Dividends and Taxes

by

Roger Gordon and Martin Dietz[*]
(UCSD* and *University of St. Gallen)

Abstract: How do dividend taxes affect firm behavior and what are their distributional and efficiency effects? To answer these questions, the first problem is coming up with an explanation for why firms pay dividends, in spite of their tax penalty.

This paper surveys three different models for why firms pay dividends, and then uses each model to examine the behavioral and efficiency effects of dividend taxes. The three models examined are: the "new view," an agency cost explanation, and a signaling model.

While all three models forecast dividends, their forecasts regarding other firm behavior, and their forecasts for the efficiency and distributional effects of a dividend tax, often differ. Given the evidence to date, we find the agency model is the one most consistent with the data. Under this model, the efficiency effects of a dividend tax largely depend on the difference between the tax rates on dividends and capital gains, with the further complication that agency costs generate too much investment in the corporate sector.

The objective of this paper is to provide an overview of the existing debate about the behavioral and efficiency effects of taxes on dividends. The tax treatment of dividends differs widely across countries and has changed dramatically since 2001 in the U.S. What difference does this make?

In order to be in a position to assess how dividend taxes affect behavior and efficiency, we first need to provide an explanation for why firms pay dividends, in spite of their unfavorable tax treatment. Certainly firms need to provide a payoff to their equity holders. But providing this return through dividends has in the past subjected their shareholders to higher tax liabilities than they would face if the funds for example were used instead to repurchase shares in the firm, reinvested in productive assets, or used to acquire other firms, in each case generating income for shareholders that is taxable as capital gains. Section 1 briefly describes this longstanding dividend puzzle.

[*] This paper was written for the David Bradford Memorial Conference, held at NYU Law School on May 5, 2006. We would very much like to thank George Zodrow, William Andrews, and the other participants for comments on an earlier draft. Dietz thanks the Fritz-Thyssen-Stiftung for financial support.

There are a variety of explanations proposed in the tax and finance literature for dividend payments. The objective of this paper is to describe in a simplified setting three key theories. The paper will be organized by theory.

The "new view", summarized in section 2, assumes that firms are not allowed to repurchase shares or to acquire shares in other firms, so that dividends are the only feasible way to pay out profits to shareholders. The agency-cost model, developed in section 3, assumes that managers tend to invest more than is in the interests of shareholders, leading to wasteful expenditures if the funds available to the manager exceed the amount of investments paying an above-market return. In response, shareholders through the Board of Directors force managers to pay out dividends each period to limit the “free cash flow” available to the manager. The signaling model, summarized in section 4, argues that managers choose to pay out profits in order to signal to investors that the firm has more than enough cash on hand, so is doing well. Having a more costly signal, such as dividends, may be attractive since equilibrium signals will be smaller.

In section 5, we summarize the economic forecasts of the three theories for firm behavior, and compare these forecasts with patterns clearly seen in the data. While all the theories forecast dividend payments, they vary in the consistency of their other implications with the data.

The paper then explores the implications of each theory for the efficiency and distributional effects of dividend taxes. Here, the “new view” forecasts no behavioral effects or efficiency costs of dividend taxes, at least when imposed on firms currently paying dividends.[1] The tax simply reduces share values. In the signaling model, dividend taxes also have no efficiency consequences when imposed on firms that both pay dividends and repurchase shares.[2] Firms do respond to the tax by changing the mixture of their payouts, doing so to leave the effective cost of a signal unchanged. In this theory, share prices remain unchanged, or can even increase for firms that gain from having available a more costly signal.

The agency model comes closest to a traditional instinct of tax economists about the efficiency effects of the tax. Here, dividend taxes discourage the Board from paying out dividends. The behavioral response and efficiency costs are both linked to the net tax penalty on dividends relative to capital gains. Share prices do fall in response to the tax. The dividend tax, by causing a fall in dividends, however, also enables managers of existing firms to invest yet more.[3] The forecasted overinvestment complicates the analysis of the efficiency consequences of taxes on savings and investment more generally.

None of the three theories, as they stand, are consistent with all of the evidence available to date about patterns of dividend payout behavior. Of the three theories, though, we

[1] Dividend taxes discourage entry of new firms, however.
[2] Dividend taxes, though, can aid firms that gain from having available a more costly signal.
[3] Investment in new firms would be discouraged, however.

expect that the agency model is the one that can most easily be developed further so as to be consistent with the full range of past evidence about dividend behavior.

1. Initial model of the dividend puzzle

In order to make clear the nature of the dividend puzzle and in the process define notation for the subsequent discussion, consider the after-tax return received by an investor in corporate equity:[4]

$$R_t = (1-m)\frac{D_{t+1}}{V_t} + (1-z)\left(\frac{V_{t+1} - V_{t+1}^N}{V_t} - 1\right) \tag{1}$$

Here, R_t denotes the after-tax return per dollar invested in equity, m is the personal income tax rate on dividend income, D_{t+1}, z is the "effective" tax rate on accruing capital gains, V_t is the value of the individual's equity holdings at date t, while V_{t+1}^N is the amount of new issues of equity (or repurchases if negative) during the period. Throughout, we assume that $m > z$, since capital gains have commonly faced a lower statutory tax rate, and these taxes are deferred until realization and avoided entirely if the shares are held until death.[5]

Let ρ denote the net-of-tax rate of return that the investor can get elsewhere.[6] Since bonds are the obvious alternative outlet for savings, let $\rho = r(1-t)$, where r is the market interest rate and t is the statutory tax rate on interest income.[7] The value of the firm then adjusts each period so that equity earns a return equal to that available elsewhere, implying that $R_t = \rho$. Therefore,

$$\left(1+\frac{\rho}{1-z}\right)V_t = \left(\frac{1-m}{1-z}\right)D_{t+1} + V_{t+1} - V_{t+1}^N \tag{2}$$

Substituting for successive values of V_{t+i} and using the standard transversality condition, we find that

$$V_t = \sum_{i=1}^{\infty} d^i \left[\left(\frac{1-m}{1-z}\right)D_{t+i} - V_{t+i}^N\right], \tag{3}$$

where $d = 1/(1+\rho/(1-z))$. The presumed objective of the firm at each date is to maximize the current share value. It does so subject to the cash-flow constraint

---

[4] Our notation is largely conventional, and in particular is drawn from Poterba and Summers (1985).

[5] To justify this description of capital gains taxes, we can assume that the individual will sell the shares at a random date, based on events unrelated to the ex post return on the shares, e.g. consumption needs. To the degree to which shareholders respond to tax incentives by realizing capital losses quickly and deferring the realization of capital gains, the effective capital gains tax rate is reduced further, and may not even by positive. (See Constantinides (1983) or Stiglitz (1983).)

[6] For simplicity, we assume that all shareholders have the same opportunity cost, ρ.

[7] Until recently in the U.S., the tax rates on dividends and interest were equal, in which case $m = t$.

(4) $$(1-\tau)\pi_t(L_{t,} K_t) + V_t^N = D_t + I_t\,,$$

where

$$K_{t+1} = K_t + I_t\,.$$

Here π_t denotes the after-tax profits at date *t*, τ is the corporate tax rate, K_t denotes the firm's capital stock, L_t equals the labor supply (taken to be exogenous), while I_t denotes new investment at date *t.*[8] The available choices for the firm include D_t, I_t, and V_t^N. The one constraint is that dividends must be nonnegative.

The tax effects on capital accumulation are summarized in the shadow price of capital:

(5) $$q_t = \sum_{i=1}^{\infty} d^i \frac{(1-\tau)(1-m)}{1-z} \pi_i'\,.$$

Here, q_t measures the market value of the after-tax present value of the return on a marginal investment, so corresponds to Tobin's q. In equilibrium, investors are willing to invest an extra dollar in the firm only if the after-tax returns they get, in present value, equal a dollar.

Consider then the effects on current share values of an increase in dividends by a dollar in some period *t+k*, financed by an increase in new share issues by a dollar in that period. Equation (3) then implies that share values change by

(6) $$d^k\left(\frac{1-m}{1-z} - 1\right)$$

This expression is negative whenever $m > z$. As a result, a manager can increase firm value by simultaneously cutting dividends and cutting new share issues or increasing share repurchases.[9] In the process, income taxed at rate *m* is replaced by income taxed at rate *z*, so that the shareholder gains with no offsetting costs to the firm. The only equilibrium is one with no dividend payments. Of course, the dividend tax then collects no revenue, but also generates no excess burden since repurchases, taxes aside, are a perfect substitute for dividends for both the firm and its shareholders.

[8] To simplify notation, we ignore depreciation. Allowing for depreciation introduces standard extra terms, with no change in the qualitative results.

[9] Another alternative is to use the funds freed by a cut in dividends to buy shares in another firm. The formal derivation would be entirely unchanged.

The trouble with this model is that dividends are clearly nonzero in the data, and most firms pay dividends.[10] This is the dividend puzzle.

Of course, any model solving the "dividend puzzle" must explain the use of dividends, in spite of these tax incentives. In addition, there are a number of other obvious stylized facts or strongly confirmed empirical results that should be consistent with the forecasts from a model. Among these are:

Stability of dividends: Dividend payments by a firm tend to be very stable over time, much more so than firm profits (see Lintner (1956)). Some firms, though, do not pay any dividends.

Occasional new share issues: New share issues occur occasionally both among firms that do not pay dividends and among firms that do pay dividends.

Share repurchases: Share repurchases are increasingly common, though repurchases by a given firm are highly volatile over time.[11]

Response to tax: Dividend payout rates increase when the tax rate on dividends falls.[12]

Mergers and acquisitions: Mergers and acquisitions are very common but do not seem to respond to the dividend tax rate.[13]

2. "New View"

Probably the most commonly cited explanation for dividend payments in the public finance literature is known as the "new view."[14] The key difference of the "new view" model from the model in section 1 is the additional constraint that $V_t^N > 0$, ruling out repurchase of shares or acquisition of shares in other firms. Repurchase of shares has been legally barred in the U.K.[15] In the U.S., if repurchases occur on a periodic basis and in proportion to each shareholder's initial holdings then the resulting capital gains will be treated as a dividend for tax purposes by the IRS. While this legal restriction alone is not really sufficient to justify the constraint that $V_t^N > 0$, at least at the time the new view was developed repurchases in the U.S. were sufficiently small that this assumption was broadly consistent with the data.[16]

---

[10] Recently, the number of firms paying dividends has fallen while the total amounts paid out to investors has roughly stayed constant. See Fama and French (2001) and DeAngelo, DeAngelo, and Skinner (2004).
[11] In the U.S., the importance of share repurchases has been increasing since the mid-1980. Nowadays, dividends and share repurchases are of roughly equal size in aggregate. See Grullon and Michaely (2002).
[12] This empirical result has been documented many times. See, e.g. Poterba (2004), Chetty and Saez (2005), and Brown, Liang, and Weisbenner (2004).
[13] See, e.g. Auerbach and Reishus (1988).
[14] This model was derived independently by King (1977), Auerbach (1979), and Bradford (1981).
[15] Acquisition of shares in other firms remained possible, however.
[16] Acquisitions, though, have always been an important use of firm funds.

How do results change when this constraint is added to the prior model? Expression (6) still measures the change in firm value if dividends and new share issues are increased simultaneously, and this expression remains negative. We therefore conclude that dividends and new share issues cannot both be positive simultaneously – at least one of these variables must equal zero.

This result creates three different potential situations.

1) If $D_t = V_t^N = 0$, then the firm simply retains and invests all earnings.

(2) If $V_t^N > 0$ but $D_t = 0$, then $q_t = 1$.

(3) If $V_t^N = 0$ but $D_t > 0$, then in equilibrium $q_t = (1-m)/(1-z)$ or equivalently

(7) $$1 = \sum_{i=1}^{\infty} d^i (1-\tau)\pi_i^{'}$$

Now, the marginal investment is being financed through a dollar no longer paid as dividends, so costs the shareholders $(1-m)/(1-z)$, yet still provides a return of q_t.

In this model, what are the effects of an increase in the tax rate *m* on the investment rate and on economic efficiency? Until 2001, the tax rates on dividends and interest income were equal, so changed together. We examine two policy changes: one in which both tax rates increase together, and one in which just the dividend tax rate changes.[17] In each case, the impact of a tax change on firm behavior and on economic efficiency varies depending on the regime a firm is in. We focus on steady-state situations to simplify the algebra.

As long as the firm is in regime (1), behavior and economic efficiency cannot be affected by a dividend tax. Firms would not normally remain in regime (1) in steady state, so we focus on the other two regimes.

For firms in regime (3), as seen from equation (7) the tax rate *m* does not affect the equilibrium capital stock. If only *m* changes, then the equilibrium capital stock is left unaffected. We then infer from the firm's cash-flow constraint that dividends do not change either. The only effect is on firm values. Any effects on efficiency then arise solely from the general equilibrium effects caused by the wealth redistribution, analogous with the results reported in Auerbach and Kotlikoff (1983).

[17] In 2001, both *m* and *t* fell, but *m* fell by more.

The tax rate t enters implicitly in equation (7), however, since $d^{-1} = 1 + r(1-t)/(1-z)$. If t and m increase together, then equation (7) implies that the equilibrium capital stock increases, since the alternative asset is now less attractive. Dividends then fall temporarily, to finance the additional investment.

In general, the efficiency implications of this increase in investment are unclear.[18] As emphasized in Bradford (1975), the efficiency implications of the extra investment per se depends on what else was foregone in order to finance the additional investment. If the financing comes from extra savings, then the additional investment creates an efficiency gain as long as $\pi' > \rho$. If the financing comes from a drop in investment in some other sector, then the answer depends on the tax rate as well in this other sector, so on the difference in the equilibrium pre-tax returns in the two sectors. For example, if the funds would otherwise have been invested abroad, earning a pretax return of r, then there is an efficiency gain only if $\pi' > r$. In steady state, equation (7) implies that

$$\pi' = \frac{r(1-t)}{(1-z)(1-\tau)}, \tag{8}$$

implying that $\pi' > \rho$. However, $\pi' > r$ if and only if $\tau + z(1-\tau) > t$, so only if corporate income had been taxed more heavily than interest income.

What happens in regime (2)? In a steady state, in which the capital/labor ratio remains unchanged at the value satisfying equation (5), equation (5) implies that

$$\pi' = \frac{\rho}{(1-m)(1-\tau)}. \tag{9}$$

If just the dividend tax rate increases, then the required rate of return on capital goes up and the equilibrium capital stock falls. If $t = m$ and both tax rates increase together, then investment is unchanged *if* the interest rate is unchanged. What happens to the domestic interest rate depends on whether the economy is open or closed, and if closed on what happens to domestic savings? For a small open economy, r should remain unchanged, and then so should investment.

What happens to economic efficiency as a result? The same complications as before enter. If the economy is open, then investment is unchanged when m and t both increase, but savings fall, implying an efficiency loss since $\rho < r$.

How successful is this model in explaining the stylized facts? The model of course was designed to explain the existence of dividends, and also explains why not all firms pay dividends. The response of dividend payments to variations in the dividend tax is also consistent with the model if all past tax changes have involved simultaneous changes in

[18] Of course, any tax change affects behavior throughout the economy. We focus solely on the efficiency effects of the resulting changes in dividend and investment behavior.

both t and m, since an increase in t results in an increase in investment and a fall in dividends.[19]

The model is not consistent with the other facts, however:

Stability of dividends: For firms in regime (3) that pay dividends, dividends are a residual: $D_t = \pi_t - I_t$. Given how volatile profits are, and the bunched time pattern for new investment,[20] dividends should be highly volatile, inconsistent with their stable pattern.

Occasional new share issues: Firms in regime (1) issue new shares and pay no dividends, but the model cannot explain why firms might both issue new shares *and* pay dividends.

Share repurchases: Of course, the model assumes repurchases cannot occur.[21]

Merger and Acquisitions: If $q < 1$ in equilibrium, then it becomes cheaper for a firm to buy new capital through acquiring a firm that already owns this capital than to buy the new capital directly. The higher is m relative to z, the stronger this tax incentive. If mergers involve no real cost, then the equilibrium has $q = 1$, so no dividend payments. If mergers are costly, they should still respond strongly to m, contrary to the evidence.

3. Agency role for dividends

An alternative explanation for the use of dividends, or at least cash payouts, was sketched out in Easterbrook (1983) and Jensen (1986) and received empirical support in LaPorta et al. (2000). The new issue they raised was agency costs. Corporate managers they argue like to invest more than is in the interests of shareholders, so beyond the point that maximizes the value per share. To constrain this empire-building tendency of the manager, shareholders through the Board of Directors can force the firm to pay out a certain amount of cash each period. If the managers find they have worthwhile investments that they can no longer finance with retained earnings, then they can turn to outside investors for the extra funding. This outside funding they argue would be available only if the projects being funded are in fact worth pursuing. Since there are costs associated with obtaining outside funds, e.g. the fees to investment bankers who certify the quality of the firm's securities, the Board would not normally want to leave the firm with no retained earnings. Payouts would instead trade off the reduced chance of particularly low return projects being pursued with the increased chance that the firm needs to seek outside financing for high return projects, with the associated costs.

[19] If the increase in m is temporary, dividends would also drop even if t is left unchanged.
[20] See Doms and Dunne (1998) for evidence on the time pattern of new investment for a firm.
[21] Auerbach and Hassett (2003) develop a hybrid model that allows for a limited amount of repurchases.

While there have been a number of papers providing empirical evidence on the association between free cash flow and corporate payouts, to our knowledge there is not yet a formal model capturing this intuition. Yet such a model is needed in order to explore carefully the efficiency implications of a tax on dividends. The model necessarily involves a number of steps. Enough complications are added that we chose to simplify by restricting the model to two periods, so that the resulting initial value of the firm to shareholders equals

$$V_0 = E\sum_{i=1}^{2} d^i \frac{1-m}{1-z} D_i - d(EV_1^N - EV_1^R) + d^2 E\big(K_2 + (1-\tau)\pi(K_2) - D_2\big),$$

where the expectations are taken as of time 0.

To generate agency costs requires a number of key changes to the initial model. First, outside investors cannot fully monitor the firm, else the Board of Directors, acting in their interest, could impose the efficient capital stock regardless of the incentives faced by the manager. In particular, assume that all that outside investors can observe is the industry and any dividend payments, share repurchases, or new share issues on the public exchanges undertaken by the firm. Let their unconditional expected profits at date 1 be denoted by $\bar{\pi}_1$, so that the true profits π_1 satisfy $\pi_1 = \bar{\pi}_1 + \tilde{\varepsilon}_1$. The Board can then choose payouts based on $\bar{\pi}_1$, while the manager chooses investment, I_1, share repurchases, V^R, or new share issues, V^N, based on the firm's cash-flow constraint: $(1-\tau)\pi_1 - D_1 = I_1 + V^R - V^N$.[22] While we assume that only the manager knows $\tilde{\varepsilon}_1$ at this date, for simplicity we assume that nobody at that point knows $\tilde{\varepsilon}_2$. Also, we assume that $\tilde{\varepsilon}_i$ is uncorrelated with any movements in the market, so that investors impose no risk premium for bearing this risk. We also assume that the manager is risk neutral, so ignore an offsetting incentive for the manager to underinvest due to her being more risk-averse at the margin than outside investors.

A second key change needed to generate agency costs is a difference between the objectives of the manager and the interests of shareholders. Here, we assume that the manager receives wage and non-wage benefits that depend on the size of the firm, in addition to receiving a return on *n* shares in the firm (out of a total number of outstanding shares *N*).[23] We can characterize the size of the firm by its capital stock, K_t, and the resulting benefits by $W(K_t)$.[24] Her overall expected income, evaluated as of period 2, evaluated based on the information available in period 1, is then[25]

[22] Note the change in notation from prior models. In this model, it is useful to distinguish explicitly between new share issues and share repurchases.
[23] We assume that the manager cannot trade these shares, so that *n* is fixed.
[24] Formally, we assume $W' > 0$, and $W'' < 0$.
[25] Technically, we assume that any share repurchases occur after the ex-dividend day in period 1, so that D_1 is divided among all *N* shares.

(10)

$$U \equiv \frac{n}{N^R}(1-z)V_2^{true} + \frac{n}{N}[(1-m)((1+\rho)D_1 + D_2)] + (1-t_w)[W(K_1)(1+\rho) + W(K_2)],$$

where V_2^{true} reflects knowledge of the actual $\tilde{\varepsilon}_1$ but no information about $\tilde{\varepsilon}_2$, and N^R measures the number of shares still outstanding after any share repurchases or new share issues. Here, we have assumed that the manager literally owns shares so receives dividends on them, and faces capital gains tax rates on any capital gains. As an alternative, explored below, we assume that the manager owns options to buy shares that expire in period 2, so receives no dividends and is taxed on the value of the share relative to some preset strike price. We denote the effective tax rate on the benefits $W(K_i)$ by t_w, a rate that depends on the composition of these benefits between taxable and nontaxable forms.

In contrast with the new-view model, we impose no constraint on share repurchases, forcing the model to come up with some other explanation for dividends. Based on the reasoning used in section 1, we immediately conclude that the manager would never choose to pay dividends, so that any payouts chosen by the manager occur through share repurchases.

We will argue below, though, that the Board of Directors may well force the manager to pay out funds each period, to lessen the firm's free cash flow. Since the information available to the Board of Directors would not change over time, except to the extent that the manager chooses to issue or repurchase shares, this payout rate would be stable over time. Reflecting U.S. tax enforcement provisions that would likely classify stable payouts as dividends for tax purposes, we assume that they in fact take the form of dividends. The question will be when the Board in fact requires dividend payouts, in spite of their tax disadvantage. Under what circumstances can the Board succeed in improving the performance of the manager through setting a higher dividend payout rate?

In order to capture the role of market screening in limiting the discretion of managers, it is important to capture accurately the information conveyed to the market through any share repurchases or new share issues. Consider first the case of repurchases. Under U.S. securities regulations, a firm must announce that it will repurchase up to so many shares during the coming time period, and then can repurchase as many shares as it wishes up to the stated maximum during that time period. Following the reasoning in Grossman-Stiglitz (1980), however, we assume that the market can infer the number of shares actually repurchased through observing overall trade on the market, and then back out information about $\tilde{\varepsilon}_1$ given the amount the firm chose to repurchase. We do so in order to best capture the intuition of Jensen and Easterbrook that the market will provide funds only for good projects.

Consider then the impact on the utility of the manager from using V^R for share repurchase and remaining funds for new investment. Shareholders are assumed to observe V^R, and to update their expectations about firm value appropriately.

What is the impact on the utility of the manager of increasing new investment by a dollar vs. increasing V^R by a dollar? At the margin, if the manager allocates another dollar to new investment, the payoff to the manager in period 2 equals

$$\text{(11)} \qquad \frac{n}{N^R}(1-z)(1+(1-\tau)\pi_2^{'})+(1-t_w)W'.$$

Instead this dollar could be used to repurchase yet more shares. The price per share in period 1, $p = dE\left(V_2^{true} \mid V^R\right)/N^R$, depends on the number of shares, N^R, left after the share repurchase and on the information conveyed to outside shareholders by the overall expenditures on share repurchases, V^R. In addition, the overall number of shares repurchased, $N - N^R$, must satisfy $p(N - N^R) = V^R$, so that $dEV_2^{true}(N - N^R)/N^R = V^R$. Given expression (10), spending an extra dollar on share repurchases provides a payoff to the manager only due to the resulting change in N^R, implying a return to the manager in period 2 equal to

$$\text{(12)} \qquad \frac{(1-z)nV_2^{true}}{NdEV_2^{true}}\left(1-\frac{(N-N^R)d}{N^R}\frac{\partial EV_2^{true}}{\partial V^R}\right)$$

The last term captures the degree to which shareholders become more optimistic about the firm when it chooses to repurchase more shares, since larger repurchases signal more current profits.[26]

In the resulting equilibrium, managers should equate at the margin the gains from further investment vs. further share repurchases, so that expressions (11) and (12) are equated. In a separating equilibrium, in which firms with different $\tilde{\varepsilon}_1$'s choose different V^R, shareholders infer $\tilde{\varepsilon}_1$ so that $EV_2 = V_2^{true}$. Carrying out the algebra, we then find that

$$\text{(13)} \qquad (1-\tau)\pi_2^{'} = \frac{N^R}{N}\frac{\rho}{1-z} - \left(1-\frac{N^R}{N}\right) - \frac{(N-N^R)}{N}\frac{\partial EV_2^{true}}{\partial V^R} - \frac{(1-t_w)N^R}{(1-z)n}W'.$$

[26] This implied positive derivative is consistent with the jump in share prices observed in the data when repurchases are announced.

Firms with a higher $\tilde{\varepsilon}_1$ must both invest more and repurchase more shares according to equation (13). To the degree that investment increases due to an increase in $\tilde{\varepsilon}_1$, the left-hand side decreases. Similarly, an increase in V^R causes the right-hand side to fall. The relative sizes of the increases in I_1 and V^R are determined in equilibrium by equation (13), while the absolute sizes must satisfy the budget constraint $I_1 + V^R = (1-\tau)\overline{\pi}_1 + \tilde{\varepsilon}_1 - D_1$. Investors then appropriately infer that firms with a higher V^R are worth more due to their higher I_1.

Comparing equation (13) with equation (8), we find that the equilibrium capital stock exceeds that in equation (8) for several reasons. First, given that $N^R / N < 1$, the first term in equation (13) is smaller than that in equation (8), while the second term in equation (13) reduces opportunity costs further.[27] Second, a larger share repurchase causes the equilibrium price paid to go up, limiting the attractiveness of such repurchases and generating more new investment instead. Third, as expected, more investment implies higher future wages for the manager, making new investment more attractive than in the other models.

What if the manager instead considers issuing new equity, to obtain funds to increase investment beyond what can be financed with retained earnings? Here, we assume that the firm must file a prospectus through an investment banker, listing a given number of shares for sale on the market at a given price. This prospectus should in itself reveal information to the market about the state of the firm. Optimistically, we assume that the prospectus per se reveals $\tilde{\varepsilon}_1$.[28] Issuing such a prospectus is costly, however. Assume that the costs are *C*, reducing the amount of retained earnings available for investment by this amount.

If the manager proceeds with this prospectus, she can then choose how many shares to issue in this situation of symmetric information, doing so to maximize her utility given by equation (10).[29] Carrying out the optimization, we find that the manager will issue new equity and invest until

---

[27] Intuitively, if the firm repurchases shares, it reveals information to the market about $\tilde{\varepsilon}_1$, so must share the benefits of $\tilde{\varepsilon}_1$ with those investors who sell their shares. With new investment, in contrast, the market does not know about the added value of the firm, so that the firm does not need to share the benefits of $\tilde{\varepsilon}_1$ with those investors who still sell their shares.

[28] If the prospectus does not reveal $\tilde{\varepsilon}_1$, this information could still be inferred by the size of the new share issue. Qualitative results do not change. However, the resulting investment incentives change, since issuing more shares affects the equilibrium price paid in the latter case but not the former.

[29] When issuing a prospectus reveals information about $\tilde{\varepsilon}_1$, one question is why the Board does not then jump in to dictate the amount of investment. The threat of this of course changes the behavior of the manager. In particular, she can avoid any change in the outcome by using available retained earnings to invest in the lowest return projects, and then use funds raised from outside to invest in the high return projects. As long as these projects all earn more than the rate of return required by shareholders, the Board would not gain from intervening. By the time information is revealed, it is too late.

(14) $$(1-\tau)\pi_2^{'} = \frac{\rho}{1-z} - \frac{N(1-t_w)}{n(1-z)}W'.$$

The firm still invests more than would be implied by equation (8), but less than is implied by equation (13) except when $N^R = N$. Contrary to the intuition in Easterbrook (1983) and Jensen (1986), though, requiring the manager to meet the market test when funding investment does not undermine the manager's ability to build an empire.

Given the fixed costs, C, there will in fact be three different situations the firm can end up in. First, if investing all retained earnings leads to a value of $(1-\tau)\pi_2^{'}$ below the value of the right-hand side of equation (13) when $V^R = 0$, then the firm repurchases enough shares so as to satisfy equation (13). If the value of $(1-\tau)\pi_2^{'}$ when the firm simply invests all retained earnings is above the value of the right-hand side of equation (13) when $V^R = 0$, then the firm will either simply invest all retained earnings or else pay the fixed cost and issue new shares, resulting in the equilibrium specified by equation (14). At the point where the manager is just indifferent between new share issues and not, when $\tilde{\varepsilon}_1$ equals a value denoted by ε_a, investment is discretely higher with new share issues – to justify the cost *C*, the manager must raise discretely more outside financing than *C* in order to compensate for the share dilution needed when raising enough funds to cover these fixed costs. In contrast, the capital stock is continuous as a function of $\tilde{\varepsilon}_1$ at the point where the firm is just indifferent to repurchasing any shares.

The solid line in Figure 1 describes the resulting patterns of capital investment as a function of $\tilde{\varepsilon}_1$. In particular, if the firm issues new shares, equation (14) implies the same equilibrium capital stock regardless of the amount of new share issues needed to finance it. In the intermediate regime in which all retained earnings are invested, a dollar extra $\tilde{\varepsilon}_1$ implies a dollar extra investment. When the firm repurchases shares, however, equation (13) implies that larger $\tilde{\varepsilon}_1$'s result in somewhat larger investment, but not dollar for dollar.

How do these levels of investment compare with the level that maximizes share values? Conditional on the dividend payments, the capital stock K^* that maximizes share values satisfies

(15) $$(1-\tau)\pi_2^{'}(K^*) = \frac{\rho}{1-z}.$$

K^* is represented by the horizontal dashed line in Figure 1. K^* is necessarily below the capital stock when the firm either issues or repurchases shares. However, K^* may be above the capital stock chosen for values of $\tilde{\varepsilon}_1$ just above the point where the firm issues new shares. Existing shareholders clearly lose, however, due to the jump in investment when new issues first occur: at this point the manager is indifferent, trading off a gain in wage income with a loss in share values, while outside investors simply suffer the loss in share value.

If the manager owns stock options rather than shares, how do the above results change? With stock options, the manager does not receive dividends. Since the manager takes the dividend payout rate as given, this per se has no effect on her behavior. With qualified options, the effective tax rate on capital gains is again the capital gains tax rate. With nonqualified options, the tax rate is the labor income tax rate for any gains that occur before the option matures. Since options commonly mature up to ten years after the issue date, most gains expected by the manager should occur subject to this labor tax rate. With nonqualified options that are solidly "in the money", the key change is therefore that the tax rate on V_2^{true} in equation (10) becomes *t* rather than *z*. With less weight put on share values compared with wage income, the bias towards overinvestment becomes larger, holding the fraction of the variation in firm value going to the manager fixed. [30]

If the options are solidly not in the money, however, then marginal variation in firm value has no effect on the manager's utility, while extra capital still generates higher wages. In this case, the manager favors new share issues as long as they generate more revenue, implying a yet greater bias in investment patterns. In general, given the chance that the options will end up not paying off, the manager puts more weight on empire building than share value maximization with options, holding fixed the fraction of the marginal variation in share values going to the manager . While the shape of the curve in Figure 1 certainly changes however, its qualitative properties remain the same.

How then does the choice of dividends by the Board affect the outcome for the firm, and given this what characterizes the optimal dividend payout rate? Shareholders are worse off to the extent that the capital stock chosen by the manager differs from K^*. If the Board chooses to pay out more dividends, the firm is left with less retained earnings. The manager is then less likely to have enough internal funds to be interested in repurchasing shares. The probability of ending up with the capital stock implied by equation (13) is therefore lower. The probability that the manager ends up short enough on funds to seek new share issues is higher, so that the capital stock implied by equation (14) is more likely.

The dotted line in Figure 1 describes the resulting patterns of capital investment as a function of $\tilde{\varepsilon}_1$ when dividend payouts are higher. With dividend payments, the function shifts to the right by the size of the dividend payments.[31]

[30] Options, though, provide a means of paying the manager a higher fraction of the marginal variation in firm value while still limiting the ex ante size of the manager's compensation. The resulting increase in the fraction of the marginal variation going to the manager, holding dollar compensation fixed, could more than offset the incentive effects of the increased tax rate on changing share values.

[31] The derivation here is trivial when the firm had previously been issuing new shares or simply investing all retained earnings. For firms that had previously been repurchasing shares, if D_1 goes up by a dollar and

The pattern of marginal net gains/losses to shareholders arising from a higher dividend payment, as a function of the realized value of $\tilde{\varepsilon}_1$, then depends on the movement of the capital stock towards or away from K^*, and on the extra chance of paying the fixed costs *C*. Since paying dividends is costly, the optimal dividend payout rate occurs where the expected gains just equal this tax cost of paying dividends.

Formally, if we differentiate the expected value of shares in period 1 with respect to the dividend payout rate, the first-order condition for the optimal payout rate is:

$$(16)\quad \frac{m-z}{(1-z)(1-\tau)} d^{-1} = \Delta V_a \phi(X_a + D_1) + \int_{X_a+D_1}^{\infty} \left(\pi_2'(K(\varepsilon)) - \pi_2'(K^*)\right) \frac{\partial I_1}{\partial D_1} \phi(\varepsilon) d\varepsilon$$

Here, we wrote out the expectation over possible values of $\tilde{\varepsilon}_1$ explicitly, taking advantage of the fact that $\partial I / \partial D = 0$ for values of $\tilde{\varepsilon}_1 < \varepsilon_a$. ΔV_a measures the loss in value per share that occurs when new share issues first occur at ε_a, where $\varepsilon_a = K_a - K_0 - (1-\tau)\overline{\pi}_1 + D_1 \equiv X_a + D_1$. The left-hand side of equation (16) is proportional to the tax cost of dividend payments. The right-hand side measures the net benefits from paying dividends, due to the resulting changes in investment. The first term, measuring the cost arising from more firms choosing to issue new shares, is negative. The second term measures the welfare effect of the drop in investment when retained earnings fall due to the extra dividend, partly offset perhaps by a drop in share repurchases. The term inside the integral is positive when $K > K^*$, and conversely.

To what degree is this model consistent with the stylized facts listed in section 1? Of course, the model implies that firms can pay dividends. If expected profits are low enough relative to desired rates of investment or if agency problems are small enough, then the Board would choose not to pay any dividends, so that the model is consistent as well with some firms not paying dividends.

The model also implies quite stable dividend payout rates. Under this model, the Board of Directors chooses the dividend payout rate. As long as the information available to the Board is stable over time, then the dividend payout rate will be stable as well. Their information is left unchanged if the firm neither issues nor repurchases shares, so reveals no new information.

If the manager chooses to repurchase or issue new shares, however, the Board can infer that the firm's capital stock is higher than it would be if the firm chose neither to issue nor to repurchase shares. This seems to suggest based on the above model that the Board

---

$\tilde{\varepsilon}_1$ goes down by a dollar, the capital stock, expenditures on share repurchases and the associated value of the remaining shares all remain unchanged, so that the marginal impact of a dollar of share repurchases on firm value also remains unchanged.

would set a discretely higher dividend payout rate in period 2 in response to either new share issues or repurchases in period 1, assuming unchanged expectations for $\tilde{\varepsilon}_2$. Such a response raises issues not addressed in the above two-period model. In particular, any resulting increase in the dividend payout rate in period 2 makes the manager worse off, so that anticipating this response from the Board the manager is more reluctant in period 1 to have nonzero share repurchases or new share issues, and faces a further incentive to limit the size of any repurchases. The Board, taking into account this response from the manager, gains from precommitting to limit the response of future dividend payouts to these new share issues/repurchases. As a result, a multi-period version of the above model, taking these interactions into account, would imply strong pressures towards a stable dividend payout rate, even in response to new share issues/repurchases.

Under this model, new share issues and share repurchases can well occur, whether or not the Board chooses to pay dividends. One decision is based on ex ante information while the other is based on ex post information.

Why might share repurchases have become more common over time, however? If compensation schemes have improved over time, perhaps through the use of options to make incentives more high-powered for any given dollar compensation, then managers need to give more weight to share values and less to wage payments. With lower agency costs, and smaller differences between the chosen capital stock and the capital stock preferred by the Board of Directors, the Board's optimal dividend payout rate is lower. With lower dividends, repurchases become more common and new share issues less common.

Increasing the tax rate on dividends certainly raises the cost of using dividends to limit the discretion of managers. The Board would therefore cut the dividend payout rate according to this model when the dividend tax rate goes up. With a lower dividend payout rate, investment goes up for $\tilde{\varepsilon}_1 > \varepsilon_a$, drops discretely at ε_a, and doesn't change for $\tilde{\varepsilon}_1 < \varepsilon_a$.

The model does not suggest any impact of the dividend tax on the frequency of mergers and acquisitions.

One other implication of the model is a link between ex post cash flow and investment, even holding expectations unchanged for $\tilde{\varepsilon}_2$. As seen in Figure 1, though, the link is not monotonic. In addition, any increase in expected cash flow should simply lead to an increase in dividend payments, so no effect of expected cash flow per se on investment.

Given this model, what can we say about the considerations that should enter into the government's choice of a tax rate on dividends, taking as given the other tax rates? Assume that any revenue collected in a period is returned to individuals as a lump-sum, so that everything is evaluated based on the valuation to the individual. Individual expected utility $EU(C_1)+\alpha EU(C_2)$ depends on consumption in the two periods (initial consumption is fixed), so equals[32]

(17) $$EU\left((1-m)D_1 - V^N - S_1 - z(V_1 - V^N - V_0) + L_1\right)$$

$$+\alpha EU\left(K_2 + \pi_2(1-\tau) + S_1 r(1-t) - z(V_2 - V_1) + L_2\right).$$

The lump-sum transfers (government revenue) equal

$L_1 = mD_1 + \tau\pi_1 + z(V_1 - V^N - V_0)$, and

$L_2 = \tau\pi_2 + z(V_2 - V_1) + trS_1$

while S_1 denotes the amount invested in assets other than corporate equity in period 1. Given that $V^N = I_1 + D_1 - (1-\tau)\pi_1$, $V_1 - V^N - V_0 = (\rho V_0 - D_1(1-m))/(1-z)$, and $V_2 - V_1 = \rho V_1/(1-z)$, we can rewrite individual utility as

(17a) $$EU\left(-\frac{m-z}{1-z}D_1 + (1-\tau)\pi_1 - I_1 - S_1 - \frac{z}{1-z}\rho V_0 + L_1\right)$$

$$+\alpha EU\left(K_2 + \pi_2(1-\tau) + S_1\left(1 + r(1-t)\right) - \frac{z}{1-z}\rho V_1 + L_2\right)$$

Differentiating individual utility with respect to the dividend tax rate, assuming that the market interest rate remains unchanged due to international capital mobility, making use of the envelope conditions for D_1 and S_1, and assuming that risks are small enough so that risk neutrality is a reasonable approximation, yields

(18) $$U_1'\left[\left(\frac{m-z}{1-z}\right)\frac{\partial D_1}{\partial m} + \delta E\frac{\partial I_1}{\partial m}\left(\tau\pi_2' + \frac{z\rho d}{1-z}(1 + (1-\tau)\pi_2')\right) + \delta tr\frac{\partial S_1}{\partial m}\right],$$

where $\delta = 1/(1+\rho)$. Here, the first term measures the direct efficiency effect of a change in the dividend payout rate in response to a change in the dividend tax rate. This expression is close to the conventional measure of $m\Delta D$, given how low effective capital gains tax rates have been. Since D_1 falls in response to a rise in *m*, this first term represents an efficiency loss from the tax as long as $m > z$.

[32] We ignore any changes in behavior in period 0, when the tax change is announced, just as we ignored changes in corporate investment in the initial period, on the assumption that the tax change is announced after these decisions have been made.

In interpreting the remaining two terms, recall that the rate of return to savings, $r(1-t)$, remains unchanged, so that intended total savings should remain unchanged except due to effects of the efficiency gains or losses that arise due to the tax change. Since shareholders do not know, though, how much investment occurs within the firm, we then expect to first order that $\partial S_1 / \partial m = -E\partial I_1 / \partial m$.

Raising the dividend tax rate then results in a fall in dividends, more retained earnings so an increase in corporate investment, and a fall in other savings since overall savings should remain unchanged. The net effects of the last two terms in expression (18) depends on whether more taxes are collected on the increased corporate investment than are lost due to the fall in other savings.

There are strong pressures in setting tax rates to maintain $(1-\tau)(1-z) \approx (1-t)$, since otherwise there are many opportunities for income shifting between the corporate and personal tax bases, e.g. through use of debt finance, shifting the ownership of patents, changes in forms of compensation, etc. If we assume in fact that $(1-\tau)(1-z) \approx (1-t)$, then the tax rates on corporate and other savings are equal. The sum of the last two terms in equation (18) would then be zero if the pretax rates of return are equal as well. Without agency costs, then, the remaining terms cancel out. However, due to agency problems, we expect the equilibrium return on corporate assets to be below that available elsewhere. A dividend tax, by shifting savings towards corporate investments, which have a lower rate of return, lowers government revenue and lowers efficiency further due to this portfolio shift.

In spite of the presumed overinvestment in corporate capital arising from agency problems, in the above model a dividend tax does not help alleviate these misallocations. In the model, the only route through which a dividend tax can affect the amount of investment chosen by the manager is through its effects on the dividend payout rate. Since the Board can choose this rate to do as well for shareholders as is feasible, the government is not in a position to do better.

Within this model, however, other taxes can help alleviate the misallocations arising from agency problems. In particular, a higher corporate tax rate, yielding $(1-\tau)(1-z) < (1-t)$, will reduce the equilibrium capital stock. This tax rate can in principle be set so that in equilibrium $E\pi_2^{'} = r$, in spite of agency costs.

The model suggests yet another reason for having a higher corporate tax rate, perhaps offset by a lower capital gains tax rate so as to leave $E\pi_2^{'}$ unchanged.
In particular, the larger is the random variation in the cash flow of the firm, the greater is the efficiency loss due to random rates of investment. The corporate tax lessens the ex post variation in the firm's cash flow so the ex post variation in investment, thereby improving efficiency further. From this perspective, it also helps to align the corporate tax base more closely to cash flow since the source of the problem is variation in cash flow.

As in a "new view" model, an increase in *m* lowers share values, in proportion to the present value of dividend payments expected from the firm. While the dividend payout rate changes here, by the envelope theorem any induced change in D_1 has no first-order effect on share values.

While the above model focuses on agency problems among existing firms, the model also has implications for how dividend taxes affect decisions among new firms. Knowing that future managers will tend to overinvest once agency problems arise due to a separation of ownership and control, agency problems will cause initial entrepreneur to be more cautious in setting up firms to begin with. A higher dividend tax rate, by leading to more retentions and yet more overinvestment later in the lifecycle of a firm, can lead to a fall in the initial size of new firms, as in Sinn (1991), and discourage the equilibrium rate of new firm creation, as in Dietz (2005). This differential response among new and established firms is parallel to that found in the "new view."

4. Signaling model for dividends

The third model for dividends we explore focuses on the use of dividends to signal to investors the true value of the firm. Unlike in the case of agency costs, there have been a number of past papers modeling the use of dividends as a signal of firm profits,[33] so we see less need to develop yet another model in detail. Instead, we build on the model by Miller and Rock (1985), modifying it to more closely resemble the agency-cost model described above.

To capture a signaling rather than an agency-cost explanation for dividends, we alter the agency-costs model in several ways.

First, we eliminate agency costs by eliminating the term $W(K_t)$ that created an artificial incentive for the manager to expand investment.

Second, we assume that the manager rather than the Board of Directors determines the size of the dividends, as well as share repurchases. Equivalently, assume that the Board and the manager have the same information and the same incentives.

Third, we assume that the manager cares about the current share price as well as the true value of the firm. In particular, assume that the manager initially owns $n+s$ shares. Of these, she plans to hold n shares until the firm liquidates, but to sell s shares in period 1 at the market-clearing price p, after the firm announces any dividends and any plans to buy or sell shares but before these measures take place. The manager's objective is then to maximize

[33] See, e.g. Bhattacharya (1979), Williams (1988), Miller and Rock (1985), Bernheim (1991), and Bernheim and Redding (2001).

(19) $$sp + \frac{n}{N}\frac{1-m}{1-z}D_1 + \frac{n}{N^R}dV_2^{true}$$

subject to the cash-flow constraint $D_1 + I_1 + V^R = (1-\tau)(\bar{\pi}_1 + \tilde{\varepsilon}_1) + V^N$.

The manager again observes $\tilde{\varepsilon}_1$ while outside investors can only try to infer its value, based on observable behavior of the firm. Assume in addition that $E(\tilde{\varepsilon}_2 \mid \tilde{\varepsilon}_1) = \lambda\tilde{\varepsilon}_1$, so that the manager also knows more than outside investors about profits in the second period.

Fourth, for reasons described in more detail below, we assume that dividends and share repurchases must be proportional. In particular, for each dollar of overall payouts, we assume that β dollars are dividends and $(1-\beta)$ dollars are used to repurchase shares.[34] The firm can choose independently how many new shares to issue, but as before there is a fixed cost C of issuing any new shares.

Consider first the decisions of a firm that chooses not to pay these fixed costs, so that $V^N = 0$. The market price per share of the firm cum dividend in period 1, after the announcement that P dollars will be spent in total on dividends and share repurchases, equals

(20) $$p = \frac{1}{N}\frac{1-m}{1-z}\beta P + \frac{1}{N^R}dE(V_2^{true} \mid P).$$

Since the only information known by the manager and not known by the market is $\tilde{\varepsilon}_1$, there is an implicit function $EV_2(\tilde{\varepsilon}_1, P) = E(V_2^{true} \mid P)$

The manager's first-order condition for the optimal dividend payout rate, after some simplification, then equals:

(21) $$(1-\tau)\pi_2' = \frac{\rho}{1-z} - \frac{m-z}{1-z}\beta d^{-1} + \left(1 - \frac{n}{s+n}\frac{N}{N^R}\right)\frac{\partial EV_2}{\partial\tilde{\varepsilon}_1}\frac{\partial\tilde{\varepsilon}_1}{\partial P},$$

If there were no informational effects of the payouts, then the third term equals zero, so that the remaining terms describe the payout rate that maximizes share values, for any given β. Consistent with the data, and consistent with the model (as shown below), shareholders will infer that firms that can afford larger payouts must have a larger $\tilde{\varepsilon}_1$. The resulting increase in EV_2 and in p benefits the manager directly, through her

[34] This assumption raises the question, though, whether the IRS will classify the share repurchases as dividends for tax purposes. We assume here that the firm can manipulate the timing of share repurchases to avoid this.

receiving a higher price for any shares she sells, but hurts the manager on her remaining shares since the amount spent repurchasing shares results in fewer shares being repurchased. As a result, the sign of the expression in parentheses is ambiguous in general, though for purposes of discussion we presume it is positive.

If the expression in parentheses is positive, then this last term raises the required rate of return, reducing the capital stock below the level that maximizes share values based on full information. The weight on this last term, and so the size of this effect, is smaller the lower is N^R. Therefore, firms with a larger $\tilde{\varepsilon}_1$, who then pay out more funds leading to a lower N^R, also invest more. For firms that pay out more funds, therefore, EV_2 is higher not only because the inferred value of $\tilde{\varepsilon}_2$ is higher but also because the inferred capital stock is higher.

For firms that choose to issue new shares, we assume as before that the prospectus reveals $\tilde{\varepsilon}_1$, so that the manager then chooses how many new shares to issue (and how much to invest) so as to maximize firm value. For these firms,

(23) $$\pi_2'(1-\tau) = \frac{\rho}{1-z}.$$

These firms will not pay dividends, given their tax disadvantage.

The firms that are just indifferent to issuing new shares or not but choose not to issue new shares must then have

(23a) $$\pi_2'(1-\tau) > \frac{\rho}{1-z},$$

Given their fixed cost, the minimum size of new issues is at least equal to *C*, so that firms that just choose not to issue shares end up with a capital stock that is smaller by an amount at least equal to *C*. Given the tax disadvantage of dividends and given that they are the lowest quality type within the dividend paying firms, the Pareto dominating signaling equilibrium would then have these marginal firms pay no dividends.

In general, there are multiple signaling equilibria amongst dividend payers. If there were pooling at some level of dividends, e.g. zero dividends, then there must be a discrete jump in dividends for firms with $\tilde{\varepsilon}_1$ slightly above (and slightly below) the range of $\tilde{\varepsilon}_1$'s that pool. Otherwise, firms with an $\tilde{\varepsilon}_1$ just below either the lower or the upper bound of $\tilde{\varepsilon}_1$'s that poor will prefer to increase their payouts slightly, resulting in negligible costs but a discrete jump in firm value. If there are no gaps in the distribution of dividend payout rates, then there can be no pooling. In that case, all other firms with higher $\tilde{\varepsilon}_1$ than this marginal firm would pay positive dividends determined by equation (21).

We also assume that the value of β prevailing in the market equilibrium is the value that maximizes ex ante share values, before managers observes $\tilde{\varepsilon}_1$. With a lower β (a smaller fraction paid out as dividends), payouts are cheaper given the tax disadvantage of dividends. However, the equilibrium payout rate will be higher, leading to yet more underinvestment. The optimal β trades off these two offsetting effects, generating the optimal cost of a signal,[35] subject to the constraint that dividends must be positive. If the optimal cost of a signal is above the cost of paying dividends, then there should be dividends but no share repurchases. For a somewhat lower optimal cost, we would see a mixture of dividends and share repurchases, while for a low enough optimal cost of a signal we would see only repurchases being used. The equilibrium β can then vary by industry.

How do the above results change if the manager also owns stock options? Those holding an option do not receive any dividends but do benefit from the capital gains that result from share repurchases. This reduces the benefits of payouts, for any given β. It also lowers the value of β that maximizes the ex ante utility of managers.

To what degree is this model consistent with the various stylized facts laid out in section 1? The model is consistent with some firms paying dividends and others not (those that issue new equity). Unless there is a pooling equilibrium at zero dividends for some range of firms, there would not be firms that neither pay dividends nor issue new shares.

This model implies more stable dividends than under the "new view," since higher $\tilde{\varepsilon}_1$ leads to more investment, but less stable dividends than in the agency-cost model.

Also, some firms in the model do issue new shares. However, according to the model, we should never see such firms also paying dividends.

The model is easily consistent with firms paying both dividends and repurchasing shares. The two payouts should move together, however, contrary to the data suggesting that repurchases are much more volatile. The size of repurchases relative to dividends should grow as managerial compensation shifts towards options and away from stock compensation.

The model also is easily consistent with the dividend payout rate falling as the tax rate on dividends increases. Finally, the model has no direct implications for the rate of mergers and acquisitions.

What then does the model imply about the efficiency effects of a tax on dividends? Here, our results correspond to those in Bernheim (1991). According to the model, there is an optimal cost of a signal. If firms can achieve this cost with $0 < \beta < 1$, then they can continue to achieve this cost for any higher tax rate on dividends, by decreasing β appropriately, leading to a drop in the dividend payout rate, an offsetting increase in

[35] See Bernheim (1991) for a more formal exploration of the optimal cost of such a signal.

repurchases, and no other real effects. In particular, the net cost of the signal, the overall payout rate, tax payments, and share values are all unchanged. At the margin, the dividend tax has no real effects.

When the optimal cost of a signal is higher than the cost of paying dividends, however, then firms would not repurchase shares and signal solely with dividends. In this case, raising the tax rate on dividends moves the cost of a signal closer to the value that maximizes ex ante share values, and raises revenue as well! In response to the higher dividend tax rate, share values should rise and investment should increase.

The optimal tax rate on dividends should then be high enough that all dividend-paying firms also repurchase shares. Any higher tax rate has no real effects.

5. Discussion

How successful are each of these models in explaining the list of stylized facts described in section 1? Clearly all three models were designed to forecast dividend payments, and all can explain why only some firms pay dividends.[36]

Table 1 summarizes how each of the models does in explaining the other stylized facts laid out in Section 1. One clear observation from the data is that a firm's dividend payout rate is very stable over time. Here, the agency-cost model is the most consistent with this observation, since in that model the Board of Directors chooses the payout rate, and the information they use to choose the payout rate changes slowly over time. The "new view" model, in which dividends change dollar for dollar with any fluctuations in profits, is the model least consistent with this observation. In the signaling model, dividends vary less than dollar for dollar with profits, since some of the extra profits in equilibrium are retained to finance extra investment.

The second stylized fact is that new share issues occur, sometimes in conjunction with dividend payments. While new share issues per se are consistent with all three models, only the agency-cost model is consistent with a firm both paying dividends and issuing new shares. In that model, the Board chooses the dividend payout rate based on limited information while the manager chooses whether to issue new shares based on extra information about the firm's current cash flow.

The data also show that many firms both pay dividends and repurchase shares. The "new view" model rules out share repurchases by assumption, though Auerbach and Hassett (2003) describe an extension in which some share repurchases can occur. In the agency-cost model, both dividends and share repurchases can arise for the same reason that both dividends and new share issues can occur. Finally, in the signaling model, the optimal signal often consists of a combination of dividends and share repurchases, though whether or not this is true can vary by industry.

[36] In the signaling model, however, at least in a separating equilibrium, firms can either pay dividends or issue new shares but only one firm does neither.

Another well documented observation is that the dividend payout rate falls when the dividend tax rate increases. Both the signaling model and the agency-cost model are consistent with this observation. The "new view" model forecasts no effects of a permanent increase just in the dividend tax rate. However, the "new view" would still forecast a fall in the dividend payout rate in response to an increase in the tax rate on other financial income and in response to a transitory increase in the dividend tax rate. Past changes in U.S. dividend tax rates have always been combined with changes in tax rates on other financial income and were inevitably viewed to be transitory changes.

As seen from the summary in Table 1, the agency-cost model can most easily explain the full set of these stylized facts. Ironically, this is the model that has received the least attention of the three among research papers in public finance.

The models also have very different forecasts for the effects of a dividend tax on corporate investment rates. According to the "new view," a permanent increase in the dividend tax rate has no effect on investment in existing firms, though it discourages entry of new firms. In the other two models, however, the dividend payout rate falls and the extra retained earnings generate extra real investment among existing firms.[37] Note that the sign of this effect is directly contrary to the traditional view that an increase in the dividend tax rate should reduce investment. Consistent with the traditional view, though, new firm entry falls according to the agency cost model. In contrast, new firm entry is encouraged according to the signaling model, since the cost of any future signals either remains unchanged or shifts closer to its optimal level. Past empirical studies of taxes and investment provide only limited evidence for *any* effects of taxes on investment, and these past results are certainly not adequate at this point to say anything about the effects of a change in the dividend tax rate per se on investment.

The models also differ in their forecasts for the effects of an increase in the dividend tax rate on firm values. According to the "new view," the *only* effect of a permanent increase in the dividend tax rate is a reduction in firm values. An agency-cost model also forecasts that share values fall in proportion to the present value of expected dividend payments. In contrast, a signaling model forecasts that an increase in the dividend tax rate has no effect on the share value of firms that both pay dividends and repurchase shares, while it should increase the share values of firms that are not repurchasing shares but do pay (or anticipate paying) dividends. Providing evidence of the effects of a dividend tax increase on share values requires some care, since it requires identifying the specific date at which the market learns about a possible increase in the tax rate. Auerbach and Hassett (2006) attempt to identify such dates for the 2003 cut in the dividend tax rate, and find that share values did increase in response, consistent with the "new view" and the agency-cost model, but inconsistent with a signaling model.[38]

---

[37] More specifically, in a signaling model investment should increase in firms that pay only dividends and not change in firms that both pay dividends and repurchase shares.

[38] They also report that share values increased particularly among firms not currently paying dividends. They rationalize this result by pointing out that equation (3) above implies that the present value of dividends is a higher fraction of firm value to the extent that the present value of new share issues (minus

Clouding this result is the fact that the change in the dividend tax was linked to many other tax changes.

The choice of model has important consequences for forecasts of the efficiency effects of changes in the dividend tax rate. In the "new view" model, a permanent change in the dividend tax rate has no real effects on behavior among existing firms, so no first-order efficiency consequences there, though it does discourage entry of new firms. The agency-cost model forecasts that the tax discourages the Boards of Directors from using dividends to limit the “free cash flow” available to managers, resulting in an excess burden from a dividend tax of at least $-(m-z)\Delta D/(1-z)$. The tax generates additional efficiency costs by causing capital to shift into existing corporate firms, which overinvest due to agency problems. Finally, the signaling model implies that increasing the dividend tax rate leaves entirely unaffected firms that are both paying dividends and repurchasing shares, but shifts the cost of a signal closer to its optimal value in firms that had been paying dividends but not repurchasing shares, in the process raising efficiency. The tax also encourages entry to the extent that entering firms expect to benefit from having a higher cost signal at some point in the future, further raising efficiency.

These sharply different forecasts from the three models for the efficiency effects of a dividend tax certainly make it valuable for empirical work in public finance to focus on tests that help differentiate among these models. Certainly, the past literature includes evidence beyond the stylized facts listed in Section 1, though these papers did not focus in particular on testing among these various models.

Bernheim and Wantz (1995), for example, document that share prices respond more strongly to announced changes in the dividend payout rate during years when the dividend tax rate is higher. This pattern is consistent with a signaling model, since the level of dividend payouts falls in response to a higher dividend tax rate, but the range of underlying share values being signaled remains unchanged. In the agency-cost model as written, announced changes in the dividend payout rate provide no new information to shareholders, so should leave prices unaffected. The model could easily be generalized so as to give the Board more information than shareholders, so that dividend announcements do suggest that the firm is doing better than shareholders had thought. For any extra dollar profits known to the Board, presumably dividends go up by less when the dividend tax rate is higher, reconciling the agency-cost model as well with the Bernheim-Wantz evidence. It is harder to see how to reconcile the "new view" model with this evidence.

The recent papers by Chetty and Saez (2005) and Brown et al (forthcoming) both document that the cut in the dividend tax rate in 2003 in the U.S. induced a larger increase in the dividend payout rate in firms where managers owned more shares, and a smaller response where managers owned more options. These observations remain inconsistent with the "new view," at least if the tax change is viewed to be permanent, since desired payout rates should remain unaffected. With regard to the agency-cost

share repurchases) is larger. This forecast for the relative price response, depending on the expected amount of new share issues, also holds in the agency-cost model, though not in a signaling model.

model, we did not attempt above to derive the Board's optimal choice of a compensation scheme for the manager. In a standard approach, the Board would trade off the cost of imposing more risk on the manager through having higher powered incentives with the gains from the resulting improvement in firm performance. Presumably, in equilibrium firms that inherently have worse agency problems will both use higher-powered incentives for their manager, and pay out more in dividends to limit the discretion of the manager.[39] With such an equilibrium, we expect higher dividends to be associated with higher-powered incentives, yielding forecasts broadly consistent with the evidence. These observations are readily consistent with a signaling model, where the manager decides on the payout rate, since her choice depends on the incentives she faces.

Finally, consider the evidence reported in Gordon and Bradford (1980) that the estimated market value of higher expected dividend payouts, as judged by the degree to which equilibrium expected share appreciation is lower to offset the higher expected dividends, is cyclical: dividends are valued more highly during boom periods and less during recessions. The estimated values are considerably higher than $(1-m)/(1-z)$ during booms and considerably lower than $(1-m)/(1-z)$ during recessions. This evidence is certainly inconsistent with the forecasts from the "new view" model, where the market value of a dollar of extra dividends should be equivalent to $(1-m)/(1-z)$ in expected capital gains.

The agency model, as presented above, also implies that the market value of a dollar of extra dividends should be equivalent to $(1-m)/(1-z)$ in expected capital gains, so does not generate the cyclical variation in this value found in Gordon and Bradford. However, we also noted that when this model is extended to more periods the Board gains by precommitting to maintaining a more stable dividend payout rate, in order not to give managers an incentive to hide information by not issuing or repurchasing shares. In boom period, then, the increase in dividends should be more muted, so at the margin an increase in dividends is worth more than $(1-m)/(1-z)$, and conversely when dividends are falling during a recession. An extension of the agency model to a multiperiod setting therefore seems likely to yield forecasts consistent with the Gordon and Bradford evidence.

The signaling model may also have some chance to explain the Gordon and Bradford estimates, since in this model dividends are stochastic. Following convention, the estimation procedure used in Gordon and Bradford (1980) assigned a risk premium to shares based on the covariance of the ex post capital gain on a share with that on the market, implicitly assuming that dividends are risk free. Yet if dividends are stochastic, the risk premium should instead be based on the covariance of the ex post overall return on a firm's equity with the overall return on the market portfolio (adjusting for taxes). By ignoring the possibility that dividends are stochastic, the resulting misspecification forces a reinterpretation of the coefficients. If the resulting bias to the coefficient on expected

[39] Options would then simply be another way to provide higher-powered incentives without increasing overall compensation by as much.

dividends were positive during boom periods and negative during recessions, then a signaling model could be consistent with the reported evidence.

These other sources of evidence on dividend behavior therefore seem consistent with the signaling model and with natural extensions of the agency model, though cannot readily be reconciled with the "new view" model.

On net, it appears that natural extensions of the agency model will likely be consistent with the full range of evidence described above. The signaling model is consistent with some of the evidence, but cannot readily explain why firms might simultaneously issue new shares and pay dividends, why so many firms neither issue dividends nor new shares, why dividend payout rates are so stable, or why patterns of share repurchase are so different from patterns of dividend payouts. The "new view" is inconsistent with yet more of the past evidence. Whether these "natural" extensions of the agency model in fact work as we expect has yet to be shown. As the model currently stands, the forecasted effects of a dividend tax on dividend payout rates and on efficiency are quite conventional, but the tax is forecasted to generate an increase in investment rates among existing corporations. In addition, the model suggests overinvestment in the corporate sector, complicating the analysis of tax policy more generally.

References

Auerbach, Alan J. 1979. "Wealth Maximization and the Cost of Capital," *Quarterly Journal of Economics* 93, pp. 433-46.

Auerbach, Alan J. and Kevin A. Hassett. 2003. "On the Marginal Source of Investment Funds," *Journal of Public Economics* 87, pp. 205-32.

Auerbach, Alan J. and Kevin A. Hassett. 2006. "The 2003 Dividend Tax Cuts and the Value of the Firm: An Event Study," In Taxing Corporate Income in the 21st Century, edited by Alan J. Auerbach, James R. Hines, and Joel Slemrod. Cambridge: Cambridge University Press.

Auerbach, Alan J. and Laurence J. Kotlikoff. 1983. "National Savings, Economic Welfare, and the Structure of Taxation." In *Behavioral Simulation Methods in Tax Policy Analysis,* edited by Martin S. Feldstein. Chicago: University of Chicago Press, pp. 459-498.

Auerbach, Alan and David Reishus. 1988. "Taxes and the Merger Decision." In *Knights, Raiders and Targets*, edited by John Coffee, Louis Lowenstein, and Susan Rose-Ackerman. Oxford University Press, pp. 300-13.

Baker, Malcolm and Jeffrey Wurgler. 2004. "A Catering Theory of Dividends, *Journal of Finance* 59, pp. 1125-65.

Bernheim, B. Douglas 1991. “Tax Policy and the Dividend Policy,” *RAND Journal of Economics* 22, pp. 455-76.

Bernheim, B. Douglas and Lee S. Redding. 2001. “Optimal Money Burning: Theory and Application to Corporate Dividends,” *Journal of Economics & Management Strategy* 10, pp. 463-507.

Bernheim, B. Douglas and Adam Wantz. 1995. "A Tax-Based Test of the Dividend Signaling Hypothesis," *American Economic Review* 85, pp. 532-51.

Bhattacharya, Sudipto. 1979. “Imperfect Information, Dividend Policy, and ‘the Bird in the Hand’ Fallacy,” *Bell Journal of Economics* 10, pp. 259-70.

Black, Fischer. 1976. “The Dividend Puzzle,” *Journal of Portfolio Management* 2, pp. 5-8.

Bradford, David F. 1975. “Constraints on Government Investment Opportunities and the Choice of Discount Rate,” *American Economic Review* 65, pp. 887-99.

Bradford, David F. 1981. "The Incidence and Allocation Effects of a Tax on Corporate Distributions," *Journal of Public Economics* 15, pp. 1-22.

Brown, Jeffrey R., Nellie Liang, and Scott Weisbenner. forthcoming. "Executive Financial Incentives and Payout Policy: Evidence from the 2003 Dividend Tax Cut," *Journal of Finance*.

Chetty, Raj and Emmanuel Saez. 2005. "Dividend Taxes and Corporate Behavior: Evidence from the 2003 Dividend Tax Cut," *Quarterly Journal of Economics* 120, pp. 791-833.

Constantinides, George. 1983. "Capital Market Equilibrium with Personal Tax," *Econometrica* 51, pp. 611-36.

DeAngelo, Harry, Linda DeAngelo, and Douglas J. Skinner. 2004. "Are Dividends Disappearing? Dividend Concentration and the Consolidation of Earnings," *Journal of Financial Economics* 72, pp. 425-56.

Dietz, Martin D. 2005. "Dividend and Capital Gains Taxation in a Cross-Section of Firms," mimeo.

Doms, Mark and Timothy Dunne. 1998. "Capital Adjustment Pattern in Manufacturing Plants," *Review of Economic Dynamics* 1, pp. 409-29.

Easterbrook, Frank. 1984. "Two Agency-Cost Explanations of Dividends," *American Economic Review* 74, pp. 650-9.

Fama, Eugene F. and Kenneth R. French. 2001. "Disappearing Dividends: Changing Firm Characteristics or Lower Propensity to Pay?," *Journal of Financial Economics* 60, pp. 3-43.

Feldstein, Martin, Louis Dicks-Mireaux, and James Poterba, 1983, "The Effective Tax Rate and Pretax Rate of Return," *Journal of Public Economics* 21(2), 129-58.

Gordon, Roger H. and David F. Bradford. 1980. "Taxation and the Stock Market Valuation of Capital Gains and Dividends: Theory and Empirical Results," *Journal of Public Economics* 14, pp. 109-36.

Grossman, Sanford J. and Joseph E. Stiglitz. 1980. "On the Impossibility of Informationally Efficient Markets," *American Economic Review* 70, pp. 393-408.

Grullon, Gustavo and Roni Michaely. 2002. "Dividends, Share Repurchases, and the Substitution Hypothesis," *Journal of Finance* 57, pp. 1649-84.

Jensen, Michael. 1986. "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers," *American Economic Review* 76, pp. 323-9.

King, Mervyn. 1977. *Public Policy and the Corporation.* London: Chapman and Hall.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert W. Vishny. 2000. Agency Problems and Dividend Policies Around the World," *Journal of Finance* 55, pp. 1-33.

Lintner, John. 1956. "Distribution of Income of Corporations Among Dividends, Retained Earnings,and Taxes," *American Economic Review, Papers and Proceedings* 46, pp. 97-113.

Miller, Merton H. and Kevin Rock. 1985. "Dividend Policy under Asymmetric Information," *Journal of Finance* 40, pp. 1031-51.

Poterba, James. 2004. "Taxation and Corporate Payout Policy," *American Economic Review, Papers and Proceedings* 94, pp. 171-175.

Poterba, James M. and Lawrence H. Summers. 1985. "The Economic Effects of Dividend Taxation." In *Recent Advances in Corporate Finance,* ed. by Edward Altman and Marti Subrahmanyam. Homewoood, IL: Richard D. Irwin, pp. 227-84.

Sinn, Hans Werner. 1991. "The Vanishing Harberger Triangle, *Journal of Public Economics* 45, pp. 271-300.

Spence, Michael. 1973. "Job Market Signaling," *Quarterly Journal of Economics* 87, pp. 355-74.

Stiglitz, Joseph. 1983. "Some Aspects of the Taxation of Capital Gains," *Journal of Public Economics* 21, pp. 257-94.

Williams, Joseph. 1988. "Efficient Signalling with Dividends, Investment, and Share Repurchases," *Journal of Finance* 43, pp. 737-47.

Table 1
Forecasts vs. Data

	New View	**Agency Costs**	**Signaling**	**Data**
D stable	no	Yes	somewhat	yes
V^N and D	no	Possible	No	possible
V^R and D	no	Possible	probable	possible
$\partial D / \partial m$	$= 0$	< 0	< 0	< 0
$\partial I / \partial m$	$= 0$ existing < 0 new	> 0 existing < 0 new	≥ 0 existing > 0 new	??
$\partial(\text{efficiency}) / \partial m$	$= 0$	< 0	> 0	??
$\partial V / \partial m$	< 0	< 0	> 0	< 0?

Figure 1
Profits and Investment in an Agency-Cost Model