV).

Case 1: $\beta = 0$

The intuition for Proposition 3 is perhaps most transparent when the tax basis of investors' shares is zero, which requires that α and S_0 are both zero. In this case, the PV of internal equity comes down to a simple comparison: shareholders could either receive an after-tax payout at date 1 of $C_1\ (1 - \tau_{cg})$, which they can invest at a rate of $1 + r\ (1 - \tau_i)$, or, if the firm chooses to retain the cash, shareholders could receive an after-tax payout at date 2 of $C_1\ [1 + r\ (1 - \tau_c)]\ (1 - \tau_{cg})$. The main benefit of paying cash to shareholders today, and allowing them to invest directly in the riskfree asset, is that future interest income is taxed only at the personal level; the main cost is that shareholders are forced to pay taxes immediately on first-period earnings. These effects exactly offset when personal and corporate tax rates are the same. More generally, when $\beta = 0$, Proposition 3 simplifies to:

$$\mathrm{PV(RE_1)} = \mathrm{RE_1}\frac{r(1-\tau_{cg})}{1+r(1-\tau_i)}[(1-\tau_c)-(1-\tau_i)]. \tag{15}$$

The sign of eq. (15) depends solely on whether cash held inside or outside the firm earns a higher after-tax interest rate ($1 - \tau_c$ vs. $1 - \tau_i$). The double taxation of equity drops out because it is, in essence, a sunk cost: if $\tau_i = \tau_c$, the present value of taxes is the same regardless of whether the firm pays out cash today or tomorrow, and regardless of the capital gains tax rate.

Case 2: $\beta = 1$

The case above, $\beta = 0$, maximizes the tax benefits of internal equity. Intuitively, β determines how much tax is triggered by a share repurchase or, equivalently, deferred until date 2 by retaining cash inside the firm. The deferral benefit drops as β gets larger and vanishes when β equals one since, in that case, no part of the purchase price represents capital gains. From eq. (10), $\beta = 1$ only if $\alpha = 1$ – that is, only if all capital gains are taxed immediately regardless of the firm's payout decision, so that the tax basis equals the current price. Internal and external equity in this case become essentially equivalent. Proposition 3 simplifies to:

$$\mathrm{PV(RE_1)} = \mathrm{RE_1}\frac{r(1-\tau_{cg})}{1+r(1-\tau_i)-\tau_{cg}}[(1-\tau_c)(1-\tau_{cg})-(1-\tau_i)]$$

$$\approx RE_1 \frac{r}{1+r(1-\tau_i)}[(1-\tau_c)(1-\tau_{cg})-(1-\tau_i)]. \tag{16}$$

The second line is a close approximation to the first if tax rates aren't too big. It is identical to the tax cost of external equity given in Proposition 2.[4]

Thus, internal and external equity are the same, and the tax cost of both is given by eq. (16), only when capital gains are taxed on accrual, i.e., when $\alpha = \beta = 1$. This assumption is implicit in Miller (1977) and in the standard interpretation of trade-off theory. The tax costs of internal equity are always smaller if β is less than one, and might well be negative even when external equity is costly. In fact, if β is less than one and a Miller equilibrium holds for external equity, $(1 - \tau_c)(1 - \tau_{cg}) = (1 - \tau_i)$, Proposition 3 implies that internal equity necessarily has tax benefits.

Dividends

We'll discuss Proposition 3 further in a moment, but it's useful to consider first how the results change if dividends are used instead of repurchases. The motivation for doing so is two-fold. First, firms do use dividends in practice, despite their clear tax disadvantages. Second, the tax literature often assumes that firms have to use dividends for regulatory or agency reasons, so understanding the tax costs of equity when dividends are used allows an easier comparison with prior studies (e.g., King, 1974; Auerbach, 1979; Poterba and Summers, 1985).

The algebra for dividends is similar to that for repurchases; the main difference is that the entire distribution is taxable. We assume that dividends cannot be more than cumulative net income and, at date 2, cash remaining after dividends (equal to contributed capital) is disbursed through a share repurchase. Our analysis again compares the extremes, when the firm either pays a dividend at date 1 equal to first-period earnings or fully retains the cash until date 2.

The firm arrives at date 1 with cash $C_1 = NI_1 + S_0$. If the firm chooses to pay dividends equal to NI_1, shareholders' cashflow at date 1 is

$$CF_{1,div} = NI_1\,(1-\tau_{dv}) - \alpha\,\tau_{cg}\,(V_{1,div} - S_0). \tag{17}$$

The first term is the after-tax dividend and the second term is capital gains tax ($V_{1,div}$ is equity value after

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[4] The small difference in the first line arises because the value implications of retained earnings feed immediately into capital gains taxes at date 1, while the value implications of external equity do not; see our discussion prior to Proposition 2. If internal and external equity are treated the same, the tax costs would be identical when $\alpha = \beta = 1$ (compare the expression in eq. 16 to the expression in footnote 3 when $\alpha = 1$).

the dividend payment, derived in a moment). The new tax basis of equity becomes $TB_1 = S_0 + \alpha\,(V_{1,div} - S_0)$. At date 2, the firm's cash holdings grow to $S_0\,[1 + r\,(1 - \tau_c)]$, of which $S_0\,r\,(1 - \tau_c)$ represents net income that is paid out as a dividend and the remainder, S_0, is paid out as a liquidating repurchase. Shareholders receive, after taxes, the following at date 2:

$$CF_{2,\,div} = S_0\,[1 + r\,(1 - \tau_c)(1 - \tau_{dv})] + \alpha\,\tau_{cg}\,(V_{1,div} - S_0). \tag{18}$$

$V_{1,div}$ is determined by the present value (at date 1) of $CF_{2,div}$, and the total value of equity at date 1 is the sum of $V_{1,div}$ and $CF_{1,div}$.

Alternatively, the firm can choose to retain cash until date 2. In this case, shareholders don't receive a dividend at date 1 but owe capital gains taxes of

$$CF_{1,retain} = -\alpha\,\tau_{cg}\,(V_{1,retain} - S_0). \tag{19}$$

At date 2, the firm's cash holdings grow to $C_2 = C_1\,[1 + r\,(1 - \tau_c)] = (NI_1 + S_0)\,[1 + r\,(1 - \tau_c)]$, of which $NI_1 + (NI_1 + S_0)\,r\,(1 - \tau_c)$ represents cumulative earnings, paid out as a dividend, and the remainder S_0 is paid out as a liquidating repurchase. After personal taxes, shareholders receive

$$CF_{2,retain} = NI_1(1 - \tau_{dv})[1 + r\,(1 - \tau_c)] \;+\; S_0\,[1 + r\,(1 - \tau_c)(1 - \tau_{dv})] \;+\; \alpha\,\tau_{cg}\,(V_{1,retain} - S_0). \tag{20}$$

Again, $V_{1,retain}$ is found as the present value of eq. (20), and the total value of equity is the sum of $V_{1,retain}$ and $CF_{1,retain}$. The tax benefit of internal equity is then just the difference between the present value of the two alternative policies, paying a dividend today vs. retaining the cash until date 2. After some algebra, we have the following result.

Proposition 4. *When the firm uses dividends, the tax benefit of internal equity at date 1 (or equivalently the present value of retained earnings vis-à-vis dividends) equals*

$$PV(RE_1) = RE_1\,\frac{r(1-\tau_{dv})}{1+r(1-\tau_i)-\alpha\tau_{cg}}\,[(1-\tau_c)(1-\alpha\tau_{cg})-(1-\tau_i)]\ , \tag{21}$$

where RE_1 is retained earnings (equal to NI_1 if earnings are fully retained) and α is the fraction of capital gains taxed at date 1.

Proposition 4 differs from Proposition 3 in two respects. First, the numerator contains $1 - \tau_{dv}$ rather than $1 - \tau_{cg}$ because distributions are now taxed at the dividend rate. Second, the term in brackets depends on α, not β. Intuitively, when repurchases are used, the ratio of the tax basis to current price, β, determines how much tax is triggered today by a repurchase (and how much is deferred by retaining cash). But α plays this role when dividends are used: the entire distribution is taxed if the firm pays dividends, but only a fraction α is taxed, via capital gains, if the firm chooses to retain cash.

It is important that the capital gains tax rate, not the dividend tax rate, appears in the term in brackets. Even when the firm uses dividends, the cost of internal equity depends on whether $(1 - \tau_c)(1 - \alpha\tau_{cg})$ is bigger than or less than $(1 - \tau_i)$. The after-tax rate on dividends, $1 - \tau_{dv}$ enters eq. (21) only multiplicatively, so does not determine whether internal equity is better than debt. [Auerbach (1979) shows a similar result for the special case when $\alpha = 1$.] Intuitively, dividend taxes are a sunk cost regardless of the payout decision, and the present value of retained earnings depends solely (in sign, not magnitude) on capital gains taxes. This result is worth repeating: the cost of internal equity depends primarily on the capital gains tax rate even when firms use dividends.

Our earlier analysis of external equity assumed that firms use share repurchases. When dividends are used, Proposition 2 changes only by the substitution of τ_{dv} for τ_{cg} in the term in brackets:

$$PV(S_1) = S_1 \frac{r}{1 + r(1 - \tau_i)}[(1 - \tau_c)(1 - \tau_{dv}) - (1 - \tau_i)]. \tag{22}$$

This equation ignores the immediate effect of S_1 on capital gains taxes, as discussed previously. If we take that effect into account, the cost of external equity becomes

$$PV(S_1) = S_1 \frac{r(1 - \alpha\tau_{cg})}{1 + r(1 - \tau_i) - \alpha\tau_{cg}}[(1 - \tau_c)(1 - \tau_{dv}) - (1 - \tau_i)]. \tag{23}$$

Comparing this to Proposition 4, internal equity is less costly than external equity if $\alpha\tau_{cg} < \tau_{dv}$, which of course holds as long as $\tau_{cg} < \tau_{div}$. [King (1974) and Auerbach (1979) show a similar result for $\alpha = 1$.] Thus, dividends don't change our key qualitative conclusion: internal equity is less costly than external equity, regardless of whether the firm uses dividends or repurchases. If α and/or β is sufficiently low, firms might actually prefer internal equity over debt, even when tax rates are such that they would never want to raise external equity financing.

3. Understanding the literature

The results above have significant implications for a firm's capital structure, payout policy, and cost of capital. The model also clarifies a number of prior studies. We discuss the literature first because it shapes the way we think about taxes and financing decisions.

Most clearly, our results show that the traditional view of debt and taxes, as exemplified by Miller (1977), is valid only when capital gains are taxed on accrual, i.e., when $\alpha = \beta = 1$. The main features of the traditional view are (i) internal and external equity are assumed to be equivalent, and (ii) the tax cost of equity depends on the total taxation of equity relative to debt, $(1 - \tau_c)(1 - \tau_e) - (1 - \tau_i)$. The first statement is generally false and the second is, at best, incomplete (it misses the distinction between internal and external equity and it is unclear about τ_e).

Like Miller, dynamic trade-off models generally don't distinguish between internal and external equity (Fischer, Heinkel, and Zechner, 1989; Leland, 1998; Goldstein, Ju, and Leland, 2001; Stebulaev, 2004). Capital structure dynamics in the models are driven by agency problems and adjustment costs – the focus of the studies – not by a tax advantage of internal over external equity. The literature sometimes acknowledges that, because capital gains are not taxed until they are realized, the effective tax rate on capital gains is less than the statutory rate. But simply allowing for a low effective tax rate isn't sufficient because it misses the differential tax costs of internal and external equity.

In an important recent paper, Hennessy and Whited (2004) present a dynamic model that deviates from the characterization above. Their model allows for personal taxes and, unlike most dynamic theories, it recognizes that retained earnings have different tax effects than new equity financing. For example, Hennessy and Whited argue that debt is more attractive when it substitutes for external equity than when it finances distributions to shareholders, an observation similar to our point that internal equity is less costly than external equity. Because of this similarity and the rather intimidating nature of Hennessy and Whited's dynamic model, it is useful to consider their results more closely. (The following comments also apply to the related analysis of Stiglitz, 1973.)

It turns out that Hennessy and Whited make two key assumptions: (i) investors do not pay capital gains taxes, and (ii) firms implicitly cannot use share repurchases. The tax effects of retained earnings in their model seem to be a special case of Proposition 4 when either α or τ_{cg} is zero (though an exact comparison is hard because of the model's complexity). The stylized examples in their Section I illustrate this point nicely: investors don't pay capital gains tax in any of the examples and retained earnings are beneficial if $\tau_c < \tau_i$, the same conclusion from Proposition 4 when $\alpha = 0$. Hennessy and Whited effectively make the same assumptions in their formal dynamic model: shareholders pay tax on the entire amount of any cash distribution and they otherwise pay no capital gains taxes. These assumptions can be satisfied only if the firm uses dividends and either α or τ_{cg} is zero.

We believe that Hennessy and Whited's predictions would change substantially if they accounted for capital gains taxes. In particular, the assumption that $\alpha\tau_{cg} = 0$ maximizes the tax advantage of internal equity, which is a key source of dynamics in their model. Indeed, our results suggest that, ignoring other considerations like flotation costs, Hennessy and Whited's model might well predict a stable, target debt ratio if it made the same tax-on-accrual assumption implicit in Miller (1977) (if it did, internal and external equity would become equivalent as long as firms can use share repurchases to distribute cash). We hasten to add, however, that we don't regard the tax-on-accrual assumption as empirically valid (we provide evidence later). Our point is simply that assumptions about capital gains taxes are critical for understanding their results.

Our paper also relates to the large public economics literature on dividend taxes. King (1974), Auerbach (1979), Bradford (1981), and Poterba and Summers (1985) study how corporate and personal taxes affect valuation and firms' real investment decisions (Auerbach, 2002, provides a recent survey). Their infinite-period models are similar in spirit to ours, and, like us, they observe that retained earnings are less costly than new equity. [The implications of that result, however, are overlooked by the capital structure literature; see, e.g., Graham's (2003) recent survey.] The main difference with our results in that King et al. assume that firms have to use dividends and that capital gains are taxed on accrual; thus, their results are a special case of Proposition 4 with $\alpha = 1$.

The focus of much of the dividend tax literature – see, in particular, Auerbach (1979) and Poterba and Summers (1985) – is on the 'tax capitalization' or 'trapped equity' view of dividends. This view says that, if firms are prohibited from using share repurchases, payout policy turns out to be irrelevant: in equilibrium, shareholder wealth doesn't change if the firm retains a dollar of earnings vs. pays a dollar of dividends because the present value of taxes is the same in both cases. (In our language, the notion of 'trapped' equity is equivalent to saying that internal equity has zero tax costs.) This view is important because, as Auerbach and Poterba and Summers explain, it has powerful implications for tax policy: if the trapped equity view is accurate, dividend taxes will affect a firm's value but not its cost of capital or investment decisions.

Our results provide an easy way to understand the trapped equity view – and to see that it holds only in special circumstances. From Proposition 4, shareholders are indifferent between dividends and retained earnings only if tax rates are 'just right,' i.e., only if $(1 - \tau_c)(1 - \alpha\tau_{cg}) = (1 - \tau_i)$.[5] Our model *does*, however, confirm the trapped equity prediction about real investment decisions: we show below that, as a general rule, dividend taxes do not affect the cost of capital for internal equity.

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[5] The tax literature often assumes accrual taxation, in which case dividend policy is irrelevant only if $(1 - \tau_c)(1 - \tau_{cg}) = (1 - \tau_i)$. This fact is actually imbedded, though not obvious, in Auerbach's (1979) model. Poterba and Summers (1985) consider a firm that is all-equity financed, so τ_i doesn't enter their analysis; their version of 'trapped equity' requires that the firm always has enough internal cashflow to cover investments, that it has to use dividends rather than repurchases, and that it cannot raise debt.

4. Implications for corporate behavior

The analysis above establishes two key results. First, internal equity is generally less costly than external equity. Second, the tax costs of internal equity depend on α and β, which determine how much tax is triggered by a payout to shareholders. The results have significant implications for thinking about capital structure, payout policy, and the cost of capital.

4.1. Capital structure

A number of implications for capital structure are fairly immediate. First, at a given point in time, the tax incentives to lever up may be substantially smaller than typically assumed. In standard trade-off theory, the tax advantage of debt over 'equity' equals $(1 - \tau_i) - (1 - \tau_c)(1 - \tau_e)$, where τ_e is taken to be a weighted average of the dividend and capital gains tax rates, with weights determined by the firm's dividend payout ratio (see, e.g., Graham, 2000). This formula overstates the tax advantage of leverage for firms with internal cash, who choose between debt and retained earnings, not debt and new equity. In our model, the tax advantage of debt over internal equity depends on $(1 - \tau_i) - (1 - \tau_c)(1 - \alpha\tau_{cg})$ if firms use dividends and $(1 - \tau_i) - (1 - \tau_c)(1 - \beta\tau_{cg})$ if firms use repurchases, neither of which depends on the dividend tax rate. The tax advantage of debt may even be negative if α and β are sufficiently low – that is, firms could find it optimal, for tax reasons, not to increase leverage at all.

Second, the cost differential between internal and external equity suggests that profitable firms, with internal cash, should have less leverage than firms that need external finance (holding all else constant). If firms lever up until the costs of financial distress outweigh the tax advantages of debt, firms with more internal equity will choose lower leverage: a dollar of debt substituted for retained earnings yields fewer tax savings than a dollar of debt substituted for external equity.

Third, capital structure dynamics through time might differ significantly from the predictions of trade-off theory. Trade-off theory is often presumed, for empirical tests, to predict that firms have target debt ratios to which leverage reverts over time. But if internal equity is less costly than external equity, optimal capital structure will be a function of internally-generated cashflows and leverage can wander around without a specific target. Debt will tend to decrease when the firm has an internal cash surplus and increase when it has a cash deficit (the firm faces a trade-off between debt and retained earnings in the first case, but between debt and external equity in the second).

This last observation is perhaps the most interesting. It suggests that, as long as $\alpha < 1$, debt could behave much as it does in the pecking-order theory of Myers (1984) and Myers and Majluf (1984). Indeed, our model suggests a kind of tax-induced pecking order, with debt and internal equity both preferred to external equity (the ordering of debt and internal equity is ambiguous and could change over time, for example, as a function of current leverage). Thus, our model might help explain two findings that have been described as 'major failures' of trade-off theory: (i) profitable firms seem to have too little leverage, and (ii) changes in debt largely absorb short-run variation in internal cash surpluses and deficits (e.g., Shyam-Sunder and Myers, 1999; Fama and French, 2002).

4.2. Payout policy

The model's implications for payout policy stem, in large part, from the observations above. The model is particularly helpful for understanding the so-called 'dividend puzzle,' the view that paying dividends is suboptimal from a tax standpoint. One version of this view says that dividends destroy value because, if firms chose to retain the cash instead, investors could convert highly-taxed dividends into less highly-taxed capital gains (Black, 1976; DeAngelo, 1991; DeAngelo and DeAngelo, 2004). The inference seems to be that retained earnings are preferred if $\tau_{cg} < \tau_{dv}$.

However, if the argument is simply about the *timing* of a payout – dividends will be paid sometime just not necessarily this year – taxes provide an incentive to delay dividends only if internal equity is better than debt, i.e., only if $(1 - \tau_c)(1 - \alpha\tau_{cg}) > (1 - \tau_i)$.[6] The relative tax rates of dividends and capital gains aren't at all important. Further, what we perceive as two commonly held beliefs, that debt levels are too low for profitable firms (with excess cash) and that dividends destroy value for tax reasons, are logically inconsistent with each other: the first says that firms should distribute cash (and raise debt), the second says they should not. Also, if a Miller-like equilibrium holds with respect to internal equity, then we are back to Auerbach's (1979) trapped-equity view: on the margin a dollar of retained earnings is worth the same as a dollar of dividends, so there is no dividend puzzle.

The dividend puzzle is more accurately a statement about the *form* of a cash payout; i.e., given that a payout takes place, repurchases are clearly preferred to dividends (except, perhaps, if $\tau_{cg} > \tau_{dv}$; this is both intuitive and easily shown in our model). Our results do nothing to explain why firms use dividends rather than share repurchases.

As an aside, the model suggests that past financing decisions might affect current payout policy. From

[6] This statement assumes that the firm has excess cash now and in the future (dividends today reduce dividends tomorrow). The incentive to retain cash is higher if external equity might be needed someday. For example, if as a consequence of paying dividends today, the firm might have to raise new equity in a year, then it would have to weigh the tax advantage of internal over external equity (in a year) against the one-year cost of holding cash. Hennessy and Whited (2004) explore this trade-off more formally.

Proposition 3, the tax benefits of internal equity vis-à-vis share repurchases are a decreasing function of β, the tax basis of equity relative to current price:

$$PV(RE_1) = RE_1 \frac{r(1-\tau_{cg})}{1+r(1-\tau_i)-\beta\tau_{cg}}[(1-\tau_c)(1-\beta\tau_{cg})-(1-\tau_i)]\,. \tag{25}$$

Equity financing at date 0 raises the tax basis of investors' shares, which, in turn, raises the tax costs (or reduces the benefits) of retained earnings at date 1. Thus, past equity issues tend to make repurchases more attractive relative to retaining the cash.

4.3. Cost of capital

The traditional view of a firm's cost of capital is fairly straightforward. According to trade-off theory, a firm's cost of capital is a weighted average of the after-tax cost of debt and the cost of equity. The relative weighting of the two is generally assumed to be fairly constant, consistent with the notion that the firm has a target debt ratio.

Our model shows that this view is incomplete. Most important, a firm's cost of capital should depend not only on a firm's mix of debt and equity, but also on its mix of internal and external finance: the tax advantage of internal equity implies that a firm will accept projects with lower returns if they can be financed with retained earnings rather than new equity. In our model, it is easy to show that the cost of internal equity, expressed as a required return, is $r\,(1-\tau_i) / (1-\alpha\tau_{cg})$ if the firm uses dividends and $r\,(1-\tau_i) / (1-\beta\tau_{cg})$ if the firm uses repurchases; the cost of external equity in the first case is $r\,(1-\tau_i) / (1-\tau_{dv})$ and in the second is $r\,(1-\tau_i) / (1-\tau_{cg})$. [The cost of capital is the minimum return, after corporate taxes, that the firm requires on a project depending on how it is financed; the cost of debt is simply $r\,(1-\tau_c)$, the after-tax return on the riskless asset.] Thus, regardless of whether the firm uses dividends or repurchases, the cost of internal equity is generally lower than the cost of external equity, an observation missed by traditional trade-off theory. It is also important that the cost of capital for internal equity doesn't depend on the dividend tax rate, as we noted earlier.

Stepping a bit outside our model, it isn't at all clear how the cost of internal or external equity relates to the expected return on a firm's stock. The standard way to determine a firm's cost of equity is to estimate the rate of return required by investors in the stock market. However, without going into the details, the discount rate implied by equity prices in our model doesn't have to equal either the cost of internal or external equity shown above – that is, as a general rule, the expected stock return doesn't equal the cost of equity financing. A full analysis of these effects is beyond the scope of the paper. In practice, quantifying them precisely is likely to be difficult because we would need to know not only the marginal source of funds today (internal vs. external equity), but also how investments made today affect the marginal source of funds in the future.

A corollary to these arguments is that investment decisions should depend on a firm's internal cashflow. That is, the advantage of internal equity implies that the firm's investment-to-cashflow sensitivity should be positive, consistent with empirical evidence (see, e.g., Fazzari, Hubbard, and Petersen, 1988; Hoshi, Kashyap, and Scharfstein, 1991). The size of this effect will depend on whether the firm uses dividends or repurchases, on corporate and personal taxes, and on the parameters α and β. (Fazzari et al. also observe that taxes might lead to a positive investment-to-cashflow sensitivity; their analysis is based on Auerbach's (1979) model.) In short, our results imply that cost of capital is more complex than suggested by the traditional trade-off model.

5. Tax costs of equity: Empirical evidence

Our results show that the cost of internal equity depends on α, the fraction of capital gains that are realized and taxed each period, and β, the tax basis of investors' shares relative to current price. This section provides estimates of α, β, and the tax costs of equity for a large sample of U.S. corporations from 1966 – 2003. For simplicity, we estimate the parameters for a representative investor who faces typical tax rates on dividends, capital gains, and interest income, and who's tax basis corresponds to the average tax basis of all shareholders. We allow tax rates to change through time to match the historical experience of U.S. investors.

5.1. Tax rates

Figure 1 on the next page shows estimates of marginal tax rates from 1966 – 2003. The corporate tax rates, from Poterba (2004, Table A.5), represent the top marginal tax rate on corporate income in each year. The personal tax rates, from the National Bureau of Economic Research (www.nber.org/taxsim), represent dollar-weighted average marginal tax rates on interest, dividends, and realized long-term capital gains for a large sample of U.S. taxpayers. The rates are estimated by NBER's TAXSIM model, as described by Feenberg and Coutts (1993).

5.2. Estimating the tax basis

The costs of internal equity depend not only on corporate and personal tax rates, but also on the tax basis of investors' shares relative to current price. While the tax basis isn't directly observable, we can get an estimate using price and volume data for each firm. As described below, we construct several measures

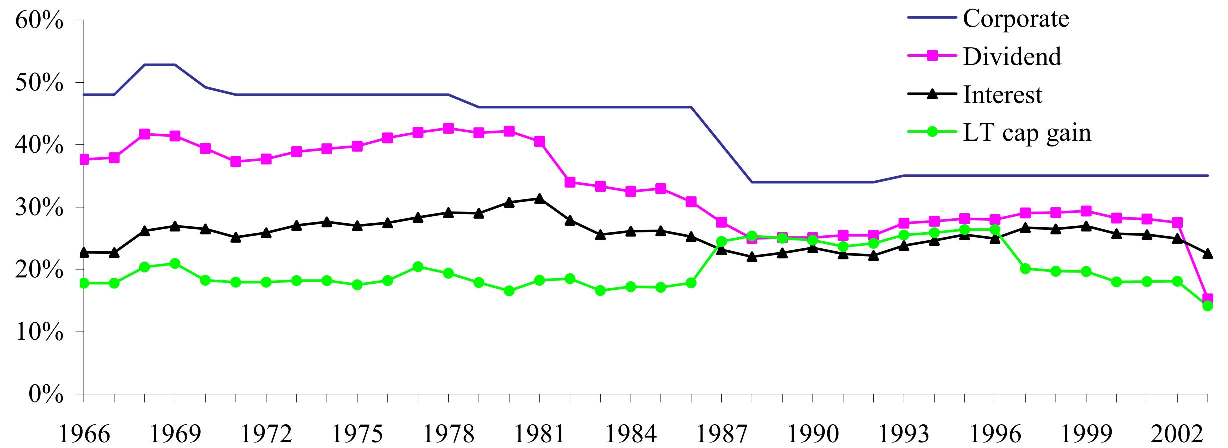


Figure 1. Corporate and personal tax rates, 1966 – 2003
The figure shows the top marginal corporate tax rate and estimates of average marginal personal tax rates on interest, dividends, and realized long-term capital gains. The corporate rates come from Poterba (2004) and the personal rates come from NBER's TAXSIM model.

based on different assumptions about trading behavior.

Proportional trading

In the simplest case, we assume that all investors holding a stock are equally likely to trade, regardless of when they purchased their shares (similar to Grinblatt and Han, 2001). This assumption allows us to recursively estimate the firm's tax basis using observed trading volume (and given an estimate of the beginning tax basis). For example, if the tax basis at the beginning of trading is TB_0, then

$$TB_1 = v_1 P_1 + (1 - v_1) TB_0$$
$$TB_2 = v_2 P_2 + (1 - v_2) TB_1 = v_2 P_2 + (1 - v_2) v_1 P_1 + (1 - v_2)(1 - v_1) TB_0$$
$$TB_3 = v_3 P_3 + (1 - v_3) TB_2 = v_3 P_3 + (1 - v_3) v_2 P_2 + (1 - v_3)(1 - v_2) v_1 P_1 + (1 - v_3)(1 - v_2)(1 - v_1) TB_0,$$

where P_t and v_t are price and trading volume on date t. The logic is that v_t shares are purchased on date t but then a fraction v_{t+k} are sold on each subsequent date. As a result, the tax basis evolves according to $TB_t = v_t P_t + (1 - v_t) TB_{t-1}$. Recursively substituting for TB_{t-i}, the tax basis is a weighted average of past prices where the weights are given by

$$w_t^{t-i} = v_{t-i} \prod_{j=0}^{i-1} (1 - v_{t-j}) . \qquad (26)$$

In principle, the starting tax basis, TB_0, should be the average price at which equity is contributed prior to and at the IPO. Since that isn't publicly available, we try two possible assumptions (it's useful to note, too, that TB_0 becomes less important as trading progresses). A conservative guess – conservative in the sense that is minimizes the tax advantage of internal equity – is to set TB_0 equal to the first observed

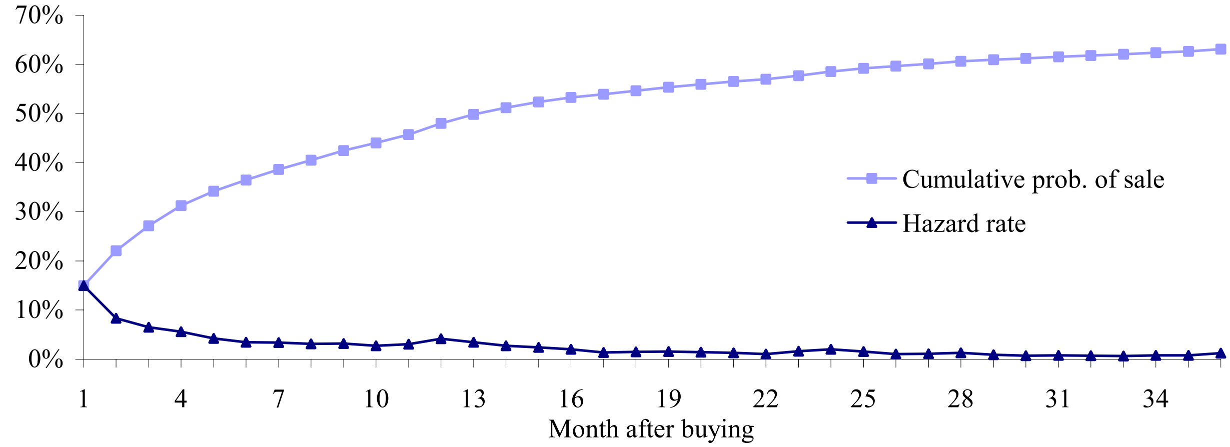


Figure 2. Holding periods and trading probabilities
The graph shows (i) the probability that an individual investor sells in month t conditional on having held the stock for t-1 months (the hazard rate), and (ii) the cumulative probabilty of a sale within the first t months. Source: Ivković, Poterba, and Weisbenner (2004).

price. This price almost certainly overstates TB_0 by a considerable margin since firms are both underpriced at the IPO and go public after being successful. Our second assumption, therefore, sets TB_0 equal to one-half the first trading price.

IPW hazard rates

The algorithm above assumes that trading volume is as likely to come from investors who bought yesterday as from those who bought, say, five years ago. This assumption provides a useful benchmark but probably isn't accurate: Ivković, Poterba, and Weisbenner (IPW; 2004) show that investors are much more likely to sell if they recently bought than if they've already held for many months. More specifically, they estimate investors' propensity to sell as a function of how long they've owned the stock for a large sample of individual investors. The hazard rate, i.e., the probability of a sale in a given month conditional on holding the stock up to that time, is 15% for the first month, declines to less than 4% by month 6, and drops to about 1% by month 35. The hazard rates and the cumulative probability of a sale within t months are shown in Figure 2.

We use IPW's hazard rates to obtain three additional estimates of the tax basis. For the first estimate, we assume that investors trade exactly as predicted by IPW's hazard rates (and that shareholders at the IPO act as if they just bought the shares). Accordingly, trading volume should evolve as follows:

$v_1' = h_1$
$v_2' = h_1 \, v_1' + h_2 \, (1 - v_1')$
$v_3' = h_1 \, v_2' + h_2 \, (1 - h_1) \, v_1' + h_3 \, (1 - h_2) \, (1 - v_1')$,

where h_i is the IPW hazard rate for an investor who still holds after i-1 months. Continuing the sequence, trading volume would eventually converge to a steady state value determined by the h_i (we assume that the hazard-rate curve is flat after month 36). The pattern of h_i also determines the fraction of shares held today that were bought last month, the month before, and so on. We use these fractions to weight past prices in the calculation of the firm's tax basis each month.

Compared to the 'proportional trading' algorithm, this procedure puts more weight on long-term past prices in the calculation of TB_t. In a rough sense, the IPW hazard rates suggest that the market contains two groups of investors: short-term investors who trade heavily and long-term investors who do not. Short-term investors make up a large fraction of the trading volume, while long-term investors hold a relatively large fraction of the firm.

IPW hazard rates scaled and truncated

The procedure just described weights prices in the way implied by IPW's hazard rates but doesn't use a firm's actual trading volume. To incorporate volume into the analysis, we have to make an assumption about which investors cause month-to-month changes in turnover (again, assuming the IPW hazard rates are constant over time, volume is completely determined as a function of time elapsed since the IPO, eventually converging to constant, steady-state value). For our second IPW-based estimate of the tax basis, we assume that all investors' propensities to trade move up and down together, proportionally, to match observed trading volume. In other words, we scale the hazard-rate curve up or down, month-by-month, while maintaining the shape.

As an alternative, our third IPW-based estimate assumes that abnormally *high* volume in a month (i.e., higher than predicted by the IPW hazard rates) is caused entirely by 'day traders' who buy and sell their shares within the month. Such intra-month trading does not affect our estimate of the tax basis, so we simply truncate the volume for the month at the level predicted by IPW's hazard rates. When trading volume is *lower* than predicted, we assume that all investors trade less than predicted and scale the hazard rates down to match actual volume, as above.[7]

5.3. Sample

The sample consists of all (7,066) NYSE and AMEX ordinary common stocks on CRSP from 1966 – 2003. We calculate the tax basis for each firm as described above, using daily data for estimates based on

[7] We also consider an intermediate case in which abnormal volume is caused partly by intra-month traders and partly by a proportional increase in all hazard rates. In this scenario, we arbitrarily truncate volume at twice the level predicted by IPW. These results are similar to those reported in the paper.

proportional trading and monthly data for estimates based on IPW hazard rates (IPW only report monthly estimates of hazard rates). Our estimate of α, the fraction of capital gains taxed and realized each year, is simply the annual trading volume for the firm.

In the statistics and figures below, we truncate the estimates of α and β at one. The logic in doing so for α should be clear: in the extreme, all capital gains and losses might be realized, so α should be at most one (volume higher than one must represent intra-year trading). The logic in doing so for β is more subtle: if β is more than one, the share price must have dropped and investors haven't fully realized their capital losses; this would imply, using our formula for the tax costs of internal equity, that the firm has a big incentive to repurchases shares in order to accelerate the capital loss. This effect seems artificial since investors could realize the capital loss on their own by simply trading in the market; they don't have to wait for a share repurchase. Thus, we assume that, at best, a repurchase doesn't trigger any capital gains that are otherwise delayed (β is at most one).

5.4. Estimation results

Table 2 summarizes our estimates of α (trading volume) and β (the tax basis relative to current price). The statistics are based on a pooled time series and cross section of monthly estimates. We estimate β in four basic ways, as described above, the first method assuming proportional trading and the others based on IPW's hazard rates. All four methods require an assumption about a firm's tax basis when it enters the sample, generally but not always after the firm's IPO. We report results using either the first price (P_1) or half the first price ($.5P_1$) as the initial tax basis.

The table suggests, not surprisingly, that β is less than one for a majority of firms, reflecting the tendency for prices to increase over time. (The fraction below one ranges from 52% for the 'PROP' estimates that assume $TB_1 = P_1$, to 70% for the IPW-truncated estimates that assume $TB_1 = .5P_1$.) Average β is between 0.73 and 0.88 depending on how it is measured. Figure 3, on the subsequent page, shows that average βs vary over time but are generally in the same range (the graph shows estimates based on proportional trading and truncated IPW hazard rates assuming $TB_1 = .5P_1$). Variation across stocks is also substantial; the 10th percentiles for the various measures (not tabulated) are on average 0.51, the 25th percentiles are on average 0.66, and the standard deviations are around 0.20.

In our model, β determines the tax advantage of internal over external equity when firms use share repurchases to distribute cash. The cost of internal equity depends on $(1 - \tau_i) - (1 - \tau_c)(1 - \beta\tau_{cg})$, while the cost of external equity depends on $(1 - \tau_i) - (1 - \tau_c)(1 - \tau_{cg})$, identical except for the absence of β.

Table 2. Trading volume and estimates of the tax basis
The table shows summary statistics for annual trading volume and estimates of shareholders' tax basis relative to current price, both updated monthly. The sample consists of 7,066 NYSE and AMEX stock from 1966 – 2003. The tax basis is estimated four ways as described in Section 5.2. The first estimate (PROP) assumes that all investors holding a stock are equally likely to trade, regardless of when they purchased their shares. The remaining estimates are based on hazard rates from Ivkovic, Poterba, and Weisbenner (2004). The first of these (IPW) infers from the hazard rates the fraction of shares held by investors who bought last month, the month before, and so on; this estimate ignores actual trading volume. The second IPW-based estimate (IPW scaled) scales the hazard rates up or down each month to match observed volume. The third IPW-based estimate (IPW truncated) is like the second but assumes that any abnormally high trading volume in the month (higher than predicted by the IPW hazard rates) comes entirely from intra-month traders.

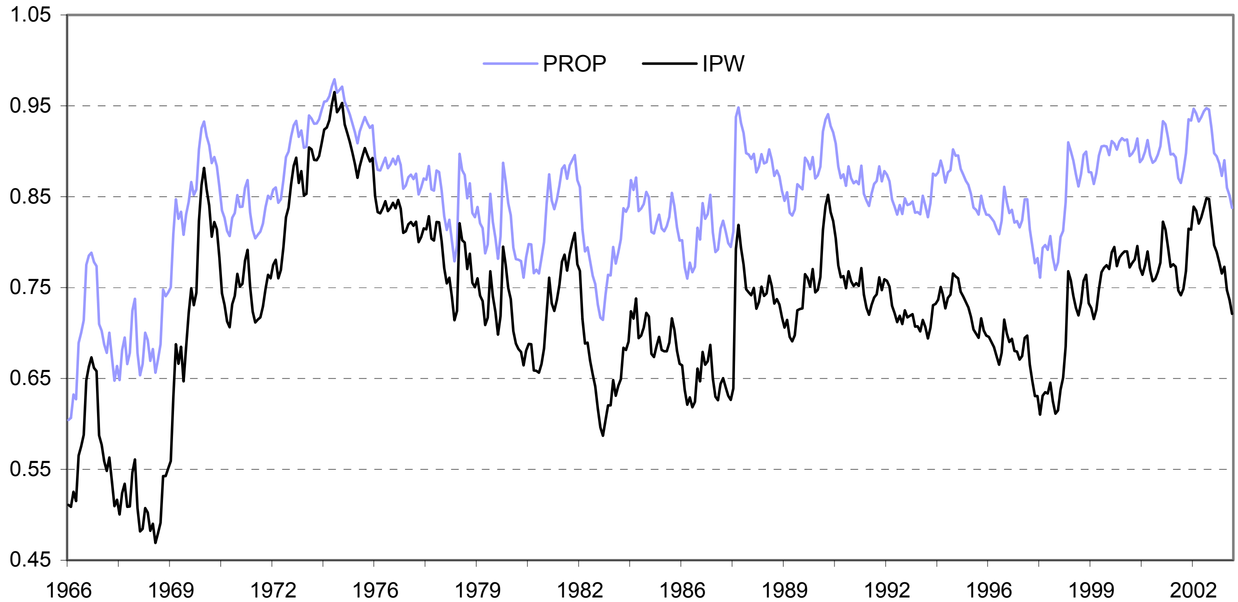
Variable	Mean	Std	Q1	Median	Q3
Trading volume	0.47	0.32	0.20	0.38	0.72
Estimates of the tax basis relative to current price, assuming the initial basis = .5P_1					
PROP	0.85	0.18	0.72	0.92	1.00
IPW	0.77	0.22	0.59	0.80	1.00
IPW scaled	0.80	0.20	0.64	0.84	1.00
IPW truncated	0.73	0.23	0.54	0.73	1.00
Estimates of the tax basis relative to current price, assuming the initial basis = P_1					
PROP	0.88	0.16	0.79	0.98	1.00
IPW	0.81	0.21	0.64	0.88	1.00
IPW scaled	0.85	0.18	0.72	0.94	1.00
IPW truncated	0.80	0.22	0.62	0.87	1.00

Thus, firms with low βs should find retained earnings much better than new equity, while the roughly 35% to 40% of firms with $\beta \geq 1$ face the same tax costs regardless of whether they issue equity or retain cash (assuming they use share repurchases).

If firms use dividends, the tax advantage of internal equity depends on α rather than β. We estimate α by the firm's annual trading volume. Table 2 and Figure 3 show that turnover trends up over time, averaging 0.47 from 1966 – 2003. Turnover is much less than one except at the very end of the sample. This suggests that a large fraction of capital gains taxes are deferred each year, so the tax advantage of internal equity is particularly high when firms use dividends.

Table 3 looks more carefully at the tax costs of equity. We report estimates of one-year tax costs (i.e., not perpetuity values) when firms use either dividends or repurchases, as given in Propositions 2 – 4. Tax costs are a function of α, β, marginal tax rates, and interest rates during the sample period. We use the marginal tax rates from Figure 1 and Tbill rates from the Federal Reserve. In addition, we set corporate

Panel A: Average tax basis



Panel B: Average trading volume

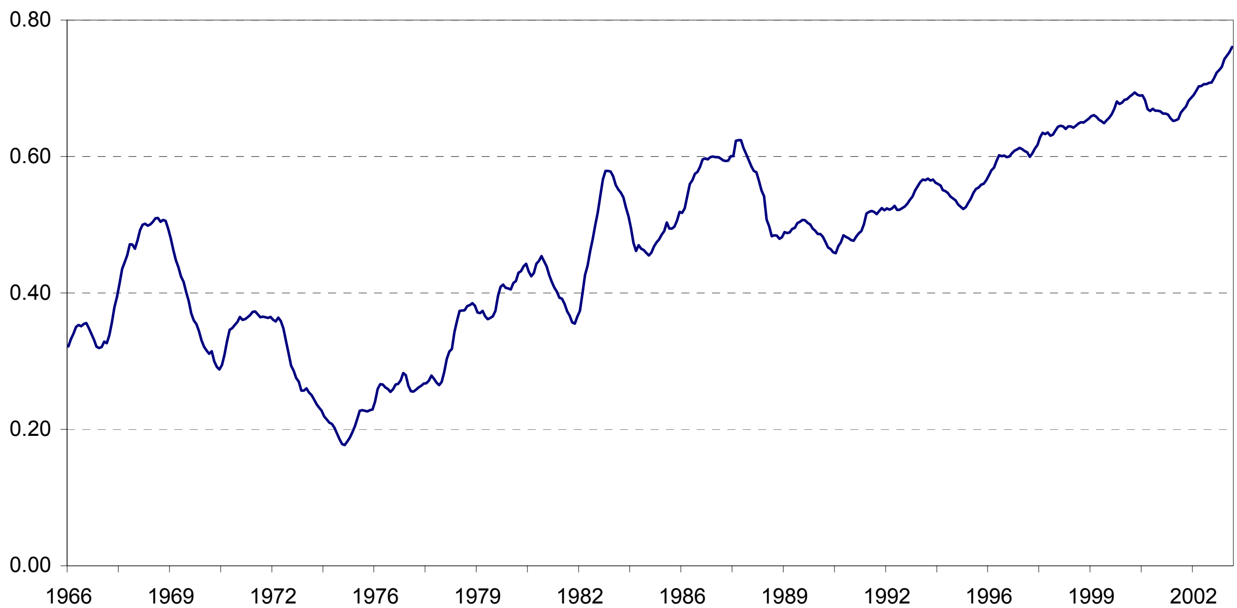


Figure 3. Average trading volume and tax basis

The figure shows annual trading volume and estimates of shareholders' tax basis relative to current price, both updated monthly. The sample consists of 7,066 NYSE and AMEX stock from 1966 – 2003. The average tax basis is estimated either assuming proportional trading (PROP; all investors holding a stock are equally likely to trade, regardless of when they purchased the shares) or using the trading probabilities estimated by Ivkovic, Poterba, and Weisbenner (2004). The IPW-based estimate (IPW truncated) assumes that abnormally high trading volume in the month comes entirely from intra-month traders.

Table 3. Tax costs of internal and external equity

The table summarizes the tax costs of internal and external equity for a sample of 7,066 NYSE and AMEX stocks from 1966 – 2003. Negative numbers signify tax costs, positive numbers signify tax benefits. The numbers represent one-year (not perpetuity) tax costs per dollar of equity, expressed in percent, based on the equations in Section 2. The cost of external equity depends only on tax rates (see Figure 1) and interest rates (one-year Tbill rates from the Federal Reserve). The cost of internal equity depends also on α (the fraction of capital gains realized and taxed in a given year, relevant if firms use dividends) and β (the tax basis relative to current price, relevant if firms use repurchases). We estimate α using the firm's annual trading volume and β using the four methods described in Section 5.2. The first estimate of β (PROP) assumes that all investors holding a stock are equally likely to trade, regardless of when they purchased their shares. The remaining estimates (IPW, IPW-scaled, and IPW-truncated) are based on hazard rates from Ivkovic, Poterba, and Weisbenner (2004). The four methods all assume that a firm's initial tax basis equals one-half its first observed price. The table shows tax cost estimates using the top corporate tax rate and various fractions of the top rate, as indicated.

		τ_c = statutory			τ_c = 0.66 statutory			τ_c = 0.33 statutory			τ_c = 0		
	β estimate	Mean	Std	% > 0	Mean	Std	% > 0	Mean	Std	% > 0	Mean	Std	% > 0
Tax costs if firms use dividends (%)													
External	--	-2.31	1.07	0.00	-1.70	0.82	0.00	-1.11	0.59	0.00	-0.52	0.39	2.33
Internal	--	-1.02	0.45	0.00	-0.42	0.30	2.31	0.17	0.32	72.86	0.76	0.49	95.03
Tax costs if firms use repurchases (%)													
External	--	-1.80	0.72	0.00	-1.05	0.39	0.00	-0.31	0.23	5.25	0.42	0.45	75.02
Internal	PROP	-1.62	0.68	0.00	-0.87	0.38	0.02	-0.15	0.29	25.49	0.58	0.52	87.95
	IPW	-1.54	0.68	0.00	-0.80	0.39	0.04	-0.07	0.31	37.41	0.66	0.53	91.78
	IPW scaled	-1.57	0.67	0.00	-0.82	0.38	0.03	-0.10	0.30	32.71	0.63	0.53	90.24
	IPW truncated	-1.51	0.67	0.00	-0.76	0.38	0.08	-0.03	0.32	43.64	0.69	0.54	92.26

tax rates to various fractions of the top rate, motivated by Graham's (1996) evidence that many firms have relatively low effective marginal tax rates (his average estimates range from 19.1% to 33.2% between 1980 – 1992, compared with top rates of 34% to 46% in Figure 1).

Table 3 shows that external equity can be quite costly unless the corporate tax rate is much smaller than the top rate. At the full statutory rate, the one-year tax cost of new equity averages 1.80% per dollar raised if firms use share repurchases [the cost is roughly $r(1 - \tau_i) - r(1 - \tau_c)(1 - \tau_{cg})$] and 2.31% per dollar if firms use dividends [roughly $r(1 - \tau_i) - r(1 - \tau_c)(1 - \tau_{dv})$]. The costs drop to 1.05% and 1.70%, respectively, if the corporate tax rate is 2/3 the top rate, roughly the average marginal tax rate suggested by Graham's (1996) estimates.

Internal equity can have substantially lower tax costs, especially if firms use dividends. At the full corporate rate, the tax cost of retained earnings averages roughly 1.56% if firms use repurchases (vs. 1.80% for external equity) and 1.02% if firms use dividends (vs. 2.31% for external equity). The costs drop to approximately 0.81% and 0.42%, respectively, if the corporate tax rate is 2/3 the top rate and close to zero if the corporate rate is 1/3 the top rate (in the latter case, the cost of external equity is 0.31% for repurchases and 1.11% for dividends). The advantage of internal over external equity is particularly large when firms use dividends because payouts trigger substantial taxes. Postponing the payout (i.e., financing with retained earnings) is therefore quite valuable.

Figure 4 plots historical estimates of average tax costs assuming a corporate tax rate equal to 2/3 the top rate. For the figure, we report the simple average of the tax costs when firms use dividends or repurchases, to give a sense of the tax costs when firms use both (the cost with repurchases is the average of the four estimates shown in Table 3). The tax costs of equity vary substantially over time, largely driven by changes in interest rates. The cost of external equity ranges from –0.12% to –2.92% and the cost of internal equity ranges from –0.09% to –1.20%. On average, the cost of internal equity is just under half the cost of external equity, –0.62% vs. –1.37%. This evidence, while clearly rough, suggests that the tax advantages of internal equity may be substantial for many firms.

6. Conclusions

The impact of taxes on financing and investment decisions has long been studied in corporate finance. We believe the standard view can be summarized well, if somewhat simplistically, by the observation that the corporate tax advantage of debt, though partially offset as the personal level, gives the firm a big incentive to increase leverage. In the absence of bankruptcy costs, a firm's value increases and its cost of

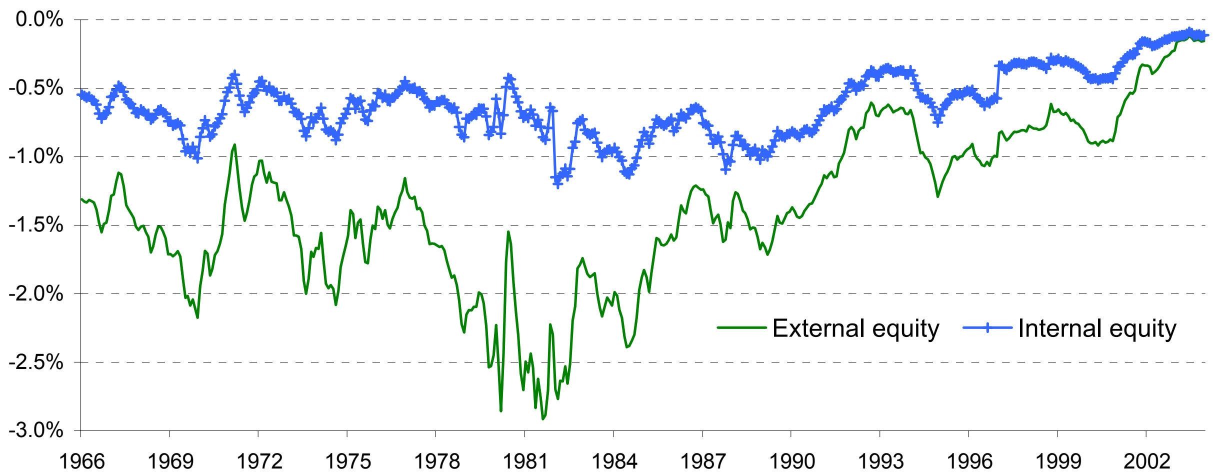


Figure 4. Tax costs of internal and external equity
The figure shows average 1-year tax costs of internal and external equity (as a negative number, per dollar of equity) for a sample of 7,066 NYSE and AMEX stocks from 1966 – 2003. Tax costs are estimated separately for dividends and repurchases, based on the expressions in Section 2, and then averaged for the graph. The cost of external equity depends only on tax rates and interest rates; the cost of internal equity depends also on α and β. We estimate α using the firm's annual trading volume and β using the four methods described in Section 5.2. The corporate tax rate is assumed to be 2/3 the top marginal tax rate.

capital decreases with leverage.

This paper argues that the connection between taxes and financing decisions is both more complicated and more interesting than the traditional view suggests. Our central point is that, under quite general conditions, internal equity is less costly than external equity for tax reasons. This conclusion follows from the simple observation that payouts to shareholders accelerate personal taxes, so retaining cash inside the firm has an advantage – the deferral of personal taxes – that helps offset the tax disadvantage of equity. Thus, the tax cost of internal equity depends not only on corporate and personal tax rates, but also on (i) the fraction of capital gains that are realized and taxed each period, and (ii) the tax basis of investors' shares relative to current price.

We believe the paper makes two main contributions. First, it clarifies the impact of taxes on a firm's capital structure, payout policy, and cost of capital. The tax advantage of internal over external equity suggests that capital structure should be a function of internally generated cashflows, that optimal leverage will wander around over time, and that firms have less incentive to lever up than is typically assumed. Surprisingly, the tax cost of retained earnings depends critically on the capital gains tax rate even when the firm uses dividends.

The paper also shows that the cost of capital for retained earnings, expressed as a rate of return, is lower than the cost of capital for new equity. This result implies that a firm's overall cost of capital depends not only on its mix of debt and equity, as in traditional trade-off theory, but also on its mix of internal and external finance. Further, firms' investment decisions, like their capital structures, should be a function of internally generated cashflows.

The second main contribution is to clarify and connect the capital structure and dividend tax literatures. The capital structure literature typically doesn't distinguish internal from external equity, implicitly assuming that capital gains are taxed on accrual and either that firms use only share repurchases or that the dividend and capital gains tax rates are the same. (Hennessy and Whited, 2004, is an exception; see our discussion in Section 3.) The dividend tax literature, in contrast, does observe that taxes drive a wedge between the cost of internal and external equity. Our paper generalizes this result and explores a different set of implications. We also show that the 'trapped equity' view proposed in the tax literature (see, in particular, Auerbach, 1979, and Poterba and Summers, 1985) will hold only if tax rates are just right, i.e., only if a Miller-like equilibrium holds.

We believe our main observations are quite general, but the formal analysis clearly makes many simplifying assumptions. In particular, we largely ignore uncertainty, we avoid the complications that arise with many or infinite periods (though an extension to infinite periods, at the cost of a few additional assumptions, is available on request), and, perhaps most importantly, we gloss over investor heterogeneity in tax rates and trading behavior. Understanding how these assumptions affect the results would be both useful and quite challenging.

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