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Keskusteluaiheita - Discussion papers

No. 322

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DIVIDENDS, GROWTH AND MANAGEMENT PREFERENCES

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ISSN 0781-6847 23.05.1990

KANNIAINEN, Vesa, DIVIDENDS, GROWTH AND MANAGEMENT PREFERENCES. Helsinki : ETLA, Elinkeinoelämän Tutkimuslaitos, The Research Institute of the Finnish Economy, 1990. 23 p. (Keskusteluaiheita, Discussion Papers, ISSN 0781-6847; no. 322).

ABSTRACT: The paper proves that under concave preferences of the management, the optimal growth of a firm is the higher, the smaller is the management's absolute risk aversion and the smaller is its pure rate of time preference. The optimal growth is also the higher, the larger is the marginal valuation of capital and the pure rate of time preference of the shareholders. The growth rate is higher for large firms than for smaller firms if the relative risk aversion of the management is decreasing. In the absence of further shocks, the equilibrium marginal valuation of capital is shown to be the ratio of the discount rates of the management and the owners. The theoretically correct investment criterion is derived. Finally, it is proved that under the optimal policy, an introduction of a dividend tax is fully irrelevant for the investment policy and the dividend distributions not only in the "long run" but also during the adjustment phase.

KEYWORDS: Dividends, growth, risk aversion

I Introduction

Corporate dividend policy has been one of those key areas in corporate finance that have been poorly understood in spite of substantial theoretical and empirical research effort.[1] It was convincingly argued by Miller and Modigliani (1961) that in the absence of transactions costs and taxation, dividend policy should be of no consequence for valuation of corporate shares. The prediction emerging from this view i.e. that corporate dividends should be expected to behave more or less like a random walk process is, however, rejected by data. First, dividends per share seem to be extremely stable over time. Second, the dividend payout ratio (share of current profits distributed) varies systematically across firms. Third, the payout ratio is unexpectedly low on the average. Fourth, an unanticipated change in corporate dividend policy is transformed to revaluation of shares.[2]

The current paper aims at explaining corporate dividend policies in terms of the managements risk aversion in a stochastic environment. Dividends are regarded as an alternative to internal growth. The paper shares the Miller-Modigliani view of the indifference of shareholders as to cash dividend and capital gains. But it claims that it is highly misleading to conclude that the dividend policy does not matter. The paper argues that due to the management's risk aversion, there is an optimal dividend policy which matters for the management, althoug not for the shareholders. Given the growth prospects, dividend policy is chosen so as to stabilize the compensation of a risk neutral management in the absence of a market for the management's risk.

The paper makes a strong claim that the standard model used extensively in the literature, i.e. the one where the management is assumed to maximize the share price, has no value in the explanation of dividends. The untenable implication of that model is that dividends are rather a volatile residual in corporate cash flows. The empirical evidence has not the slightest difficulty in rejecting this implication. The set-up of the model is presented in section II and the optimality condition derived in section III.

The equilibrium concept emerging from the model can be viewed as a continuous time Stackelberg differential game solution. Corporate management and the stock market can be regarded as the players in a repeated game. The control variable of the management is the investment flow (alternatively the dividend flow) while rationally formed expectations of future dividends and hence of current share value are the control variable of the market. Management acts like a Stackelberg leader in the sense that in forming its policy, it fully exploits its understanding of the pricing rule of the market.

The paper also shares the well-known "new view of equity finance" which proves that capital taxation has nothing to do with the optimal payout policy as long as postponing dividend payments does not mean ultimate avoidance of dividend taxes.[3] Indeed, the optimal dividend policy derived in the model of the current paper does not require differentiated tax treatment of distributed and undistributed profits. The irrelevance of the dividend tax is proved in section IV.

II Management Preferences under Uncertainty

A necessary input for understanding the behavior of a corporate firm is the acknowledgement of conflicting interests of the shareholders and the management team. It is well-known that in the world of imperfect observability of management's decisions and in the conditions of imperfect markets for the management input, no first-best contracts can emerge to solve the agency problem (cf. Barnea, Haugen and Senbet (1985)). Thus, it is advisable to appreciate the message suggested by the principal-agent literature which claims that the management's actions are governed by its own utility.

In the spirit of the expected utility hypothesis, assume then that there is a preference ordering over the sequences of instantaneous utilities of the management. Separability of utility and a given pure rate of time preference ($\alpha > 0$) are assumed. The latter provides the valuation of the momentary utilities, u(.), in relation to each other. The instantaneous utility is taken to depend upon the current market value of the firm, V. This follows from the idea that the management compensation (not to be modelled explicitely) is positively related to the current value of the firm.

The utility u(V) is assumed to be continuous and twice differentiable with positive but diminishing marginal utility. Hence, $u_V > 0$, $u_{VV} < 0$. This concavity property is important because it builds into the model the idea that it is in the management's interest to choose its policy so as to smooth down excessive fluctuations in share prices. The undiversifiable risk of the management becomes important here. Though there may be assumed to be a well-functioning market for the managament, there is no market for the management team's risk once its employment contract has been signed.

For subsequent analysis and following Pratt (1964), it is useful to take

$$(1) \qquad A(V) = - u_{VV}(V)/u_V(V)$$

as a measure of local risk aversion, or the "absolute" risk aversion using Arrow's (1965) terminology. A measure of the "relative" risk aversion is then given by VA(V) = R(V).

Let k_t stand for the capital of the firm, x_t the state of the world and $\{dk_t = jdt\}$ the investment plan of the firm. The preferences of the management can then be written as

$$(2) \qquad J(k_t, x_t) = \max_j \; E_t \int_t^{\infty} u(V_s(k_t, x_t)) \exp\{-\alpha(s-t)\} ds.$$

The sufficient conditions for the differentiability of the value function J(.) derived by Benveniste and Scheinkman (1979) are assumed to be satisfied. Let $x_t \pi(k_t)$ denote the gross cash flow of the firm where $\pi_K > 0$, $\pi_{kk} < 0$, to reflect the diminishing marginal productivity. The state of the world is described by an Ito-process

$$(3) \qquad dx_t/x_t = \sigma dz_t$$

where dz_t is assumed to follow a Wiener process with mean zero and unit variance. This captures the idea that the uncertainty of the more distant future is greater that the uncertainty of the more immediate furure. In terms of the conditional variance, $var(x_s/x_t) = (s-t)\sigma^2$ while $E_t x_s = x_t$, $s \geq t$. It follows $(dx_t)^2 = x_t^2 \sigma^2 dt$.[4]

An assumption is made the shareholders delegate all decision making to the management. Their only channel to influence the behavior of the management is to price the shares in the market place to reflect their evaluation of the investment and hence the dividend plan announced by the management. The dividend stream (or new share issues if negative) is given by $x_t\pi(k_t) - j_t$. The expected return per unit of time is $\beta V(t)dt = (x_t\pi(k_t) - j_t)dt + E_t(dV_t)$, where β measures the owner's required rate of return. This provides the fundamental pricing rule

$$(4) \qquad V_t(k_t,x_t) = V_t = E_t \int_t^{\infty} [x_s\pi(k_s) - j_s]\exp\{-\beta(s-t)\}ds$$

The pricing rule (4) functions like a constraint in the management's maximization problem (2) together with the given initial conditions, k_t and x_t. The natural interpretation is that the management team is in a position of a Stackelberg leader in that it can both preannounce its strategy and utilize the information of the market reaction.

Mathematically, the above problem (2) is not a standard control problem. The reason is that there are three state variables, k_t, x_t, and V_t but only two initial conditions. The unconventional feature is that V_t is not predetermined but a forward-looking "jump" variable. It is free to take any non-negative value in face of variation in the announced growth policy of the management. The market is assumed to form rational expectations of future returns to capital and so arrive at the right current valuation. Fortunately, the above problem can be transformed to a problem of (stochastic) dynamic programming.

III The Optimality Condition

The best policy among all the candidates can be thought to be found through the following interation (which does not, of course, take place in calender time). Given the current state of the world, x_t, the management announces first an arbitrary policy, say $\{dk^o_s = j^o_s, s \geq t\}$. The market then prices the shares as $\{V^o_s, s \geq t\}$ over the whole future path and the management calculates its utility J^o from (2). In the next iteration, a perturbation of the investment plan $\{dk^1_s = j^1_s, s \geq t\}$ is announced leading to a renewed valuation V^1_s and utility J^1. The iteration ends when J(.) has been found which satisfies $J(.) \geq J^n$ for any n. Reoptimization takes place at each instant when the state of the world, x_s, has changed.

In the short run, the control path $\{dk_s = jds\}$ has to be such that at each point in time the value function obeys the following optimality condition

(5) $$\alpha J(k_t, x_t)dt = \max_j\{u(V_t)dt + E_t(dJ)\}$$

The left-hand side is the total return, in terms of utility, required by the management over the time interval dt. The right-hand side is the total expected return. It consists of the current utility and the expected change in total utility.

Optimality requires equality between those two. Applying Ito's Lemma, one can solve

$$(6) \qquad E_t(dJ) = [jJ_k + (1/2)x^2\sigma^2 J_{xx}]dt$$

where $J_k = \delta J/\delta k$, $J_{xx} = \delta^2 J/\delta x^2$. Substitution into (5) gives the Hamilton-Jacobi-Bellman equation

$$(7) \qquad \alpha J(k_t, x_t) = \max_j \{u(V_t) + jJ_k + (1/2)x^2\sigma^2 J_{xx}\}.$$

At each point in time, j has to be chosen so as to balance the current utility against changes in the expected sum of all discounted future utilities associated with this investment policy. The necessary condition for this is from (7)

$$(8) \qquad u_V V_j + J_k = 0.$$

From (4), one can solve $V_j = -1/\beta$. Thus, (8) gives $J_k - u_V/\beta = 0$. This result gives a natural interpretation for the shadow price J_k as the sum of the discounted marginal utilities. For the characterization of the optimal program, all required information is included in this first-order condition. Yet it is useful to try to eliminate the unknown shadow price.

Since J(.), J_k and J_{xx} are all Ito-processes, they cannot be differentiated with respect to time. But equation (7) can be differentiated with respect to k (it is an identity) to give

$$(9) \qquad -\alpha J_k + u_V V_k + jJ_{kk} + (1/2)x^2\sigma^2 J_{xxk} = 0.$$

At each point along the optimal path, $J_k = J_k(k_t,x_t)$. Applying Ito's Lemma again and the differential operator, one obtains

$$(10) \qquad (1/dt)E_t(dJ_k) = jJ_{kk} + (1/2)x^2\sigma^2 J_{kxx}.$$

Substituting into (9) gives the stochastic version of the Euler equation

$$(11) \qquad -\alpha J_k + u_V V_k = -(1/dt)E_t(dJ_k)$$

where

$$(12) \qquad V_k = V_{kt} = E_t \int_t^\infty x_s \pi_k \exp\{-\beta(s-t)\}ds$$

is the marginal valuation of capital from the point of view of the shareholders. The left-hand side of (11) can be rewritten as $-u_V[\alpha/\beta - V_k]$. To evaluate the right-hand side, use $J_k = u_V/\beta$ to derive

$$(13) \qquad (1/dt)E_t(dJ_k) = (1/\beta)u_{VV}(1/dt)E_t(dV_t).$$

Since also the market valuation $V = V(k_t,x_t)$ is an Ito-process, Ito's Lemma gives $E_t(dV) = jV_k + (1/2)V_{xx}x^2\sigma^2$. However, from (4), $V_{xx} = 0$. Then (11) can be written as

$$(14) \qquad dk_t = \{\beta[1 - (\alpha/\beta)(1/V_k)]/A(V)\}dt$$

This is the fundamental condition for the optimal capital and dividend policy of the risk averse management. It should be stressed that it is a non-differentiable Ito process because the shadow price V_k and the risk aversion function $A(V)$ are functions of the Wiener process $dx/x = \sigma dz$. A new realization of this stochastic process changes V and V_k and hence the optimal j. By logical necessity, the optimal policy is of the feedback type. Note that (14) can also be cast as an efficiency condition from the point of view the shareholders as $\alpha = V_k(\beta - jA(V))$.

Equation (14) dictates when it is optimal for the management not to distribute all profits even when the shareholders are indifferent as to the timing of dividends. This holds precisely when $\beta V_k > \alpha$. The result (14) also provides sharp predictions as to the optimal speed of growth and distributions in terms of the management's and shareholder's preferences:

<u>Proposition 1:</u> Given the initial state (k_t, x_t), assuming $\beta V_k > \alpha$, and given the size of the firm, the optimal growth is the higher, the smaller is the absolute risk aversion, the smaller is the pure rate of time preference of the management, the larger is the marginal valuation of capital and the larger is the pure rate of time preference of the shareholders.

These results follow directly from (14). One realizes that though all the decision-making is delegated to the management, the optimal program is significantly affected by the required return of the shareholders, too. This follows from the interaction of the market valuation and the management's utility. In a sense, our result (14) can be regarded as a kind of stochastic extention of Tobin's well-known q model, first derived rigorously from an optimization problem in a certainty case by Yoshikawa (1980).

Since the relative risk aversion is given by $R(V) = VA(V)$, (14) can be rewritten in terms of the growth rate as $g = V_k dk/V = [(V_k - \alpha/\beta)/R(V)]dt$. By measuring the size of the firm by its market value, it follows

Corollary 1. Under the hypothesis of decreasing (increasing) relative risk aversion, the growth rate increases (decreases) with the size of the firm.

An interesting observation is that the optimal policy as given by (14) is unaffected by the magnitude of the momentary variance of x_t, as given by σ^2. This follows from the property that the equilibrium share price is unaffected by the variance of x_t. However, the variance of the stock price matters as expected. Let the momentary variance of the stock price be denoted by $\sigma_V{}^2$. This is the undiversiable risk of the management. For perfect insurance, the management would be willing to pay a premium, say ϵ. Then the risk aversion function is twice the risk premium per unit of variance for infinitesimal risks, $2\epsilon/\sigma_V{}^2 = A(V)$.[5] Substituting into (14) gives the proof for the following corollary:

Corollary 2: Given the initial state (k_t, x_t), the rate of growth of the firm is unaffected by the variance of x_t, depends positively on the momentary variance of the share price σ_V (the undiversifiable risk of the management team), but negatively on the risk premium, required by the corporate management for full insurance.

All the above results have been stated in terms of investment or growth rate. In an inverse form they all apply to profit distributions since growth and dividends are the alternatives to the firm.

It was possible to reduce the optimal behavior into equation (14), which is a stochastic differential equation. There is no obvious answer to the question of the long-run properties of this equation. Because of its complexity, it cannot explicitely be written in the form of an Ito differential equation. The complexity could be somewhat reduced by moving to an exponential utility, $u(V) = -\exp\{-\theta V\}$ with the consequence that $A(V) = \theta$ and independent of V. Moreover, it is possible to assume that the upper boundary of the distribution of $\lim_{t\to\infty} V_t$ (i.e. ∞)

is inaccessible in the sense of Malliaris and Brock [(1982) ch.9]. This assumption can be regarded as justified given the concavity of $u(V)$ and $\beta > 0$. The lower boundary of $\lim_{t\to\infty} V_t$ (i.e. 0), however, clearly is accessible. Then in the latter case, a stationary distribution will exist for $\lim_{t\to\infty} k_t$, say k^*, in the very trivial sense. If not zero, it is some non-negative constant.

The existence of finite density functions both for $\lim_{t\to\infty} V_t$ and $\lim_{t\to\infty} k_t$ on the interval $(0,\infty)$ is most probable in the case where $x_t \geq o$ (cf.footnote 4) can be assumed. Then also $0 < \lim_{t\to\infty} V_{kt} < \infty$.

The question of the "steady state" may be of limited interest in the case where the boundaries are non-absorbing states. Indeed, at each point in time, the possibility of a new shock is positive.[6] For the sake of the intution it is, however, very helpful to derive the steady state properties of the model under the assumption that no further shocks are anticipated after some point in time. This case leads to an easy characterization and it certainly is of help at least in guiding in the thinking about the long-run properties of the solution. Thus, suppose that x_t is expected to stay unchanged after time t and equal to, say, 1. In such a case, the stationary values, say V^* and k^* exist (they exist because they can be produced) and are related to each other as

(15) $$V^* = \pi(k^*)/\beta.$$

This discounted present value can easily be derived from (4). Since $\pi(k)$ is monotonically increasing in k, this equilibrium is unique. The concavity both of $\pi(k)$ and $u(V)$ also suggest that it is optimal to choose the path which leads to this equilibrium.

It is thus rational to expect a stationary equilibrium to be obtained in the long run in the case where no further shocks are anticipated. This result helps to reveal an important mechanism in the model. In this particular case, the steady state value of V_k, say V_k^*, exists and can be solved from (14) as $V_k^* = \alpha/\beta$. Note that it is the ratio of the discount rates. On the other hand, from (4), $V_k^* = \lim_{t\to\infty} V_{kt} = \pi_k(k^*)/\beta$. Then equating the V*'s gives the investment criterion of the firm

(16) $$\pi_k(k^*) = \alpha.$$

Not surprisingly, it is the management's time preference, not the owners required return, that dictates the relevant investment criterion. This simple result, which can be called underinvestment or overinvestment results depending on whether $\alpha > \beta$ or $\alpha < \beta$, has not been derived rigorously in the earlier literature. It gives the common sense explanation to the idea that management's risk aversion may restrict the investment programs.

Proposition 2. If no further shocks are anticipated, a unique equilibrium exists with the property that the marginal valuation of capital is the ratio of the discount rates of the management team and the owners. Underinvestment arises if this ratio exceeds one.

IV The Irrelevance of the Dividend Tax

The set of consistent models based on explicit optimization and able to generate a well-defined dividend policy and internal growth of a firm has so far been almost empty in the literature. The most promising exception is, however, the model by Sinn (1990). In this model the internal growth, however, fully higes upon the assumption that there is a positive tax on corporate dividends. In that model, the firm does not rely on external sources of funds like borrowing, nor does in our model. The management is assumed to maximize the share value taking into account the fact that the shareholders have to pay a tax on their cash dividends whenever the corporation makes distributions.

The results of the current paper are strikingly different from those of Sinn (1990). In our model, there is an optimal dividend payout policy throughtout the adjustment while no dividends are paid in Sinn's model in that phase. Second, the adjustment of capital is smoothed out over time even in the absence of taxation while it is gradual in Sinn's model only if dividends are taxed. The third difference concernes the effects of the dividend tax. In Sinn's model, the dividend tax raises the required return on investment over the steady state cost of capital. In our model, no such excessive yield requirement can be created during the adjustment path nor in the long run (regardless of the type of the long-run equilibrium).

Assume that cash dividends are taxed at a rate $\tau > 0$. Then the tax-adjusted market value of the firm reads as

$$(17) \qquad V^{\tau}{}_{t} = E_t \int_t^{\infty} (1-\tau)[x_s \pi(k_s) - j_s]\exp\{-\beta(s-t)\}ds.$$

Hence, $V^{\tau}{}_{t} = (1-\tau)V_t$. Moreover, $V^{\tau}{}_{k} = (1-\tau)V_k$. Then, from (2), $J^{\tau}{}_{k} = (1-\tau)J_k$. It follows that under the dividend tax, the optimality condition (8) reads as

$$(18) \qquad (1-\tau)[u_V V_j + J_k] = 0.$$

In other words, the firm's policy is independent of the tax on cash dividends of the shareholders. As (17) and (18) suggest, the dividend tax is fully capitalized in the share prices not only in the long run but also during the immediate period of adjustment. There is a negative wealth effect on shareholders and a negative income effect on the management's consumption opportunity set. But there is nothing the management càn do about this by changing its policy. As a consequence, the "new view of equity financing" is correct, according to our results, not only in the long-run equilibrium as it has been exclusively stated so far but also during the adjustment phase. This result is obviously worth emphasizing because it has not been obtained in the earlier literature.

Proposition 3. Under the optimal policy, an introduction of a dividend tax is fully irrelevant for the investment policy and dividend distributions of a firm both along the optimal path and in the long run.

VI Final Comments

Modelling explicitely the management preferences like the principal agent literature suggests seems to give a good payoff in terms of new results in a very simple model. The current model has produced quite sharp predictions as to the optimal dividend and growth policy of a risk averse corporate management in a genuine stochastic framework. The model does produce hypotheses as to the cross-firm differences in their dividend policy. Though the informational asymmetries have not been discussed, a possible interpretation is possible that cash dividends actually signal information of a firm's growth potential for rational stock market participants.

The dividend policy and the internal growth of a firm are the key interrrelated mechanisms built into the model of the current paper. The payoff this approach includes the new tax results derived in the previous section.

One may wonder whether the introduction of corporate debt would change the results obtained. Debt would serve for two different economic functions. First, debt would increase the possibilities of risk-sharing. In the current model, risks are shared between the shareholders and the management while introducing debt would shift some of the burden of the risks to the debtholders together with a share of the return to capital. Second, since the transactions cost of changing dividends and a marginal adjustment of debt are obviously quite different, it might be optimal to let the debt adopt the role of a financial buffer or shock absorber. For example, daily changes in dividends are clearly uneconomic. This view provides some hint as to the observed stability of corporate dividends.

As a final conclusion one should note that the model in no way suggests that full efficiency is achieved in pricing of stocks. It is true that since the utility of the management depends upon the behavior the share prices, there is no room for reoptimization (except in response to new information) in some later stage if the initial policy has been optimal. Hence, the time-inconsistency problem of Kydland-Prescott

(1977) does not arise regardless of rational expectations. But there is an adverse selection problem initially. Since no steady state may exist due to the stochastic framework, the management does not need to reveal its true time preference which was shown to be crucial as a surrogate for the cost of capital. Hence, there is initially the incentive to lie about the true time preference. If the time preference of the management is undervalued by the market, corporate shares are overpriced relative to the full information equilibrium.

Footnotes.

1. For a comprehensive survey, see Ang (1987).

2. My (unpublished) empirical figures suggest that the bulk of annual dividends relative to corrected profit figures varies usually between 10-30 %. My data base consists of Finnish manufacturing companies quoted on the Helsinki Stock Exchange.

3. For this model, cf. Auerbach (1983) and Sinn (1987).

4. An assumption $x^t \geq 0$ could be imposed by assuming $dx/\sqrt{x} = \sigma dz$ instead of (3). However, it is more appropriate not to exclude a priori the possibility of negative cash flow. Obviosuly, if V_s from (4) at some point s drops to zero, it is optimal to terminate the investment and production policies.

5. As is well-known, this holds precisely when the revenue is normally distributed and the utility is of the exponential variety. As an approximation, it holds for any distribution and any utility function, cf.Sandmo (1969), Newberry and Stiglitz ((1981) ch. 21).

6. A proof of the existence of a stochastic equilibrium is a highly scarce commodity in the field of stochastic optimization. Such a proof, however, has been given in the case of a competitive firm with constant returns but convex

adjustment costs by Lucas and Prescott (1971). Merton (1975), on the other hand, assumed the existence of a unique distribution of capital-labor ratio in a stochastic growth model and proceeded to derive the functional form of that distribution.

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