Taxes and Financing Decisions

Corporate Finance and Taxes: A Review

Robert A. Haugen and Lemma W. Senbet

Robert A. Haugen is a member of the faculty of the University of Illinois — Urbana-Champaign. Lemma W. Senbet is a member of the faculty of the University of Wisconsin — Madison and an Associate Editor of Financial Management.

I. Introduction

The corporate and personal income tax can play a significant role in the investment, financing, and dividend decisions of the firm. In terms of the corporate income tax, distributions to fixed income securities are generally deductible in computing taxable income, while distributions to residual claims are not. In the absence of other debt related costs or tax induced differential returns, the relatively favorable treatment of interest expenditures leads to a preference for debt financing by firms. In terms of the personal income tax, the taxation of capital gains under the new tax law is deferred until realization. In the absence of either desirable distributional properties of dividend payments that are not replicable on personal account [28] or costless tax shelters [46], investors will prefer that dividend payments are minimized unless the returns are commensurately higher on high dividend paying stocks. However, if there are differential returns favoring dividends, firms will minimize dividend payments because of their lack of tax deductibility. Indeed, it remains a major challenge to the profession to produce a convincing explanation as to why regular dividend payments exist at all.

Thus, the absence of financing costs, incomplete markets, supply adjustments, and costless tax avoidance results in unrealistic corner solutions for both leverage and dividend policy. In recent years, researchers have generalized their theoretical models by introducing imperfections and by allowing for the reactions both of investors and firms to the levy of taxes, and of government to avoidance of taxes. These generalizations have enhanced our understanding of the tax system's impact on security pricing and of the firm's financing and dividend policies.

This paper provides a review of recent contributions to the literature on the impact of taxes on corporate financial behavior. Thus, the paper focuses only on the tax dimension of corporate finance and it purposely ignores other dimensions, such as agency costs and

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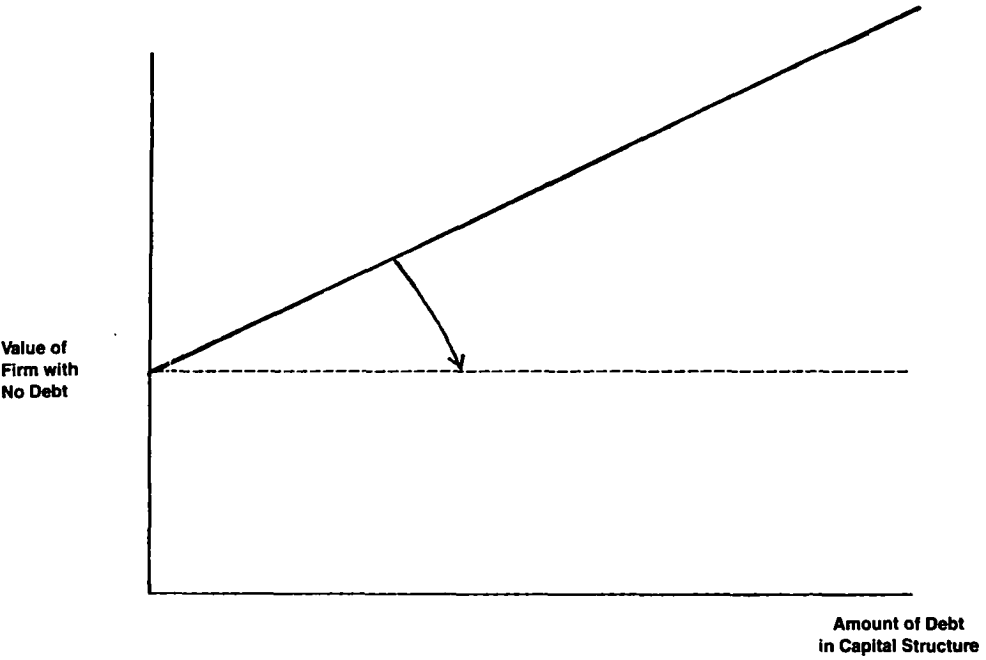
Exhibit 1. Debt and Firm Value: Modigliani and Miller (solid line) and Miller (broken line)



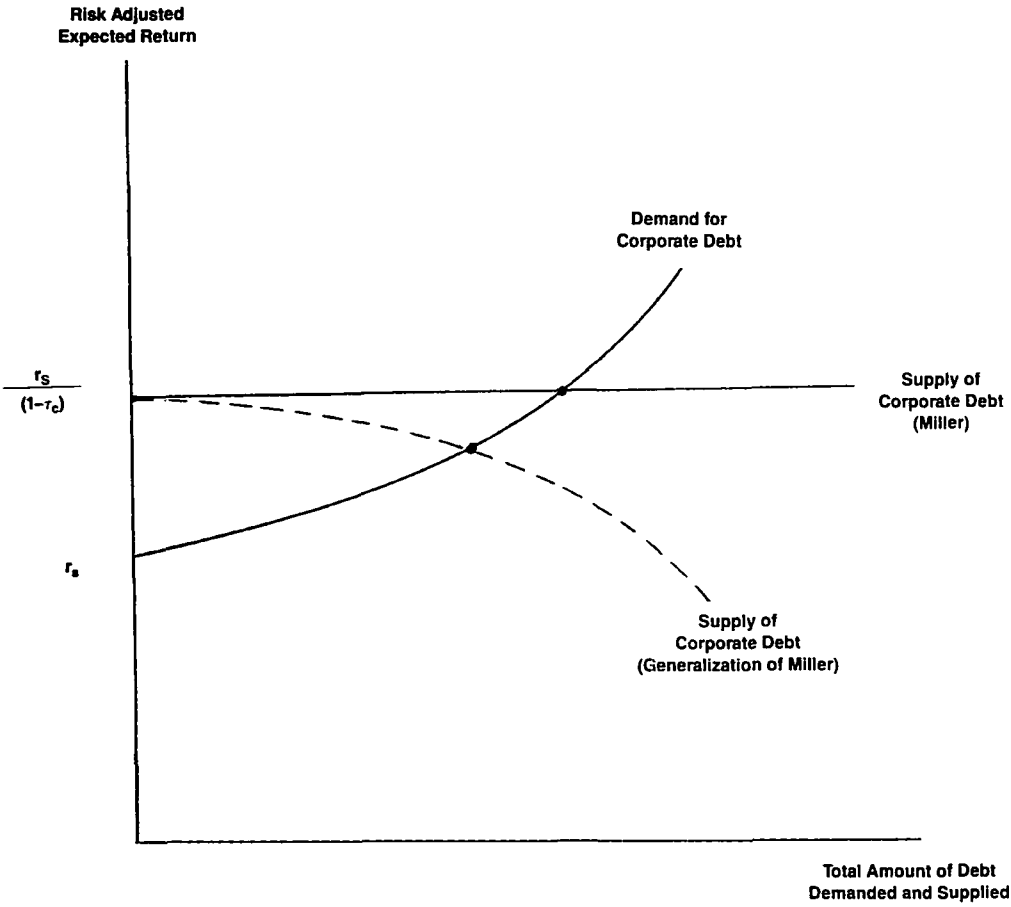
other considerations. In Section II we address the relationship between taxes and capital structure, focusing on recent attempts to generalize the Miller [43] equilibrium. In Section III we move to the impact of taxes on dividend policy. Here we focus on the possible role of tax avoidance by investors and attempt to reconcile the apparent conflict between the conditions of the original Miller equilibrium, where firms are indifferent to capital structure, and the conditions under which costless tax avoidance leads to an indifference by investors to dividends and capital gains.

II. Debt and Taxes

Under the assumptions of Modigliani and Miller [49], the relationship between the value of the firm and the market value of its outstanding debt is given by the solid line in Exhibit 1. Note that the firm will issue as much debt as possible if it wishes to maximize its market value. In other words, if corporate debt sells at the same (risk-adjusted) expected rate of return as common stock and municipal bonds, corporations will flood the market with debt.[1] Suppose instead that debt sells at a higher (risk-adjusted) expected rate of return. Now, the firm benefits from the tax deduction, but it pays a penalty through the premium in the cost of debt. Accordingly, the slope of the function in Exhibit 1 is reduced. Suppose that the differential in the (risk-adjusted) expected returns between corporate debt and stock and municipal bonds becomes large enough to equate the after-tax returns for someone in the same bracket as the corporate tax rate. Here will be the case when $r_c = r_s/(1-\tau_c)$, where r_s is the (risk-adjusted) expected return on stock investments, r_c is the risk-adjusted cost of corporate debt and τ_c is the corporate tax rate. Now the penalty through the differential premium exactly offsets the benefit of the tax deduction. In Exhibit 1 the slope of the function becomes zero as given by the broken line. If the differential in return becomes larger, the slope becomes negative.

[1] Assume that common stock is tax exempt so that it yields the same return as municipal bonds.

Exhibit 2. Equilibrium in the Market for Corporate Debt



Thus, if the (risk-adjusted) expected return on debt is greater than $r_s/(1-\tau_c)$, firms will issue no debt; debt drives down the value of the firm. If it is less than $r_s/(1-\tau_c)$, firms will finance entirely with debt; debt drives up the value of the firm. The supply curve for corporate debt is, therefore, perfectly horizontal at a (risk-adjusted) interest rate of $r_s/(1-\tau_c)$, as given by the solid, horizontal line of Exhibit 2.

The equilibrium interest rate on corporate debt occurs at the intersection of supply and demand. The demand curve derives from the differential tax rates for individual investors. Miller *assumes* that individuals are taxed at heterogeneous rates that are higher for high income investors, but which, for any one investor, do not change as the level of income changes. Since the interest payments on debt are taxable, investors will prefer municipal bonds and common stock, unless there is a (risk-adjusted) differential in the pretax expected return on corporate debt. If this differential is very small, only those investors in the very lowest brackets will prefer corporate debt as an investment. As the differential is increased, investors in progressively higher brackets will be enticed into the market for corporate debt. The demand curve is thus upward

sloping, reflecting the greater demand for corporate debt as its pretax interest rate is increased.[2] (Demand curves are *upward* sloping, because interest rates, and not prices, are plotted on the vertical axis.)

In Exhibit 2 the rising demand curve intersects the horizontal supply curve at a risk-adjusted interest rate that fully reflects the corporate tax rate. Investors in brackets greater than this will prefer stock and municipal bond investments. Investors in brackets less than this will find it in their interest to invest in corporate bonds. However, this portfolio polarization between stocks and bonds breaks down in an incomplete market.

Although, technically speaking, this violates the conditions of the Miller model, investors will also form clienteles on the basis of their stock investments if markets are incomplete.[3] Low bracket investors will also hold stock for purposes of diversification. It is in the interests of these investors to invest in the stocks of highly levered firms, because the interest tax deduction results in a greater reduction in taxes when used by the firm than if these investors borrowed on their own personal accounts. On the other hand, investors in tax brackets higher than the corporate tax rate will find it to their advantage to lever on their own account because the tax deduction associated with interest expense is more valuable to them. They will borrow funds to invest in the stocks of unlevered companies.

Firms will be indifferent to issuing debt or equity to finance their investments, because the amount of debt outstanding has no impact on the value of the firm, as can be seen by the broken line of Exhibit 1. While the level of corporate debt is *determinate* at the aggregate level, it is *indeterminate* at the individual firm level.

In addition to assumed conditions of certainty or a complete market, Miller must place restrictions on tax arbitrage through personal borrowing or short sales. As argued by Schaefer [57], the Miller equilibrium will break down without such restrictions due to *exogeneity* of personal tax rates, even though these rates are heterogeneous across investors. In addition to these, however, there are two other conditions that are critical to the properties of the Miller equilibrium:[4]

(i) Interest on debt must always be deducted when paid. Alternatively, it can be assumed that redundant interest deductions can be marketed to other firms without cost through merger, safe harbor leasing arrangements, or other mechanisms.

(ii) Tax rates for individuals must be assumed to be fixed and unrelated to the level of individual income. Although tax rates differ across different individuals, for any one individual they are a known constant across all future states of the world.

As discussed in the sections that follow, modification of any of these conditions results in significant changes in the properties of the equilibrium.[5,6]

A. Generalizations of the Miller Equilibrium

Redundant Tax Shelters. In Miller's analysis firms will be indifferent toward issuing debt whenever interest, which is paid at the premium rate, can be used to reduce the level of corporate taxable income dollar for dollar. There are, however, situations in which interest charges are redundant as tax deductions, at least to the firm that originally issued the debt. Suppose that in these situations the deductions cannot be costlessly transferred to other firms through merger or other arrangements such as safe harbor leasing. Suppose also that they cannot be carried forward or back, without limit or loss of interest, to reduce the tax burden in other years. Given these conditions, there will be an optimal amount of debt to issue that will be related to the probability of taking the interest payments as a deduction.

Interest payments can be redundant as a tax shelter if the firm has non-cash deductions, such as depreciation charges and investment tax credits. In this case the firm may have sufficient cash to pay the interest in full, but net taxable income, after deducting the interest charges, may be negative. Technical insolvency may result even in the absence of depreciation charges if the market value of the firm exceeds the debt claim, but

[2]The demand curve can also be upward sloping on the basis of costs of tax avoidance rather than the tax rates themselves as shown by Barnea, Haugen, and Senbet [5].

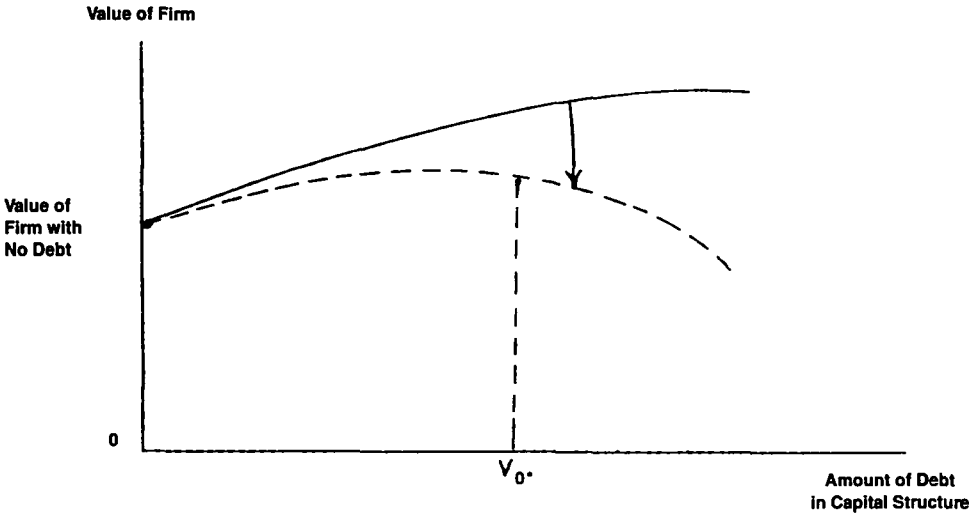
[3]See Sarig and Scott [56] for inconsistencies associated with this kind of clientele interpretation.

[4]The germ for the Miller equilibrium originates from Farrar and Selwyn [24], and the results were also anticipated by Stiglitz [61]. However, the insightful characterization of the bond market equilibrium by Miller has opened up a large volume of new research as reviewed in this paper.

[5]The Miller analysis abstracts also from the effects of international taxation facing multinational corporations and international investors. International aspects provide an important avenue of inquiry, because international comparisons across differential tax regimes can facilitate the verification of tax effects of finance. In this paper we wish to focus on domestic taxation. For international equilibrium analyses of debt and taxes see Senbet [58], Litzenberger and Rolfo [39], and Lee and Zechner [35].

[6]The Miller equilibrium also assumes that the investment policy is fixed and that the government is passive in the face of agents' attempts to minimize taxes. These issues are largely ignored in this paper. We also ignore issues relating to tax effects of pension management and leasing, although the basic principles are applicable to these issues [9].

Exhibit 3. Debt and Firm Value: Generalization of Miller



taxable income is negative. In this case the interest can be paid with cash raised by issuing securities based on the residual market value of the firm.

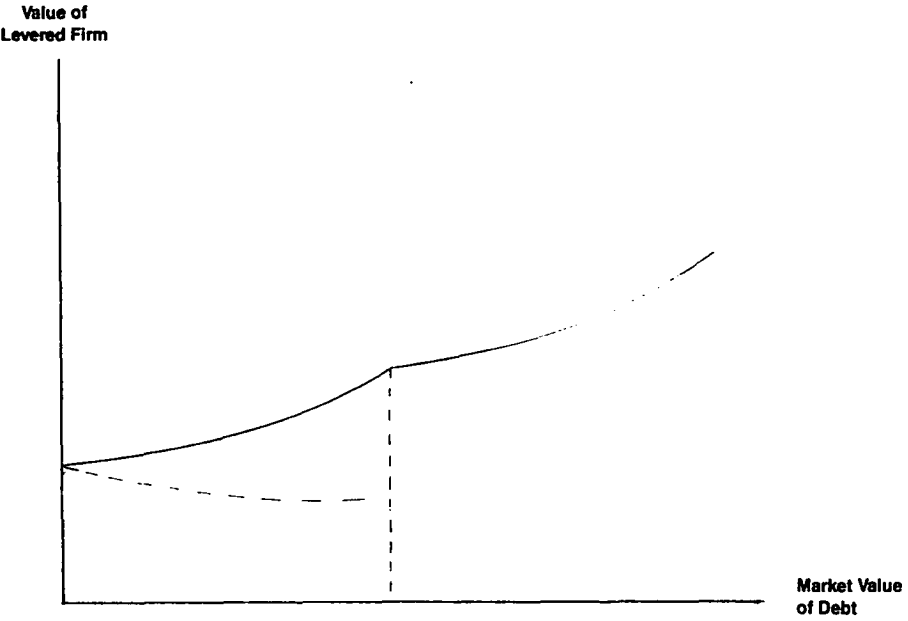
In the case of *riskless debt*, where *technical* insolvency is a possibility, Barnea, Haugen and Talmor [7] have shown that the firm will face an optimal capital structure. This optimality is achieved when, at the margin, the risk-adjusted probability of taking the interest deduction in full is equal to the fraction of the corporate tax rate that is reflected in the risk-adjusted differential between the expected returns on corporate debt and corporate stock. If the differential fully reflects the corporate tax rate, all firms will issue debt up to the point where technical insolvency becomes a possibility. If the differential were lowered to reflect a tax rate that was 80% of the corporate rate, all firms would find it optimal to issue debt until the probability of remaining technically *solvent* was 80%. Under these circumstances, the supply curve for debt becomes downward sloping, as with the broken curve of Exhibit 2.[7] The equilibrium risk-adjusted differential between bond and stock returns reflects a tax rate that is less than the corporate rate.

[7]The downward sloping nature of the supply curve is not just endemic to redundant tax shields. Other supply side restrictions, such as agency costs, yield similar predictions as shown by Barnea, Haugen, and Senbet [5].

The situation becomes more complicated when *risky* debt is considered, however. DeAngelo and Masulis [18] have introduced other tax deductions, such as depreciation charges and investment tax credits, into the Miller equilibrium in the presence of risky debt. As additional units of debt are issued by the firm, the probability increases that the earnings will be small enough to make the interest payments on the additional units redundant as a tax deduction. Their expected value as a tax shelter decreases. As additional units of debt are issued, the value of the firm increases, but at a decreasing rate, as with the solid curve of Exhibit 3.

If we introduce a differential between the (risk-adjusted) expected return on debt and equity, each firm will issue debt until, for the last unit of debt issued, the diminishing expected benefit associated with the tax deduction is exactly equal to the penalty associated with the yield differential. As the yield differential becomes smaller, each firm will issue additional amounts of debt. Thus, in the context of this model, the supply curve for debt is downward sloping, as with the broken curve of Exhibit 2. The risk-adjusted differential expected return on corporate debt again reflects a break-even tax rate that is less than the corporate rate. In the presence of the differential, the relationship between firm value and the amount of debt issued is given by the broken curve in Exhibit 3, and the optimal

Exhibit 4. Relationship Between Risky Debt and the Value of the Levered Firm



amount of debt for the firm is given by V_D^*.

The result of DeAngelo-Masulis (D-M) is driven, however, by a peculiar assumption about the manner in which corporations are taxed. They assume that the firm can deduct both the interest and the principal payments on the debt, which is consistent with a wealth tax. On the other hand, the deduction of depreciation payments is consistent with an income tax.[8] In a later paper, Talmor, Haugen, and Barnea [63] show that if interest (but not principal) is allowed as a deduction, the relationship between the market value of the levered firm and the market value of its debt is given by the solid line in Exhibit 4. This line is based on the assumption that there is risk-adjusted differential between bond and stock returns. The value of the levered firm now increases at an increasing rate, because, as more *risky* debt is issued, the fraction of the total promised payment that is considered to be *interest* increases.[9] The IRS will take interest to be the difference between the total debt payment and the market value of the debt when originally issued. The difference between the promised payment and the market value of the debt becomes larger as the debt becomes riskier under increasing leverage. We should note that the kink in the curve comes at the point where the market value of the debt is equal to the depreciation charge.

If we introduce a risk-adjusted differential between bond and stock returns, the function shown in Exhibit 4 pivots downward, as with the broken curve. At some point the firm will find it beneficial to switch from an all debt corner solution to an all equity capital structure. With differing depreciation charges, this point will come at differing levels of debt for different firms, and the supply curve for debt will again be downward

[8]Note, however, this asymmetric treatment may not apply to other investment-related deductions, such as investment tax credits. Also, the deductibility of principal and interest in a single period, such as in DeAngelo and Masulis [18], can be viewed as a limiting case of the multiperiod treatment of debt deductions. Of course, this parallel is imperfect under uncertainty due to truncation of debt payment in a multiperiod setting. Thus, the issue of debt deductions in a finite, multiperiod horizon is more complex than apparent, and as yet we do not have a satisfactory theory of multiperiod capital structure.

[9]See also Park and Williams [51] and Baron [8] for discussion of similar issues.

sloping, as in Exhibit 2. Firms, however, will adopt corner positions in their capital structures.

In the original Miller equilibrium, the risk-adjusted differential between bond and stock returns should be expected to be constant over time. When we modify the equilibrium to account for the possibility of redundant interest charges, we would expect the break-even tax rate to be less than the corporate rate, and we would expect it to be variable over time, as the expected profits and available depreciation charges fluctuate.

Endogenous Personal Tax Rates. The Miller equilibrium allows personal tax rates to vary across investor groups, but these rates are constant for any particular group. In other words, investors face exogenous marginal tax rates which are invariant with taxable personal income. Dammon [16] examines an equilibrium in which investors determine their marginal tax rates *endogenously* in the process of their portfolio decisions.[10] All investors face an identical progressive marginal tax *function*. An immediate implication of endogenous personal tax rates is that investors face an uncertain marginal tax bracket in the future due to holdings of risky taxable securities along with human capital.

The introduction of progressive personal taxation enables Dammon to characterize capital structure equilibrium under similar perfect market conditions as the original Modigliani-Miller environment. Note that the Miller equilibrium generates perfect market-type results under tax imperfections. But because of the nature of his tax environment, Miller introduces another severe market imperfection: investors are prohibited from issuing securities on personal account for tax arbitrage purposes.[11] Otherwise the equilibrium breaks down as investors with proportional taxation seek infinite tax arbitrage opportunities. In Dammon's framework, a well established equilibrium obtains without explicit restrictions on tax arbitrage, and investors are allowed to issue securities on the same terms as firms. Under progressive taxation, the investor's marginal tax bracket changes as he engages in tax arbitrage activities. Thus, endogenous personal tax rates provide a natural limit on tax arbitrage opportunities.

Except for taxes, the environment considered by Dammon is identical to the original Modigliani-Miller framework, which was later refined by Stiglitz [61] and Fama [23] to allow for risky debt. In the absence of taxes, this environment would have resulted in capital structure irrelevance. However, this is not the case under endogenous personal tax rates. Once firms' investment policies are fixed, financing through debt securities engenders a net tax subsidy, which is a function of uncertain marginal personal tax rates.[12] The market value of the levered firm is thus equal to its unlevered counterpart plus the present value of the risky net tax subsidy. The net tax subsidy could vary across states of nature, and for some states it could even be negative. The firm's optimal capital structure is such that the division of states (into those in which the firm is solvent and those in which it is not) yields the maximum value of the net tax subsidy.[13]

Dammon's capital structure equilibrium can be made more intuitive if we highlight its predictions. The fact that the net tax subsidy varies across states of nature implies that the firm's debt-equity ratio is uniquely determined by the firm's pre-tax cash flow *pattern*, or its distribution of operating cash flows. This clearly predicts that similar industries with similar cash flow patterns employ similar debt-equity ratios. Apart from this industry effect, Dammon is more specific in showing that there is a negative relationship between the firm's operating (asset) beta and its leverage. The intuition is that firms producing their highest pre-tax cash flows in states where the value of the tax savings is relatively high will benefit from the use of debt. Recall that the tax subsidy is a negative function of endogenous personal tax rates, and these rates are likely to be highly correlated with the performance of the economy or the market. Thus, firms with higher asset beta (or operating risk) will employ lower financial leverage and hence this theory links the firm's use of leverage with the firm's real characteristics, which are observable.

[10]See Auerbach and King [3] for further analysis of the trade-off between tax minimization and diversification in investor portfolio selection under an environment of *constant* tax rates.

[11]It is this explicit tax arbitrage restriction along with market incompleteness that is the driving force behind the results of Taggart [62].

[12]A special case of Dammon is also in Ross [55] with similar arguments.

[13]Dammon shows that conditions required for capital structure irrelevance are more restrictive than the traditional conditions of Stiglitz and Fama. They include "equal access" in the sense of Fama where investors issue securities on the same footing as corporations, and a competitive market in the sense of availability of perfect substitutes, corporate supply adjustments à la Miller, and corporate demand adjustments to arbitrage away tax benefits. In this equilibrium, optimal capital structure along with optimal borrowing and lending portfolios emerge for the corporate sector as a whole. Interestingly, these results are independent of capital market structure (*i.e.*, completeness or incompleteness). Recall that incompleteness affects the Miller equilibrium under his tax environment as shown by Taggart [62].

B. Empirical Evidence

Miller and Modigliani [45] provide a rigorous and carefully designed work in support of the MM tax-adjusted valuation model. This model is adjusted to take account of growth opportunities and the associated tax subsidy. They run cross-sectional multiple regressions on a sample of 63 electric utility firms for each of 1954, 1956, 1957. They ignore personal taxation. They contend that their empirical work supports the corporate tax-adjusted model, and that the tax subsidy accounts for about 23% of the value of the firm. It appears now that the authors have a divergence of opinion on their painstaking empirical work as reflected in their respective Presidential Addresses [43, 48]. One could infer that Miller disowns the study and Modigliani continues to maintain faith in it. Thus, the empirical evidence provided by Miller and Modigliani can be viewed as mixed just on the basis of their current disagreement! This is aside from well known empirical problems, such as measurement of growth rates, controls for operating risk, *etc.*

In a more recent paper, Masulis [40] examines the tax impact of changes in financial structure on the value of the firm through an empirical investigation of exchange offers. In an exchange offer, one or more of the security classes of a firm are given the right to exchange part or all of their present holdings for a different class of firm securities. Masulis examines the abnormal returns to stocks in the vicinity of the announcement date and finds that the lower bound estimate for the increase in firm valuation per dollar change in debt level was in the range of 0.23 to 0.45. The results were found to be consistent with the presence of positive tax effects, wealth transfers across security classes, and information effects that are positively related to debt level.

Hess [28] examines the relationship between the returns on 30 stocks and changes in the risk-free rate of return. Given the Miller equilibrium and the presumption that stock returns are tax exempt, the adjustment of stock returns to changes in bond returns should be proportional to one minus the corporate tax rate. Hess finds no consistent relationship among the 30 stocks and rejects the restriction of a common response across the stocks to the interest rate variable. Thus, his results are also inconsistent with Miller.

There is some casual evidence that supports the conditions of the Miller equilibrium, however. At the beginning of World War II the corporate tax rate increased drastically, but there was no substantial corresponding increase in the debt-to-equity ratio of U.S. corporations, contrary to the prediction of MM. It turned out that personal tax rates also increased simultaneously by the same amount. If so, Miller would predict the intersection point between supply and demand schedules to be roughly the same. It appears that it was the stationarity of leverage for the corporate sector that motivated the writing of Miller's article.

On the other hand, indirect evidence based on implicit tax rates reflected in security prices is mixed. McCulloch [42] uses the yield differential between taxable Treasury bond issues to infer a tax rate for the marginal investor that is significantly lower than the corporate tax rate (the federal tax rate plus the applicable state income tax rate). Also, Gordon and Malkiel [25] find an implied, break-even tax rate that is significantly below the corporate tax rate. On the other hand, Skelton [60] finds an implied tax rate that is close to the statutory federal corporate tax rate, especially for short-term bonds. In a recent time series study, Trzcinka [64], after allowing for the possibility that municipals are characterized by greater risk than corporates in the same rating classification, finds an implied rate close to the federal corporate tax rate for both long-term and short-term issues. However, a more recent study of long-term bonds by Ang, Peterson, and Peterson [1] again results in an implicit marginal tax rate that is significantly below the corporate statutory tax rate. They control for risk using a matched-pair technique. In a study providing more support for Miller, Jordan and Pettway [31] argue that the prices of long-term corporate and municipal issues will reflect tax rates expected to be in effect over the lives of the bonds. These rates may differ from current rates. Consequently, they restrict their empirical analysis to short-term issues and find that breakeven tax rates are extremely close to the 46% federal corporate rate in effect at the time. Note, however, that if equity income is taxed at a significant tax rate, the Miller equilibrium predicts an implicit rate that is substantially ***higher*** than the corporate tax rate.

Empirical evidence on leverage clienteles is also mixed. Kim, Lewellen, and McConnell [KLM, 34] find that investor marginal tax brackets explain little of the variation in the extent of financial leverage in investor stockholdings, although they do find a bimodal distribution of leverage ratios among firms. The Miller equilibrium predicts such a distribution as firms adopt the extreme leveraged position desired by the bondholder clienteles. However, KLM fail to consider the impact of itemized deductions and the effect of state and local income taxes on marginal tax rates. In a later

paper, Harris, Roenfeldt, and Cooley [27] measured marginal tax rates for stock clienteles indirectly through ex-dividend day stock price behavior. Their evidence, which would reflect both itemized deductions and state and local income taxes, indicates that their estimates of marginal tax rates are strongly negatively correlated with the financial leverage of the associated firms. Others [32, 47] have argued that investor marginal tax rates cannot be inferred by ex-dividend stock price behavior.

Overall, the currently available evidence is only partially supportive of the Miller hypothesis.[14] The Miller equilibrium has been generalized to take account of (i) costly tax arbitrage and agency problems by Barnea, Haugen, and Senbet [5], (ii) endogenous marginal personal tax rates by Dammon [16] and (iii) non-debt related tax shields by DeAngelo and Masulis [18]. These theories predict a downward sloping supply curve as in Exhibit 2, which is consistent with the recent empirical evidence supporting an implied tax rate below the Miller's prediction. One has to be cautious, however, about the DeAngelo-Masulis (DM) hypothesis. It predicts that firms that employ relatively high amounts of non-debt tax shields will have lower debt in their capital structure. However, contrary to this, a number of empiricists [12, 50] have reported empirical results supporting a *positive* relationship between financial leverage and the level of non-debt tax shields. Another study by Mazeo [41] examines the behavior of firms during the period of time surrounding the maturity date of a debt issue. The evidence suggests that the firm's decision to refinance with a particular security (*e.g.*, debt or equity) is unrelated to the level of non-debt tax shields. Thus, it appears that the DM hypothesis is not upheld empirically.[15]

[14]An extension of the Miller equilibrium by Taggart [62] into an incomplete market implies that there must be tax-induced leverage clienteles for corporate stock. Otherwise, the Miller hypothesis implies polarized portfolios where high tax investors plunge into tax exempt securities, and low tax investors plunge into taxable securities. Neither equity clientele nor portfolio polarization seem supported by the available data. The clientele evidence is in accord with endogenous personal tax rates [16].

[15]Dammon and Senbet [17] argue that the source of the problem is the prevailing assumption of exogenous investment policies. They develop a unified theory of interaction between production and finance in which investment based tax shelters (*e.g.*, depreciation) and tax benefits of debt financing are endogenously determined. While this theory generalizes the DM work, it nonetheless shows that a cross-sectional relationship between non-debt tax shields and the amount of debt financing is highly complex and non-monotonic. Thus, in empirical testing one must be careful to specify the proper null hypothesis, which may require identifying the underlying production technology.

C. Tax-Induced Management of Capital Structure

We close this section by highlighting the manner in which taxes play a role in the actual management of capital structure. Consider the following valuation equation, which focuses only on the tax dimension of debt financing:

$$V_L = V_U + T^* V_D, \qquad (1)$$

where

V_L = the value of the levered firm,
V_U = the value of the unlevered counterpart of equivalent risk class and operating cash flows,
T^* = the marginal value of tax savings associated with debt financing,
V_D = the value of debt currently outstanding.

In managing capital structure, T^* is a key parameter. It is a function of both corporate and personal taxation of bond and common stock income. The effective T^* can, of course, be viewed as net of costs associated with redundant tax shields. However, we wish to treat these costs as *part* of the other dimensions of debt financing along with costs associated with agency problems. Let us concentrate for the moment only on pure tax effect. An environment that serves as the starting point is the Miller perpetual world of certainty in which it can be shown that

$$T^* = 1 - \frac{(1-\tau_C)(1-\tau_{PS})}{1-\tau_{PB}}, \qquad (2)$$

where τ_{PB} and τ_{PS} are, respectively, marginal tax rates applicable to bond and equity income. Of course, when equity income is *tax exempt*, $T^* = 0$ in equilibrium. In this stylized world, management of capital structure is just a waste of time and one makes investment decisions without worrying about how to finance them! On the other hand, if equity income (composite of dividends and capital change) is taxed at a non-zero rate (τ_{PS}), the Miller-type equilibrium still obtains, but the implied ordinary personal tax rate (τ^*_{PB}) that drives T^* to zero must exceed the corporate tax rate by $\tau_{PS}(1-\tau_C)$. Suppose that τ_C, the federal plus the applicable state income tax rate, equals 50% and τ_{PS} equals 20%. Then the implicit τ^*_{PB} must be equal to 60%. Unfortunately, this is purely academic, since the current maximum tax rate on ordinary income is 50% (plus some applicable state income tax rate). With $\tau_{PB} = 0.50$, $T^* = 1 - (0.5)(0.8)/0.05 = 0.2$, and the

firm will rationally seek to raise capital only in the form of debt. Thus, a model that considers only the tax dimension predicts a corner solution for capital structure management under the current tax rule.

The other dimensions of capital structure, such as non-debt tax shields and agency costs, are countervailing forces against the tax subsidy. As shown in the literature [5], these costs affect the bond market equilibrium in a peculiar way. By giving a downward slope to the supply curve, they reduce the implicit tax rate equilibrating the market, as shown in Exhibit 2. In practice, management needs to obtain the *observed* tax rate implicit in differential returns between fully taxable and tax-exempt securities of equivalent risk class. As discussed earlier, empirical evidence on the magnitude of the implicit tax rate is mixed. The implicit tax rate on long-term maturity bonds appears lower than on their short-term counterparts. It may well be that the forces that generate the downward sloping supply curve are systematically differentiated on the basis of maturity. It has been argued, for instance, that shortening maturity structure reduces, or even eliminates, agency costs.

At any rate, management of capital structure requires knowledge of the implicit tax rate equilibrating the bond market for each maturity category. Each firm first determines its T* in Equation (2) by plugging in the relevant parameters, such as the observed implicit marginal rate (τ^*_{PB}) and the corporate tax rate (τ^*_C) in the same manner as the unidimensional case. Assuming a τ^*_{PB} of 30%, τ_C of 50%, and zero taxation on equity income yields $T^* = (\tau_C - \tau^*_{PB})/(1 - \tau_{PB}) \cong 30¢$ for every dollar of debt financing. However, unlike the previous case the firm would curtail its issuance of debt when it bumps into a "safety band" that is moderated by management's concern about incurring excessive costs associated with agency problems. Of course, the "safety band" is hard to determine in practice and may be largely judgmental, because the agency cost models are not as refined in terms of actual measurements as the unidimensional tax models. Nonetheless, the latter provide useful guidance in practice, when they are used along with subjective managerial judgment about the countervailing costs of debt financing.

III. Dividends and Taxes

A. Personal Income Taxes and the Capital Asset Pricing Model

Since total stockholder return is given by dividend yield plus growth, or price appreciation, firms can reduce the tax exposure of their shares by lowering their dividend payout ratios. It is expected that stocks with low dividend yields should sell at lower pre-tax risk-adjusted expected rates of return in order to make their after-tax returns commensurate with those of higher yielding stocks.

Brennan [13] first introduced personal income taxes into the capital asset pricing model (CAPM). Assuming that capital gains are taxed at a lower rate than dividends, that investors can borrow and lend at a risk-free rate of interest, r_F, and that dividends are known with certainty, he derived the following analog to the security market line in the no-tax CAPM.

$$E(r_j) = \underbrace{r_F}_{\text{Risk-Free Rate}} + \underbrace{a_1\beta_j}_{\text{Risk Premium}} + \underbrace{a_2(d_j - r_F)}_{\text{Tax Exposure Premium}}$$

In the preceding equation, you can interpret a_1 as the slope of the relationship between systematic risk, β_j, and expected rates of return, and a_2 as a coefficient relating the firm's dividend yield, d_j, to its expected rate of return, $E(r_j)$. Firms with dividend yields (the ratio of the dividend to the market price) greater than the risk-free rate sell at premium expected returns, while firms with lower dividend yields sell at lower returns. In the Brennan model, the coefficient a_2 is a weighted average of the marginal tax rates of investors in the market and is a positive number.[16]

Direct tests of tax effects of dividends in asset prices have investigated the extent to which the dividend yield is a priced factor in a model such as Brennan's. In other words, is a_2 significantly different from zero? Through an extensive empirical study, Black and Scholes [11] conclude that they are unable to detect tax-induced differential returns between stocks with differential dividend yields. Their empirical procedure uses a minimum variance portfolio that has an expected return equal to the coefficient a_2 in the preceding equation. One must be cautious in interpreting their results, however. They estimate the expected return after subtracting the risk-free rates from the monthly portfolio returns, but the portfolio is a zero investment portfolio that should not earn the risk-free rate. After adding back the risk-free rate to their estimate of the portfolio's expected return, their results may well be

[16] Litzenberger and Ramaswamy [38] extend the model to incorporate margin requirements and borrowing constraints on investors. The *structure* of the Brennan model is unchanged by these restrictions, but the coefficients now reflect the shadow price of the constraints. Under certain circumstances, a_2 may not be positive.

consistent with a significant dividend yield coefficient.[17]

Litzenberger and Ramaswamy [38] empirically tested a modified version of Brennan's model discussed heretofore. They looked at a large sample of stocks in the period 1940 through 1980. In the 60 months prior to any given month of their test, they estimate the beta factors for all the stocks in their sample by relating the returns on each stock to the returns on their New York Stock Exchange market index. In response to criticism by Miller and Scholes [46], who alleged that the dividend effect found in previous studies was really an announcement effect, they then estimate the dividend for each stock for the month, using a statistical model that employs information that was available at the beginning of the month. Having estimated the dividend, they then compute each stock's dividend yield.

At this point L-R examine the relationship between the dividend yields for different stocks and the returns produced in each month, after allowing for the effect of differences in beta on differences in security return. Do the stocks that have large dividend yields, and therefore great tax exposure, tend to be priced so as to produce larger returns before taxes? To answer this question, Litzenberger and Ramaswamy examine the relationship between pre-tax return and dividend yield in each of the months covered by their study, by fitting a regression line through the cross section of stocks in their sample. The slopes of each of these lines are then averaged, and the average turns out to be positive and statistically significant. Thus, their study supports the view that, like bonds, stocks with greater tax exposure tend to sell at lower prices and greater expected pre-tax rates of return.

The results seem intuitively pleasing, until one considers the possibility of supply adjustments on the part of firms. In the context of the Brennan model, firms can reduce their costs of capital merely by reducing their payout ratios. Given this possibility, why should dividends exist at all? This is the dividend puzzle!

B. Ex-Dividend Day Price Behavior

Further evidence that dividend taxation affects stock prices is found in ex-dividend day price behavior. In an idealized capital market the stock price must drop from the cum-dividend day to the ex-dividend day by exactly the amount of the dividend. Otherwise an arbitrageur can profit from selling (buying) the stock on the cum-dividend day and buying (selling) it back on the ex-dividend day if the price drops by more (less) than the dividend. Therefore, one interesting way to examine the impact of dividends on stock returns is to study the ex-dividend day price behavior. Empirical studies have uniformly shown that the drop in the price is, on average, less than the dividend, contrary to the ideal situation. The earliest such documentation was due to Campbell and Beranek [14]. Market imperfections, particularly taxes, have been proposed as a potential explanation for the underadjustment of the ex-dividend price. The first tax-based explanation is due to Elton and Gruber [21].

The tax-based explanation of Elton and Gruber hinges on an arbitrage argument that a stockholder, intending to sell the stock, should be indifferent between selling it on the ex-dividend day or the cum-dividend day. To see this, suppose that S stands for the cum-dividend stock price and S* for the ex-dividend price. Dividends in the amount of D are taxed at an ordinary tax rate of t_0 and capital gains are taxed at a preferential rate of t_g. A current shareholder can follow two strategies, namely (i) selling the stock for S the instant before it goes ex-dividend and paying capital gains taxes, or (ii) selling the stock ex-dividend (after having received dividends) and paying taxes on capital gains as well as dividends. Capital gains taxes are paid on the difference between the selling price and the original purchase price.

	Payoff
Strategy a	$S - t_g(S - S_0)$
Strategy b	$S^* - t_g(S^* - S_0) + D(1 - t_0)$

The arbitrage equivalence between the two strategies suggests the tax-adjusted drop in the price from the cum-dividend day to the ex-dividend day.

$$S - S^* = D\left(\frac{1 - t_0}{1 - t_g}\right)$$

Elton and Gruber calculated the value of $(S - S^*)/D$ for a sample of firms that traded on the NYSE from April 1, 1966 to March 31, 1967 and they found that this test statistic was significantly lower than one, about 0.78 on average. They attributed this partial adjustment to differential taxes that favor capital gains.[18]

[17]This possibility was suggested to us by E. Talmor.

[18]However, Kalay [32] and Miller and Scholes [47] argue that short-term trading by members of the exchange and tax-exempt investors will break the link between ex-dividend price behavior and clientele marginal tax rates.

Barclay [4] attempts to confirm the tax-based explanation of the ex-dividend day price behavior by looking at data from the period prior to establishment of the federal income tax system. If the partial ex-dividend day price adjustment is attributable solely to taxes it should disappear during this earlier period. Barclay examines the ex-dividend day behavior of the pre-tax period ranging from 1900 to 1910 on a sample of 146 firms actively traded on the New York Stock Exchange. Again the performance measure, $(S - S^*)/D$, is used, and, interestingly, the hypothesis that the measure is equal to one during the pre-tax period could not be rejected. Thus, this evidence supports the notion that stock prices fell by the full amount of the dividend on the ex-dividend day during the earlier period. Accordingly, this evidence is consistent with the tax-based explanation for partial ex-dividend price adjustment during the tax era. In other words, dividends and capital gains are perfect substitutes in the absence of taxes, and investors appear to have discounted dividends relative to capital gains since the enactment of the federal tax.

C. Dividend Clienteles

It is often argued that the dividend puzzle can be addressed through a clientele argument. Investors in different tax brackets will adjust their stockholdings until the dividend payouts of firms match the desires of different investor groups or clienteles. In equilibrium, the aggregate supply of stocks with different dividend yields will adjust until no company is able to affect its cost of capital by adjusting its dividend.

The existence of clienteles in the stock market can be questioned, however, because there are mechanisms for investors to separate the dividend and capital gains components of a stock's total return, and then invest exclusively in either one [28].

If you want to invest exclusively in the dividend of a given stock, you need only do the following:

(i) Buy a share of stock.

(ii) Buy a put option on the stock, with any arbitrary exercise price, X, that expires shortly after the ex-dividend date.

(iii) Sell a call option on the stock with an exercise price and expiration date equal to that of the put.

(iv) Borrow the present value of X and use the money to help finance the purchase of the share.

Now consider the proceeds of this strategy on the expiration date of the options. First, if the stock price, S^*, is greater than X, we obtain

STOCK VALUE:	S^* + DIVIDEND
PUT VALUE:	0
CALL VALUE:	$-(S^* - X)$
DEBT VALUE:	$- X$
TOTAL VALUE:	DIVIDEND

On the other hand, if the stock value turns out to be less than X, we obtain

STOCK VALUE:	S^* + DIVIDEND
PUT VALUE:	$X - S^*$
CALL VALUE:	0
DEBT VALUE:	$- X$
TOTAL VALUE:	DIVIDEND

As you can see, no matter what happens to the stock, you get the dividend as the only payoff from the strategy. If you want to invest in dividends, you need not restrict your investments to stocks with high dividend payouts. You can easily invest in low payout companies and strip the dividends from the stocks with the preceding strategy. There is no need for any particular type of clientele in certain companies.

The preceding strategy is not unique, but suggestive of the available mechanisms for dividend stripping. While the transactions costs associated with adopting such a strategy may be large for the individual investor, financial institutions can, and in fact do,[19] employ the strategy on a large scale and then market the dividend fund to investors.

In spite of these arguments, the cost of transacting and the lack of actively traded options on all stocks may induce the formation of dividend clienteles, in which investors with high (low) tax rates hold low (high) dividend yield stocks. It is curious that the clientele argument was first proposed by Miller and Modigliani [44] to support the dividend irrelevance hypothesis even under differential capital gains and dividend taxation. They suggested a scenario in which the distribution of corporate dividend payout ratios would adjust until it corresponded exactly with the distribution of investor preferences for those payout ratios. They then conjectured that no corporation would be able to affect its value by changing its dividend yield. Each firm attracts its own clientele.

The existing empirical evidence suggests that divi-

[19]One such service is Gateway Investment Advisors of Cincinnati, Ohio.

dend clienteles exist *and* that there is a tax effect of dividend on the market valuation of the firm's securities. The tax effect is contrary to the Miller-Modigliani conjecture. Elton and Gruber [21] observed that the performance measure, (S − S*)/D, increased with the dividend yield of the security, where S* is the ex-dividend stock price and D stands for the dividend. This is consistent with the clientele effect. The implied investor tax bracket fell nearly monotonically with increasing yield when they partitioned their observations into deciles.[20] Similarly, Barclay [4] partitioned observations into ten portfolios by annualized dividend yield for periods before and after the federal income tax system was enacted. The latter period showed a monotonic positive relationship between the performance measure, (S − S*)/D, and the dividend yield. However, there was no clear evidence of such relationship for the earlier sample.

One can also infer the existence of dividend clienteles from empirical studies testing tax-adjusted asset pricing relationships. In particular, Litzenberger and Ramaswamy [38] observed nonlinearity in the asset pricing relationship. The coefficient for the tax penalty, a_2, changes with the dividend yield in a negative fashion. Again this supports the clientele hypothesis in which high (low) tax investors hold low (high) dividend yield stocks.[21]

D. Dividends and Tax Arbitrage

Miller and Scholes [46] have suggested an answer to the puzzle. They argue that the fraction of its earnings a firm pays out as dividends should have no impact on the expected return of its common stock. Essentially, they argue that investors can shelter dividends from taxes in many ways. Among them, Miller and Scholes suggest the following: If you have some taxable dividends from your stock investments, all you need is a tax deduction to shelter them. To get one, you need only borrow money and invest it in something like a tax deferred annuity. You will not be taxed on the income from the annuity, and you will not increase your risk if the income from the annuity is derived from risk-free investments. If you borrow (and invest) enough money so the interest on the debt is equal to the amount of your dividends, you can use the dividends to pay the interest, and use the interest as a tax deduction to cover the dividends. In effect, you have transformed the dividends into a tax-deferred annuity. Since you can do this with any form of investment income, the tax exposure of investment income should matter little to you. If tax exposed investments sell at lower prices, you can take advantage of these discounted prices while paying no taxes on the associated investment income.

The preceding argument relies crucially on the assumption that avoiding taxes on dividend income is costless. It is easy to show [28], however, that tax-induced return differentials between fully taxable and tax-deferred investments create an endogenous cost of tax avoidance. In other words, the Miller-Scholes tax avoidance strategy is perfect only if the personal borrowing rate for the offsetting interest deduction is equal to the tax exempt rate of interest. However, given the bond market equilibrium, the personal borrowing rate must also be on the order of the corporate borrowing rate, which reflects the full gross-up of the corporate tax subsidy. Thus, the cost of tax arbitrage is *endogenously* determined in the equilibrium, so long as a tax-free debt-like instrument is traded in an integrated financial sector. The endogenous cost is

$$r_c - r^* = \frac{r^*}{1 - T_c} - r^* = r^* T_c/(1 - T_c),$$

where r^* is the tax-exempt rate.

Peterson, Peterson, and Ang [PPA, 52] attempt to provide some direct evidence that investors do not generally shelter dividend income in the manner suggested by Miller and Scholes. Using data from nearly 200,000 individual tax returns, they compare taxes on income minus dividends with taxes actually paid and divide this difference by dividend income. This estimate of the effective marginal tax rate on dividends averages nearly 40% across all returns, while it is estimated to be 30% on capital gains income. In reality, however, PPA provide us only with evidence that individuals pay taxes, and do not provide evidence that individuals fail to take advantage of opportunities to shelter dividend income. Presumably, these individuals have optimized their total portfolios including

[20] There is a debate concerning Elton and Gruber's calculation of the implied tax rate from the performance measure, (S − S*)/D. Kalay [32] points out that a large deviation from one opens up an arbitrage opportunity for a speculator who buys the stock cum dividend and sells it ex-dividend. The after-tax return on this arbitrage portfolio is positive, which can, of course, be offset by transaction costs. Kalay's point suggests that the performance measure must be bounded by transaction costs. In response, Elton, Gruber and Rentzler [22] measure short-term trading costs which, they argue, are too high to affect the ex-dividend price behavior.

[21] There are direct studies of dividend yields and stock ownership patterns (investor demographics) based on actual individual accounts. See Pettit and Lewellen, *et al.* [52]. The results are mixed in terms of discerning the clientele effect.

their tax shelters. To measure the effective tax on marginal dividend income, one would have to allow for the portfolio reoptimization that would occur if dividends were removed from portfolio returns. In other words, it may well be the case that the stochastic properties of dividends are such that they match up well with certain tax shelters. In the absence of dividend income in the portfolio, these shelters would be costly. They may be nearly costless, however, if they serve to shelter dividend income. If dividends are removed from the portfolios, and investors are allowed to reoptimize, taxes may not fall significantly because the shelters would be removed as well. Testing for this possibility, of course, would be extremely difficult. Nevertheless, it is essential to account for portfolio reoptimization in any test of the effective marginal tax rate on dividend income. Otherwise, the results, such as in [52], only tell us what is obvious. The tax system in the U.S. raises revenue for the federal government.

Hess [29] also examines the relationship between the returns on 30 stocks with stable dividend payments and changes in the dividend yield. He rejects the hypothesis that the coefficient relating stock returns to the dividend yield variable is the same across the 30 stocks. Moreover, the restricted estimates are often negative. This evidence is inconsistent with Miller and Scholes [46], and Brennan [13], and Litzenberger and Ramaswamy [38].

E. Can Debt Policy and Dividend Policy be Simultaneously Tax Neutral?

Interest payments on debt are deductible by the firm, while dividend payments to equity holders are not. Imagine for simplicity, that some equity shares (dividend shares) pay all their return in the form of dividends, while the remaining shares (capital gains shares) pay all their return in the form of capital gains. Dividends and capital gains can, of course, be split in the manner discussed heretofore with options. For investors, therefore, the tax exposure of debt and dividend shares exceeds that of capital gains shares. In the face of the differing tax status for the three securities, is it possible to have simultaneous irrelevance of both debt and dividend policy? We wish to address this question as a way of providing a clue to the dividend puzzle.

As we have discussed, it is possible to argue that the demand for the dividend shares will remain significant if dividends can be costlessly sheltered. However, even neglecting the endogenous costs associated with sheltering, we still are presented with a dilemma. The same mechanisms that can be used to shelter dividends can be used to shelter interest. Given this, debt dominates equity as an investment if it sells at a differential that reflects the corporate tax rate.

To attain an equilibrium characterized by simultaneous tax neutrality [28], (i) the risk-adjusted return differential between debt and equity must fully reflect the corporate tax rate, and (ii) dividend and capital gains shares must sell at the same risk-adjusted expected rate of return. The debt-equity differential can be argued to persist in the presence of costs associated with tax avoidance. The challenge is to motivate a significant demand for dividends under this scenario.

Since dividend shares can be separated from capital gains shares, it is possible to argue that dividends are desired by investors because the market is, in some sense, incomplete. Similar arguments are frequently used to justify the demand for debt in a tax-free world. Debt separates the total return to assets and can be used to complete the market by levering equity. Similarly, the total equity return can be split into dividend and capital gains shares that can be held by different investors. Payments on dividend shares can be made so as to lever capital gains shares in a manner that enhances market completeness [59]. It can be further argued that tax-deductible debt may not dominate equity in this regard, because if debt payments were distributed in this desired fashion, they would lose their status as a tax deduction.

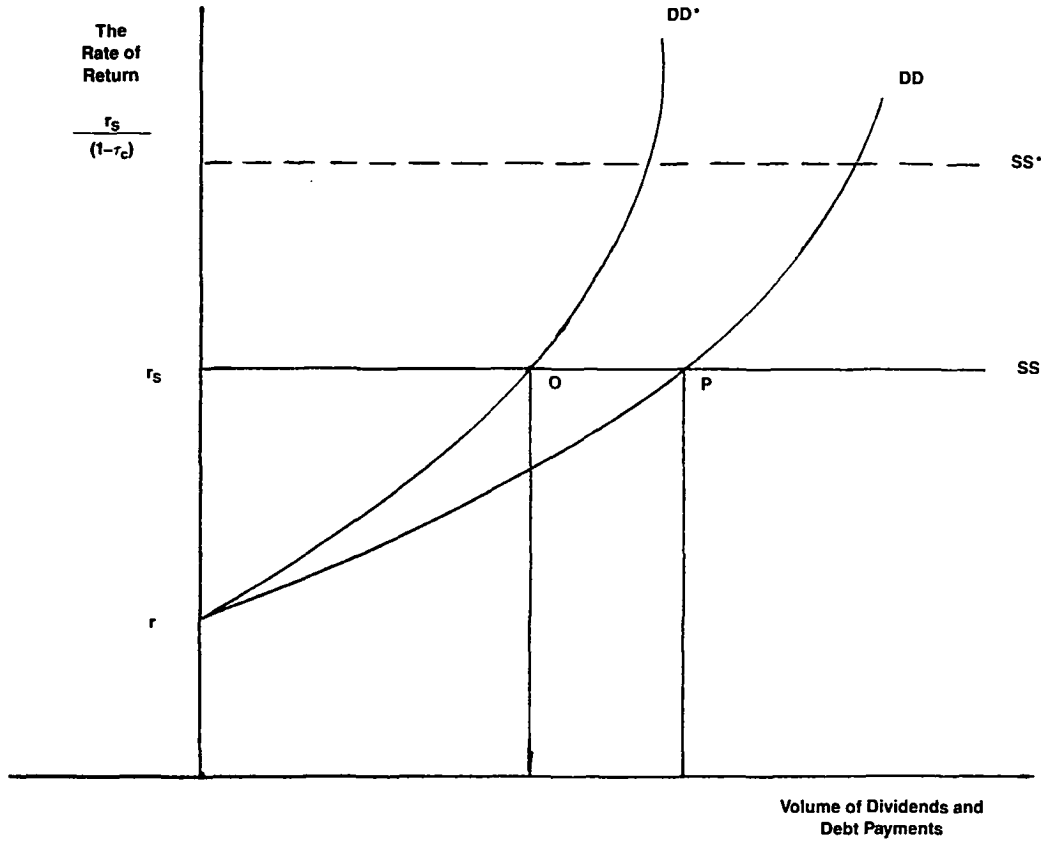
Thus, the horizontal supply curves for both dividend and capital gains shares coincide at a common level, SS, as shown in Exhibit 5, reflecting their equal tax status from the point of view of the firm. In the presence of market incompleteness, the demand for dividend shares rises from below,[22] intersecting SS at the rate applicable to capital gains shares. The supply curve for debt is also horizontal at a level SS*, fully reflecting the corporate tax rate. The rising demand curve for debt, DD*, intersects SS* at that level, leaving the firm simultaneously indifferent to debt and equity policy. Of course, the challenge to advocates of this scenario is to explain how firms adjust their dividend payments in ways that are viewed as desirable by investors.

IV. Summary

Modifying the Miller equilibrium to account for redundant tax shelters or marginal personal tax rates that

[22]Note that dividend shares are desired by some investors even if their certainty equivalent expected return is below that of capital gains shares.

Exhibit 5. Tax Neutrality of Dividends and Debt Policies



DD—Market Incompleteness (Hedging Services)
DD*—Taxes and Hedging Services

increase with income level results in significant changes in the character of the equilibrium. These changes include the possibility of optimal internal leverage ratios and implicit tax rates in corporate debt returns that are well below the corporate tax rate. Recent evidence seems to support a positive tax effect of leverage, and this is consistent with earlier evidence of Modigliani and Miller [45].

On the other hand, the evidence is not supportive (often contradictory) of a negative cross-sectional relationship between leverage and the relative use of nondebt tax shields. This empirical puzzle is potentially explained by ongoing research that endogenizes the firm's investment decisions along with its capital structure decisions. Moreover, if personal income from equity is taxed, Miller would predict an implicit tax rate in debt returns that is above the corporate rate. Thus far, with one exception, only studies concentrating on short-term debt issues have found evidence that the implicit rate is *as high as* the statutory corporate tax rate at the federal level. Otherwise, the evidence supports a substantially lower implicit tax rate. Moreover, under the new tax law, the highest personal rate is considerably lower than the corporate rate, although it

still can be continuously upward sloping under differential costs of tax avoidance. Again, this suggests a positive tax effect of debt financing and an important role for taxes in the actual management of capital structure.

With regard to tax effects of dividends, the weight of the evidence points to the conclusion that stocks with relatively high degrees of tax exposure sell so as to yield relatively high pre-tax expected rates of return. Non-linearity in the relationship between expected stock returns and dividend tax exposure plus differentials in the ex-dividend day behavior of high and low dividend paying stocks support the notion that investors tend to form clienteles based on stocks' dividend yield. There remains a mystery as to why, if the cost of equity capital is positively related to dividend payout, dividends exist at all. This "dividend puzzle" serves to remind us that taxes are only one of several important factors that can rationalize the wide variety of financial contracts traded in today's market place. Moral hazard problems, impediments to the free flow of information between financiers and investors, and lack of market completeness may also serve to rationalize much of the variety in financial contracting as well as the differentials that may exist between the expected rates of return on different forms of contracts.

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