FIRM VALUATIONS, THE COST OF CAPITAL AND THE TAX TREATMENT OF CAPITAL GAINS

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By recognising the cash flow characteristics of personal taxes on dividends Auerbach [1], Bradford [9] and King [14] find they reduce the current value of a firm’s equity without affecting the marginal cost of capital funded from retained earnings. This paper draws on work by Boadway and Bruce [8] to show why personal taxes levied on realized capital gains have the same effects, where the common practice of approximating them with accrual based taxes set at lower rates is misleading. We use these findings to recommend reforms to dividend imputation schemes that would convert progressive personal taxes on (taxed) equity income into accrual based taxes.

Key Words: Capital Gains Taxation, Imputation Tax Credits

JEL Classification: H20; G30

1. INTRODUCTION

The traditional or ‘old’ view of the classical corporate tax system argues the combined corporate and personal taxes reduce investment in the corporate sector by raising the cost of capital.¹

¹Harberger [11] examines the way the corporate tax affects the allocation of resources in a two sector general equilibrium model. The role of personal taxes are considered in appended notes where it is argued they raise the cost of capital and exacerbate the resource flows from the corporate to the non-corporate sectors. Miller [16] also uses the double tax relationships to explain the debt-equity and payout policy choices of corporate firms. We argue below that personal taxes have no affect on the cost of capital, whereas they do affect payout policy choices.
in practice personal tax liabilities arise only at the time it is distributed as dividends and realized capital gains. These taxes give shareholders an incentive to realize income later, and losses earlier, to reduce their effective tax rates. Auerbach [1], Bradford [9] and King [14] recognize this important feature of the tax treatment of dividends in their ‘new’ view of corporate taxation, where dividend taxes have a capitalization effect. That is, they have the characteristics of cash flow taxes that reduce the market value of equity without changing the cost of capital funded from retained earnings.2 Personal taxes on capital gains, however, are modelled as accrual taxes, but they are set at lower rates to reflect the fact they are taxed at realization.3 And that is how they are approximated in most studies. (For examples see Auerbach [2], Bailey [5], Benge [6], Sinn [22] and Zodrow [30].)

We extend the ‘new’ view in this paper by replacing accrual based taxes on capital gains with realization based taxes to reflect their treatment in most countries.4 Like dividend taxes, they do not affect the cost of capital funded from retained earnings despite an important, but subtle, difference between them. As noted by Boadway and Bruce [8], all funds distributed to shareholders as dividends are subject to tax, while funds distributed through share repurchases are a mix of capital gains, which are taxable, and repayments of capital, which are not.5 Consequently, the personal tax rates on funds distributed through share repurchases change over time with share prices, and consistent with conventional wisdom about the properties of time dependent cash flows taxes, Boadway and Bruce find they affect the cost of capital for all-equity firms.6 But when firms can also trade debt the interest rate after corporate tax determines the opportunity

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2Personal taxes on dividends and realised gains affect the cost of capital funded from new shares by reducing their current market prices. For a clear exposition of this see Sinn [23] who considers firms at different stages of their lives. Newly established firms with insufficient retained earnings to fund investment will raise outside capital by selling new shares. In contrast, mature firms with sufficient retained earnings to fund investment do so without selling new shares.

3There are no personal taxes on capital gains in the analysis by Bradford.

4There are two main reasons why most governments do not tax capital gains on accrual. First, investors may not be able to pay the tax without selling the asset when they face liquidity constraints, and second, it is difficult to determine how some asset values change over time due to the absence of markets where identical assets trade regularly.

5Stiglitz [25] considers circumstances where shareholders with finite time horizons have a preference for firms to retain taxable income and make initial distributions as ‘return of capital’ which are free of personal tax. But realised gains and dividends are combined together as taxed distributions and subject to a constant personal tax rate set at the average of the different tax rates on them. This conceals changes over time in the mix of realised gains and return of capital shareholders receive when they sell shares.

6Boadway and Bruce compare after-tax distributions as realised gains over two future time periods without computing firm valuations. Korinek and Stiglitz [15] obtain a similar result when there are anticipated changes in personal tax rates on dividends in future time periods. Investment by firms facing borrowing constraints are discouraged when payouts to shareholders are subject to higher future tax rates.
cost of equity capital, where the personal tax rates that satisfy this equilibrium relationship for a 
(notional) marginal investor are constant over time.\(^7\) And since these taxes get capitalized into 
firm values they do not affect the cost of capital.

Another feature of realized gains that makes them harder to analyze is they can also be 
initiated by shareholders selling shares at any time to other investors, and not solely by firms 
repurchasing shares. As noted by King [14] and Zodrow [30], this choice is determined by factors 
outside the control of firms. While it makes the timing of realized gains uncertain, it does not 
make personal taxes on them accrual based as the tax liabilities arise from realization choices 
and not the passing of time. Any holding period gains from delaying realization are the same as 
those arising from delaying dividend payments, and attempts to accommodate them as accrual 
based taxes set at lower rates will conceal their true economic effects. Most analysts follow Bailey 
[5] and compute ‘accrual equivalent’ tax rates using estimates of share turnover rates. But this 
provides information about the timing of realized gains that allows us to use realization based 
tax rates without needing to replace them with their ‘accrual equivalents’.

Despite the cash flow characteristics of personal taxes on equity income, the double tax 
relationships associated with the ‘old’ view determine the payout policies of firms under the 
‘new’ view. Indeed, by relaxing share repurchase constraints adopted in expositions of the ‘new’ 
view we reconcile it with the familiar analysis in Miller [16], where the double tax relationships 
cause investors to divide into tax clienteles for debt and equity. With progressive personal tax 
rates some prefer interest, while others prefer realized gains, but no taxable investor has a tax 
preference for dividends. An important motivation for the ‘new’ view is to explain the payment 
of dividends, which it does by imposing constraints on share repurchases (and its substitutes, 
including takeovers and inter-corporate share trading). When firms cannot repurchase shares 
they are forced to pay equity income as dividends.\(^8\) But as Sinn [23] points out, this explanation

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\(^7\)In the absence of default costs price taking firms are willing to trade debt and equity when the interest rate 
after corporate tax is equal to the rate of return on equity (with the two securities being equally risky at the 
margin). If the interest rate after corporate tax is higher they supply only equity, while the reverse applies when it 
is lower. Marginal investors have tax preferences that preserve this equilibrium relationship, but none are needed 
for the two securities to trade. So long as there are investors with a tax preference for equity and others with a 
tax preference for debt they will both trade, and when they do, they will have the same marginal cost. Thus, it 
is the tax rates for the (notional) marginal investor that get capitalised into firm values.

\(^8\)In the US the Inland Revenue Service can reclassify income distributed through share repurchases as dividends 
for tax purposes when it deems these share trades are undertaken to reduce personal tax. Zodrow [30] (p.501) 
argues “the recent explosion in share repurchases not subject to such reclassification suggests that even if the 
assumption that profits must eventually be distributed as taxable dividends was once reasonable, it is now
for the dividend puzzle is a separate issue to the finding that dividend taxes have no affect on the cost of capital.

Clearly, the cash flow characteristics of taxes on realized gains apply to any capital asset, and not just corporate equity. In practice, most taxes are a mixture of income and cash flow taxes. Consider the treatment of human capital where wages and salaries are subject to personal tax whereas changes in the value of human capital are untaxed. Thus, they are not accrual based taxes, nor are they cash flow taxes due to the absence of tax deductions on investments in human capital.

In response to the greater international mobility of capital many countries have reduced the level of taxation on capital income by integrating corporate and personal taxes. Most have adopted some form of imputation where corporate tax revenue is credited to shareholders as an offset against their personal tax liabilities once (taxed) equity income is distributed to them. By using the corporate tax as a withholding tax, realization based personal taxes are converted into full accrual taxes whenever the personal tax rates are less than or equal to the corporate rate. Under dividend imputation corporate tax credits are restricted to (taxed) equity income distributed as dividends. It is the most common form of imputation, where full dividend imputation applies in Australia, New Zealand and the Nordic Countries of Finland, Norway and Sweden, while Canada, France and the United Kingdom have partial dividend imputation. But this leaves realized gains subject to combined corporate and personal taxes, which are a mixture of accrual and realization based taxes that create investor preferences for firm payout policies, where high tax investors can have a preference for realized gains, and low tax investors a preference for dividends and interest.

We show how all the personal taxes on (taxed) equity income can be converted into accrual taxes by comprehensive imputation which fully integrates corporate and personal taxes by granting corporate tax credits on distributions as dividends and realized gains. Norway adopted untenable.” Contemporary explanations for the dividend puzzle rely on information signalling when there is asymmetric information between shareholders and firm managers. Sarig [20] finds empirical evidence for the role of dividends as information signals.

Shareholders with marginal rates equal to the corporate rate exhaust tax credits as they accrue, while those with lower rates preserve the value of excess credits without affecting inter-temporal consumption by realising income as it accrues and then reinvesting it back in the firm. In contrast, there are holding period gains for shareholders with tax rates above the corporate rate.

In 2003 the Singapore Government replaced dividend imputation with a one-tier corporate tax system that exempts all dividends from personal tax when paid from taxed equity income.
comprehensive imputation as a component of its 1992 tax reforms to reduce the level of taxation on capital income under a dual tax system.\footnote{Sørensen [24] provides a clear summary of the dual tax system adopted by Norway and the subsequent changes to avoid income shifting by closely held firms. The dual tax systems adopted in Finland, Norway and Sweden impose a flat uniform personal tax on capital income which is set equal to the corporate tax rate, while labour income is subject to progressive marginal tax rates with the lowest rate set at the uniform tax on capital income. Corporate tax is credited to shareholders through dividend imputation in Finland and Sweden, while Norway adopted comprehensive imputation. They could have instead chosen to exempt all corporate income from personal tax and not credited corporate tax revenue to shareholders. But that would have also exempted preference income from any tax.} One possible explanation for it not being adopted more widely, especially in countries with dividend imputation, is concern about the additional administrative costs from having to record corporate tax credits for each shareholder over the time they hold shares. If capital gains are only ever realized by firms repurchasing shares they can be treated in the same way as dividends. That is, the tax credits can be attached like coupons to the (taxed) income distributed by firms to shareholders. But that is not possible when investors can also realize gains by trading shares with each other. It therefore means the tax credits on retained income must be recorded for each shareholder as they accrue. Another explanation for countries not adopting comprehensive imputation might be the different way personal taxes on dividends and realized gains are modelled in the formal analysis of their economic effects. In particular, where the taxes on dividends are realization based, while on realized gains they are accrual based.\footnote{At the time Australia and New Zealand adopted dividend imputation little, if any, serious consideration was given to granting tax credits on realised capital gains. Studies of the economic effects by Benge [6], Benge and Robinson [7] and Sieper [21], model personal taxes on realised gains as accrual based taxes set at lower rates. While there were no personal taxes on realised gains in New Zealand at the time, dividend imputation did not harmonise their tax treatment with dividends. In particular, realised gains were taxed on accrual at the corporate rate for all shareholders, whereas dividends were taxed on accrual at their personal tax rates (which were initially less than or equal to the corporate rate).}

Comprehensive imputation makes progressive personal taxes holding period neutral when the highest marginal personal tax rate is set at or below the corporate rate, and firms have no (untaxed) preference income.\footnote{In Australia and New Zealand the top marginal personal tax rate is higher than the corporate tax rate.} Preference income arises when economic income exceeds taxable income due to accelerated depreciation allowances and differences in measured and economic depreciation. Shareholders want firms to retain this income as it is only taxed at realization. When Norway adopted comprehensive imputation steps were taken to eliminate preference income by setting depreciation allowances as close as possible to economic depreciation. While comprehensive imputation subjects (taxed) business income in the corporate sector to accrual based personal taxes, remaining business income would be subject to realization based...
personal taxes. They could also be converted into accrual taxes by renaming the corporate tax a business tax and applying it to all business income as a withholding tax. Based on our main finding in this paper, that personal taxes on realized gains have the same economic effects as dividend taxes, comprehensive imputation seems a natural policy response, especially when the objective is to tax income from all sources for each investor at their marginal personal tax rate. Whether this approach removes the holding period gains and losses at lower administrative cost than the generalized cash flow tax proposed by Auerbach and Bradford [3], is an open question. It taxes marginal capital income without needing to measure income, and is not subject to the liquidity problems associated with the standard cash flow tax proposed by Vickery [29].\textsuperscript{14}

We compare the different effects of accrual and realization based taxes in section 2 by looking at their separate impacts on the current value of an asset with pre-determined net cash flows. This provides useful insights for the formal analysis which commences in section 3 where the market valuation of a corporate firm is derived under a classical corporate tax system in a modified version of the certainty model used by Auerbach [1]. The corporate and personal taxes on equity income are then integrated using imputation tax credits in section 4, where the analysis commences with dividend imputation to provide a platform for recommending comprehensive imputation.

2. ACCRUAL VS. REALIZATION BASED TAXES - A PRIMER

Consider a capital asset with value $V_t$ and pre-determined net cash flows $X_t$ in each period $t$ over an infinite horizon. When the marginal cost of capital is constant at rate $\rho$ it generates after-tax income equal to its opportunity cost in every time period $t - 1$ to $t$, with:

$$\rho V_{t-1} = (1 - \theta)X_t + (1 - c)\Delta V_t,$$

where $\Delta V_t = V_t - V_{t-1}$ is the change in the assets’ value. The net cash flows are taxed at rate $\theta$ while the capital gains are taxed at rate $c$, and they are set equal to each other (with $\theta = c$) for a comprehensive income tax, where the current value of the asset can be solved using the\textsuperscript{14}The retrospective capital gains tax rate in Auerbach [2] is a special case of the generalised cash flow tax that imposes an accrual tax on an ex-ante basis using certainty equivalent measures of the tax liability to make investors holding-period neutral.
transversality condition $\lim_{T \to -\infty} [1 + \rho/(1 - c)]^{-T} V_T = 0$, as:

$$V_{t-1} = \sum_{s=0}^{\infty} \frac{X_{t+s}}{(1 + \frac{\rho}{1 - c})^{s+1}}. \quad (1)$$

As an accrual based tax it reduces the value of the asset by raising the cost of capital. If the tax is confined to the net cash flows (with $c = 0$), the asset value is:

$$V_{t-1} = (1 - \theta) \sum_{s=0}^{\infty} \frac{X_{t+s}}{(1 + \rho)^{s+1}}. \quad (2)$$

As a realization based tax it reduces the current value of the asset through a scaling coefficient on the net cash flows without changing the cost of capital. Thus, it has a ‘capitalization’ effect, and in that sense has the characteristics of a cash flow tax. Indeed, if we also allow a tax deduction for the initial purchase price of the asset then it becomes a cash flow tax which just taxes economic rent.

The two taxes are equivalent when the asset value is constant over time (with $\Delta V_t = 0$), and that occurs here when the net cash flows are constant. With the accrual tax the asset value is $V_{t-1} = (1 - c)X/\rho$, which is the same as the asset value with the realization based tax set at the same rate (with $c = \theta$). Once the asset value changes over time the taxes have different tax bases. If the net cash flows rise in every future time period the asset has a lower value under the accrual tax, while it is a higher value when the net cash flows fall.

Despite the added complexity of allowing firms to convert cash flows into capital gains by retaining and investing earnings, and by introducing debt and equity finance which are taxed differently, the simple properties of the two types of taxes identified here will also apply to the current valuations of corporate firms.

3. FIRM VALUES WITH A CLASSICAL CORPORATE TAX

A large literature has examined the economic effects of the classical corporate tax system which taxes equity income at the corporate rate with interest being a deductible expense. Once the firm distributes income to investors as interest, dividends and realized capital gains it is also

\footnote{For simplicity we assume the tax system allows full loss offset so that any tax deductions on capital losses are paid to the asset holder.}
taxed at the personal level. The different taxes are summarized in the following table.

<table>
<thead>
<tr>
<th>Taxes</th>
<th>Interest</th>
<th>Dividends</th>
<th>Realized Gains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate</td>
<td>$\tau$</td>
<td>$\tau$</td>
<td></td>
</tr>
<tr>
<td>Personal</td>
<td>$\Phi$</td>
<td>$\theta$</td>
<td>$c$</td>
</tr>
</tbody>
</table>

Equity income is therefore taxed twice, once on accrual at the corporate tax rate $\tau$, and then again by personal taxes when distributed as dividends at rate $\theta$ and realized gains at rate $c$, whereas interest is subject only to personal tax at rate $\Phi$. In the next section we derive the value of a corporate firm when all distributions are taxed at realization, and then in the following section compare it to the value of the firm when capital gains are subject to personal tax on accrual. We do this to highlight the difference made by the common practice of approximating taxes on realized gains with accrual based taxes.

To simplify the formal analysis we will follow most other studies of the classical corporate tax system in a frictionless certainty model by assuming investors cannot avoid paying personal taxes. Constantinides [10] and Stiglitz [26] show how investors can realize capital and labour income without paying tax by shorting securities with the same characteristics. We rule this out by placing restrictions on investor short-selling, which can be rationalized by arguing there are borrowing constraints and/or trading costs, and we consider firms that need to distribute some of their income to shareholders as dividends and/or realized gains because they do not have growth opportunities to justify full retention in every future time period.\(^{16}\)

### 3.1. Realization Based Personal Taxes

In most countries personal tax rates on realized gains ($c$) are normally set at or below the tax rates on dividends ($\theta$) and interest ($\Phi$), with $c \leq \theta$ and $c \leq \Phi$. For example, in Australia dividends and interest are taxed at the same personal rate, with $\theta = \Phi$, while the personal tax on realized gains is set at half the cash tax rate when shares have been held by investors for at least twelve months, where this leads to $c \leq \theta = \Phi$. To capture the fundamentally different characteristics of corporate and personal taxes we write the after-tax return at each time $t$ for

\(^{16}\)Korinek and Stiglitz [15] and Sinn [23] consider young firms that need to raise new capital to fund investment as well as mature firms that need to distribute some of their income to shareholders as dividends and/or realised gains. Since our primary concern is to study the economic effects of distribution based taxes we focus on mature firms in the following analysis.
investors initially holding shares in a corporate firm at $t-1$, as:

$$Y_t = (1 - \theta)D_t - c_t E_t^R + E_t^0 - E_{t-1}$$  \hspace{1cm} (1)$$

where $D_t$ is the dividend paid, $E_t^R$ the dollar amount distributed through share repurchases, $E_t^0$ the current value of equity outstanding at $t-1$, and $E_{t-1}$ the value of the firm’s equity at $t-1$.\(^{17}\) Equity values are expressed here in ex-dividend terms, while dividend payments and realized gains are measured net of corporate tax. Notice how the marginal tax rate on funds distributed through share repurchases is time dependent ($c_t$) despite the constant marginal tax rate on realized gains ($c$). When firms buy back shares they distribute capital and income to investors, where only income is subject to tax. Consider what happens when a firm repurchases $S_t^R$ of its shares at time $t$. The holder of each share receives its current market price $p_t$, which can be decomposed into a repayment of the initial purchase price $p_0$ plus capital gain $p_t - p_0$, where the after-tax distribution to shareholders is $[p_t - c(p_t - p_0)]S_t^R$. By defining the tax rate on each dollar of funds distributed through share repurchases as $c_t = c (p_t - p_0) / p_t$, we write the tax payment on share repurchases in (1) as $c_t E_t^R$, with $c > c_t$ and $E_t^R = p_t S_t^R$.\(^{18}\) In contrast, all funds distributed as dividends are subject to personal tax at rate $\theta$, where this leads to $\theta > c > c_t$ in the following analysis.

New share sales ($E_t^N$) are included by writing the current value of the firm's equity, as:

$$E_t = E_t^0 + E_t^N - E_t^R,$$  \hspace{1cm} (2)$$

where this allows us to rewrite (1), when shareholders maximize utility by equating their (common) rate of time preference ($\rho_t$) to the after-tax return on equity, as:

$$\rho_t E_{t-1} = (1 - \theta)D_t + (1 - c_t)E_t^R + (E_t - E_{t-1} - E_t^N).$$  \hspace{1cm} (3)$$

The first two terms are dividends and realized gains, respectively, which are subject to both

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\(^{17}\)We follow the approach adopted by Auerbach, and Poterba and Summers by assigning common marginal personal tax rates to the firm’s investors. And these tax rates, which are held constant over time, are for marginal investors with no tax preference for interest, dividends or realised gains when all three trade.

\(^{18}\)This is how the tax rate on realised gains is defined in Broadway and Bruce [8] where they examine the economic effects of tax integration in small open economies.
corporate and personal tax, while the unrealized gains \((E_t - E_{t-1} - E^N_t)\) are net of just corporate tax. These unrealized gains are taxed again in the future when distributed to shareholders as dividends or realized gains, where shareholders can realize gains by selling shares back to firms via share repurchases or to other investors. Share trades between investors are accommodated in (3) by an equal rise in share repurchases and new share sales, with \(dE^R_t - dE^N_t = 0\), as they are equivalent to new share sales from the standpoint of initial shareholders (at \(t - 1\)).

By comparing the after-tax returns to equity in (3) with the corresponding expressions in Auerbach [1] and Poterba and Summers [19] we can see how they tax all the capital gains on accrual at personal rate \(c\), whereas only realized gains are taxed at the personal level in (3). And this is consistent with the tax treatment of dividends. We replicate the analysis of Auerbach, and Poterba and Summers in section 3.2 below.

To obtain the current market value of the firm we add and subtract the change in outstanding debt \((B_t - B_{t-1})\) to the right hand side of (3), where:

\[
\rho_tE_{t-1} = (1 - \theta)D_t + (1 - c_t)E^R_t + (V_t - V_{t-1} - V^N_t),
\]

with \(V_t = B_t + E_t\) being the market value of the firm at each time \(t\), and \(V^N_t = B_t - B_{t-1} + E^N_t\) the value of new debt and equity issued. Since outstanding debt at \(t - 1\) is paid market interest rate \(i_t\) at time \(t\), the change in debt over the period is due solely to new bond sales, with \(B^N_t = B_t - B_{t-1}\). In other words, there are no capital gains from holding debt as its face and market values coincide.

Ultimately, the payouts to debt and equity as dividends and realized gains are constrained by the firm’s net cash flows \(x_t(K_{t-1})\) and the proceeds from selling new securities \((V^N_t)\) less interest.

---

19 The after-tax returns to shareholders is obtained by Poterba and Summers [19] in equation (1.4). Using the notation in this paper it is:

\[
\rho_tE_{t-1} = (1 - \theta)D_t + (1 - c_t)E^R_t + (1 - c)(E_t - E_{t-1} - E^N_t),
\]

where all the capital gains are taxed on accrual at rate \(c\). Auerbach [1] obtains the same expression when equation (5) is used to rewrite equation (8). (The only significant difference in notation is that both papers use symbol \(V\) instead of \(E\) to denote the market valuation of equity, and they model share repurchases as reductions \(E^N_t\).)

20 In most countries dividends and interest are subject to the same personal tax rate for each investor. We use different symbols to isolate their different economic effects in the following analysis. Poterba and Summers [19] look at an all-equity firm, while Auerbach [1] includes debt through the cash flow constraint on payouts to investors.
paid on debt \((1 - \tau)R_t\), with:

\[
G_t = D_t + E_t^R = x_t(K_t-1) + V_t^N - (1 - \tau)R_t,
\]

where the net cash flows are equal to the firm’s operating surplus after corporate tax \((1 - \tau)X_t(K_t-1)\), which is a function of the (non-depreciating) capital invested in the previous period \((K_t-1)\), less new capital investment \(K_t - K_t-1\), with \(x_t(K_t-1) = (1 - \tau)X_t(K_t-1) - (K_t - K_t-1)\). This constraint is imposed on the payouts in (4) by writing dividends and share repurchases as \(D_t = \alpha^D G_t\) and \(E_t^R = \alpha^R G_t\), respectively, with \(\alpha^D + \alpha^R = 1\).

To simplify the analysis without affecting the characteristics of the results we hold \(\rho, i, \text{ and } b\) constant over time. By constraining distributions to shareholders \(G_t\) using equation (5), and adopting the standard convention of defining the debt-value ratio as \(b \equiv B_{t-1}/V_{t-1}\), we can write the interest payment as \(R_t = i_t b V_{t-1}\) and the value of equity as \(E_{t-1} = (1 - b)V_{t-1}\), where the summed after-tax returns to the firm’s initial debt and equity in (4), become:

\[
[p(1-b) + i(1-\tau)(1-\hat{\theta}_t)b]V_{t-1} = (1-\hat{\theta}_t)x_t - \hat{\theta}_t V_t^N + V_t - V_{t-1},
\]

with \(\hat{\theta}_t = \alpha^D \theta_t + \alpha^R \epsilon_t\) being the weighted average tax rate on distributions as dividends and realized gains. After rearranging terms and solving this expression forward using the transversality condition \(\lim_{T \to \infty} \prod_{s=t}^T (1 + r_s)^{-1} V_T = 0\), we find the current value of the firm is:

\[
V_{t-1} = \sum_{s=0}^{t+s} \prod_{z=t}^{t+s} (1 + r_z)^{-1} \left\{ \frac{(1-\hat{\theta}_{t+s})x_{t+s} - \hat{\theta}_{t+s} E_{t+s}^N}{1-\theta_{t+s}b} \right\},
\]

with \(r_z = [p(1-b) + i(1-\tau)(1-\hat{\theta}_z)b]/(1-\hat{\theta}_z b)\) being the cost of capital.

Despite the apparent complexity of this expression there are relatively straightforward explanations for the role of the tax terms. Realization based personal taxes on equity income have the characteristics of cash flow taxes that reduce payouts to shareholders through the scaling coefficient on the net cash flows without affecting the cost of capital, where higher leverage provides a

\(\footnote{We define \(\alpha^D\) and \(\alpha^R\) as the proportions of distributions \(G_t\) paid as dividends and share repurchases, respectively. To simplify the notation they are assumed constant over time. This is justified when investor tax preferences are also constant.}\)

\(\footnote{This expression is obtained by using \(V_t^N = B_t - B_{t-1} + E_t^N\).}\)
tax shield. The role of the tax terms in the coefficient on new share sales is less obvious because it undoes implicit tax deductions provided by the taxes on the net cash flows. We illustrate the role of the personal taxes more clearly in the following section.

3.1.1. Payout Policy and the Cost of Capital

In a competitive equilibrium profit maximizing firms choose their leverage and payout policies to minimize the cost of capital. If debt and equity both trade, optimally chosen leverage satisfies:

$$\frac{dr_t}{db} = \frac{[i(1 - \tau) - \rho(1 - \hat{\theta}_t)]}{(1 - \hat{\theta}_t b)^2} = 0,$$

where firms are indifferent when $i(1 - \tau) = \rho$.

While none of the personal taxes play a role in this decision, they do affect payout policy, with investors being indifferent between interest, dividends and realized gains, respectively, when $i(1 - \Phi) = \rho(1 - \theta) = \rho(1 - c_t)$. After combining this with the firm’s indifference condition we obtain the familiar double tax relationships for the marginal investor ($M$) in Miller (1977), where $(1 - \Phi_M) = (1 - \tau)(1 - \theta^M) = (1 - \tau)(1 - c_t^M)$. Whenever interest and dividends are subject to the same marginal personal tax rates (with $\Phi = \theta$), we have $(1 - \Phi) > (1 - \tau)(1 - \theta) < (1 - \tau)(1 - c_t)$ for all investors, where no dividends are paid.

All high-tax investors ($\Phi > \tau$) with a tax preference for realized gains hold shares, while those with a tax preference for interest hold debt.25

The effects of the personal taxes on the cost of capital are isolated by deriving the optimality condition for investment in each period $t - 1$ using (7) when no dividends are paid, with $\hat{\theta}_t = c_t$.

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23 When this indifference condition holds for firms the Modigliani-Miller [17] leverage irrelevance theorem holds.

24 If realised gains are ruled out by constraints on share repurchases and inter-corporate equity the investor indifference condition for interest and dividends becomes $i(1 - \Phi) = \rho(1 - \theta)$. Using the indifference condition for firms, with $i(1 - \tau) = \rho$, we find the tax relationship for the marginal investor then satisfies $\Phi_M = (1 - \tau)(1 - \theta^M)$. Thus, no equity trades whenever $\Phi = \theta$, unless there are leverage related costs to offset the corporate tax deduction on interest. A large literature has examined costly default arising from asymmetric information between investors and firm managers about the risk borne by bondholders. This work is summarised in Tirole [28] and Harris and Raviv [12].

25 As noted earlier, marginal investors are not required for debt and equity to trade. So long as some investors have a tax preference for debt and others a tax preference for equity, both securities will trade. And when they do, the indifference condition for firms must hold, where the tax rates for the marginal investor are consistent with this relationship between the security returns. These tax clienteles also arise under uncertainty if there is common information in a frictionless competitive capital market. Firms (or financial intermediaries) will provide investors with risky mutual funds that allow them to satisfy their risk preferences by holding only tax preferred securities. In effect, the capital market is double complete for investors. In practice, however, that is not the case due to trading costs, where investors hold bundles of debt and equity to trade off their risk and tax preferences in the manner described by Auerbach and King [4]. When firms can bundle securities into portfolios at lower cost they create mutual funds to attract investors with different risk and tax preferences. Kim, Lewellen and McConnell [13] find empirical evidence for these shareholder leverage clienteles in market data for the US.
as:

\[
\frac{1 - ct - 1 b}{1 - c t b} (1 - \tau)X_t' = \left(\frac{1 - ct - 1}{1 - c t}\right) (1 + r_t) - 1.26
\]

It collapses to the familiar condition \((1 - \tau)X_t' = r_t\) when the personal tax rate on realized gains is constant over time, with \(c_{t-1} = c_t\). And that is the case when debt and equity both trade because the tax rates for the (notional) marginal investor determine the value of the firm in (7) that pays no dividends, with \((1 - \Phi^M) = (1 - \tau)(1 - c_t^M)\). After rearranging terms we find the tax on realized gains \(c_t^M = c^M = (\Phi^M - \tau)/(1 - \tau)\) is constant for unchanged \(\Phi^M\) and \(\tau\).27 Investors may move between the tax clienteles, but without affecting this tax relationship when firms can trade both securities in every period.28

The following special cases will highlight the role of the different taxes in (7).

(i) Since all the taxes apply to equity income the current value of an all-debt firm is independent of \(\tau, \theta\) and \(c\). This is confirmed by setting \(b = 1\) and \(E^N_t = 0\), where from (7) we have \(V_{t-1} = \sum_{s=0}^{\infty} (1 + r)^{-(s+1)}X_{t+s}\) with \(r = i(1 - \tau)\).29 If firms produce output with constant to scale (CRS) technologies using homogeneous inputs we can write the net cash flows as \(x_t = (1 + r)K_{t-1} - K_t\), and the value of the firm as \(V_{t-1} = K_{t-1}\).30 Thus, Tobin’s [27] \(q\), which measures the impact of marginally higher investment on the firm’s value, is unity with \(q = dV_{t-1}/dK_{t-1} = 1\).

(ii) None of the personal taxes enter the expression for the cost of capital, which is \(i(1 - \tau)\) for an all-debt firm, and \(\rho\) for an all-equity firm.

(iii) The tax adjustment on new share sales can be illustrated by considering an all-equity

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26This condition is obtained by partially differentiating the current value of the firm in (7) with respect to \(K_{t-1}\), where \(\partial V_{t-1}/\partial K_{t-1} = 0\). 27This is the standard way the effects of the classical corporate tax system are explained in most undergraduate corporate finance textbooks. It is the equilibrium outcome in Miller [16] where investors form tax clienteles. 28Once \(\tau\) changes the tax rates for the marginal investor will also change. For example, if it rises then the cash tax rate must also, with \(\Phi^M < \Phi^M_{1-1}\) and \(c_t^M < c_t^M_{1-1}\), where the higher cost of capital in (8) reduces current investment, with \((1 - \tau)X_t' > r_t\). Korinek and Stiglitz consider the effects of anticipated or temporary dividend tax changes when firms pay no realized gains (with \(\theta_t = \theta_t\)). They affect investment choices, even though firms trade debt and equity, because credit rationing restricts their access to debt. 29Using \(x_t = (1 + r)K_{t-1} - K_t\) we can write (7), with \(b = 1\) and \(E^N_t = 0\), as:

\[V_{t-1} = \sum_{s=0}^{\infty} (1 + r)^{-(s+1)} \{(1 + r)K_{t-1+s} - K_{t+s}\} = K_{t-1}\]

The tax deduction for interest in the cost of capital shields all income included in the net cash flows from corporate tax. In other words, the after-tax coefficient \((1 - \tau)\) on the interest rate cancels the same coefficient on the net cash flows which are defined here in after-tax terms. 30With CRS production we can use Euler’s Theorem to write the net operating surplus as \(X_{t-1} = X_t'K_{t-1}\), and with \((1 - \tau)X_t' = r\) for optimally chosen investment, the net cash flows become \(x_t = rK_{t-1} - (K_{t-1} - K_t)\).
firm that only funds new investment by selling shares, with \( E_t^N = K_t - K_{t-1} \). Its value becomes \( V_{t-1} = \sum_{s=0}^{\infty} (1 + r)^{-(s+1)} \{ (1 - \bar{\theta}_{t+s})(1 - \tau)X_{t+s} - E_{t+s}^N \} \), where only the operating surplus is subject to tax.\(^{31}\)

(iv) Presentations of the ‘new’ view of corporate taxation adopt share repurchase constraints (and constraints on inter-corporate equity) to explain the payment of dividends. Ruling out distributions as realized gains makes \( \bar{\theta}_t = \theta \), where from (7) the value of the all-equity firm that issues no new shares becomes \( V_{t-1} = (1 - \theta) \sum_{s=0}^{\infty} (1 + r)^{-(s+1)} x_{t+s} \), with \( r = \rho \).\(^{32}\) When firms use CRS technologies we therefore have \( V_{t-1} = (1 - \theta)K_{t-1} \). By distributing all income as dividends the personal tax is capitalized like a cash flow tax into share prices, with \( q = 1 - \theta \).\(^{33}\)

Thus, when the firm retains and invests another dollar in optimally chosen capital its market value rises by the value of the after-tax dividend forgone, thereby lowering the cost of capital funded from retained earnings below the cost of capital funded from selling new securities (which is unity).

These special cases highlight the cash flow tax characteristics of personal taxes on equity income distributed as dividends and realized gains. Indeed, no personal taxes would ever be paid by shareholders if they could realize income without selling any of their shares in the manner suggested by Constantinides [10] and Stiglitz [26].

### 3.2. The ‘New’ View

As noted earlier, the ‘new’ view of the classical corporate tax system writes the after-tax return to equity, as:

\[
\rho E_{t-1} = (1 - \theta)D_t + (1 - c)E_t^R + (1 - c)(E_t - E_{t-1} - E_t^N),
\]

where capital gains are taxed on accrual at rate \( c \). All the funds distributed through share

\(^{31}\)When \( E_t^N = K_t - K_{t-1} \), we have \( x_t = (1 - \tau)X_t - E_t^N \), where after personal tax \( (1 - c_t)x_t - c_tE_t^N = (1 - c_t)(1 - \tau)X_t \).

\(^{32}\)In the absence of realised gains we have \( \bar{\theta}_t = \theta \), where the value of an all-equity firm (with \( b = 0 \)) that issues no new shares \( E_t^N = 0 \) is obtained from (7), as:

\[
V_{t-1} = (1 - \theta) \sum_{s=0}^{\infty} (1 + r)^{-(s+1)} \{ (1 + \tau)K_{t-1+s} - K_{t+s} \} = (1 - \theta)K_{t-1}.
\]

\(^{33}\)The corporate tax also affects the value of the firm because it drives up the cost of equity \( \rho \).
repurchases are now taxed at rate $c$ instead of $c_t$ because the capital deduction $(E_{t-1})$ provided in the tax base for unrealized gains $(E_t - E_{t-1} - E^N_t)$ shields repaid capital from tax. In effect, all (taxed) income retained by the firm is taxed on accrual at rate $c$, and then at rates $\theta$ and $c$ when distributed to shareholders as dividends and realized capital gains, respectively.

By following the approach used to obtain (7), we find the market value of the firm is now:

$$V_{t-1} = \sum_{s=0}^{\infty}(1+r)^{-(1+s)} \left\{ \frac{(1-\bar{\theta})x_{t+s} + (c-\bar{\theta})E^N_{t+s}}{(1-c) + (c-\theta)b} \right\},$$  

with $r = [\rho(1-b) + i(1-\bar{\theta})(1-\tau)b][1-c] + (c-\bar{\theta})b^{-1}$ being the cost of capital, and $\bar{\theta} = \alpha^D\theta + \alpha^Rc$ the weighted average tax rate on distributions to equity as dividends and realized gains.

This expression differs from (7) by the presence of the accrual based tax ($c$) that raises the cost of capital. It also reduces the scaling coefficient on the net cash flows and the tax adjustment on new share sales.

3.2.1. Payout Policy and the Cost of Capital

When debt and equity both trade, we have:

$$\frac{dr}{db_{dx=0}} = \left[ \frac{[i(1-\tau)(1-c) - \rho](1-\bar{\theta})}{[(1-c) + (c-\theta)b]^2} \right] = 0.$$  

Firms are indifferent to the two securities when $i(1-\tau)(1-c) = \rho$, while investors are indifferent to interest, dividends and realized capital gains, respectively, when $i(1-\Phi) = \rho(1-\theta)/(1-c) = \rho$.

Clearly, the accrual based personal tax $c$ raises the cost of equity capital. By combining these indifference conditions for payout policy we find the tax rates for the marginal investor ($M$) satisfy $(1 - \Phi^M) = (1 - \tau)(1 - \bar{\theta}^M) = (1 - \tau)(1 - c^M)$. If interest, dividends and realized gains

\[34\] Notice that distributions from current income are not taxed twice due to a corresponding fall in the current value of equity in the tax base for capital gains.

\[35\] Debt is added to the payout constraint in (9), where this allows us to solve the value of the firm, as:

$$V_{t-1} = (1 + \gamma)^{-1} \left\{ \frac{(1-\theta)}{1-c} D_t + E^R_t + \left( \frac{1-\Phi}{1-c} \right) R_t - V^N_t + V_t \right\}.$$  

with $\gamma = [\rho(1-b) + i(1-\Phi)b]/(1-c)$. Then the cash flow constraint in (5) is used to solve the pre-tax payout to equity, as $G_t = D_t + E^R_t = x_t + V^N_t - (1-\tau)R_t$, where $D_t = \alpha^DG_t$ and $E^R_t = \alpha^RG_t$, with $\alpha^D + \alpha^R = 1$. After substitution, we obtain (10) by following the procedure used to solve (7). It is the combined market value of the firm’s debt and equity obtained by Auerbach [1] when realised capital gains are ruled out by share repurchase constraints (with $\bar{\theta} = \theta$). Auerbach [1] embeds this market valuation inside a definition of wealth that eliminates the coefficient at the front of the net cash flows in (10) and considers firms that issues no new shares.
are subject to the same personal tax rate, with $\bar{\theta} = \Phi = \theta = c$, no fully taxable investor has a tax preference for dividends or realized gains, where the combined personal and corporate taxes drive out equity, and the value of the firm in (10) collapses to $V_{t-1} = \sum_{s=0}^{\infty} (1 + r)^{-s+1} x_{t+s}$, with $r = i(1 - \tau)$.

To obtain the equilibrium outcome in Miller where no dividends are paid and investors separate into tax clienteles, the statutory tax rate on realized capital gains has to be set below the tax rate on cash distributions (with $\Phi = \theta > c$) for high-tax investors (with $\Phi = \theta > \tau$) to prefer them whenever $(1 - \Phi) < (1 - \tau)(1 - c)$. Once both securities trade the accrual based tax rate on capital gains for the (notional) marginal investors satisfies $(1 - \Phi^M) = (1 - \tau)(1 - c^M)$, with $c^M = (\theta^M - \tau)/(1 - \tau)$. It is the tax rate that raises the cost of capital, where the condition for optimally chosen investment at each time $t-1$ is obtained from (10) as $(1 - \tau) X'_t = r$. The personal tax on dividends has no affect because it is realization based and is constant over time.

Consider the following special cases.

(i) Whenever $\bar{\theta} = c$ the tax coefficients on the net cash flows and new share sales in (10) cancel, where the value of the firm under CRS production becomes $V_{t-1} = K_{t-1}$, with $r = \rho(1 - b)/(1 - c) + i(1 - \tau)b$. As no personal taxes are capitalized into the value of the firm in these circumstances the marginal cost of retained earnings is the same as the marginal cost of raising new capital, with $q = 1$. And this is confirmation of the property that a comprehensive income tax is fully equivalent to equal tax rates on cash distributions and capital gains. But, as noted earlier, $\Phi > c$ is required for debt and equity to both trade, which rules out dividends whenever $\Phi = \theta$.

(ii) If share repurchase constraints rule out realized gains for the all-equity firm that sells no new shares, we have $\alpha^R = 0$ and $\bar{\theta} = \theta$, where from (10) its current value under CRS production becomes:

$$V_{t-1} = \left( \frac{1 - \theta}{1 - c} \right) K_{t-1},$$

with $r = \rho/(1 - c)$. Now the personal taxes on equity income have a capitalization effect whenever $\theta \neq c$. This is the special case examined in Auerbach [1] where a dollar of retained earnings generates a capital gain for shareholders of $q = (1 - \theta)/(1 - c)$. After paying tax on this gain at rate $c$ they receive $(1 - \theta)$, which is exactly what they get when the dollar is instead
distributed as a dividend. By trapping income inside the firm share repurchase constraints lower
the cost of retained earnings below unity, which is the marginal cost of funds from selling new
shares, whenever $\theta > c$. That is why the ‘new’ view is frequently referred to as the ‘trapped’
view of dividends.

By comparing (7) and (10) we can see why taxes on realized gains cannot be approximated
with accrual based taxes set at lower rates. For an all-equity firm the cost of equity capital with
the realization based tax in (7) is $r = \rho$, whereas it is higher at $r = \rho/(1-c)$ for the accrual based
tax in (10). By the logic of the ‘capitalization’ argument, however, constant realization based
taxes have no affect on the cost of capital, and no adjustment, other than to set the accrual tax
rate to zero, would properly capture its economic impact on investment. But setting it to zero
would misrepresent its impact on the firm’s payout policy and conceal the capitalization effect.
Consider an all-equity firm with CRS production that issues no new shares and pays no dividends
(with $\bar{\theta} = c$). A marginal increase in its current capital stock ($K_{t-1}$) raises the firm’s value by
$q = (1-c)^M$ with the tax on realized gains in (7), whereas it rises by $q = (1-c)/(1-c) = 1$
with the accrual based tax in (10).

4. FIRM VALUES WITH IMPUTATION TAX CREDITS

A number of countries have integrated personal and corporate taxes on equity income by
granting corporate tax credits on distributions from (taxed) equity income, where most restrict
the credits to dividends. In effect, the corporate tax is used as a withholding tax that converts
realization based personal taxes on dividends into accrual taxes. While full dividend imputation
eliminates holding period gains for shareholders with marginal tax rates at or below the corporate
rate, it does not do so when: (a) shareholders have tax rates above the corporate rate; (b) firms
distribute preference income; and, (c) income is distributed to shareholders as realized capital
gains.

Shareholders with tax rates above the corporate rate owe additional personal tax they can
delay paying when firms retain income. Governments in most countries with dividend imputation
are aware of this problem and normally commit to set their top marginal personal tax rates at
or below their corporate rates.
Holding period gains also arise when firms retain preference income, which is not subject to corporate tax. It arises from measured depreciation allowances on firm assets being greater than economic depreciation. In practice it is difficult and costly to measure economic depreciation for assets that do not have active markets where similar assets trade, which is why measured allowances are computed using decay factors to apportion their historic cost values. These decay factors are, at best, approximations for economic depreciation allowances. Accelerated depreciation allowances are another reason for measured depreciation being larger than economic depreciation. By allowing firms to write down asset values more quickly they overstate deductible expenses and understate taxable income. We sidestep this issue in the following analysis by assuming taxable income is equal to economic income, so that all income distributed to shareholders is therefore subject to corporate tax.

Under dividend imputation no corporate tax credits are granted on income realized as capital gains so they are subject to combined corporate and personal taxes. Since the personal taxes are realization based there are holding period gains that distort firm payout policies. This will be demonstrated in the next section.

4.1. Dividend Imputation

To accommodate the corporate tax credits on dividends we write the after-tax return on equity under dividend imputation (DI), as:

\[
\rho E_{t-1} = (1 - \theta) \frac{D_t}{(1 - \tau)} + (1 - c_t)(1 - \tau) \frac{E^R_D}{(1 - \tau)} + (1 - c^{DI}_t) \frac{(E_t - E_{t-1} - E^N_N)}{(1 - \tau)}, \tag{11}
\]

In most countries the tax authority specifies rules for determining depreciation allowances, and they can be different to the rules adopted by accounting bodies for reporting income to shareholders.

In Australia and New Zealand dividends paid from income subject to corporate tax are called franked dividends, while those paid from untaxed income are called unfranked dividends. Tax credits are only granted on franked dividends. For excellent summaries of the economic effects of dividend imputation see Benge and Robinson [7] and Sieper [21].

This expression is obtained by separating capital gains into those eventually distributed as dividends and those eventually distributed as realised capital gains, where:

\[
\rho E_{t-1} = \frac{(1 - \theta) D_t}{(1 - \tau)} + (1 - c_t)(1 - \tau) \frac{E^R_D}{(1 - \tau)} + \alpha^D (1 - \theta) \frac{(E_t - E_{t-1} - E^N_N)}{(1 - \tau)} + \alpha^R(1 - \tau) \frac{(E_t - E_{t-1} - E^N_N)}{(1 - \tau)}.
\]

We assume the proportion of equity income eventually paid as dividends is taxed on accrual at rate \( \theta \), where all tax credits are realised on accrual by setting \( \theta \leq \tau \). No personal tax is paid on income retained and eventually distributed as realised gains. Instead, it is taxed at realisation, where the tax rate on funds distributed through...
where $\bar{c}^{DI} = \alpha^D\theta + \alpha^R\tau$ is the weighted average accrual tax rate on capital gains. As a way to identify the combined effects of the corporate and personal taxes we have isolated the pre-tax returns as dividends, realized gains and unrealized gains in each of the three terms in (11), respectively. With distributions and equity values measured net of corporate tax their pre-tax values are computed by multiplying them by $1/(1 - \tau)$. Consider each of them separately, where the first term in (11) is pre-tax income distributed as dividends $D_t/(1 - \tau)$ which shareholders declare as taxable income and receive $(1 - \theta)D_t/(1 - \tau)$ after personal tax. Any corporate tax paid on this income is credited to shareholders who use it to offset their personal tax liabilities; excess credits are refunded to them. Consequently, no corporate tax is collected on taxed equity income paid as dividends (whenever $\theta \leq \tau$). In contrast, pre-tax income distributed as realized gains in the second term $E_t^R/(1 - \tau)$ are taxed twice - once at corporate rate $\tau$ and then again at personal rate $c$, where the tax rate on funds shareholders receive from share sales is set at $c_t < c$ due to repayments of capital included in $E_t^R$. Finally, the pre-tax unrealized gains in the third term $(E_t - E_{t-1} - E_t^N)/(1 - \tau)$ are subject to combined corporate and personal taxes, where the portion of retained earnings eventually distributed as dividends ($\alpha^D$) are taxed on accrual at rate $\theta$, while the remaining retentions eventually distributed as realized gains ($\alpha^G$) are taxed on accrual at corporate rate $\tau$.

By following the approach used earlier we find the value of the firm under dividend imputation, is:

$$V_{t-1} = \sum_{s=0}^{t+s} \prod_{z=t}^{t+s} (1 + r_z)^{-1} \left\{ (1 - \theta^{DI}_{t+s})x_{t+s} + (\bar{c}^{DI} - \theta^{DI}_{t+s})E_{t+s}^N \right\},$$

where in each time period $t$, $r_t = [\rho(1 - b) + i(1 - \theta^{DI}_{t})b(1 - \tau)(1 - \bar{c}^{DI} + \bar{c}^{DI} - \theta^{DI}_{t})]^{-1}$ is the cost of capital, and $\theta^{DI}_{t} = \bar{c}^{DI} + \alpha^R G_t(1 - \tau)$ the weighted average tax rate on distributions

share repurchases is $c_t = c(p_t - p_{0})/p_{t}$, which is less than the marginal personal tax rate $c$ whenever $p_t > p_0$. Thus, equity income distributed as realised gains is taxed on accrual at the corporate tax rate $\tau$ because shareholders receive no tax credits on this equity income. We obtain (11) by summing the last two terms using the weighted average tax rate on capital gains $\bar{c}^{DI}$.

The cash flow constraint in (5) is used to write the after-tax payouts to equity, as:

$$G_t = D_t + E_t^R = x_t + V_t^N - (1 - \tau)R_t,$$

where $D_t = \alpha^D G_t$ and $E_t^R = \alpha^R G_t$, with $\alpha^D + \alpha^R = 1$. By using this to rewrite the equity payouts in (11) and then adding debt, the firm’s current market value, becomes:

$$V_{t-1} = (1 + r_t)^{-1} \left\{ \frac{(1 - \theta^{DI}_{t})x_t + (\bar{c}^{DI} - \theta^{DI}_{t})E_t^N}{(1 - \bar{c}^{DI}) + (\bar{c}^{DI} - \theta^{DI}_{t})b} \right\} - V_t.$$

We obtain (12) by following the approach used to obtain (7).
to shareholders.40

This expression has a similar structure to the value of the firm in (10), which is the familiar expression obtained by Auerbach, and Poterba and Summers, under a classical corporate tax system. Both (10) and (12) contain a mix of accrual and realization based personal taxes, where dividends are taxed at realization and capital gains on accrual in (10), whereas the reverse applies under dividend imputation in (12). However, it makes more sense to compare the firm valuations in (7) and (12) because all the personal taxes on equity income are modelled as realization based taxes. Dividend imputation converts personal tax \( \theta \) into an accrual tax whenever \( \theta \leq \tau \), which is why it affects the cost of capital in (12) but not in (7). As there are no corporate tax credits on realized gains personal tax \( c \) has a capitalization effect in both expressions.

4.1.1. Payout Policy and the Cost of Capital

When debt and equity both trade under dividend imputation, optimally chosen leverage satisfies:

\[
\frac{dr}{db} = \frac{[i(1-c^{DI}) - \rho(1-\tau)(1-\hat{\theta}^{DI})]}{[(1-c^{DI}) + (c^{DI} - \hat{\theta}^{DI})b]^2} = 0.
\]

Again, the cost of capital is unaffected by taxes on distributions \( \hat{\theta}^{DI} \), where the firm is indifferent between interest, dividends and realized capital gains, respectively, when \( i = \rho/(1-\theta) = \rho/(1-\tau) \), while investors are indifferent between them when \( i(1-\Phi) = \rho = \rho(1-c_t) \). By combining these conditions we find the tax relationship for the marginal investor \( (M) \) is now

\[
(1-\Phi^M) = (1-\theta^M) = (1-\tau)(1-c^M),
\]

where all investors are indifferent between interest and dividends on tax grounds whenever \( \Phi = \theta \). High-tax investors (with \( \Phi = \theta > \tau \)) will have a tax preference for realized gains, despite them being double taxed, whenever \( (1-\Phi) = (1-\theta) < (1-\tau)(1-c_t) \).

By using (12) we find the condition for optimally chosen investment at each time \( t-1 \), is:

\[
\left\{ \frac{(1-c^{DI}) + (c^{DI} - \hat{\theta}^{DI} b)}{(1-c^{DI}) + (c^{DI} - \hat{\theta}^{DI} b)} \right\} (1-\tau)X'_t = \left( \frac{1-\hat{\theta}^{DI}}{1-\hat{\theta}^{DI}} \right) (1+r_t) - 1.
\]

40This is captured in (12) by the scaling coefficient on the cost of equity capital, which is lowered by the corporate tax \( \tau \) and raised by the weighted average accrual tax on capital gains at rate \( c^{DI} = \alpha_c \theta + \alpha_r \tau \). There is no such scaling coefficient on the cost of equity capital in (7) as there are no accrual based personal taxes on equity income.
Consistent with the analysis of the classical corporate tax system in subsection 3.1.1 a constant tax rate on realized gains has no effect on the cost of capital, where from (13) we have, \( \bar{\theta}_t = \bar{\theta}_t^{DI} = \bar{\theta}^{DI} \) and \( (1 - \tau)X_t = r \). Now the personal tax on dividends affects investment because it is an accrual based tax that raises the cost of capital. The following special cases will clarify the role played by the taxes on equity income in (12).

(i) The size of the scaling coefficient is determined solely by the personal tax rate on realized gains under dividend imputation. To see why, consider the circumstances identified by Constantinides [10] and Stiglitz [26] where shareholders can realize gains without paying tax by shorting securities with the same characteristics as their shares, so that \( c = c_t = 0 \) and \( \bar{\theta}_t^{DI} = \theta^{DI} \) in every time period \( t \). All the tax terms inside the parentheses in (12) cancel, where the value of the firm under CRS production becomes \( V_{t-1} = K_{t-1} \), with \( r = [\rho(1-b)/(1 - \theta^{DI}) + ib](1 - \tau) \) and \( q = 1 \). In the absence of realization based taxes there is no scaling coefficient on the net cash flows, and as a consequence, no tax adjustment on new share sales, with \( (\bar{\theta}_t^{DI} - \theta^{DI})E_t^{N} = 0 \). Thus, all income is taxed on accrual at rate \( \theta \) on dividends and rate \( \tau \) on capital gains while ever \( \theta \leq \tau \), and these taxes raise the cost of capital.

(ii) If realized gains are ruled out by share repurchase contraints equity income is distributed as dividends \( \bar{\theta}_t^{DI} = \theta^{DI} = \theta \), where the value of an all-equity firm under CRS production, using (12), is \( V_{t-1} = K_{t-1} \), with \( r = \rho(1 - \tau)/(1 - \theta) \) and \( q = 1 \). All income generated by the firm is taxed on accrual at rate \( \theta \), while ever \( \theta \leq \tau \). When debt and equity both trade the value of the firm is once again equal to the current value of its capital stock, but the cost of capital becomes \( r = [\rho(1-b)/(1 - \theta) + ib](1 - \tau) \). In other words, the personal taxes do not have a capitalization effect in the absence of realized gains.\(^{41}\)

In summary, dividends and realized gains are subject to different tax treatment under dividend imputation. Specifically, dividends are taxed on accrual at personal rate \( \theta \) (when \( \theta \leq \tau \)), while realized gains are taxed by a combination of accrual \( (\tau) \) and realization \( (c) \) based taxes. This difference affects firm payout policies and the cost of capital.

\(^{41}\)To avoid this problem the New Zealand Government set \( \theta \leq \tau \) when they adopted dividend imputation in 1999, but in subsequent reforms the highest marginal personal tax rate has been raised above the corporate rate. The Australian Government made a commitment to set \( \theta \leq \tau \), but has not done so due to subsequent cuts in the corporate rate and a reluctance to reduce marginal personal tax rates significantly.
4.2. Comprehensive Imputation

In the absence of taxes, trading costs and asymmetric information shareholders view dividends and realized capital gains as perfect substitutes. It therefore seems logical to extend corporate tax credits to both of them, where doing so would eliminate many of the tax distortions to firm financial policies and the cost of capital under the classical corporate tax system. In particular, it would remove any holding period gains on retained (taxed) equity income by converting realization based personal taxes into accrual taxes, where income paid to investors with marginal rates at or below the corporate rate would be taxed at their marginal rate whether distributed as interest, dividends or realized gains. Thus, the reforms would make the income tax base more comprehensive, whilst at the same time preserving any progressivity in marginal tax rates.\(^42\)

Imputing corporate tax credits on dividends is relatively straightforward because firms can indicate whether they are paid from taxed or preference income.\(^43\) But that is not possible for realized gains which can be initiated by shareholders selling shares to other investors. Firms therefore need to declare their retained (taxed) income each period and record it to the credit of each shareholder. Whenever shareholders sell shares they use their accumulated corporate tax credits to offset personal tax liabilities on the portion of realized gains arising from retained taxed income. These credits would be reduced by dividend payouts, with excess credits being refunded to sellers at the time of sale. Future tax credits would then be credited to new shareholders.

When a share is sold at time \(t\) the shareholder declares a pre-tax capital gain of \((p_t - p_0)/(1 - \tau)\) as taxable income (in the absence of preference income). It is subject to personal tax at rate \(c\) which is offset by corporate tax credits at rate \(\tau\). These credits are fully utilized whenever \(c \leq \tau\), where low tax investors realize gains as they accrue to avoid incurring losses in the value of excess credits when they are not carried forward at interest (after corporate tax). In the following analysis we therefore assume the highest marginal personal tax rates are set at or below the corporate rate (with \(c \leq \tau\) and \(\theta \leq \tau\)), and all low tax shareholders realize tax credits

\(^{42}\)While income from all sources would be taxed on accrual at a uniform rate for all investors under a truly comprehensive income tax base, the comprehensive imputation tax system is comprehensive in the narrower sense that it taxes income from all sources on accrual at the same marginal tax rate for each shareholder when tax rates are determined by a progressive rate scale.

\(^{43}\)In Australia and New Zealand dividends paid from taxed income are called franked dividends, while those paid from preference income are called unfranked dividends. Shareholders can only claim tax credits on their franked dividends.
as they accrue. With equity income taxed on accrual at the marginal personal tax rates of each shareholder, the after-tax return on equity under comprehensive imputation (CI), becomes:

\[
\rho E_{t-1} = (1-\theta) \frac{D_t}{1-\tau} + (1-c) \frac{E^R_t}{1-\tau} + (1-\bar{G}^{CI}) \frac{(E_t - E_{t-1} - E^N_t)}{1-\tau}, \tag{14}
\]

with \(\bar{G}^{CI} = \alpha^D \theta + \alpha^R c\) being the weighted average personal tax rate on capital gains. Following the approach adopted earlier in (11) we separate income at each time \(t\) as dividends, realized gains and unrealized gains, respectively. When the corporate tax is used as a withholding tax each of them is converted into their pre-tax values by the scaling coefficient \(1/(1-\tau)\) and are then subject to personal tax, where the proportion \((\alpha^D)\) of pre-tax retained income \((E_t - E_{t-1} - E^N_t)/(1-\tau)\) eventually distributed as dividends is taxed on accrual at rate \(\theta\), and the remaining proportion \((\alpha^R)\) eventually distributed as realized gains is taxed on accrual at rate \(c\).

After adding debt to (14) and following the approach used earlier, we find the current value of the firm under comprehensive imputation, is:

\[
V_{t-1} = \sum_{s=0}^{\infty} (1+r)^{-(1+s)} x_{t+s}, \tag{15}
\]

with a cost of capital of \(r = \left\{ \frac{\rho}{(1-\bar{G}^{CI})} \right\} (1-b) \right\} (1-\tau)\). In the absence of realization

44 This expression is obtained by separating pre-tax retained equity income into the proportion eventually distributed as dividends \((\alpha^D)\) and the remaining proportion eventually distributed as realised capital gains \((\alpha^R)\), with:

\[
\rho E_{t-1} = (1-\theta) \frac{D_t}{1-\tau} + (1-c) \frac{E^R_t}{1-\tau} + \alpha^D (1-\theta) \frac{(E_t - E_{t-1} - E^N_t)}{1-\tau} + \alpha^R (1-c) \frac{(E_t - E_{t-1} - E^N_t)}{1-\tau}.
\]

Now the personal tax on funds realised as pre-tax capital gains in \(E^R_t/(1-\tau)\) is set at the statutory rate \(c\) because capital is exempted from tax by the deduction for the initial value of the equity capital \(E_t-1\) in the tax base for retained equity income. We obtain (14) by summing the last two terms using the weighted tax rate on capital gains \(\bar{G}^{CI}\).

45 We use the cash flow constraint in (7) to solve the pre-tax payout to equity, as:

\[
\alpha^D G_t + \alpha^R G_t = D_t + E^R_t = x_t + V^N_t - (1-\tau) R_t,
\]

with \(G_t = D_t + E^R_t\) and \(\alpha^D + \alpha^R = 1\), where the summed cost of debt and equity for the firm, becomes:

\[
V_{t-1} = (1+r)^{-1} \left\{ \frac{(1-b\bar{G}^{CI}) x_t + (\bar{G}^{CI} - \bar{G}^{CI} b) E^N_t}{1-\bar{G}^{CI} + (\bar{G}^{CI} - \bar{G}^{CI} b) b} \right\} - V_t.
\]

The tax terms here cancel because the weighted average distributions tax is equal to the weighted average accrual tax, with \(\bar{G}^{CI} = \bar{G}^{CI} = \alpha^D \theta + \alpha^R c\). We obtain (15) by solving this expression forward using the approach followed earlier to obtain (7).
based taxes there is no scaling coefficient on the net cash flows, where the accrual based personal
taxes reduce the value of the firm by raising the cost of capital. Indeed, the cost of capital for
an all-equity firm paying dividends and realized gains is $\rho/(1 - c^{CI})$, while it is $\rho/(1 - \theta)$ when
share repurchase constraints rule out realized gains.

4.2.1. Payout Policy and the Cost of Capital

Using (15) we find optimally chosen leverage under comprehensive imputation satisfies:

$$\frac{dr}{db_{dx=0}} = [i - \rho/(1 - c)](1 - \tau).$$

Firms are willing to pay interest, dividends and capital gains, respectively, when $i = \rho/(1 - \theta) =
\rho/(1 - c)$, while the corresponding indifference condition for investors is $i(1 - \Phi)/(1 - \tau) =
\rho/(1 - \tau) = \rho/(1 - \tau)$. Taken together the tax rates for the marginal investor satisfy $(1 - \Phi^M) =
(1 - \theta^M) = (1 - c^M)$, with $c^{CI} = \Phi^M = \theta^M = c^M$. If the personal tax rate on capital gains is
set at or below the personal tax rate on dividends and interest for all investors, with $c \leq \theta = \Phi$,
only realized gains would trade in this setting.

Clearly, full accrual based taxes on equity income affect investment by raising the cost of
capital $(\tau)$, where from (15) we find the condition for optimally chosen investment $(K_{t-1})$ satisfies
$(1 - \tau)X_t' = r = i = \rho/(1 - \theta^M) = \rho/(1 - c^M)$ when firms are willing to pay interest, dividends
and realized gains.

To illustrate how tax credits are imputed to shareholders on realized gains when firms generate
preference income we define retained after-corporate tax income for each share at time $t$ as $y_t$,
where the tax credit is $\tau y_t/(1 - \tau)$. It is measured net of any dividends paid in that time period.
If a share purchased at time $0$ is sold at time $T$ the tax payable by the shareholder, is:

$$c \left[ p_T - \left( p_0 + \sum_{t=0}^{T} \frac{y_t}{1 - \tau} \right) \right] + \sum_{t=0}^{T} (c - \tau) \frac{y_t}{1 - \tau}.$$

The first term isolates the personal tax payable on preference income, while the second is the
summed value of any tax credits. Preference income is not subject to corporate tax and is the
sale price of the share $(p_T)$ less its adjusted ‘basis’ being the initial purchase price $(p_0)$ plus taxed
retentions over the time the share is held, $\sum_{t=0}^{T} y_t/(1 - \tau)$. In the absence of preference income marginal investors (with $c = \tau$) receive no tax credits, and pay no further tax, while high tax investors (with $c > \tau$) owe additional tax and have an incentive to delay releasing capital gains. In contrast, low tax investors (with $c < \tau$) realize excess tax credits as they arise to preserve their value. Since preference income is not taxed inside firms at rate $\tau$, it is taxed on realization as either dividends or realized gains. Thus, shareholders have an incentive to delay realizing this income whenever it exceeds their excess tax credits. These distortions to payout policy are removed by setting personal tax rates at or below the corporate rate, and eliminating preference income by setting measured depreciation allowances at their economic values.

As noted in the introduction, comprehensive imputation can be expanded to cover all business firms by renaming the corporate tax a business tax and extending imputation tax credits to the owners of non-corporate firms. Taxed business income would then be subject to accrual based personal taxes, leaving other non-business capital assets, like houses and other private property, subject to realization based personal taxes. This could be addressed by adopting the generalized cash flow tax proposed by Auerbach and Bradford [3].

5. CONCLUDING REMARKS

When tax liabilities arise from the choice to realize income rather than from the passing of time they do not change the cost of capital. This important insight was first recognized in the ‘new’ view of the classical corporate tax system for personal taxes on dividends which are realization based taxes that reduce firm values through a scaling coefficient on their net cash flows. The analysis was extended in this paper to show why personal taxes on realized gains have the same effects as the taxes on dividends. We used these findings to examine the value of corporate firms under dividend imputation where equity income is subject to a mix of accrual and realization based personal taxes that distort the payout policies of firms. These distortions are minimized by comprehensive imputation which converts realization based personal taxes on (taxed) equity income into accrual taxes. Whether it dominates other tax reform proposals for integrating personal and corporate taxes is an open question. It does at least provide a mechanism for applying the same schedule of progressive marginal tax rates to business and
labour income.

REFERENCES


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