Imperfect information, dividend policy, and “the bird in the hand” fallacy

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This paper assumes that outside investors have imperfect information about firms’ profitability and that cash dividends are taxed at a higher rate than capital gains. It is shown that under these conditions, such dividends function as a signal of expected cash flows. By structuring the model so that finite-lived investors turn over continuing projects to succeeding generations of investors, we derive a comparative static result that relates the equilibrium level of dividend payout to the length of investors’ planning horizons.

1. Introduction

This article develops a model in which cash dividends function as a signal of expected cash flows of firms in an imperfect-information setting. We assume that the productive assets in which agents invest stay in place longer than the agents live and that ownership of the assets is transferred, over time, to other agents. The latter are a priori imperfectly informed about the profitability of assets held by different firms. The major signaling costs that lead dividends to function as signals arise because dividends are taxed at the ordinary income tax rate, whereas capital gains are taxed at a lower rate. Within this framework, this paper explains why firms may pay dividends despite the tax disadvantage of doing so.

Recently, Leland and Pyle (1977) and Ross (1977) have used the paradigm of Spence’s signaling model (1974) to examine financial market phenomena related to unsystematic risk borne by entrepreneurs and firm debt-equity choice decisions, respectively. In its spirit and cost structure, our model is closely related to the Ross model (1977). The essential contributions of our model are the following. First, we develop a tax-based signaling cost structure founded on the observation that signaling equilibria are feasible, even if signaling cost elements that are negatively related to true expected cash flows are small, provided there are other signaling costs that are not related to true cash flow levels. Second, we develop the model in an intertemporal setting that allows

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us to identify the relative weights placed on the benefits (increase in value) and costs of signaling with dividends. Our model suggests an interesting comparative static result concerning the shareholders' planning horizon; namely, the shorter the horizons over which shareholders have to realize their wealth, the higher is the equilibrium proportion of dividends to expected earnings. Other comparative static properties of the dividend-signaling equilibrium, with respect to major variables like the personal income tax rate and the rate of interest, are also developed and are shown to be in accord with the empirical results ofBrittain (1966).

To keep the analysis manageable, and to highlight the essential characteristics, we employ two major analytical simplifications. First, we assume that the valuation of cash flow streams is done in a risk-neutral world. Second, we allow the "urgency" of the agents' need to realize their wealth to be parameterized by the length of the planning horizons over which they maximize expected discounted realized wealth, with no detailed consideration of the intertemporal pattern of asset disposal. These assumptions are further discussed below, after the basic model is developed. The general structure of the dividend-signaling model and the conditions for the existence of dividend-signaling equilibria are developed in Section 2. In Section 3 we analyze an example with uniformly distributed cash flows to facilitate discussion of comparative static properties and issues related to multiperiod planning horizons and dynamic learning possibilities. Section 4 contains the concluding remarks and suggestions for further research.

2. Dividends as signals

In this section we outline the nature of the dividend-signaling model and the signaling cost structure. The model applies to a setting in which outside investors cannot distinguish (a priori) the profitability of productive assets held by a cross section of firms. Existing shareholders of firms care about the market value "assigned" by outsiders, because the planning horizon over which they have to realize their wealth is shorter than the time span over which the firms' assets generate cash flows. The simplifying assumption of risk-neutrality eliminates the diversification motive. The usual noncooperative evolution arguments of the Spence-type (1974) suggest a signaling equilibrium, if a signal with the appropriate cost-structure properties exists. Dividends are shown to satisfy the requirements.

We ignore the incorporation of other sources of information (e.g., accountants' reports) on the ground that, taken by themselves, they are fundamentally unreliable "screening" mechanisms because of the moral hazard involved in communicating profitability. Hence, the model of this paper is somewhat exploratory in nature, a property that it shares with most other signaling models in which the costliness of signals derives from exogenous considerations.

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1 The old "bird in the hand" argument that agents have to realize their wealth for consumption and that, somehow, dividends are "superior" to capital gains for this purpose is, of course, fallacious in a perfectly informed, competitive financial market, even under uncertainty. For a proof, refer to Miller and Modigliani (1961).

2 A complementary approach to the dividend-signaling problem, which deals with signaling of insiders' information in the presence of indicators of ex post profitability that are not exogenously costly, is developed in Bhattacharyya (1977). A synthesis of the two types of models would provide a richer framework that could incorporate an interesting "partial" role for sources of information like accounting reports.
To preserve the simplicity of the model’s structure, we assume that assets owned by firms generate cash flows that are perpetual streams, which are, in most of what follows, taken to be intertemporally independently identically distributed. In this section, and for most of the paper, we assume that existing shareholders have a single-period planning horizon. The firms are assumed to have sufficient investment opportunities, so that all of the cash flows from existing assets can be rationally reinvested. This simplifying assumption can be relaxed somewhat. The communication of even ex post cash flows from existing assets is assumed to be costly, because cash payouts in the form of dividends on regular share repurchases are assumed to be taxed at a higher personal tax rate than capital gains.3 In the absence of explicit cash payout, before taking on outside financing for new investments, ex post cash flows cannot be communicated without moral hazard, because one of the “inside” variables that a firm cannot readily communicate without moral hazard is the level of new investment.

It is assumed that the signaling benefit of dividends derives from the rise in liquidation value $V(D)$ caused by a committed, and actually paid, dividend level $D$. We develop the model in terms of a marginal analysis for a new project taken on by a firm. This simplification serves two purposes. First, not analyzing dividend decisions vis-à-vis existing and new asset cash flows enables us to postpone discussion of dynamic learning issues to the example in Section 3. Second, this mode of analysis permits us to retain simplicity and flexibility with respect to the modeling of costs incurred in making up shortfalls of cash flows relative to promised dividends. For example, one way of making up such shortfalls is likely to be the postponement of investment/replacement plans, although fundamentally we adhere to the sound partial equilibrium practice of analyzing the dividend decision when the investment policy is given.4 It is assumed that dividend decisions are taken by shareholders’ agents, whom we term insiders or managers. These agents optimize the after-tax objective function of shareholders, possibly because their own incentive compensation is tied to the same criterion. The insiders are the only people who know the cash flow distributions of their projects.

Let $X$ represent the uncertain cash flow from the new project being considered at the end of the period that corresponds to the current shareholders’ planning horizon. It is assumed that dividends paid to shareholders are taxed at a personal income tax rate of $(1 - \alpha)$ and, for simplicity, that capital gains are not taxed at all. Let $D$ denote the incremental dividend commitment made on account of the new project, and $V(D)$ the signaling response of incremental liquidation value. If $X$ is above $D$, $D$ in dividends is paid, current shareholders receive $\alpha D$ after taxes, and the extent of outside financing required for reinvestment is reduced by $(X - D)$, relative to a state of nature in which $X$ equals $D$. If $X$ is below

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3 In a recent paper Miller and Scholes (1978) have pointed out that the tax disadvantage of dividends is reduced by investors’ ability to offset dividend income by interest deductions on borrowings, combined with investment of the proceeds from the borrowing in tax-sheltered means of accumulation like life insurance contracts and retirement accounts. Whether or not this effect has more than inframarginal implications empirically, and, if the effect is valid at the margin, then the reconciliation of this model with other tax-based models of financial structure like that of Miller (1977), are very much unresolved issues at present.

4 In fact, the model only requires that there be sufficient investment opportunities for the cash flows.
$D$, $D$ in dividends is still paid, and it is assumed that making up the “shortfall” $(D - X)$ results in costs to current shareholders amounting to $(1 + \beta)(D - X)$, relative to a state of nature in which $X$ equals $D$.

The essential justification for our assumption that the cost of making up a cash-flow deficit is more than the benefit of a cash-flow surplus of the same size is that frictionless access to extra external financing is assumed to be unavailable. Basically, we are assuming, realistically, that one of the “market conventions” that prevails in a dividend-signaling equilibrium is that a firm “should” be able to meet its dividend commitment without recourse to extra, “unanticipated” new financing. Thus, the possibility of $X$’s being low means that to pay the committed level of dividends the firm is forced to incur the costs of either the organization and transaction costs of selling real, physical assets in the secondary market or postponing, but not necessarily canceling, investment/replacement programs of positive net present value. Similar dissipative costs are assumed to arise if the firm can cope by keeping buffer stocks of liquid assets earning less than the discount rate or if it has the ability to negotiate, at extra cost, some unanticipated “bail-out” financing. If the substitution of cash-flow surpluses for previously planned external financing is costly—because the surplus has to be temporarily kept as liquid assets or because the cancellation of planned external financing is costly—, then there is an effect in the same direction on the cost structure. As we shall see, these “frictional” costs play an essential role in making for a feasible signaling equilibrium.

Given the foregoing discussion, we can write the incremental part of the objective function of current shareholders and their agents as:

$$E(D) = \frac{1}{1 + r} \left[ V(D) + \alpha D + \int_{D}^{\bar{X}} (X - D)f(X)dX \right] + \int_{D}^{\bar{X}} (1 + \beta)(X - D)f(X)dX$$

$$= \frac{1}{1 + r} \left[ V(D) + M - (1 - \alpha)D - \beta \int_{D}^{\bar{X}} F(X)dX \right],$$

where $f(X)$ and $F(X)$ represent the density and distribution functions of $X$ assumed to be distributed over $(D, \bar{X})$, $M$ represents the mean cash flow, and $r$ is the per period rate of interest after personal income taxes. In our economy with only one class of investors, $r$ can be either the interest rate on a tax-exempt bond, or $\alpha$ times the before-tax interest rate on taxable bonds.

Current shareholders’ agents choose $D$ to maximize $E(D)$. In equilibrium, the endogenous $V(D)$ schedule provides consistent valuation of cash flows beyond the planning horizon. That is, given the equilibrium $V(D)$ schedule and the optimizing dividend decision, all shareholders make a competitive after-tax

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5 For simplicity we exclude using cash flow surpluses relative to dividend commitments for other assets assuming, essentially, perfect correlation of cash flows. Adding that factor would not alter the basic nature of the structure.

6 A similar cost of making up the deficit of liquid assets relative to deposit withdrawals plays a critical role in bank asset management models (see e.g., Pyle (1972)).

7 The assumption of a flat and nonstochastic term structure is solely for simplicity, although a partial equilibrium model like ours does not go into the details of how $r$ is affected by agents’ time preferences and endowments in this economy. Note also that the risk-neutrality assumption has been useful for valuing the “truncated” deficit makeup cost.
market return of \( r \) on their investments in firms. The critical existence condition for a Spence-type (1974) signaling equilibrium is that the marginal signaling cost—which in our model is seen to be \((1 - \alpha) + \beta F(D)\), from (1b)—must be strictly negatively related to the source of true value, the mean cash flow \( M \).

If the cross section of projects is such that the “family” of distribution functions \( \{F(Z)\} \) has the same ordering across the cross section for all \( Z \), and the ordering is possibly weak only where at least some \( F(Z) = 1 \), then this existence condition is satisfied for \( D < \hat{X} \), since \( M \) is lower for a project whose cash-flow distribution function \( F \) strictly dominates that of the other in comparison. Of course, the assertion that this condition is sufficient in our model assumes that the equilibrium implications of today’s dividends for future dividends are such that the true value of future cash flows, taking account of the personal income tax implications of future dividends, is positively related to \( M \). This seems very reasonable, and it holds in all the examples of Section 3.

In the next section—specifically in equations (6c) and footnote 13—I derive the asymptotic distribution-free equilibrium solutions for \( D \) as a function of mean cash flow \( M \) (denoted \( \bar{t}/2 \) there), and the signaling cost and interest rate parameters for single- and multiperiod shareholder planning horizons. It is technically possible for a solution for \( D \) to lie between \( M \) and \( \hat{X} \) and satisfy the maximization and consistency criteria defined above. But it is difficult to justify the survival of an exogenously costly signaling equilibrium that “requires” \( D \) to be greater than \( M \), since \textit{ex post} cash flows can be disclosed by paying out before taking on outside financing for new investment, at a lower average tax cost.

3. An example of comparative statics

Having discussed the general structure of the model and the costs that permit dividends to function as a signal, we now use a simple example to examine in more detail the nature of equilibrium and its comparative statics. Suppose the incremental cash flow of the project whose value is being signaled is, in any given period, distributed uniformly over \([0, t]\) with mean \( t/2 \). All projects are perpetuities and, for the time being, the cash flows of each project are taken to be intertemporally independently identically distributed. In the cross section of firms the value of \( t \) is assumed to vary between \( t_{\text{min}} \) and \( t_{\text{max}} \), but investors cannot discriminate among projects with different \( t \)’s held by different firms. It is further assumed that \( t_{\text{min}} = 0 \). This is partly for analytical convenience but, \textit{vis-à-vis} a marginal project in any given firm, this is a natural assumption since one of the “inside” variables that a firm cannot costlessly communicate to the market without moral hazard is the amount of investment it undertakes. Initially, we continue to assume shareholders have a one-period planning horizon.

Using equation (1b), we find that, given a market signaling value function \( V(D) \), the current shareholders’ agents choose \( D \) to maximize

\[
\max_D E(D) = \frac{1}{(1 + r)} \left[ \frac{t}{2} + V(D) - (1 - \alpha)D - \beta \frac{D^2}{2r} \right].
\]

\[\tag{2}\]

In our model we consider only all-equity firms. Introducing debt would not alter the basic nature of the results. However, the simultaneous optimization of debt and dividend policy would be complex. If substantial dividend payments exist, then the simple Miller-type (1977) equilibrium in which only aggregate corporate debt is determinate is not likely to hold. We should note that introducing different shareholder tax rates into the signaling model is very tricky, if both shareholder unanimity and the consistency condition are to be preserved.
As in Section 2, $V(D)$ is the exdividend value associated with committing and later paying dividends $D$, at the end of the one-period horizon. Maximization of $E(D)$ with respect to $D$ yields the first-order condition,

$$V'(D^*) - (1 - \alpha) - \beta \frac{D^*}{t} = 0,$$

where the optimum $D^*$ is, of course, conditional on $t$.

The market signaling value function $V(D)$ survives in equilibrium only if expectations are fulfilled, i.e., only if $V(D^*)$ is the true value of future (post-horizon) cash flows for the project whose cash flows are signaled with dividend $D^*$. To impose this requirement, future levels of dividends to be paid by the firm on account of the project must be specified because $V(D^*)$ should only reflect the value that is not dissipated by taxes and other losses of future dividends. In a model with genuine time structure, this is a difficult issue to decide. The perpetuity structure of our model, in conjunction with an assumption that succeeding generations of shareholders will also have one-period horizons, would suggest a stationary dividend for any given $t$, given the intertemporally independently identically distributed nature of cash flows. On the other hand, there is the argument that in a model with genuine time structure, there should be some learning about $t$ from the observed ex post frequency of asset sales or unanticipated new financing needed for making up shortfalls of cash flows compared with promised dividends. Therefore, as time goes on, outside investors' ability to discriminate among project cash flows of different firms should improve.

There appears to be no simple way to incorporate dynamic learning phenomena into an imperfect information signaling model, and we do not attempt to make any contributions to that area. In the context of intertemporally independently identically distributed project cash flows, dynamic learning may be ignored if outside investors cannot observe unanticipated, deficit makeup financing as such, although the extra cost of such financing is an integral part of our model. In addition, a strong argument in favor of a stationary structure—which is perceived most clearly in the case of a corner solution of full payout—is that a firm cannot, without moral hazard, distinguish (for outsiders) an early-in-life payout from a new project from payouts supported by later-in-life cash flows from an old project.

An equilibrium $V(D)$ schedule predicated on a stationary dividend assumption is defined by the consistency condition, along the equilibrium schedule $D^*(t)$, that

$$V(D^*(t)) = K \left[ \frac{t}{2} - (1 - \alpha)D^*(t) - \beta \frac{D^*(t)}{2t} \right],$$

where $K = 1/r$. It can be shown that the same consistency condition (4) is
implied when the mean cash flows of projects follow random walks without drift over time, so no significant learning can take place. Although this is a strong assumption, it is at least fully internally consistent to ignore dynamic learning in this situation. It should be noted that, because of the perpetuity structure and the stationary dividend assumption, the same equilibrium consistency condition (4) applies to the current market value of the project. The analysis that follows applies to the intertemporally independently identically distributed cash flows case with dynamic learning ignored as well as to the driftless random walk case.

Equations (3) and (4) provide us with sufficient information to solve for the equilibrium $V(D)$ and $D^*(t)$ schedules and to check that the second-order condition for the maximization problem of equation (2) is satisfied. In Section 4 we discuss possible mechanisms by which the consistency condition (equation (4)) may be arrived at in this setting. Here we work out the detailed implications of our model.

Totally differentiating equation (4), and substituting for $V'(D)$ from equation (3), we obtain

$$\frac{(K + 1)(1 - \alpha) + \beta D}{t} \frac{dD}{dt} = K \left[ \frac{1}{2} + \beta \frac{D^2}{2t^2} \right]$$  \hspace{1cm} (5)

as the equation that must hold along the equilibrium schedule $D^*(t)$. Given our assumption that $t_{min} = 0$, the boundary condition to equation (5) for the surviving Pareto-superior schedule, which corresponds to the "lowest" member incurring no dissipative costs of signaling, as in Riley (1975), is given by

$$D^*(0) = 0.$$  \hspace{1cm} (5a)

To solve equation (5) subject to the boundary condition (5a), we try a solution of the form

$$D^*(t) = At,$$  \hspace{1cm} (6a)

which obviously satisfies (5a). Substituting from (6a) into (5), we get the quadratic of the variables are immediate:

$$e[V(D)] = V(e[D]) = V(D)$$

$$e[(1 - \alpha)D] = (1 - \alpha)D$$

$$e \left[ \frac{\beta}{2t} \right] = \frac{\beta D^2}{2t}$$

where $e$ is the conditional expectations operator with respect to any future period, and the right-hand-side terms refer to current values of the variables. Given these implications, it is evident that the agents' objective function, which should reflect expected next-period liquidation values, formally remains the same as that in equation (2), and the same equilibrium consistency condition, equation (4), must hold for the current value schedule $V(D)$. We show in the text below that, given the structure provided by equations (2) and (4), the equilibrium dividend $D^*(t)$ is indeed proportional to $t$ and that $V(D)$ is linear in $D$, for the uniform distribution case here. Thus, the same formal solution is also an internally consistent fulfilled-expectations signaling equilibrium when $t$'s follow a random walk. It should also be clear from the linearity of the distribution-free asymptotic ($\beta \to 0$) solutions below, and the conditional expectations arguments above, that a similar argument holds for the "asymptotic case."
equation for $A$

$$
\frac{(K + 2)}{(K + 1)} A^2 + \frac{2(1 - \alpha)}{\beta} A - \frac{K}{\beta(K + 1)} = 0.
$$

The positive root for $A$ is given by

$$
A = -\frac{(1 - \alpha)}{\beta} \cdot \frac{(K + 1)}{(K + 2)} + \frac{(1 - \alpha)}{\beta} \times \frac{(K + 1)}{(K + 2)} \sqrt{1 + \frac{\beta K(K + 2)}{(K + 2)(1 - \alpha)^2(K + 1)^2}}. \quad (6b)
$$

Given equation (3), together with the boundary condition $V(0) = 0$, equilibrium $V(D)$ is given by

$$
V(D) = ((1 - \alpha) + \beta A)D. \quad (7)
$$

It is easy to verify that, given this $V(D)$, the first-order condition for the maximization problem of equation (2) is satisfied at $D/t = A$, and that the second-order condition for a maximum is also satisfied for $\beta > 0$. The solution for $\beta = 0$ or the binomial approximation for $\beta \ll (1 - \alpha)^2$ is given by

$$
A = \frac{1}{2} \cdot \frac{K}{(K + 1)(1 - \alpha)}. \quad (6c)
$$

Of course, if $\beta = 0$, then the "equilibrium" $V(D) = (1 - \alpha)D$ does not result in a strict maximum for the shareholders' maximization problem. In practice, $\beta$ is likely to be small and the resulting convexity "weak." The implications of this are further discussed in Section 4.10

Two important comparative statics of the equilibrium solution $D^*(t)$ are as follows. First, equilibrium $A$ is decreasing in the tax rate $(1 - \alpha)$ in both (6b) and (6c). Second, since $(K + 1)/(K + 2)$, $K(K + 2)/(K + 1)^2$, and $K/(K + 1)$ are all increasing functions of $K$, the equilibrium $A$ is an increasing function of $K$, and thus a decreasing function of the rate of interest $r$. On a note of casual empiricism, both of these comparative-static results are in accord with the empirical results of Brittain's comprehensive study (1966) of corporate dividends.

To provide an intuitive understanding of these comparative statics, it is helpful to develop the notion of what is needed in the way of signaling cost for insiders to "tell the truth," i.e., for there to be an optimum $D^*(t)$ solution which satisfies a consistency condition of the type in equation (4). (The task is a little tricky because $V(D)$ is endogenized and thus responds to parameter variation.) The essence of the notion is captured by the following description of the role that the tax cost of dividends plays in making for a feasible signaling equilibrium. In the absence of the tax costs, an interior optimum $D^*(t)$ would be produced only by a $V(D)$ that had a very low response to $D$—but then $V(D^*(t))$ would be a gross underestimate of undissipated value. The tax costs help make for:

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10 The asymptotic solution (6c) is useful only to the extent that if its comparative statics are the same as those of (6b), then we may assert that the comparative statics derived for this example have general validity for other distribution function examples for $\beta$ in some neighborhood of zero. This is possible because the asymptotic solution (6c) is independent of the distributional characteristics of cash flows (substituting mean cash flow $M$ for $t/2$), and because of the continuity of solutions in parameters.
(i) a higher response of $V(D)$ to $D$ that still provides an interior optimum $D^*(t)$, and (ii) $V(D^*(t))$’s being equal to undissipated value because of the higher costs of signaling.

In the case of the tax rate comparative static, it is clear that if for a higher tax rate $V(D)$ responded only to the new $(1 - \alpha)$ in (7), then the optimizing $D(t)$ would continue to equal $A^*t$, with the same $A$ as in the equilibrium for a lower tax rate. At this “old” $D(t)$, $V(D(t))$ would be an overestimate of undisbursed future value, since the tax cost of the same proportionate dividend is now higher, whereas $V(D(t))$ would have changed in just the reverse direction relative to the “old” equilibrium. In equilibrium this is resolved by a lower interior optimum $A$, induced by an appropriate response of $V(D)$ to $D$, in accordance with equations (6b) and (7). For the asymptotic solution (6c), the net effect is to leave $V(D^*(t))$, the equilibrium value of cash flows less tax costs, unaffected. In the same manner, when $K$ is higher, the higher relative magnitude of the value of future cash flows requires in equilibrium a higher response of $V(D)$ to $D$, which induces a higher $A$—“to tell the truth.”

It may be pointed out that the response of equilibrium dividend payout to the rate of interest has not, to our knowledge, received strong theoretical support in previous research (see, e.g., Pye (1972)). Attempts to explain it by arguing that debt financing is more “expensive” when interest rates are high, and thus internal financing is increased, are in conflict with leverage indifference propositions of either the Modigliani and Miller (1958) or Miller (1977) type. For the sake of completeness, it should also be pointed out that for the equilibrium solution (6b), $\partial A/\partial \beta < 0$, as would be expected from the intuition behind the comparative static result with respect to $(1 - \alpha)$.

So far, both in Section 2 and here, we have developed our model in terms of a one-period planning horizon for shareholders. This is somewhat unsatisfactory, however, for the following reasons. First, in reality, shareholder horizons are far longer than the time periods over which corporations can change their dividends. Second, as a consequence, the low response of $V(D)$ to $D$ in equation (7) appears to be unrealistic, and it also raises doubts about the assumption that shortfalls of cash flows compared to dividends can be made up by selling assets—although this is partially remedied by letting cash flow distributions lie over shorter ranges, e.g., $t/4$ to $3t/4$.

In what follows, we briefly consider a simple extension to a multiperiod horizon case, and mention the problems that exist with respect to keeping the structure of the model simple and tractable. This extension also hints at a comparative static result with respect to shareholders’ planning horizons that is reminiscent, in its effects as opposed to its reasoning, of the “bird in the hand” fallacy notion associated with dividends. Ceteris paribus, the shorter is the planning horizon, or the higher the “urgency” to realize wealth for consumption, the higher is the equilibrium dividend-payout ratio.

Suppose the current shareholders have an $(n + 1)$-period planning horizon

11 If the Miller-type (1977) equilibrium does not obtain, and optimum debt levels are chosen by the familiar tradeoff between tax deductibility of interest payments and bankruptcy costs, then, ceteris paribus, higher interest rates would tend to make expected bankruptcy costs higher by making bankruptcy more likely, and this may result in lower debt levels and more retention. (The value of the tax “shield” of debt should not be significantly affected in a perpetuity-type model.) Note also that these comparative statics are of the partial equilibrium type.

12 It can be shown that the simple linear form of the equilibrium solution holds in this case too.
and that their objective function (and hence their agents' objective) is given by

$$E(D) = \frac{1}{1 + r} \left[ \left(1 + \frac{1}{(1 + r)} + \ldots + \frac{1}{(1 + r)^n} \right) \times \left( \frac{t}{2} - (1 - \alpha)D - \beta \frac{D^2}{2t} \right) + \frac{1}{(1 + r)^n} \cdot V(D) \right]. \quad (8)$$

Let

$$\mu = 1 + (1 + r) + (1 + r)^2 + \ldots + (1 + r)^n.$$

Then the equation corresponding to equation (5) for the equilibrium $D^*(t)$ schedule is given by

$$(K + \mu) \left( (1 - \alpha) + \beta \frac{D}{t} \right) \cdot \frac{dD}{dt} = K \left[ \frac{1}{2} + \beta \frac{D^2}{2t^2} \right]. \quad (9)$$

Now, for $\mu > 1$, $K/(K + \mu) = K^*/(K^* + 1)$ for some $K^* < K$, and $K^*$ clearly declines with a rise in $\mu$ caused by an increase in $n$. Thus the results of the one-period horizon case can be used to assert that the $A$ of the equilibrium solution decreases with an increase in $n$.

The intuition behind the result is similar to that for the earlier comparative static result with respect to $K$. A longer planning horizon implies that the relative weight of intrahorizon cash flows increases and that of the end-of-period "return of capital" declines in the current shareholders' objective function. A given response of $V(D)$ to $D$ results in a lower $D(t)$'s being chosen, at which $V(D(t))$ is lower than true undissipated value. In equilibrium, a somewhat higher response of $V(D)$ to $D$, which nevertheless results in a lower $D^*(t)$, constitutes the appropriate adjustment.

It is also easily shown that, in equilibrium

$$V(D) = \mu [ (1 - \alpha) + \beta A ] D. \quad (10)$$

Equation (10), for large values of $\mu$, is consistent with the assumption that deficits of cash flows compared with dividends can be made up. The comparative statics for the tax rate and the interest rate for the one-period horizon case also carry over to the multiperiod horizon case.$^{13}$

However, multiperiod horizons raise many new issues, especially with any general equilibrium treatment in an overlapping generations setting. We briefly catalog them below, leaving them as open questions for further research. First, there are problems with shareholders of different horizons existing concurrently (because people have shorter horizons as calendar time passes); shareholder unanimity regarding corporate decision rules is not obtained. Second, to preserve

\[ ^{13} \text{As } \beta \to 0, \text{ the equilibrium dividend payout approaches} \]

$$\frac{t}{2} \cdot \frac{K}{(K + \mu)(1 - \alpha)},$$

and the undissipated value approaches

$$\frac{Kt}{2} \left[ 1 - \frac{K}{(K + \mu)} \right] = \frac{Kt}{2} \left[ \frac{\mu}{K + \mu} \right].$$

With $r = 0.10$ per "year," $K = 10$, $\mu = 18.3$ for $n = 10$ or an 11-"year" horizon. ($\mu/K + \mu$), the fraction of asset value that is not dissipated by the tax cost of dividends, is nearly two-thirds. The equilibrium level of dividends is smaller than $t/2$ for $(1 - \alpha) > 10/28.3$. 


the simplicity of the model in terms of the stationarity of optimal response \( D \) conditional on \( t \) as calendar time passes and horizons become shorter, we have to impose some *ad hoc* restriction of choice among the class of stationary decision rules only; this is also a remedy for the unanimity problem. Third, describing the shareholders' objective function as simply as in (8), in the presence of interim consumption needs, depends critically on developed consumption-loan markets and risk neutrality. Fourth, for equation (8) to correctly represent current shareholders' objective functions, i.e., to ensure that *ex post* intra-horizon actions do not affect the effective horizon of shareholders in out-of-equilibrium situations, it is necessary to assume: (i) that possible asset sales in the secondary market are made at true undissipated values and not at signaled values, and (ii) that, with the exception of possible short-term borrowing to finance dividend deficits, all corporate financing is done through rights issues to *existing* shareholders. Essentially, we have to rule out *intra*horizon market transactions with outsiders whose values to current shareholders, in their relevant metric given their horizons, depend on the signaling decision chosen by the firm. The basic intuition behind the horizon result may, however, carry over to more elaborate models.\(^{14}\)

4. Concluding remarks

Two unfinished tasks are taken up in this section. First, we discuss the signaling cost structure of our model in relation to other financial-signaling models in the literature and possible alternatives. Second, we provide a brief discussion of convergence to equilibrium in financial-signaling models.

The signaling cost structure that we have developed is not only realistic (dividends linked only to *expected* cash flows), but also the only simple structure consistent with the assumption of an exogenously costly dividend-signaling equilibrium. Superficially, another simple possibility that satisfies the marginal-cost characteristics required for signaling is a "lower-truncated" structure with cash flow \( X \) in dividends paid if and only if \( X \) is less than some "promised" \( D! \)

Since the moral hazard in costlessly communicating \( X \) to outsiders is the basis for the dissipative signaling equilibrium, this is not going to be a very enforceable structure. In a different context Ross (1977) has developed a financial-signaling model of leverage based on a "lower-truncated" cost structure of significant bankruptcy penalties for managers. A difficulty with such a structure is that unless enforceable penalties of similar magnitude relative to the benefits of nonbankruptcy exist for shareholders, there is an incentive for shareholders to make side payments to managers to induce false signaling by employing higher levels of debt. In another paper (Bhattacharya, 1977), I have developed a model of nondissipative—not exogenously costly—signaling of insiders' information about future cash flows, based on expectations revision in the market, in a setting in which there is no tax cost to directly communicating *ex post* cash flows. As noted in Section 2, it is my belief that a synthesis of the two types of models, which should allow us to provide a partial role for sources of *ex post* earnings information like accounting reports, is an interesting, if difficult, problem for further research.

\(^{14}\) These problems do, of course, make the planning horizon comparative static analysis somewhat *ad hoc*. In particular, it is difficult to attach any meaning in terms of different-horizon "clienteles," since we have not explained how an economy with different-horizon "clienteles" attached to different firms would evolve in its ownership structure.
Convergence to equilibrium in financial-signaling models is an interesting issue primarily because the time structure of events is likely to be different from that in the job-market signaling model of Spence (1974). In both our model and that of Ross (1977), the signaling cost arises in the future, whereas the benefit, the rise in value, is likely to get established in current as well as liquidation values. If unconstrained liquidation with no effect on value is posited, then current shareholders, and their agents, clearly have an incentive to signal falsely and sell out at an inconsistently high value. One must assume that premature or excessive—relative to normal trading by "retiring" stockholders—liquidation bids by shareholders would significantly affect market value so as to virtually eliminate such problems.  

It is also likely that observations of insider trading, conditional on their signaling decisions in the current shareholders' interest, or eliciting (conditional) insider bids in a tâtonnement model, will play a significant role in convergence to the equilibrium valuation schedule as a function of the signal. These are clearly issues that need further study, as do the issues related to multiperiod planning horizons discussed in Section 3.

References


15 This is essentially a "no-Ponzie-game" type assumption. Informational aspects of prices and bids have been noted by Grossman and Stiglitz (1976) among others.

16 Liquidation bids in response to overvaluation will be continuous functions in a risk-averse setting. For the same time-structure reasons, our model, with its weak convexity provided by the deficit makeup cost (β), may be "stable" because although setting a D(t) different from equilibrium D*(t) may reduce the objective function conditional on the assumed horizon by only a small amount, it will also tend to provide an incentive to liquidate currently. The model of Leland and Pyle (1977) does not share the time-structure characteristics discussed here. In the model of Ross (1977) the relative weights of current value and end of period payoff (including bankruptcy penalties) in managers' objective functions is exogenously given.