# WEALTH MAXIMIZATION AND THE COST OF CAPITAL*

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## I. INTRODUCTION

In a simple world of certainty, with perfect capital markets, no taxes on capital income, and all investment financed through direct ownership, a utility-maximizing investor would strive to maximize the present value of his investment. This wealth maximization would be achieved by the acceptance of all investment projects having a positive present value when discounted at the individual's personal rate of time preference.

Once the possibility of corporate finance is introduced, complications arise concerning the optimal choice of financing method and the appropriate discount rate to use in present value calculations. In the absence of taxation certain principles are generally accepted. First, it is irrelevant whether equity-source investment funds come from retained earnings or the sale of new shares. Second, firms should use a composite "cost of capital" in their discounting decisions, a weighted average of the interest rate on debt and the rate of time preference of stockholders. Finally, if the cost of capital varies with the degree of debt finance, or "leverage," [1] firms should choose the debt-equity ratio for which it is minimized. While many authors have arrived at these results starting from the objective of wealth maximization, the exact relationship remains somewhat unclear. In addition, there has been considerable debate over the impact of corporate and personal income taxes on firm policy.[2]

In this paper we explore the issue of wealth maximization and the implied behavior of the firm, paying particular attention to the results discussed above and how they are affected by the existence

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1. Modigliani and Miller [1958] have argued that, in the absence of taxation, it cannot.

2. See Farrar and Selwyn [1967], Pye [1972], Stapleton [1972], Stiglitz [1973, 1976], King [1974], Miller [1977], Auerbach [1979], and Bradford [1978].

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of capital income taxes. Our results indicate that a tax structure similar to that in existence in the United States influences the cost of capital in a very different way than has been assumed previously and that the relative advantages of debt over equity as a method of finance, and capital gains over dividends as a vehicle for personal realization of corporate profits, may have been greatly overstated. These findings may help to explain certain aspects of corporate financial behavior that have seemed puzzling.

## II. THE MODEL

We consider the behavior of competitive firms in a discrete-time, infinite-horizon model. These firms finance their investment projects through sales of common stock, retention of earnings, and sales of debt, which, for the sake of simplicity, we take to have a term of one period. At the beginning of each period, firms distribute dividends to pre-existing shareholders, pay interest, and repay principal on debt outstanding in the previous period, and sell new shares, ex dividend. Corporate profits are taxed at rate $\tau$, but interest payments may be deducted from taxable profits. Dividends are taxed at rate $\theta$ at the personal level. We assume that capital gains are taxed upon accrual at a rate $c < \theta$. We thus abstract from the issue of tax deferment that arises when, as in the United States, capital gains are taxed upon realization, and concentrate on the favorable rate at which capital gains, relative to dividends, are taxed. All stockholders face the same personal tax rates, $\theta$ and $c$.

The one-period discount rate of equity owners during period $t$ is $\rho_t$,[3] while the interest rate is $i_t$. The ex dividend value of pre-existing shares at the beginning of period $t$ is denoted $V_t^0$. The value of new equity sold is $V_t^N$. Thus, the ex dividend value of the firm's equity at the beginning of period $t$ is

$$V_t = V_t^0 + V_t^N. \tag{1}$$

The degree to which equity is "diluted" by new equity sales may be represented by the fraction,

$$\delta_t = V_t^N/V_t. \tag{2}$$

Debt outstanding in period $t$ is $B_t$, and the firm's "leverage" is defined by the term,

$$b_t = B_t/(B_t + V_t). \tag{3}$$

3. Note that $\rho$ is the rate at which stockholders discount *nominal* flows from equity. If inflation is present, at rate $\pi$, the real discount rate is $\rho - \pi$.

If we let $x_t$ represent the cash flow of the firm at the beginning of period $t$, net of corporate tax, but before account is taken of net sales of debt and equity, interest payments, and the tax savings on such payments, then dividends paid at the beginning of period $t + 1$ (i.e., the end of period $t$) on shares held during period $t$ are

$$D_t = x_{t+1} + B_{t+1} + V_{t+1}^N - [1 + i_t(1 - \tau)]B_t. \quad (4)$$

By the very definition of dividends, $D$ must always be nonnegative.

## III. The Problem

We assume that firms seek to maximize the wealth of existing shareholders. This is accomplished by choosing, at the beginning of period $t$, an investment policy, represented by the vector $\tilde{\mathbf{x}} = (x_t, x_{t+1}, \ldots)$, a debt policy, $\mathbf{B} = (B_t, B_{t+1}, \ldots)$, and an equity policy, $\mathbf{V}^N = (V_t^N, V_{t+1}^N, \ldots)$,[4] which, among feasible choices, maximize the value of shares owned as of the beginning of period $t$, including the concurrent after-tax distribution.

Before proceeding any further, we must derive an expression for the valuation of equity. We assume that shares are equal in value to the present discounted value of the distributions their owners receive. At the end of period $t$, the total dividends paid to all stockholders are $D_t$. However, if there are personal taxes, the net distribution is smaller. The personal tax liability at the end of period $t$ is the tax on dividends $\theta D_t$, plus that on accrued capital gains on existing stock, $c(V_{t+1}^0 - V_t)$. Thus, the net distribution received by all shareholders at the end of period $t$ is

$$E_t = (1 - \theta)D_t - c(V_{t+1}^0 - V_t). \quad (5)$$

If new equity is issued between period $t$ and a subsequent period $s$, not all of the distribution $E_s$ will go to shares held as of period $t$. A fraction will go to the shares arising from the new issues. The fraction of shares held during period $s$ that were in existence before the start of period $t$ is, from (2),

$$\mu_t^s = (1 - \delta_t)(1 - \delta_{t+1}) \ldots (1 - \delta_s). \quad (6)$$

Thus, the distribution at time $s \geq t$ to shares owned as of the beginning of period $t$ is $\mu_t^s E_s$, and the value of such equity is

$$V_t^0 = \sum_{s=t}^{\infty} \left[ \prod_{z=t}^{s} (1 + \rho_z)^{-1} \right] \mu_t^s E_s. \quad (7)$$

4. The choice of $\tilde{\mathbf{x}}$, $\tilde{\mathbf{B}}$, and $\tilde{\mathbf{V}}^N$ determines the dividend policy $\tilde{\mathbf{D}} = (D_{t-1}, D_t, \ldots)$.

Using (1) and (2), and applying (7) for successive values of $t$, we obtain

$$\rho_t V_t = E_t + (V_{t+1}^0 - V_t). \tag{8}$$

Equation (8) states that, for all $t$, the one-period holding yield on equity, which includes the net distribution and capital gain, must equal the rate of time preference associated with equity holding $\rho_t$.

The wealth of existing stockholders that the firm seeks to maximize is

$$W_t^0 = V_t^0 + E_{t-1}. \tag{9}$$

Using (1), (4), and (5), we may rewrite this expression as

$$\begin{aligned} W_t^0 = {} & (1-c)V_t + (1-\theta) \\ & \times \{B_t - [1 + i_{t-1}(1-\tau)]B_{t-1} + x_t\} \\ & - (\theta - c)V_t^N + {}_cV_{t-1}. \end{aligned} \tag{10}$$

Since $i_{t-1}$, $V_{t-1}$, and $B_{t-1}$ are predetermined at the beginning of period $t$, $W_t^0$ is maximized if and only if the firm maximizes

$$W_t^* = (1-c)V_t + (1-\theta)B_t + (1-\theta)x_t - (\theta - c)V_t^N. \tag{11}$$

We are now ready to examine the characteristics of wealth-maximizing behavior. Because of the complexity of the general problem, we attack first the simpler case in which $\theta = c = 0$.

## IV. Wealth Maximization: No Personal Taxes

In this situation the firm's objective function (11) reduces to

$$W_t^* = V_t + B_t + x_t. \tag{12}$$

Firms desire to maximize the sum of their securities' market value and current cash flow. This is a standard result.

To simplify the exposition in this and succeeding sections, we introduce the term,

$$F_t = D_t - V_{t+1}^N, \tag{13}$$

which is the dividend payable at the end of period $t$, before account is taken of the sale of new equity.

Using (1), (5), (8), and (13), we obtain for the case with no personal taxes

$$V_t = (1 + \rho_t)^{-1}(V_{t+1} + F_t). \tag{14}$$

Solving for $V_t$, we obtain[5]

$$V_t = \sum_{s=t}^{\infty} \left[ \prod_{z=t}^{s} (1 + \rho_z)^{-1} \right] F_s. \tag{15}$$

Thus, as first argued by Miller and Modigliani [1961], the particular source of equity funds used to finance investment has no impact on the firm valuation. Once **x** and **B** are determined, so is $V_t$, since $F$ is, by definition, independent of $V^N$. Because of this result, we may ignore the question of share sales and repurchases when considering the question of wealth maximization in the absence of personal taxes.

Using expressions (1) and (13) to substitute into (14), and then rearranging terms, we obtain an expression for shareholder wealth:

$$W_t^* = x_t + (1 + r_t)^{-1} W_{t+1}^*, \tag{16}$$

where we define the term,

$$r_t = b_t i_t (1 - \tau) + (1 - b_t) \rho_t, \tag{17}$$

to be the "cost of capital," an average of the returns the firm must earn on equity holdings and debt, weighted by their respective portions in the firm financial structure. Because of the deductibility of interest payments, the net cost of debt is $i_t(1 - \tau)$, rather than the gross interest rate.

Solving (16) for $W_t^*$, we obtain[6]

$$W_t^* = x_t + \sum_{s=t+1}^{\infty} \left[ \prod_{z=t}^{s-1} (1 + r_z)^{-1} \right] x_s. \tag{18}$$

Shareholder wealth may be expressed as the present value of the stream of after-tax corporate cash flows, where the financial policy determines the appropriate discount rate.

It is clear that the cost of capital, defined above, determines the cutoff point for investment projects. Given the choice of financial policy and, hence, the value of $\mathbf{r} = (r_t, r_{t+1}, \ldots)$, the firm will increase $W_t^*$ by accepting those projects having positive present value when the cost of capital in each period is used as the discount rate.

Up until this point we have said very little about the determi-

5. This result is dependent on the assumption that the term $\Pi_{z=t}^{T} (1 + \rho_z)^{-1} V_T$ approaches zero as $T$ approaches infinity; that is, the firm's value grows at a rate less than $\rho$. This restriction is necessary to rule out "chain letters" in which $F$ is continually less than or equal to zero and dividends on existing shares are supported solely by the sale of new shares. A similar assumption will be made concerning the value of $W_t^*$ in equation (18) to rule out the continual sale of ever larger amounts of new debt to support payments to existing holders of debt and equity.

6. See note 5.

nation of $\rho$ and $i$, or about the place of risk in our model. A completely adequate treatment of risk is beyond the scope of this paper. It is even questionable whether firms should always seek to maximize shareholder wealth when there is uncertainty as to the particular state of nature that will occur in each period. One fairly simple, albeit imperfect, approach is to assume that the market evaluation of a firm's "riskiness" increases with the degree of leverage, and that the required rates of return $\rho$ and $i$ must increase;[7] that is,

$$\rho_t = \rho(b_t), \quad i_t = i(b_t), \quad \rho', i' > 0. \tag{19}$$

If we assume that $\rho_t$ and $i_t$ are determined in this way, it follows from (17) and (18) that, for any given stream $\mathbf{x}$, the firm maximizes $W_t^*$ by choosing $b_s$ for each period $s \geq t$ to minimize the cost of capital. Thus, the overall wealth maximization, in this case, may be viewed as a two-stage procedure in which firms first determine the financial policy that minimizes the cost of capital faced in each period, and then use this cost of capital as the discount rate in determining the optimal investment strategy.

## V. Wealth Maximization with Personal Taxes

A more interesting, and more difficult, problem arises once we remove the assumption that $\theta = c = 0$. Many of the familiar results of the previous case must be altered to take account of the existence of personal taxes.

The first difference, seen in the definition of $W^*$ (in equation (11)) is that the firm should not strive to maximize the sum of current cash flow and the market value of its securities, unless $\theta = c$. This condition is, in our model, equivalent to the integration of corporate and personal income taxes, since all corporate source income, whether retained or distributed, would be taxed at the same rate; $\tau' = \tau + \theta = \tau + c$.

Following the same procedure used to obtain equation (15), we get, after various substitutions,

$$V_t = \sum_{s=t}^{\infty} \left[ \sum_{z=t}^{s} \left(1 + \frac{\rho_z}{1-c}\right)^{-1} \right] \left[ \left(\frac{1-\theta}{1-c}\right) F_s - \left(\frac{\theta - c}{1-c}\right) V_{s+1}^N \right]. \tag{20}$$

Comparing (20) to (15), we note that, unless $\theta = c$, taxes enter in a complex way into the valuation formula. However, there is one extremely important observation that can be made. For any given values

7. See Feldstein, Green, and Sheshinski [1979] for a recent example of this approach.

of **x** and **B**, and hence **F**, a decrease in the net issue of new equity, $V_s^N$, at any time $s > t$, increases $V_t$ and hence $W_t^*$, since $\theta > c$. Thus, it will never be optimal to issue new shares and pay dividends at the same time, since $V_t$ may be increased by an equal decrease in $D_{s-1}$ and $V_s^N$.

The same logic would compel firms to continue decreasing $V^N$ below zero, repurchasing equity, as long as dividends were positive, if such behavior were not otherwise hindered. This dominance of share repurchases over dividends as a method of distribution has been recognized in the past by many authors.[8] However, share repurchases have never constituted an important part of firm distributions. Part of the answer probably lies in Section 302 of the Internal Revenue Code, which prohibits firms from repurchasing shares in lieu of distributing dividends.

Recent U. S. data confirm that new share issues have constituted only a small portion of new equity finance, and that repurchases have been a very unimportant method of distribution, compared to dividends. For example, in 1976, net issues of debt by U. S. nonfinancial corporations amounted to \$47.8 billion, retained earnings were \$44.3 billion, and dividends were \$32.2 billion. Net issues of equity were only \$10.5 billion,[9] and share repurchases were, in turn, only a small percentage of this number.[10]

Given the above discussion, we shall henceforth assume that firms neither issue new shares nor repurchase existing ones. While not greatly abstracting from reality, this restriction constitutes a very helpful simplification. Assuming that $V_t^N \equiv 0$, we see that (20) becomes

$$V_t = \sum_{s=t}^{\infty} \left[ \prod_{z=t}^{s} \left(1 + \frac{\rho_z}{1-c}\right)^{-1} \right] \left(\frac{1-\theta}{1-c}\right) F_s. \tag{21}$$

Following the same procedure used in deriving (18), we obtain

$$W_t^* = (1-\theta)\left[x_t + \sum_{s=t+1}^{\infty} \left(\prod_{z=t}^{s-1} (1+r_z)^{-1}\right) x_s\right], \tag{22}$$

where the cost of capital is

8. Among them, Bierman and West [1966], Pye [1972], and King [1974].

9. The preceding figures were obtained from the 1976:IV issue of the *Flow of Funds Accounts* published by the Board of Governors of the Federal Reserve System.

10. The breakdown between new issues and repurchases is not given for nonfinancial corporations. However, the corresponding figures for all corporate business in 1976 are listed in the December 1977 issue of the *Federal Reserve Bulletin*. While gross sales of new equity amounted to \$14.1 billion, repurchases were only \$3.1 billion.

$$(23)\quad r_t = [(1-c) - (\theta - c)b_t]^{-1}[b_t i_t(1-\tau)(1-\theta) + (1-b_t)\rho_t].$$

As in the case without personal taxes, the firm maximizes wealth, given financial policy, by choosing all projects that have a positive present value when discounted by the cost of capital, and if $i$ and $\rho$ are determined by (19), should choose the degree of leverage that minimizes the cost of capital.

The formula for the cost of capital given in (23) differs from results obtained previously, and there are a number of interesting observations to be made concerning this expression. If the firm is financed solely through debt, then $r$ reduces to the net of tax rate of interest, $i(1-\tau)$, which the firm must pay on its debt. At the other extreme, an equity-financed firm faces a cost of capital of $\rho/(1-c)$. There are two rather surprising aspects of this result. First, the cost of capital does not depend on the dividend payout rate. Second, the rate of dividend taxation does not enter at all. Equity gains are effectively taxed at rate $c$, which may be very small compared to the statutory rate of taxation of dividends. Even for the general case in which there is both debt and equity in the firm, the payout rate does not directly influence the cost of capital.

The next section contains an example that should aid in the understanding of the above results.

## VI. Firm Value and the Cost of Capital

In this section we consider the particular case of an economy in which there is no inflation, in which $i$, $\rho$, $b$, and hence $r$, are all constant, and assume that firms produce output using homogeneous, nondepreciating capital and labor, subject to a constant-returns-to-scale technology. These assumptions are made to facilitate the exposition and do not influence the characteristics of the results.

The investment in an additional unit of capital at any given time $t$ will decrease concurrent cash flow by the purchase price, and increase the cash flow in each succeeding period by the marginal product of such capital, less corporate taxes, $f'(1-\tau)$. Such a project increases $W_t^*$ by $[f'(1-\tau)/r] - 1$. Perfect competition ensures that firms will invest until the adoption of new projects does not increase wealth; that is, the after-tax marginal product of capital must equal the cost of capital:

$$(24)\quad f'(1-\tau) = r.$$

Given that firms equate the wage rate with the marginal product of labor, the cash flow available to the firm at the beginning of period

$t$ if no new investment occurs is, by Euler's Theorem, $f'(1-\tau)K_{t-1}$, where $K_{t-1}$ is the capital on hand during period $t-1$. The net cash flow at the beginning of period $t$ is therefore this amount less new investment:

$$x_t = f'(1-\tau)K_{t-1} - (K_t - K_{t-1}). \tag{25}$$

Using (22), (24), and (25), we obtain

$$\begin{aligned} W_t^* &= (1-\theta)\left\{x_t + \sum_{s=t-1}^{\infty} (1+r)^{-(s-t)}[(1+r)K_{s-1} - K_s]\right\} \\ &= (1-\theta)[x_t + K_t]. \end{aligned} \tag{26}$$

Substituting (26) into (11), we obtain

$$V_t = \left(\frac{1-\theta}{1-c}\right)[K_t - B_t], \tag{27}$$

which is similar to results obtained by Auerbach [1978] for the case of all equity finance and Bradford [1978] for the case in which $\tau = c = 0$. Since $\theta > c$, the market value of equity is lower than the reproduction cost of its capital stock, less the market value of its debt. In the language of Tobin [1969], "$q$" is less than unity.

Since this capitalization occurs, the presumed superiority of capital gains over dividends disappears, and the effective tax on equity income is lower than a weighted average of the statutory taxes on dividends and capital gains. For example, imagine an all-equity firm considering taking one dollar out of current dividends for reinvestment. The net loss to stockholders in the current period is $(1-\theta)$, since their dividend tax liability is also reduced. The capital stock is increased by one unit, and by (27) the stock's market value goes up by $(1-\theta)/(1-c)$. Therefore, current capital gains taxes are increased by $c(1-\theta)/(1-c)$. If the stockholders then sell off the value of the stock corresponding to the new investment, they receive a capital gain of $(1-\theta)/(1-c)$, and the value of their remaining stock is the same as it would have been if the dividend had been paid out. But the total distribution is $(1-\theta)/(1-c) - c(1-\theta)/(1-c) = (1-\theta)$, which equals the dividend foregone. Thus, payout policy is irrelevant from the point of view of the stockholders.

Now, suppose that instead of selling off the increase in stock value, individuals hold it forever. Also, suppose that all returns from the new capital in succeeding periods are paid out in dividends. (Since we have just demonstrated the irrelevance of payout policy, this assumption poses no restrictions.) The initial cost is then the lost dividend $(1-\theta)$, plus the capital gains tax accrued $c(1-\theta)/(1-c)$, for a total of $(1 - \theta)/(1 - c)$. The net distribution in each period is the marginal product of capital, less corporate and dividend taxes, $f'(1 - \tau)(1 - \theta)$. Thus, this marginal asset has zero present value, discounted at $\rho$, when $f'(1 - \tau) = \rho/(1 - c)$, the all-equity cost of capital derived in the previous section.[11]

## VII. Financial Policy and the Cost of Capital

Thus far, we have had little to say about the choice of financial mix between debt and equity. One important question to ask is whether, in the absence of any notion of risk or bankruptcy, firms will finance with both equity and debt or, as has been suggested by Stiglitz [1973], will finance with only debt at the margin.

If all future streams are certain, then the degree of leverage of a firm has no impact on the values of $\rho$ and $i$ that it faces. Shares in all firms are perfect substitutes, as are bonds, so that firms are price-takers with respect to $\rho$ and $i$.

Differentiating (23) with respect to $b$, for $i$ and $\rho$ constant, we obtain (dropping subscripts)

$$\frac{dr}{db} = [(1 - c) - (\theta - c)b]^{-2}(1 - \theta)[i(1 - \tau)(1 - c) - \rho], \tag{28}$$

which is either always positive, always negative, or always zero. Thus, firms will desire all debt if $i(1 - \tau)(1 - c) < \rho$, all equity if $i(1 - \tau)(1 - c) > \rho$, and be indifferent if $i(1 - \tau)(1 - c) = \rho$. The determination of $i$ and $\rho$ depends, in turn, on the characteristics of individual investors. We consider two cases, one in which all investors face the same tax schedule, the second in which they do not. In each case we let $\phi$ denote the individual tax rate on debt income.

### *Case 1: One Class of Investors*

Without risk, debt and equity should be perfect substitutes, and investors will hold whichever yields a higher net rate of return, holding both only if these returns are equal. For an equilibrium to exist with debt and equity present, both firms and individuals must be indifferent between the alternatives. From our discussion above, the condition for firm indifference is $i(1 - \tau)(1 - c) = \rho$. By construction, individuals receive $\rho$ from holding equity. After paying a personal

11. There is a question as to whether this undervaluation equilibrium is feasible. In another paper we explored this problem in the context of an all-equity, overlapping-generations growth model (Auerbach, 1979) and found that such a regime could occur there only if the after-tax marginal product of capital, $f'(1 - \tau)$, exceeds the population growth rate.

income tax, they receive $i(1 - \phi)$ from holding debt. Thus, individuals will be indifferent if and only if $i(1 - \phi) = \rho$. Combining these two conditions, we have the result that debt and equity will exist together in equilibrium if and only if $(1 - \tau)(1 - c) = (1 - \phi)$.

Now assume that we are initially in a position in which both debt and equity are held, so that $i(1 - \phi) = \rho$, and suppose that $(1 - \tau)(1 - c) > (1 - \phi)$. Then $i(1 - \tau)(1 - c) > \rho$, and firms will shift entirely to equity. Similarly, if $(1 - \tau)(1 - c) < (1 - \phi)$, they will shift entirely to debt. Thus, the equilibrium will be characterized by all equity, all debt, or both according to whether $(1 - \tau)(1 - c)$ is greater than, less than, or equal to $(1 - \phi)$.[12]

It is interesting that the tax on dividends $\theta$ does not enter directly into the process at all.[13] Since the question of which method of finance will be used depends on $c$, it would be helpful to relate this hypothetical tax on accrued capital gains to the currently existing tax on realized gains. Bailey [1969] has shown that the effective tax rate on accrued capital gains approximately equals the statutory rate on realizations, which cannot exceed $0.5\theta$, times the ratio of realizations to accruals, which he estimated to be 0.2 for the long run in the United States. If we let $c = 0.1\theta$ and assume that $\theta = \phi$, then the equilibrium will be characterized by all equity, all debt, or both according to whether $\theta$ is greater than, less than, or equal to $\bar{\theta}$, where

$$\bar{\theta} = \tau/(0.9 + 0.1\tau). \tag{29}$$

If we take $\tau$ to be the U. S. statutory rate 0.46, then $\bar{\theta} = 0.486$. That is, an all-debt equilibrium will occur only if $\bar{\theta} < 0.506$. In comparison, the maximum statutory rate on personal capital income in the United States is presently 0.7.

In the model just presented, an equilibrium will have all equity or all debt according to whether or not "the" tax rate on personal income exceeds $\bar{\theta}$. In reality, however, the marginal tax rates faced by individuals vary greatly.

*Case 2: Two Classes of Investors*

Suppose that there are investors of two types, differing only by their marginal tax rates. Let $(\theta_1, \phi_1, c_1)$ be the rates faced by class 1, and let $(\theta_2, \phi_2, c_2)$ be those faced by class 2. For simplicity, we again assume that $\theta_1 = \phi_1$ and $\theta_2 = \phi_2$. Our objective is to derive the conditions under which debt and equity coexist in equilibrium, with one

12. A similar result has been derived by King [1974].

13. Bradford [1978] has demonstrated this point for the case in which $\tau = c = \phi = 0$.

class holding equity and the other debt. For this to occur, firms must be indifferent between debt and equity, equity-holders must prefer equity, and debt-holders must prefer debt. Without any loss of generality, we take class 1 to be the equity-holders.

In equilibrium the rate of return received by equity investors must equal their rate of time preference. Combining (5) and (8), we obtain

$$\rho^1 = (1-\theta_1)\frac{D}{V} + (1-c_1)\frac{\Delta V}{V}, \tag{30}$$

where $\rho^1$ is the rate of time preference of class 1 members and $\Delta V$ is the capital gain they receive. Similarly, the net return to holders of debt must equal their rate of time preference:

$$\rho^2 = (1-\phi_2)i. \tag{31}$$

The potential return to equity holders from holding debt is

$$\rho^{1*} = (1-\phi_1)i, \tag{32}$$

and the potential return to debt holders from holding equity is

$$\rho^{2*} = (1-\theta_2)\frac{D}{V} + (1-c_2)\frac{\Delta V}{V}. \tag{33}$$

The conditions for an equilibrium with debt and equity are

$$\rho^1 \geq \rho^{1*} \tag{34.1}$$

$$\rho^2 \geq \rho^{2*} \tag{34.2}$$

$$i(1-\tau)(1-c_1) = \rho^1; \tag{34.3}$$

that is, debt-holders prefer debt, equity-holders prefer equity, and firms are indifferent between debt and equity. Combining (30)–(34) (and substituting $\theta_1$ for $\phi_1$ and $\theta_2$ for $\phi_2$), we obtain

$$\left(\frac{1-\theta_1}{1-c_1}\right)\left[\frac{((1-c_1)/(1-\theta_1))(1-\alpha)+\alpha}{((1-c_2)/(1-\theta_2))(1-\alpha)+\alpha}\right] \geq (1-\tau) \geq \left(\frac{1-\theta_1}{1-c_1}\right), \tag{35}$$

where $\alpha$ is the fraction of gross equity gains received through dividends:

$$\alpha = \frac{D}{\Delta V + D}. \tag{36}$$

It is clear that (35) can hold only if $(1-c_1)/(1-\theta_1) \geq (1-c_2)/(1-\theta_2)$. (Since we may rearrange indices, this is always possible.) What this tells us is that if equity and debt coexist in equilibrium, equity must be held by those who receive a relatively greater tax advantage in the statutory treatment of capital gains. This result is similar to that of the simple Ricardian trade model which dictates that countries will specialize in the production of the good for which they have a *comparative* advantage.

If $(1 - c_1)/(1 - \theta_1) = (1 - c_2)/(1 - \theta_2)$, then condition (35) will be met if and only if $(1 - \tau) = (1 - \theta_1)/(1 - c_1) = (1 - \theta_2)/(1 - c_2)$, in which case both classes will be indifferent between debt and equity. Thus, the two-class example collapses to the one-class example, and no segmentation will occur. Suppose, at the other extreme, that class 2 consists of tax-exempt investors, such as nonprofit institutions. Then (35) becomes

$$(37) \qquad (1 - \alpha) + \alpha\left(\frac{1 - \theta_1}{1 - c_1}\right) \geq (1 - \tau) \geq \left(\frac{1 - \theta_1}{1 - c_1}\right).$$

Unless $\alpha$ is near unity,[14] the first inequality in (37) will be satisfied, and the condition reduces to that necessary for the existence of equity in a one-class economy. Thus, in a two-class world, with one class tax-exempt, and the other facing a marginal tax rate on regular capital income between 0.51 and 0.70, debt and equity would coexist, with the former group holding debt and the latter holding equity.

## VIII. Conclusion

This paper has reviewed the investment and financial behavior of corporations seeking to maximize the wealth of their shareholders. We have focused on the impact of personal income and capital gains taxes, finding that, in the presence of differential taxation of dividends and capital gains, wealth maximization does not imply maximization of firm market value and the source of equity financing is not irrelevant.

The appropriate cost of capital in the presence of personal taxes does not depend directly on either the dividend payout rate or the tax on dividends. Equity shares have a market value lower than the difference between the reproduction cost of a firm's assets and the market value of its debt obligations. Because of this capitalization, it need not be true that an economy without risk or uncertainty would have no equity financing.

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14. For $c = 0.1 \cdot \theta$, $\theta \leq 0.70$, and $\tau = 0.46$, the first inequality in (37) must hold unless $\alpha \geq 0.68$.

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