Dividend Policy and Income Taxation*

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September 14, 2007

Abstract

The effects of dividend and capital gains taxes on optimal dividend payout policy are analyzed in the context of a one-good model (so that capital consists of stored units of the consumption good). The aftertax discount factor is assumed to adjust to taxes to bring about equality between the discounted value of the firm’s aftertax dividend stream under the optimal dividend policy and the number of units of capital the firm is operating. A standard result—that the Miller-Modigliani dividend irrelevance proposition applies in the presence of taxes if the dividend tax rate equals the capital gains tax rate (and if capital gains are taxed as they accrue)—is demonstrated. The analysis is extended to deal with unequal tax rates. The two major results are (1) allocating retained earnings to share repurchases has the same tax implications as allocating retained earnings to new investments, and (2) either of these will be optimal if and only if the tax rate on capital gains is lower than that on dividends.

JEL codes G1, G3.

The Miller-Modigliani [9] dividend-irrelevance principle asserts (among other propositions) that, in the absence of frictions, corporate dividend policy does not affect firm value. This is so because if investment is held constant, as Miller-Modigliani assumed, then by an identity a change in dividends is offset one-for-one by a change in proceeds from new security issues. Assuming that investors value firms by discounting payments to stockholders net of proceeds of new issues, firm value is unaffected by the dividends change.

A related dividend-irrelevance proposition, often incorrectly attributed to Miller-Modigliani, applies if investment is not held constant: variations in future dividends do not affect firm value provided that retained earnings are invested in zero-net-present-value projects. This invariance is held to occur because the effect on firm value of a dividend increase is exactly offset by lower future capital gains due to

*I am indebted to Alan Auerbach, Harry DeAngelo, Marek Kapicka, Oddgeir Ottesen and Yongli Zhang for discussions and correspondence on this material.
lower retained earnings. Even in the absence of frictions, this dividend-irrelevance proposition is not correct without further restrictions, as has been pointed out by DeAngelo and DeAngelo [5], [6].

In the presence of frictions these results certainly fail, and there may exist a unique optimal dividend policy. Available results in this general case are much less complete than in the case where frictions are excluded. In this paper we analyze dividend policy in the presence of taxes on dividends and capital gains. The goal is to provide conclusions that are the counterpart for the case of positive taxes of the Miller-Modigliani results for zero taxes.

1 Taxes and the Valuation of Firms

Most discussions of the role of taxes in determining equilibrium dividend policy specify a one-good deterministic framework, and we follow this lead. In that setting firms are completely identified by the number of capital goods they operate. In the absence of adjustment costs, taxes and corporate debt, there appears to be a consensus that the equilibrium value of a firm’s equity equals the number of capital goods the firm owns, reflecting the one-good specification. There is also a consensus that in the presence of taxes equity values are, or can be, lower than this amount (Auerbach [1] or McGrattan and Prescott [8], for example).

The literature leaves unclear why equity prices value capital at less than one consumption good per unit in the presence of taxes. Assuming that firms pay out the full value of capital in dividends (so as to avoid the outcome that DeAngelo and DeAngelo postulated), the same reasoning that sets Tobin’s $q$ equal to 1 in the absence of taxes implies $q = 1$ in their presence.

Suppose first that there are no taxes, and assume that $q$ is constant over time. We have that the value of capital equals the discounted value of its next-period payoff:

$$ q = \frac{d + q}{1 + r}, $$

where $d$ is the capital rental per unit of capital and $r$ is the interest rate. In equilibrium we have $d = r$, implying $q = 1$. This reasoning is unaffected by taxation: if dividends are taxed at rate $t$ and firms pay out all earnings in dividends, we have

$$ q = \frac{d(1 - t) + q}{1 + r}, $$

where the relevant discount factor $r$ is now interpreted as the aftertax discount rate, which equals $d(1 - t)$. Again the model produces $q = 1$.

If $q$ is nonconstant, eq. (2) is replaced by

$$ q_t = \frac{d(1 - t) + q_{t+1}}{1 + r}, $$

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which implies that when $q_t > 1 \ (q_t < 1)$ capital prices rise (fall) over time. This specification is recognized as formally identical to a speculative bubble: security prices can exceed fundamental value if they are expected to exceed it by still more in the future. A considerably amount is known about conditions under which bubbles can and cannot occur. First, assuming that equity is disposable, $q_t < 1$ is ruled out: if $q_t < 1$ at any date, then at some future date $q_t$ must become negative, which is inconsistent with free disposability. In contrast, $q_t > 1$ can occur in equilibrium in some settings, and can be ruled out in other settings. In the remainder of this paper we assume that there are no bubbles in $q$, so that $q = 1$ always occurs in equilibrium. This assumption, of course, does not preclude bubbles in share prices; these can occur if firms pay low or no dividends, as will be optimal if dividend taxes are high.

Firm managers are assumed to maximize the market value of equity. In our setting the only decisions the firm manager makes are what proportion of the firm’s earnings to pay out in dividends and whether to allocate whatever earnings remain after paying dividends to share repurchases or new investment. The above argument implies that a firm that adopts a dividend policy that is optimal in the assumed tax regime will have value equal to the number of capital goods that it operates. Correspondingly, if the firm were to adopt a suboptimal dividend policy its capital would be valued at less than one consumption good per unit. This would occur because the firm would be subjecting its stockholders to higher taxes than necessary. More precisely, an equilibrium dividend payout rate is such that (1) the capital of firms that adopt that dividend payout rate is valued at one consumption good per unit, and (2) firms cannot increase the value of their capital above one consumption good per unit by deviating from the equilibrium dividend payout rate.

Including both dividends and capital gains taxation in the model makes it possible to see the error in the frequently-encountered purported demonstration that equilibrium implies $q < 1$ in the presence of dividend taxation. The argument that a firm with $k$ units of capital must have value less than $k$ consists of the simple assertion that if the firm were to pay out its capital as a dividend, stock owners would owe income taxes of $tk$ on the dividends, implying that they would value the capital at $k(1 - t)$ rather than $k$. However, the fact that a lump-sum payout leads to undervaluation of capital indicates only that paying out capital in this way is suboptimal: we saw in eq. (2) above that if instead of paying out the full value of capital immediately the firms holds the capital and pays out the revenue stream it generates, the aftertax discounted value of the dividend stream is one per unit of capital. Inasmuch as paying out capital as a taxable dividend is suboptimal, this experiment has no bearing on the valuation of capital.

It was assumed above that the recipient of a liquidating dividend is subject to the dividends tax. That is the case provided that the payment is made out of retained earnings. Since the owners of the firm have already paid capital gains taxes on the accrued capital gain resulting from earnings retention, a second tax on the liquidating dividend constitutes double taxation. If, on the other hand, the liquidating dividend
is paid out of contributed capital, then there is no income or capital gain, hence no tax. For example, if the firm had paid out all past earnings as dividends, then a liquidating dividend would necessarily constitute a return of paid-in capital, which would have no tax consequence.

Another point is that the exercise under consideration takes no account of capital gains taxation. As we will see below, paying dividends at any level greater than zero can be optimal only if the capital gains tax rate exceeds the dividend tax rate. If that is the case, the value of capital is an increasing function of the retention rate. The question is whether to assume that the capital gains tax rate applies to capital losses in the same way it applies to gains. If so, the logical implication would be that firms could increase their market values over the value implied by paying out 100 per cent of their earnings in dividends by setting a still higher dividend. Doing so would increase market value because in that case the capital gains tax, being applied to a loss, would generate cash for stockholders. This cash would be more than sufficient to pay the tax on the dividend. In fact, of course, the tax code does not allow this use of capital gains taxation—capital losses can be canceled against capital gains, but cannot be used to generate a net payment from the government to taxpayers. In the model to be presented below we sidestep this nonlinearity by restricting the dividend payout to be less than or equal to earnings.

The equilibrium conditions of the model to be presented have the important implication that the four parameters that describe the environment firms face in our setting—the pretax return on capital, the aftertax return on capital, the dividend tax rate and the capital gains tax rate—cannot be specified independently. In a full general equilibrium account, both the pretax and aftertax returns on capital would depend on the assumed tax rates, assuming the tax rates are exogenous. Determining the magnitude of these effects would involve specifying, at a minimum, the aggregate production function and individuals’ preferences. The production technology affects equilibrium factor intensities, and therefore pretax returns on capital, while saving behavior affects the aftertax discount rate. Except in the context of an example to be presented below, we will not take this circuitous route, instead assuming that the aftertax return on capital accommodates to the pretax return on capital and the assumed tax rates.

We now restate the equilibrium definition incorporating the convention that the aftertax rate of return is determined endogenously. Firms pay out proportion $\delta$ of their earnings as dividends, $0 \leq \delta \leq 1$. Denote $r(\delta)$ as the aftertax discount rate that sets the discounted value of aftertax dividends per unit of capital to one under whatever tax regime is in place, assuming a dividend payout rate of $\delta$. Let $\overline{\delta}$ be the equilibrium dividend payout rate, implying that the equilibrium aftertax discount rate is $r(\overline{\delta})$. In general, of course, $\overline{\delta}$ and $r(\overline{\delta})$ will depend on the pretax return on capital and the tax rates on dividends and capital gains. The individual firm, as a price taker, sets its dividend payout rate to maximize the value of the firm, treating $r(\overline{\delta})$ as fixed. This specification reflects the assumption that each firm is small. In
this setting $\delta = \delta$ is an equilibrium if for discount rate $r(\delta)$ the value of an individual firm is less than or equal to one for all values of $\delta$.

The outcome of this exercise is easiest to characterize if, contrary to the case in the United States and most other countries, capital gains are taxed as they accrue rather than when they are realized. We adopt this assumption throughout this paper. Under accrual taxation the Miller-Modigliani result on the irrelevance of dividend policy extends to the case of nonzero taxes if the dividend tax rate equals the capital gains tax rate. Miller and Modigliani were aware of this fact, and other analysts have derived it in a variety of models.

If dividends are taxed more heavily than capital gains, as appears to be the case in the United States and most other countries, then firms can increase their values by avoiding paying dividends. It turns out not to matter whether earnings not paid out in dividends are used for share buybacks or acquisition of additional capital; we analyze both cases and show that the tax implications of the two choices are identical. In this case the equilibrium dividend payout rule is to pay no dividends (this raises some issues related to bubbles, as discussed below). The effect on firm values of the suboptimal decision to pay nonzero dividends is calculated.

The observation that zero dividend payout is optimal when dividends are taxed more heavily than capital gains leads to the widely discussed “dividends puzzle” (Black [2]): why do firms pay dividends, given that they can decrease taxes and thereby increase value by retaining earnings and either investing or buying back shares? We provide no answer to the dividends puzzle.

### 2 A Basic Framework

The general practice in extending the Miller-Modigliani analysis to the case where taxes are positive is to work with static or two- or three-date models. Such settings require that firms pay a liquidating dividend at the terminal date (however, see DeAngelo and DeAngelo [5], where it appears that firms do not necessarily pay a liquidating dividend at the terminal date). A setting more suitable for the present purpose is to assume that the relevant cash flows are growing perpetuities. We will assume that each unit of capital yields $g$ units of output each period forever. Here $g$ is taken as given independently of the tax rates; this simplification allows us to avoid a general equilibrium analysis, as observed above.

To fix notation we begin by reviewing the case where there are no taxes. Suppose that a firm owns $k$ units of capital, each of which has price $q$. If $q$ is constant over time, as occurs in the deterministic steady states that we will examine, the value $qk$ of the firm obeys

$$qk = \frac{qk' + d'}{1 + r},$$  \hspace{1cm} (4)

where $k'$ is the next-period number of capital units the firm owns, $d'$ is next-period dividends, and $r$ is the discount rate. Dividends are given by
\[ d' = g\delta k, \]  

(5)

where \( \delta \) is the fraction of earnings paid out as dividends. It is assumed that \( \delta \) is constant over time. Assuming that retained earnings \( g(1 - \delta)k \) are used to acquire new capital, the next-period capital stock \( k' \) obeys

\[ k' = k(1 + g(1 - \delta)). \]  

(6)

Substituting (5) and (6) into (4) results in

\[ q = \frac{g\delta}{r - g(1 - \delta)}. \]  

(7)

It is easily checked that \( q > (=, <) 1 \) as \( g > (=, <) r \), so the equilibrium condition \( q = 1 \) is equivalent to \( g = r \).

Equation (7) is recognized as the Gordon [7] model: high (low) values of \( \delta \) result in a high (low) initial level of dividends, but a low (high) growth rate \( g(1 - \delta) \) of dividends. The two effects offset in present-value terms. This makes sense: if retained earnings generate the same return as the return implicit in the discount factor, then retaining earnings instead of paying them out as dividends does not affect value.

## 3 Dividends vs. Share Repurchases

We now assume that dividends are taxed at rate \( t_d \) and capital gains are taxed at rate \( t_g \). These are personal taxes, and are constant over individuals and income levels. There are no corporate taxes. As noted in the introduction, it is assumed that capital gains are taxed as they accrue, not when they are realized. If firms pay out less than 100\% of their earnings in dividends, they can use the earnings that remain either to repurchase shares or to acquire new capital. In this section it is assumed that firms allocate all earnings not paid out in dividends to repurchasing their own shares, while in the following section it is assumed instead that firms use retained earnings to acquire new capital. We could, of course, combine the two cases, but that would require an expansion of notation.

If \( t_d > 0 \) and \( t_g > 0 \), \( g = r \) results in \( q < 1 \) for any \( \delta \). This cannot be an equilibrium since investors would take over firms, convert the capital so obtained to the consumption good and realize an arbitrage profit. It follows that we cannot carry over the assumption \( g = r \) to the positive-tax case: if both tax rates are strictly positive, aftertax returns \( r \) are strictly lower than pretax returns \( g \).

We will continue to take \( g \) to be exogenous, but will specify that \( r \) is determined endogenously so as to allow \( q = 1 \) under equilibrium dividend policy. As indicated above, it is assumed that equilibrium consists of a dividend payout rate \( \overline{\delta} \) such that when all other firms adopt a dividend payout rate of \( \overline{\delta} \), implying that \( r \) equals \( r(\overline{\delta}) \), then it is value-maximizing for the firm being studied also to choose \( \delta = \overline{\delta} \).
Suppose that the firm owns one unit of capital and has $n$ shares outstanding, each of which has price $p$ at the present date. We will normalize $n$ also to equal 1, so that $np = p = 1$ in equilibrium (if dividend policy is suboptimal we will have $np = p < 1$). Since the firm does not acquire new capital, it has one unit of capital at the next date. It has $n'$ shares at the next date, each of which has price $p'$. These variables satisfy $n'p' = k = 1$ as a consequence of the assumption that the firm does not acquire new capital.

The analogue of eq. (4) in the presence of taxation is

$$p = \frac{p' - (p' - p)t_g + g\delta(1 - t_d)}{1 + r}. \quad (8)$$

Here $p' - p$ is the accrued capital gain resulting from the share repurchase. The next-period share price $p'$ is given by equating earnings net of dividend payments $g(1 - \delta)$ to the value of share repurchases $(n - n')p'$:

$$g(1 - \delta) = (n - n')p' = p' - 1, \quad (9)$$

using $n = 1$ and $n'p' = 1$. Using eq. (9) to eliminate $p'$ in eq. (8), that equation becomes

$$p = \frac{1 + g(1 - \delta)(1 - t_g) + (p - 1)t_g + g\delta(1 - t_d)}{1 + r}. \quad (10)$$

In equilibrium we must have $p = 1$ by the argument given in the preceding section. Substituting $p = 1$ in eq. (10) and solving for $r$, there results

$$r = g(1 - \delta)(1 - t_g) + g\delta(1 - t_d). \quad (11)$$

If $t_d = t_g = t$, this simplifies to

$$r = g(1 - t). \quad (12)$$

The assumption that dividends and capital gains are taxed at the same rate implies that the aftertax rate of return does not depend on the dividend payout rate. Therefore the Miller-Modigliani dividend irrelevance proposition applies under taxation in this case. This result is well known.

Suppose now that $t_d \neq t_g$. Then, from eq. (11), a dividend payout rate $\delta$ can be an equilibrium only if the aftertax return is $r(\delta)$, given by

$$r(\delta) = g(1 - \delta)(1 - t_g) + g\delta(1 - t_d). \quad (13)$$

The other condition that must be satisfied for $\delta$ to be an equilibrium is that an individual firm has no incentive to deviate by setting $\delta \neq \delta'$. Determining whether this is the case involves discounting the aftertax dividends generated by payout rate $\delta$ using the aftertax discount rate $r(\delta)$. Since we are dealing only with steady states, the relevant solution variable is the per-share value $p(\delta, \delta)$ of the aftertax cash flows.
By construction we have \( p(\delta, \bar{\delta}) = 1 \). If \( p(\delta, \bar{\delta}) > 1 \) for any value of \( \delta \) then the firm can increase its market value by deviating in favor of the dividend payout rate \( \delta \) from the dividend payout rate \( \bar{\delta} \) (supposedly) adopted by other firms. Since all firms will have the same incentive, \( \delta \) cannot be an equilibrium. However, if \( p(\delta, \bar{\delta}) \leq 1 \) for all \( \delta \), then firms have no incentive to deviate from \( \delta = \bar{\delta} \).

Evaluating the effects of a deviation in dividend payout policy from the value-maximizing policy depends on how long the deviation is expected to persist. We evaluate \( p(\delta, \bar{\delta}) \) for \( \delta = \bar{\delta} \) under the assumption that dividend policy will revert to the optimal policy in the next period. If so, the share price, \( p_0 \), will revert to its equilibrium value of \( 1 + g(1 - \delta) \) in the next period (see eq. (9)). In that case, from eq. (10), the value of cash flows satisfies

\[
 p(\delta, \bar{\delta}) = \frac{1 + g(1 - \delta)(1 - t_g) + (p(\delta, \bar{\delta}) - 1)t_g + g\delta(1 - t_d)}{1 + r(\delta)},
\]

which can be solved for \( p(\delta, \bar{\delta}) \):

\[
 p(\delta, \bar{\delta}) = \frac{1 + g(1 - \delta)(1 - t_g) - t_g + g\delta(1 - t_d)}{1 + r(\delta) - t_g}
\]

\[
 = \frac{1 + g(1 - \delta)(1 - t_g) - t_g + g\delta(1 - t_d)}{1 + g(1 - \bar{\delta})(1 - t_g) - t_g + g\bar{\delta}(1 - t_d)},
\]

using eq. (13).

Optimal dividend policy can now be determined. Suppose that \( \delta < \bar{\delta} \) implies \( p(\delta, \bar{\delta}) < 1 \). Under this inequality, eq. (16) reduces to \( t_d < t_g \). The interpretation is that \( t_d < t_g \) implies \( p < 1 \) for any \( \delta < \bar{\delta} \). In this case optimal dividend policy consists of setting \( \delta = 1 \) for any level of \( \bar{\delta} \). Since \( p > 1 \) for \( \delta > \bar{\delta}, \bar{\delta} \) can be an equilibrium only if \( \bar{\delta} = 1 \). Thus the firm pays all earnings out in dividends.

In the contrary case, when \( t_d > t_g \), then \( \delta < \bar{\delta} \) implies \( p(\delta, \bar{\delta}) > 1 \). In this case no strictly positive value of \( \bar{\delta} \) can be an equilibrium, since a firm could always deviate by setting \( \delta < \bar{\delta} \) and raise its value. The equilibrium dividend payout policy is \( \bar{\delta} = 0 \), so that the firm uses all its earnings for share repurchases.

The finding that firms optimally pay out all earnings in dividends if \( t_d < t_g \), and only then, has been stated before (Brennan [4], for example). However, other analysts have obtained a different result: Auerbach [1], for example, claimed that the dividend irrelevance proposition carries over to nonzero taxes even if \( t_d \neq t_g \). The result implies that a buy-and-hold strategy involving the shares of a firm that allocates all earnings to share buybacks is a pure bubble, assuming that the model just presented is embedded in a setting where bubbles can occur in equilibrium. That the buy-and-hold portfolio strategy is a bubble does not contradict the fact that the representative agent’s portfolio strategy—that is, the portfolio strategy of an agent who sells shares back to the firm in the same proportion as applies to the firm as a
whole—does not have a bubble. See Sethi [10] for further discussion of the fact that share repurchases can induce the existence of bubbles on securities.

Many analysts, such as Santos and Woodford [xxx] and Abel et al. [xxx], take the view that bubbles can be ruled out under assumptions that are reasonable theoretically and empirically. If so, the value of a firm that pays zero dividends forever is zero (assuming, as throughout this paper, that firms can somehow precommit to a dividend policy and that there is no possibility of takeovers). If so, it follows that when $t_d > t_g$ there does not exist an equilibrium dividend strategy: for $\delta > 0$ firms can always increase their value by decreasing $\delta$, yet $\delta = 0$ implies zero value.

4 Dividends and the Cost of Capital

The equilibrium dividend payout function,

$$
\delta = \begin{cases} 
1 & \text{if } t_d < t_g \\
0 & \text{if } t_d > t_g 
\end{cases}
$$

(17)

implies that the dividend payout relation minimizes the burden of taxes on after-tax returns. Specifically, for given pretax return to capital, dividends maximize the aftertax return to capital:

$$
r(\delta) = \begin{cases} 
g(1 - t_d) & \text{if } t_d < t_g \\
g(1 - t_g) & \text{if } t_d > t_g 
\end{cases}
$$

(18)

We can reverse the causation between the pretax return on capital $g$ and the aftertax return by taking the aftertax return on capital as exogenous and deriving the equilibrium pretax return on capital (“cost of capital”) as a function of tax rates. Inverting the relation (18) results in

$$
g(\delta) = \begin{cases} 
r/(1 - t_d) & \text{if } t_d < t_g \\
r/(1 - t_g) & \text{if } t_d > t_g 
\end{cases}
$$

(19)

where $r$ is the given aftertax return on capital. It is seen that the equilibrium dividends policy rule minimizes the cost of capital.

5 Dividends vs. Investment

We now assume that the firm allocates earnings remaining after dividend payments to acquisition of new capital rather than to share repurchases. This capital generates income at the same rate $g$ as the preexisting capital. As in the preceding section, it
is assumed that capital gains are taxed as they accrue, not when they are realized. In that case the analogue of eq. (8) is
\[ q^k = \frac{q^{k'} - t_g q(k' - k) + d'(1 - t_d)}{1 + r}, \] (20)
which has eq. (4) as a special case if \( t_d = t_g = 0 \).

Setting \( q = 1, k' = (1 + g(1 - \delta))k \) and \( d' = g \delta k \) in eq. (20), we have that \( r(\delta) \) is given by
\[ r(\delta) = g(1 - \delta)(1 - t_g) + g \delta(1 - t_d). \] (21)
For \( \delta \) to be an equilibrium we must have in addition that \( q(\delta, \delta) \leq 1 \) for all \( \delta \), where \( q(\delta, \delta) \) is given by
\[ q(\delta, \delta)k = \frac{(1 + g(1 - \delta)(1 - t_g))k + (q(\delta, \delta) - 1)t_g k + g \delta k(1 - t_d)}{1 + r(\delta)}, \] (22)
again using eq. (20). Solving eq. (22) for \( q(\delta, \delta) \) results in
\[ q(\delta, \delta) = \frac{1 + g(1 - \delta)(1 - t_g) - t_g + g \delta(1 - t_d)}{1 + r(\delta) - t_g}. \] (23)
Note that eq. (21) is the same as eq. (13), and the right-hand side of eq. (23) is the same as that of eq. (15), implying that \( p(\delta, \delta) \) of Section 3 equals \( q(\delta, \delta) \) of this section. It follows that allocating retained earnings to acquisition of new capital has the same tax consequences as buying back shares: both induce a capital gain in share prices, implying that the effective tax rate for both is \( t_g \). Firms are always indifferent between using retained earnings to buy capital or to repurchase shares, and they always prefer either to paying dividends if and only if \( t_d > t_g \).

6 Dividends and Taxes in General Equilibrium

It is easy to embed the dividend payout model just presented into a full general equilibrium setting. The obvious specification for this exercise is a standard-issue overlapping generations model. The model to be presented coincides with a special case of the model of Blanchard and Fischer [3], Ch. 3, from which this exposition is drawn, except for the inclusion of dividend and capital gains taxes here. Thus assume that each generation lives for two periods. Young people work and save part of their labor income, consuming the rest. With their savings they buy shares of stock of firms. The capital that they transfer to firms in exchange for these shares is used in production next period. When these agents become old they receive taxable income from their capital—whether this income takes the form of dividends, share repurchases or capital gains depends on the tax environment in the manner specified in the preceding sections. They also receive a liquidating dividend from the firms,
which is not taxable. For simplicity it is assumed that the labor income of workers is not taxed.

The utility of generation $t$ is of the form

$$u(c_{1t}, c_{2t+1}) = \ln(c_{1t}) + (1 + \theta)^{-1} \ln(c_{2t+1}),$$

(24)

where $c_{1t}$ is the consumption of young agents at date $t$ and $c_{2t+1}$ is the consumption of old agents at date $t + 1$. The budget constraint of generation $t$ is

$$c_{1t} = w_t - s_t$$

(25)

$$c_{2t+1} = (1 + r_{t+1})s_t + T_{t+1},$$

(26)

Here $w_t$ is the labor income of the young, $s_t$ is the saving of the young, $r_{t+1}$ is the aftertax return to capital invested from date $t$ to date $t + 1$, and $T_{t+1}$ is a lump-sum distribution of tax revenues. This specification reflects the assumption that tax revenues are distributed to the older generation.

As above, firms are subject to dividend taxation at rate $t_d$ and capital gains taxation at rate $t_g$. Since firms distribute all their earnings to shareholders in the form of dividends (capital gains or share repurchases) if $t_d < t_g$ ($t_d > t_g$), it is clear that the effective tax rate is $t \equiv \min(t_d, t_g)$. Therefore we have

$$r_{t+1} = g_{t+1}(1 - t),$$

(27)

where $g_{t+1}$ is the pretax return to capital.

To solve the model, assume first that there are no taxes. In that case logarithmic utility implies that the saving of the young is a constant proportion $1/(2 + \theta)$ of labor income:

$$s_t = \frac{w_t}{2 + \theta},$$

(28)

regardless of the return on capital $r_{t+1}$.

Production, like utility, is of the Cobb-Douglas form:

$$Q_t = K_t^\alpha N_t^{1-\alpha},$$

(29)

implying that the pretax return to capital at $t + 1$ is

$$g_{t+1} = \alpha k_{t+1}^{\alpha - 1}$$

(30)

and labor income at $t$ is

$$w_t = (1 - \alpha)k_t^{\alpha},$$

(31)

where we have converted to intensive units ($k_{t+1} \equiv K_{t+1}/N_{t+1}$). The investment-equals-saving identity is
\[ K_{t+1} - K_t = N_t s_t - K_t \]  \hfill (32)

or, in intensive units,

\[(1 + n)k_{t+1} = s_t, \]  \hfill (33)

where \( n \) is the population growth rate \( N_{t+1}/N_t - 1 \), assumed constant.

The evolution of the capital stock per worker is given by

\[ k_{t+1} = \Psi(k_t) = \frac{w_t}{(1 + n)(2 + \theta)} = \frac{(1 - \alpha)k_t^\alpha}{(1 + n)(2 + \theta)}, \]  \hfill (34)

from eqs. (28), (31) and (33). The stationary point \( k^* \) of this difference equation defines a unique stable steady state.

Assume now that the tax rate is \( t > 0 \). Allowing for taxes has two effects on agents’ budget constraints. First, the aftertax return on saving becomes \( r_{t+1} = g_{t+1}(1 - t) \). Supposing for the moment that \( g \) is unaffected by \( t \), this would imply a drop in the return to saving. Second, wealth equals the sum of labor income and the discounted value of the lump-sum distribution of tax revenues, where the latter are given by

\[ T_{t+1} = t\alpha k_{t+1}^\alpha (1 + n). \]  \hfill (35)

Denote by \((c_{1t}^*, c_{2t+1}^*)\) the steady-state equilibrium consumption levels of young and old agents. The existence of the transfer \( T_{t+1} \) implies that \((c_{1t}^*, c_{2t+1}^*)\) is on the boundary of agents’ budget set in the presence of taxes. Thus including taxes has the effect of rotating the budget line counter-clockwise around \((c_{1t}^*, c_{2t+1}^*)\). The effect of this shift in the budget line is to induce agents to consume more when young in the presence of taxes than they would in their absence. This outcome reflects solely the role of \( T_{t+1} \); in the absence of that term consumption of the young, and therefore also saving, would be unaffected by taxes, as a consequence of the assumption of logarithmic utility. The lower saving rate implied by taxes has the effect of decreasing the next-period capital stock per capita, which in turn increases \( g_{t+1} \). However, the increase in \( g_{t+1} \) is not enough to reverse the assumed decrease in \( r_{t+1} \). Thus if we modify equation (34) to reflect the role of taxes, the effect is to shift function \( \Psi \) down. The result is a lower steady-state capital stock. The models of the two preceding sections can be viewed as corresponding to the steady state of the model just presented.

If one wished to avoid the complication just outlined, one could assume that tax revenue, rather than being returned to agents as a lump-sum transfer, is consumed in nonproductive spending. In that case \( T_{t+1} \) would drop out of the budget constraint (26), so taxes would not affect the evolution of the capital stock per capita. Again, of course, this outcome reflects the restrictive specification of utility.
Comparison with “The New View of Dividend Taxation”

In this section the present analysis is compared with that in the public finance literature. In the public finance literature dealing with the effects of dividend and capital gain taxation there is a tendency to characterize alternative financial strategies according to the source of investment funds (share issues vs. retained earnings) rather than the disposition of earnings (dividends vs. share repurchases). Inasmuch as taxes apply to the disposition of earnings rather than the sources of funds required for the investment projects that generate the earnings, this practice makes the analysis unnecessarily complicated. In places it appears to introduce error. For example, Zodrow [11] wrote that “[t]here is general agreement that dividend taxes reduce the return to investment financed with new share issues” (p. 497). The basis for this conclusion is far from clear. Whether or not investment funds were generated with new share issues is not clearly relevant to an analysis of the effects of dividend and capital gains taxation. What is relevant is whether the dividend tax rate is low enough to induce firms to pay dividends. If not, the dividend tax rate has no effect on the rate of return to investment, as has been demonstrated. Further, as noted above, one cannot abstract away from general equilibrium considerations in determining the effect of taxes on aftertax returns, and many discussions of the impact of taxes that purport to show that dividend taxes reduce the return to investment financed with new share issues appear to do exactly that.

Comparison of our approach with the “new view of dividend taxation” is further complicated by the fact that the two analyses are not parallel: the new view takes dividend policy as exogenous, whereas here dividend policy is determined endogenously as part of the equilibrium. For example, a major assertion of the new view is that corporate valuations are unaffected by dividend taxation if investments are financed using retained earnings. Here the analyst is permitted to assume either that firms use retained earnings or that they issue new securities. In either case the same returns and tax rates are assumed to apply. In our setup, by contrast, whether or not earnings are retained under equilibrium strategies depends on the assumed tax rates, so one can assume that earnings are retained if the capital gains tax rate is lower than the dividends tax rate, and only then. The analyst can compare the two treatments only if the assumption that earnings are retained in the first case is translated into the assumption that the capital gains tax rate is lower than the dividends tax rate in the second case.

With this proviso, we can determine whether or not the dividend tax rate affects valuations, as asserted in the new view of dividend taxation. In the present model the new view is correct: if the dividend tax rate exceeds the capital gains tax rate, the dividend tax rate clearly does not affect valuations. Most simply, if the dividend tax rate exceeds the capital gains tax rate, firms will not pay dividends. It follows that the dividend tax rate is irrelevant to valuations (here it is understood that contemplated
Variations in the dividend tax rate are such as to preserve the inequality; if instead the dividend tax rate is set below the capital gains tax rate, then firms will pay all earnings out in dividends, resulting in the irrelevance of the capital gains tax rate. Firms will raise new capital via retained earnings or new share issues (we have seen that the two are equivalent from a tax point of view). Earnings will either be paid out to investors using share repurchases or invested in new capital; dividends will not be involved at any stage.

In still other respects the treatment of tax incidence under the new view of dividend taxation is difficult to compare with the analysis here. Zodrow [11] asserted that the new view of dividend taxation rules out share repurchases, so that earnings can be paid to investors only using dividends. As many critics have noted, this specification is empirically untenable: since the 1980s share repurchases have played an important role in corporate finance in the US. Further, the assumption is unmotivated from a theoretical point of view—modeling share repurchases does not introduce new difficulties, as we have tried to show.

Zodrow contended that if firms are unable to repurchase shares, then $q < 1$ can occur in equilibrium. In contrast, in the present model $q = 1$ occurs always in equilibrium as a consequence of the assumed one-for-one transformation between capital and the consumption good. The $q = 1$ condition has nothing to do with share repurchases; if $q < 1$ managers are not maximizing the value of the firm, contrary to the assumption of our model, and this is true whether or not share repurchases are ruled out. Restricting share repurchases in the present model has no consequences for valuation because firms can still retain earnings and acquire new investment capital. As we have seen doing so is equivalent to share repurchases from a tax point of view.

8 Conclusion

These results were derived in a highly stylized setting. We specified the simplest production technology, assuming that capital and consumption are the same good. It was also assumed that the market for corporate control operates without impediment, implying that the equilibrium value of a firm equals the number of capital units it has. This setting made it possible to present the central conclusion of this paper in a setting free of distractions. That conclusion is that pretax and aftertax returns to capital cannot be specified independently of the tax regime. Doing so results in the incorrect conclusion that the unit value of a firm’s capital does not equal 1 in general, which is inconsistent with equilibrium in the assumed setting. To avoid this outcome it was assumed here that the aftertax discount factor always adjusts so that the unit value of a firm’s capital is 1 under optimal dividend payout behavior, and less than or equal to 1 for any dividend payout behavior; in general settings both the pretax and aftertax returns to capital depend on taxes.

The tax environment could be generalized. No account was taken here of debt financing or of corporate taxes. Adapting the present model to deal with this question...
would not involve any difficulties.

More general production technologies could be specified. Under two-sector capital accumulation models, capital and consumption goods are produced using different technologies, implying that the equilibrium price ratio of capital and consumption is endogenous, and not generally equal to one. Adding adjustment costs would produce the same conclusion. We do not defend the present setting against these more general specifications. Our point is to emphasize that one cannot abstract away from equilibrium considerations in analyzing the effect of taxation on corporate valuation under optimal dividend payout behavior.

References


