NBER WORKING PAPER SERIES

TAXATION AND CORPORATION FINANCE

Roger H. Gordon

Burton G. Malkiel

Working Paper No. 576

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge MA 02138

November 1980

The research reported here is part of the NBER's research project in the Changing Role of Debt and Equity Finance in U.S. Capital Formation, which is being financed by a grant from the American Council of Life Insurance. This paper was originally prepared for a Brookings Institution conference on the economic effects of tax policy held on October 18-19, 1979. We would very much like to thank Daniel Frisch, Daniel Feenberg, Elvira Krespach, James Rauch, and Stephen Williams for assistance in the computational work. We would also like to thank Alan Blinder, David Bradford, Jerry Butters, Mervyn King, and Richard Quandt for many helpful suggestions on earlier drafts of this paper. In addition, the officers of the two financial corporations and the Securities and Exchange Commission were kind enough to make available to us their records dealing with the costs involved and settlement terms for several bankruptcies and reorganizations. Finally, we would like to acknowledge financial support from the N.B.E.R. Project on the Changing Roles of Debt and Equity, and the John Weinberg Foundation. This paper is part of the NBER's research programs in Financial Markets and Monetary Economics, and Taxation. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

NBER Working Paper #576
October, 1980

Taxation and Corporation Finance

ABSTRACT

This paper analyzes the effects of the federal tax structure on corporate financial and investment behavior. We first develop a model of corporate behavior given taxes, taking into account both uncertainty and costs of bankruptcy. Simpler models abstracting from bankruptcy costs had clear counter-factual implications. The forecasts from our model proved to be consistent with both the observed cross-sectional variation in debt-equity ratios and the time series pattern of debt-equity ratios (data that were constructed in the paper).

We then attempted to measure the efficiency costs created by corporate tax distortions as implied by the model. The forecasted efficiency cost of the distortion favoring debt finance seemed to be quite large, while the tax distortion affecting investment seemed to be less important than others have claimed. The paper concludes with a study of the efficiency implications of various proposed corporate tax changes.

Roger H. Gordon
Bell Laboratories
Murray Hill, New Jersey 07474

(201) 582-6472

Burton G. Malkiel
Department of Economics
Princeton University
Princeton, New Jersey 08540

(609) 452-4000

TAXATION AND CORPORATION FINANCE

by

Roger H. Gordon and Burton G. Malkiel

The analysis of the effect of the federal tax structure on corporate financial policy is one of the most complex tasks in the area of tax incidence and financial theory. The corporation tax, several aspects of the personal income tax, the specific provisions of the bankruptcy law and the costs involved in financial reorganization must all be considered simultaneously. Yet much of the early literature on the determination of corporation financial structure, the early Modigliani-Miller (1958, 1961) contribution being the key example, was developed without consideration of taxes. Even the literature that does allow for the effects of taxation has several drawbacks. For one, many of the implications of the models, such as the suggestion in some models that debt equity ratios will be increased without limit, or the result that new equity will never be issued, are clearly counterfactual. In addition, there has been little effort either theoretically or empirically to measure the efficiency costs of the effects of taxation on capital structure.

Stated starkly, in a world without taxation, corporate financial policy is considered to be irrelevant, i.e. all policies are equally efficient. Why then should the fact that taxation makes a particular financial policy preferable be of any concern to societv?

In Section I of this paper, we first explore various models of corporate financial policy with taxation. We find that, unless we allow for both uncertainty and costs of bankruptcy, the models have important counterfactual implications, which undermines our confidence in other forecasts of these models. We therefore use only the model allowing for uncertainty and costs of bankruptcy in drawing inferences.

In Section II, we develop a time series for the aggregate debt-equity ratio, then explore the consistency of the time series and cross-sectional variation in debt-equity ratios with the implications of the models. In Section III, we attempt to estimate the magnitude of some of the efficiency costs and the nature of the equity implications resulting from the existing tax structure.

Finally, in Section IV, we analyze a variety of possible changes in the tax structure. In addition to describing how these tax changes are likely to alter behavior, we also examine the efficiency and equity implications of such changes.

I. The Theory of Corporate Financial Policy

Though the purpose of this section is to analyze corporate financial policy with taxation, it will be useful first to review the early development of the theory without taxation. This will provide a basis for comparison when taxes are introduced.

A. Capital structure in a no-tax world

The classical articles on financial policy in this context are by Modigliani and Miller (1958, 1961). While their arguments have been clarified in later articles,[1] their basic approach continues to be used.

Their main result is that, with no taxation and no bankruptcy, corporate financial policy is irrelevant--that is, investors will be indifferent if the firm proposes to alter its debt-equity ratio or its dividend payout rate, investment policy held constant. Therefore, given any investment policy, neither dividend policy nor decisions regarding capital structure affect the value of the firm. In addition, given that stocks are risky while bonds are riskless, risk will be spread efficiently and, under certain assumptions, investment will be efficient.

The basic argument underlying these conclusions is as follows. Assume that the firm will receive $\tilde{x}$ dollars in return on its investments after expenses each period, where $\tilde{x}$ is a random variable. The firm has debt D on which it owes rD

---

[1] See, for example, Fama and Miller (1972), Hirshleifer (1970), and Stiglitz (1969, 1972, 1974).

in interest payments each period. Stockholders therefore receive $\tilde{x} - rD$ (assuming all is paid out as dividends). However, suppose stockholders have borrowed an amount B in order to purchase their shares, in which case they owe rB in personal interest payments. (The firm and the individual are assumed to face the same interest rate, r.) Stockholders as a group therefore receive a net amount $\tilde{x} - rD - rB$ each period.

Suppose the firm decided to decrease its debt-equity ratio by selling stock, using the proceeds to retire ΔD of debt. The firm's stockholders have available the option of borrowing an amount $\Delta B = \Delta D$ in order to buy the new issues of stocks. If the stockholders employ this personal leverage, they will receive each period $\tilde{x} - r(D - \Delta D) - r(B + \Delta D) = \tilde{x} - rD - rB$. (Note that ΔD could equally well have been negative implying an increase in the firm's debt-equity ratio. The stockholders could offset this change by purchasing the bonds.) The amount the stockholders receive is identical to what they would have received prior to the change. Stockholders can completely undo the effects of any action by the firm to change its debt-equity ratio and so would find the change irrelevant. Since personal borrowing is a perfect substitute for corporate borrowing, the firm cannot profit from additional leverage and since individuals can undo any degree of corporate leverage by buying bonds and shares of the levered company, the firm would not be hurt by a

capital structure that is more levered than investors desire. In fact, not only is any one firm's financial policy irrelevant, but so is the aggregate financial policy of the corporate sector.

While we have so far assumed that the entire net return to the firm is paid out as dividends, the same type of argument as used above will show that the dividend payout rate is also irrelevant. For suppose that the firm chooses to retain some additional portion of its earnings. Given the firm's investment policy, this change implies that the additional retentions will be used to retire securities (or to sell fewer additional securities on the open market to finance its investment program). Suppose the retentions are used to repurchase debt ΔD. The stockholders can then increase their borrowing by ΔD, thereby obtaining funds which will exactly offset the loss in dividends, while leaving themselves with the same cash flow in future periods as they would have had prior to the change. These kinds of individual transactions can be employed to offset payout changes rendering dividend policy irrelevant as well.[2]

What are the implications for the efficiency of risk bearing and of real investment? Diamond (1967) shows that when individuals can bear part of the risk in the return from a firm only by bearing

---

[2]Alternatively, when the firm cuts its dividends, it could issue fewer new shares ΔE. Shareholders can then offset the lost dividends by selling ΔE of their own shares and yet retain the same percent ownership in the firm as they would have had without the change in policy by the firm. The argument here does not depend on no bankruptcy, since the debt-equity ratio remains unchanged.

some proportionate share of the firm's profits, a competitive stock market will spread these risks efficiently across investors (assuming no binding constraints on short sales). Thinking of risk as a commodity (a lottery), efficient risk spreading would exist if at the margin each investor demanded the same risk premium to absorb an additional unit of risk. A fully competitive market would achieve this result since all individuals buy lottery tickets until the market price just compensates them for absorbing an additional unit of risk, thereby equating risk premiums across investors. Diamond (1967) also shows that under certain reasonable assumptions regarding competitive securities markets (which rule out any degree of market power for a firm in the securities market), real investment will also be efficient.

The above arguments on the irrelevance of corporate financial policy, include a number of implicit assumptions. The key one is that there is neither bankruptcy of the firm nor of the individual. Under this assumption, it follows naturally that everyone faces the same interest rate, independent of amount borrowed. What happens, however, if bankruptcy is introduced but is assumed neither to entail any cost when ownership is transferred to bondholders nor to create any moral hazard problems?

As long as the firm's debt and equity have perfect substitutes among combinations of the other available securities,

for any choice of financial policy by the firm, the firm's financial policy would still be irrelevant. Since any subdivision by the firm of its total random return into two securities (debt and equity) is already available to investors through combinations of alternative securities, and since the sum of the prices on these two securities must by competition equal the price of that proportional share in the firm, the firm could not gain by changing its financial policy.[3]

Under what assumptions would the firm's debt and equity have perfect substitutes among combinations of the other available securities? Those assumptions yielding the simple form of the capital asset pricing model would be sufficient. Here a traded security is characterized completely by its covariance with the return on the market as a whole. Note that no change in a firm's financial policy, given its investment policy, will affect the market return, as long as bankruptcy is costless. Therefore the value of a firm will depend only on its expected return and the covariance of this return with the market, and not on how this return is divided between debt and equity. Other conditions sufficient to imply irrelevance of the firm's financial policy are (1) the existence of complete contingent commodity markets

---

[3]Auerbach and King (1979), however, deal with a simple case involving one firm, two investors, and two states of the world, where even costless bankruptcy could lead to an optimal capital structure. Their case involves changes in the pattern of returns across states of nature that, in effect, change the set of available securities in a nontrivial way and so directly affect the utility of investors.

(see Stiglitz (1969)), and (2) the existence of financial intermediaries willing to repackage without cost the financial structure of the firm whenever it might be profitable.[4]

To the degree that any of these sets of assumptions are felt to be realistic, corporate financial policy is irrelevant as long as bankruptcy is costless and there are no taxes. But there are many reasons why bankruptcy is costly. First, the process of bankruptcy itself entails significant administrative expenses for lawyers, accountants, appraisers, etc. We explore the magnitude of these costs in Section III. The bankruptcy process also creates uncertainty for security holders, in addition to the basic uncertainty in the return on the real investments. The courts have not consistently followed legal priorities in determining settlements, and legal costs themselves are uncertain. Given the uncertain interpretation of the law, any group of security holders might bring suit claiming that they have received an insufficient share. We shall also see below that informal reorganizations, while less costly in total than bankruptcy, may be difficult or impossible to arrange.

Bondholders may also push for liquidation over reorganization, even when this is inefficient. First, there is less room for the courts to deviate from the absolute priority of bond holders under liquidation. Also, under liquidation, bondholders could receive up to the par value of their bonds even if the market value of the bonds had fallen substantially due to a

---

[4]Since by assumption a financial intermediary can create any securities that the firm can create, they can provide the perfect substitutes. See also Stiglitz (1974).

general rise in interest rates.

In addition, the very possibility of bankruptcy creates opportunities for the firm's managers, acting in the interests of stockholders, to aid stockholders at the expense of existing bondholders through inefficient financial policy and investments. For example, suppose the firm were to issue new debt with equal priority in bankruptcy to old debt, using the proceeds to undertake new investment or to repurchase stock. The previous debt holders would suddenly own a riskier asset, yet the interest rate charged could not adjust to reflect that increased risk. By issuing debt in separate issues rather than all at once, the firm may receive more favorable overall terms. Similarly, if the firm undertakes a new risky investment, implying a higher probability of bankruptcy, existing bondholders are worse off, yet again the interest rate on their securities cannot readjust.[5] Conversely, new safe investments may lower the probability of bankruptcy, aiding existing bondholders. The previous arguments about the irrelevance of the debt-equity ratio and the efficiency of investment assumed that bondholders charged the interest rate appropriate for the risk they absorbed, while we have seen in our example, that the firm might subsequently be able to change the amount of risk they absorb. Investment incentives are therefore distorted.[6]

---

[5] Bondholders will attempt to prevent such actions through covenants in the initial contract. However, their ability to prevent these actions is limited.

[6] For further discussion of these moral hazard problems in debt contracts, see Myers (1977) or Jensen and Meckling (1976).

Bondholders are not quite so vulnerable, of course. They may attempt to anticipate these actions by the firm and will charge an appropriate interest rate. Investment would still be inefficient, however, implying that the gains to stockholders from the investment are more than offset by the higher interest costs. However, in order to obtain lower interest costs, the firm would have to guarantee to bondholders initially through indenture provisions in the bond contract that it will not engage in such activities that cause harm to existing bondholders. There will likely be not insubstantial negotiation and monitoring costs involved in such guarantees, and it is most unlikely that the provisions will be foolproof. It is probably impossible to avoid the moral hazard issue completely unless the firm does not issue risky debt.

Ignoring bankruptcy costs and taxes, a firm's financial policy would be irrelevant. However, with bankruptcy costs but no taxes, risky debt entails costs but no compensating benefit. We conclude, therefore, that without taxes the firm would finance itself almost entirely by equity[7]--whatever debt is issued will

---

[7]Such a strategy will also give the firm the most flexibility in acquiring new funds as has been suggested by Myers (1977). Nevertheless, several other considerations have been suggested in the literature which should lead firms to choose more debt: (1) lower underwriting and selling, fees for debt than equity issues (Baumol and Malkiel, 1967); (2) the use of the amount of debt as a signal to investors of the management's expectations about bankruptcy risk (Ross, 1977); (3) moral hazard or agency costs involved with public equity issues on a par with those discussed above with debt issues (Jensen and Meckling, 1976); (4) moral hazard costs in the individual debt substituted for firm debt. (The individual can provide collateral other than the firm's equity, however, so individual borrowing may dominate borrowing by the firm.); and (5) the greater flexibility of debt to meet seasonal and other short-term needs for funds.

be essentially riskless. Therefore, bankruptcy costs will be effectively zero. The dividend payout rate would be viewed as irrelevant, or if individuals have preferences between dividends and capital gains, the firm would have the incentive to take them into account.[8] Given the zero probability of bankruptcy and the use only of a stock market in spreading risk, the risk from the investment will be spread efficiently among investors and, subject to certain qualifications, investment incentives will be efficient.

B. Introduction of taxes

When considering the effects of taxes on the firm's financial structure, we must consider in detail at least the corporation tax and the personal income tax. The corporation tax by itself provides a strong incentive in favor of debt finance as interest payments are deductible from operating earnings before income taxes are imposed, while a tax rate τ must be paid on the residual owned by the shareholders. However, under the personal income tax, interest income is taxed at a marginal rate m. While dividends are also taxed at this rate,[9]

---

[8] When transactions costs are taken into account, for example, the payout rate will be of concern to both investors and issuers. Individuals who need to use the returns from their investments for consumption will be able to avoid the substantial brokerage charges involved in selling off small pieces of their security holdings if they receive dividends. Alternatively, they will prefer retention by the firm if they would choose to reinvest their returns anyway. Similarly, by retention, the firm would avoid the underwriting and selling fees involved in new issues. One might therefore expect consumers to prefer firms with little need for funds and reinvestors to prefer firms with greater needs for funds.

[9] This is not necessarily the case. For example, a certain minimum amount of dividends may be excluded entirely from taxable income. Moreover, corporate shareholders are able to exclude 85 percent of dividend receipts from taxable income.

capital gains are taxed at a lower effective rate, c, which is lower than m because a) 60 percent of long-term capital gains are excluded from taxable income; b) the tax is due (without interest penalty) only when the asset is sold or perhaps not at all if it is part of a bequest; and c) the individual can selectively realize capital losses sooner than capital gains. Therefore, the personal tax alone favors equity finance. Whether the total tax system favors the use of debt or equity finance will depend on a balancing of the advantages under one tax with the disadvantages under the other. At the end of the text a glossary of symbols is included to aid the reader in following the development of the model.

1. No uncertainty, no bankruptcy

Let us first examine this problem in the idealized setting where there is neither uncertainty nor bankruptcy. The model used basically is a formalization of Miller's (1977) arguments, though it borrows also from King (1974) and Stiglitz (1973). Most of the existing literature is developed in this context. Can we rationalize the existence of both debt and equity in this context?

Let us first develop optimal investment rules for the firm. The first result is that the firm will continue to invest until the pretax marginal return on its investments (after covering depreciation and expenses) denoted by s, has been reduced to the market interest rate, r. Repurchase of debt and new real investment are alternative uses of funds, so ought to earn the same net rate of return at the margin after tax. Both alternatives

receive the same tax treatment (assuming economic depreciation in the tax law and no investment tax credit). The net returns from investment are taxed at regular corporate rates. The net reduction in cash outflow from purchasing debt is taxed at the same rate since deductions from taxable income are lowered. Thus, both alternatives must have the same rate of return before tax as well. Note that unincorporated businesses will also invest until the marginal return on their investment equals the market interest rate, for similar reasons. This implies that in spite of the corporate income tax (ignoring explicit investment incentives), investment earns the same pretax marginal rate of return in both corporate and noncorporate uses, contrary to the assumption in Harberger (1974). However, because of the personal income tax, individuals invest until $r(1-m)$ is their marginal time preference rate. We therefore conclude that even though the investment that occurs is allocated efficiently, an inefficient amount of investment occurs as a result of the distortions in the personal income tax.[10]

Let us now examine the firm's optimal decision rule for investments financed with equity. The firm should finance new investment through new issues of equity until the stock market values the returns to a dollar of marginal real investment at

---

[10] Were we to take into account the investment tax credit and accelerated depreciation, however, investment is also allocated inefficiently (see Bradford (1978)).

just a dollar. This result is analogous to Tobin's q theory of investment, as developed in Tobin (1969), Ciccolo (1975), and von Furstenberg (1977).[11]

Could the stock market consistently value a dollar of real investment at less than a dollar in this context of no uncertainty and no bankruptcy? Certainly there would be no new equity issues in such a case. However, in addition, the firm would find it profitable to borrow further, using the funds to repurchase equity. For if the firm were to borrow an additional dollar, it would owe r more in interest payments each period. Assume it repurchases q dollars of equity, where q is the value in the stock market of the returns to a dollar of the marginal real investment. The repurchase, by freeing the returns to a dollar real investment, allows the firm to just cover its additional interest payments, a result implied by optimal debt finance of investment. But since $q < 1$, the firm is left with $1-q > 0$ in profits. Equity would therefore continue to be repurchased until $q = 1$ or until there is no more equity outstanding.

If repurchase of equity is forbidden (or very costly), however, then as long as $q < 1$, the firm will issue no new equity, but existing equity will remain. The amount of equity that will remain is a historical accident. In fact, repurchase

---

[11] In these papers, q is the ratio of the total market value of the firm (debt and equity) to the replacement cost of the firm's capital stock (ignoring obsolescence). Here, q is the ratio of the value in the stock market of a marginal investment divided by its purchase cost. Though one advantage of the first definition of q is that it is easier to measure, Gordon and Bradford (1979) estimate a time series for q as defined in this paper.

of equity is illegal in Great Britain. In the United States although repurchases are not illegal as such, complications can arise. For example, one clear problem is that if repurchases are done so as precisely to imitate dividend payments (periodic percentage repurchases from each shareholder) then the payments will be taxed as dividends.[12] Bradford (1977), Auerbach (1979), and Stiglitz (1973) explore models where $q < 1$ due to a constraint preventing repurchase of equity. Any existing equity is left over from the period prior to the imposition of the corporation tax (when, as we argued above, equity finance would have been favored) or from the initial equity established in order for the firm to incorporate. These models all have the counterfactual implication, however, that no new equity will be issued.

Since it is difficult to maintain that corporations, even after forty years, would not have taken advantage of these arbitrage profits, and since new issues of equity do occur, we will henceforth assume that the debt-equity ratio does not deviate systematically from its equilibrium value. Optimal firm behavior then tells us that in equilibrium 1) $s=r$ from optimal debt finance and 2) $q=1$ from optimal equity finance. (Were q to be > 1, the firm would continue to sell new equity to undertake real investment until $q=1$.)

Let us now look at optimal portfolio behavior of investors, assuming that firms satisfy these two equilibrium conditions.

---

[12]Another problem, in principle, is prosecution for trading on inside information.

In exploring this problem let us assume that the firm pays out as dividends p percent of its after tax profits and reinvests the rest. Also assume that the investor with a marginal tax rate of m on interest payments has a marginal tax rate of n on dividends[13] and an effective tax rate of c on capital gains.

When investing a dollar in bonds, the investor receives $r(1-m) = s(1-m)$ each period. When investing a dollar in equity, the investor receives as dividends $ps(1-\tau)(1-n)$ after tax. The firm has also reinvested $(1-p)s(1-\tau)$ per dollar of real investment, implying a capital gain to the shareholder of $(1-p)s(1-\tau)(1-c)$ after personal income tax. Assuming that the investor must buy only non-negative quantities of either asset, he will invest in that asset giving the higher rate of return, and only in that asset.[14] He will be indifferent between the two assets only if

$$(1.1) \quad r(1-m) = s(1-m) = ps(1-\tau)(1-n) + (1-p)s(1-\tau)(1-c) .$$

Let us explore this indifference condition further. Miller (1977) effectively assumed here that $p = 0$ and $c = 0$; although $n = 0$ and $c = 0$ would be equivalent. These imply that

---

[13] Corporate holders of securities, for example, pay a full corporate tax rate on interest receipts but, as noted above are able to exclude from taxable income 85 percent of dividend receipts.

[14] If the individual can purchase negative quantities of either asset, then he will find it profitable to sell the less desirable asset and to invest the proceeds in the other asset. He will continue to do this indefinitely or until his tax rates have evolved to the point where he is then indifferent between the two assets.

the investor is indifferent between bonds and equity if and only if $m = \tau$. If $m < \tau$, he will invest only in bonds, if $m > \tau$ only in equity. The equilibrium debt-equity ratio therefore depends on the progressivity of the personal income tax and the distribution of wealth across tax brackets. Since $\tau = .46$ now, whereas the maximum federal marginal tax rate is 70%, many individuals could well optimally be investing in equity in this context. Since, by assumption, returns to equity come after corporate taxes but then are free of tax, returns from bonds are inferior for all holders with tax rates above the corporate tax rate despite the fact that returns to bondholders are not subject to corporate taxes.

When all investors have purchased their preferred security, the marginal investor (for whom $m = \tau$) will just be indifferent between receiving the returns from a given real investment through debt or through equity. While returns to equity come after the payment of corporate income taxes, those returns will not be taxed again. On the other hand, bond returns, while not subject to corporate income taxes, will be subject to personal income taxes at the same rate. The firm will therefore be indifferent to how it finances that given real investment. In fact, assuming that the firm is small relative to the market so that the firm cannot affect the characteristics of the marginal security holder, it will find irrelevant any change in

its financial policy, large or small. The Modigliani-Miller conclusions are thus maintained at the firm level. However, as noted above, the aggregate debt-equity ratio is determinant, depending on the distribution of wealth across tax brackets.

How realistic are Miller's assumptions? In particular, is the marginal individual tax rate on the returns to equity effectively zero? Since taxes on capital gains are paid only at realization (with no interest penalty for the postponement), or not at all if the share is still owned when the investor dies, c will certainly be very small for many investors. However, empirically the payout ratio p is approximately .55.[15] Therefore, the individual tax rate on equity is zero only as long as $n = 0$. Due to the exclusion of $200 in dividends from taxable income for married couples, for small investors $n = 0$, but almost surely in addition $m < \tau$ for those investors, so none will own equity. Similarly, tax free investors will have $n = 0$ but also $m = 0 < \tau$, implying that bonds are preferable to equity. Miller and Scholes (1978) point out that for very large investors extra dividends may enable the investor to increase his interest deduction so as just to offset any tax due, implying also that $n = 0$. For there to be a binding restriction on interest deductions, however, the investor must

---

[15] This is the average figure in the National Income and Product Accounts for 1970-75.

be deducting well over $25,000 in interest.[16] According to the Treasury's files, a representative cross-section of individual tax forms, only .02% of tax payers who received dividends appeared to face a binding constraint on interest deductions.[17] Therefore, for almost all individual investors potentially interested in equity in this context, we expect $n = m$, the tax rate on dividend and interest income is the same.

If $n = m$, at what value of m will an investor now be indifferent between debt and equity? We have indicated that $p \approx .55$. Suppose/ $c \approx .2m$, as would be the case with a 60 percent exclusion and assuming postponement of the tax until realization halves the effective rate. Investors will then be indifferent when $m \approx .70$. With reasonable values for the parameters, essentially no individual investors will own equity. To reinforce this implication of the model, let us introduce tax free debt earning an interest rate r_f. We present evidence in Appendix A that r_f has been approximately equal to .75r.[18] Thus, the

---

[16] In 1975, the maximum deduction allowed was $25,000 plus dividends plus interest income and other investment income (realized capital gains plus items on Schedule E).

[17] We would like to thank Dan Frisch for doing these calculations for us.

[18] The model would imply that if $(1-m) < .75$, the individual would borrow deducting the interest payments from taxable income in order to invest in tax free bonds. However, the IRS would disallow the interest deduction in this setting eliminating such incentives. Our implicit estimate of $m \approx .25$ is consistent with McCulloch (1975) who estimated the marginal tax rate of holders of long-term government bonds to be between .22 and .30.

maximum tax rate that individuals have to pay on interest receipts is just 25 percent;/ While under Miller's assumptions, $m = (r-r_f)/r_f = .25$. only individuals with $m \geq \tau = .46$ will prefer equity to bonds, we find that no one will face this high a marginal tax rate. We conclude that nobody will own equity.

Thus, when the relative rates of return on debt and equity are such that firms are indifferent between debt and equity finance, essentially all individual investors will prefer owning debt to equity--the equilibrium financial structure in this context will involve only debt. This conclusion is dramatically counterfactual. Thus, in a world of certainty and taxes, it does not seem possible to explain an equilibrium financial structure with both debt and equity. An analysis ignoring uncertainty is clearly unsatisfactory.

2. Uncertainty, no bankruptcy

Given these counterfactual implications of the model without uncertainty, let us explore whether we will obtain more realistic conclusions if we allow for uncertainty but not bankruptcy, so that bonds are riskless securities (ignoring inflation risk). This is the setting used by Modigliani-Miller (1958). However, we continue to allow for both corporate and personal taxes.

As before, let us first look at the firm's incentives to finance investment through debt issues. Now, at the margin the expected return on a dollar investment must be sufficiently above the market interest rate so as just to compensate shareholders

for the extra uncertainty which they bear as a result of the investment. We may then express the required expected rate of return, $\bar{s}$, on the marginal dollar investment as $\bar{s} = r+\rho$ where ρ is the risk premium demanded by shareholders, before corporate tax, in compensation for bearing the extra risk. As before, the firm would be indifferent to financing additional investment by issuing new equity when the stock market values the returns from a dollar of real investment at a dollar. We can also show as before that if the stock market consistently values the returns from a dollar of real investment at less than a dollar, then the firm can borrow to repurchase equity and make arbitrage profits.

With these two results, we can show that there still will be an incentive to increase the debt-equity ratio without limit. The return on a dollar of real investment before corporate tax can be represented by $s = r+\rho+\epsilon$. Here ϵ represents the random element, with mean zero, in the return on the investment. Optimal debt finance implies that equity holders will be indifferent to the last dollar of debt-financed real investment, so will be just willing to accept the residual s-r which has expected return ρ in compensation for also accepting the stochastic return ϵ. Optimal equity finance implies that equity holders will be willing to pay a dollar for the returns on a dollar real investment, so they will pay a dollar for an expected return $r+\rho$ along with a stochastic return ϵ, all prior to the corporate tax. Combining the two results, equity holders must be willing

to pay one dollar to receive a nonstochastic return r . However, we found in the previous section that when the alternative investments are riskless taxable bonds also earning r and tax free bonds earning $r_f \approx .75r$ that no individual would invest a dollar in equity to earn a nonstochastic before corporate tax rate of return r.[19] As long as debt remains riskless, the firm will always have an incentive to increase the debt-equity ratio without limit. The model, allowing for uncertainty but not bankruptcy, still has dramatically counterfactual implications.

3. Uncertainty with bankruptcy

Let us now allow for the possibility of bankruptcy in the model. What if bankruptcy is costless? We showed in Section I.A with costless bankruptcy and without taxes that the debt-equity ratio would be irrelevant. With taxes, however, all investors would pay less taxes through owning debt, so firms would desire to increase their debt-equity ratios without limit.[20] Since we know that firms (and their lenders) do tend to limit the extent of financial leverage, it would appear that bankruptcy

---

[19]With equity, the after tax return is at best $r(1-\tau) = .54r$ while tax free debt earns .75r.

[20]The IRS could threaten to reclassify debt as equity for tax purposes were debt finance used almost exclusively. This threat would create an incentive to maintain enough equity to forestall the danger. It is doubtful, however, that one can rely on this explanation for the existence of the amount of equity actually in existence.

is sufficiently costly to affect the value of the firm materially.

One problem that must be faced if bankruptcy is costly, however, is why the market does not find some device to avoid such costs. Presumably, avoiding these bankruptcy costs is in the best interests of the various claimants on the firm in aggregate. However, there are several reasons why bankruptcies may occur in spite of the cost. Negotiation with the full set of investors is both difficult and very costly--especially when public bondholders exist. Bankruptcy costs arise in large part precisely because of these difficulties.

While the availability of alternatives to formal bankruptcy puts some upper bound on the costs of bankruptcy (as argued by Haugen and Senbet (1978)), these alternatives are themselves costly. Costs are not avoided by informal reorganization for the essential problem remains of negotiating a complicated settlement among parties with different interests and alternative legal remedies. Indeed the problems are sometimes so complex that informal reorganizations without bankruptcy is either impossible to achieve or can be arranged only with costs as large as those incurred with formally bankruptcy. We show in Section II that this is especially true if there are many classes of security holders all of whom must agree to a reorganization plan and all of whom may take recourse in litigation if they subsequently feel they were treated unfairly.

There is also a potential problem of externalities. When any reduced coalition of investors considers preventing the firm from going bankrupt, it must ignore the resulting benefits or costs accruing to the remaining investors. But the smaller the coalition, the larger this externality. The benefits of avoiding bankruptcy for the reduced coalition may not be as large as the costs of keeping the firm out of bankruptcy even if the benefits to the investors as a whole are large enough. Bulow and Shoven (1978) and White (1979) give examples of this, where a coalition of bank lenders and equity holders would choose to force bankruptcy in spite of the costs, at the expense of the public bondholders.

Another inducement to bankruptcy is that as the size of debt increases relative to the value of the firm, the management acting in the interest of stockholders will find more inefficient investments becoming profitable as they ignore any costs born by bondholders or bank lenders resulting from an increase in the probability of bankruptcy. Bondholders, unable to prevent such actions may well stop the erosion in the value of their securities by forcing the firm into bankruptcy at their first chance, in spite of the transaction costs of bankruptcy.

Finally, formal bankruptcy may be the only way a firm in distress can obtain new financing. This is so because new loans to the bankrupt estate receive an enforceable first lien on the assets of the estate while new loans to a reorganized company cannot receive the same degree of protection.

How, then, ought these bankruptcy costs to be modelled when studying the firm's debt-equity decision? The covenant's with existing bondholders would normally require that any further debt issued be junior in priority in bankruptcy to the existing debt, unless certain earnings coverage and liquidity ratios are met, in which case bankruptcy is highly unlikely, at least over the near term. When considering additional debt, the stockholders and the potentially most junior debt holder form a coalition. Only possible bankruptcy costs born by this coalition will be considered in the decision to increase the debt of the firm. These costs will depend mainly on the existing debt-equity ratio (positively) and the variability of both prior and additional earnings or cash flow (giving together the change in the probability of threatened default), though the form of the dependence will vary by firm. Only part of the total costs of bankruptcy will be born by this coalition, however, with the fraction depending on the priority rules in bankruptcy and the circumstances under which bankruptcy would occur.[21] As we shall see below, "me first" rules are often not honored in bankruptcy reorganizations.

In analyzing the effects of uncertainty and possible costly bankruptcy on the firm's financial decision, we assume

---

[21]To the degree that part of the costs created by a higher debt-equity ratio are ignored in financing decisions, since they are born by existing bondholders, these decisions will be inefficient. Increasing the fraction of bankruptcy costs born by this coalition would therefore improve the efficiency of investment and financial decisions, and revisions in the legal structure of bankruptcy ought to aim towards this.

that the firm sells its securities on a market satisfying the assumptions of the capital asset pricing model. Brennan (1970) and Gordon-Bradford (1979) show that when the capital asset pricing model is applied in a world with personal taxes, all securities traded in the market will satisfy the equation.[22]

$$(3.1)\quad \bar{g}_i + \alpha(\bar{d}_i - r_z) = \beta_i(\bar{g}_M + a(\bar{d}_M - r_z))$$

Here, $\bar{g}_i$ is the part of the expected return on the i'th security which is given capital gains treatment, $\bar{d}_i$ is the part of the expected return taxed at ordinary rates, and r_z is the return, also taxed at ordinary rates, on the riskless asset. The subscript M refers to the market index, and β_i measures the (systematic) riskiness of the i'th security. In the derivation, it is shown that α is a weighted average across investors of the relative value of a dollar of dividends to each investor compared with that of a dollar of capital gains.[23] α is also the same for all firms. The equation says that the equilibrium risk premium on any asset (the left hand side of 3.1) compensates just for the component of that asset's risk (measured by β_i) that moves with the market as a whole--any other component can be diversified away and merits no risk-premium.

---

[22]The derivation assumes that only g_i and g_m are stochastic.

[23]When only taxes affect the relative values of capital gains and dividends, an investor's relative value of dividends would equal $\frac{1-n}{1-c}$. When $m \neq n$ for all investors, however, the weight α_b on bond interest payments will differ from the weight α on dividend receipts.

At the equilibrium debt-equity ratio for the firm, both the debt and the equity issued by the firm must satisfy the capital asset pricing equation, and the firm must find issuing debt or equity to be equally profitable at the margin. In addition, when investment is optimal as well, investors must be willing to pay a dollar to receive the returns from a one dollar marginal investment, whether the financing was from debt or from equity. What implications do these equilibrium conditions have?

Let us explore first the relative profitability of debt and equity finance when the probability or costs of bankruptcy are not affected by the choice.[24] Even for this case there are two new complications which must be addressed. First, when considering debt vs. equity finance, though total bankruptcy costs are assumed to be unchanged, the fraction of the receipts in bankruptcy going to the coalition of equity holders and the possible new bondholder may be affected by the financing decision. However, if the new debt is, in fact, junior in priority to all existing debt, as new equity would be, this may not occur. Second, even if the amount of uncertainty born by the coalition is the same whether debt or equity finance is used, the risk premium demanded for the given risk may be affected by the financing decision. However, because of the implicit assumption in the Gordon-Bradford model that all stochastic returns are

---

[24] This setting is essentially the same as that used in the previous section, and we will show that the conclusions remain unchanged when we use the capital asset pricing model.

taxed at the capital gains rate, the capital asset pricing model implies that the total risk premium (the right side of equation 3.1) required to compensate investors for bearing all the risk depends only on the covariance of the uncertainty with the market uncertainty, and not on how the uncertainty is split between bondholders and equity holders.

Since the total risk born by the coalition, and the price demanded for bearing that risk, is unaffected by the financing decision, we need only look at the risk premium received (the left side of equation 3.1) in order to decide whether the firm will find debt or equity finance more profitable. As long as the risk premiums received are equal under either debt or equity finance of a given investment, the market will value the returns independently of the form of finance, implying that the firm is also indifferent to the form of finance. It can be shown that the risk premiums will be equal in this context when:[25]

$$(3.2) \quad \alpha_b r = (1-p)r(1-\tau) + \alpha p r(1-\tau) .$$

This comparison is equivalent to that in equation (1.1) assuming

[25]When a dollar of investment is financed by equity, the expected receipts to the firm after corporate tax (including expected bankruptcy costs) are $\bar{s}(1-\tau)$. With p still representing the percent paid out as dividends, the risk premium received, as valued in the market (the left hand side of equation 3.1) is:

$$EV(\bar{s}) = (1-p)\bar{s}(1-\tau) + \alpha p\bar{s}(1-\tau) - \alpha r_z$$

where $EV(\bar{s})$ represents the expected return to equity over the risk free rate resulting from before tax return $\bar{s}$. When the same investment is financed by debt, the expected after tax receipts to the firm are $r + (\bar{s}-r)(1-\tau)$. Were there zero expected capital gains on bonds, then when bond finance is used, bondholders would receive an expected risk premium $\alpha_b r - \alpha r_z = BV(r)$, the expected value to bondholders of the return r, over the risk free rate, while equity holders would receive the rest, increasing the risk

$\alpha = \frac{1-n}{1-c}$ and $\alpha_b = \frac{1-m}{1-c}$, implying that investors prefer bonds except when α_b is extraordinarily small.[26] But of course this should be the case since we have so far ignored any effect of the financing decision on the probability of bankruptcy so the situation is basically that of the last section.

However, a decision to finance an extra dollar with debt instead of equity will increase the probability of bankruptcy, and increase the moral hazard associated with risky debt, described in section A. These increased costs will be split between the existing bondholders and the equity holders (perhaps along with a coalition of the new junior bondholders).[27] The component of the costs that will be borne by the existing bondholders will be ignored by the coalition deciding whether to

---

(footnote 25 continued)
premium they receive by $EV(\bar{s}-r) + \alpha r_z$. When comparing the expected value to investors of the return to the firm using equity vs. debt finance, we then compare $EV(s)$ with $BV(r) + EV(\underline{s}-r) + \alpha r_z$. If they are equivalent, then $BV(r) + \alpha r_z = EV(\bar{s}) - EV(s-r) = EV(r) + \alpha r_z$ or $\alpha_b r = (1-p)r(1-\tau) + \alpha p\, r(1-\tau)$.

[26] The derivation of 3.1 assumed n=m and ignored the existence of tax free bonds. When $n \neq m$, the weight α_b on interest receipts would differ (and presumably be smaller) than the α weight on dividends.

[27] To the extent that public equity also has moral hazard or agency costs, as described in Jensen and Meckling (1976), then the increased costs described are net of the decrease in agency costs associated with the decrease in equity.

increase debt. We assume that the other component of the increased costs is itself an increasing function of the existing debt-equity ratio. These increased costs include both the extra risk premium demanded resulting from the correlation of these bankruptcy costs with the market risk,[28] and, also, the decline in expected return due directly to the increase in expected bankruptcy costs. Call $c(D/E)$ the total increase in bankruptcy costs from financing an extra dollar by debt instead of equity. Now, the firm has chosen an equilibrium debt-equity ratio when:

$$(3.3) \quad \alpha_b r = (1-p)r(1-\tau) + \alpha p r(1-\tau) + c(D/E) .$$

The existence of bankruptcy costs makes equity finance relatively more attractive, and in equilibrium by enough so that the firm is indifferent at the margin between debt and equity finance. Since the function $c(D/E)$ will vary by firm for many reasons, particularly because of the variability of its stream of operating earnings, the equilibrium debt-equity ratio will also vary by firm, with firms having more variable earnings choosing a lower debt-equity ratio. In Section II B, we measure empirically the size of this variation in firm debt-equity ratios. The size of $c(D/E)$ in equilibrium will depend on the specific values of α and α_b . We will discuss below some empirical evidence on the sizes of these parameters.

---

[28] This systematic component of bankruptcy costs is often ignored. An important cause for systematic or market risk is the sensitivity of corporate returns to general market conditions. But a cyclical downturn is likely to increase the probability of bankruptcy and its associated costs. Thus, firms with high debt-equity are likely to have higher anticipated systematic risk as has been suggested by Rosenberg and Guy (1975).

Let us now explore individual debt-equity decisions by looking more closely at the capital asset pricing model. When looking at the individual's utility maximizing portfolio choice in this model, we find as seen in Gordon-Bradford (1979) that for each individual an equation analogous to 3.1 will be satisfied for all securities. In the equation, however, α will equal the ratio $\frac{1-n}{1-c}$ for that investor, and the subscript M will no longer refer to the market portfolio but to that individual's utility maximizing portfolio. Each individual will own every asset in a non-zero, though not necessarily positive, amount.[29] However, individual portfolios will vary due both to differing marginal tax rates and also to differing utility functions (if no risk free asset exists). Those with lower tax rates would normally put a smaller (if not negative) share of their portfolio into equity, but everyone would be active in the market for equities--unless an individual is completely indifferent to acquiring a share of equity, at the existing price, he can profitably either buy or sell shares.

---

[29]Negative holdings of assets ought to occur only when tax rate differences are very large. When all individuals have the same tax rates, they all own a proportionate share of the market portfolio. Except in degenerate cases (such as Miller (1977) where there is no uncertainty) portfolios will change continuously as the tax law moves away from equal rates. Large changes in rates from equality would be necessary before any holdings of equity became negative.

This conclusion contrasts with the complete portfolio specialization implied by Miller's model (1977). Since he ignored uncertainty, he ended up with corner solutions when solving for optimal portfolios.

An additional implication of the model is that risk is distributed inefficiently by the securities market as a result of tax distortions. Intuitively, the argument can be described as follows. Recall that risk will be efficiently distributed only if, at the margin, each individual demands the same risk premiums (charges the same price) for accepting a given lottery. The basic point of the argument is that because taxes influence portfolio choices this efficiency condition will not be met.

In equilibrium those in all tax brackets are indifferent between debt and equity at the margin. Any relative tax advantage to equity vs. debt must therefore be counterbalanced by a larger cost at the margin of bearing the risk in equity--the risk premium on equity ought to be larger for those with a relative tax advantage in equity.[30] Those with a relative tax advantage in equity demand a larger risk premium because they own relatively more equity in their portfolio. As a result, there will be a higher covariance of the return on new purchases of equity with

---

[30] The capital asset pricing model implies that for any given marketed security, an individual in equilibrium would just be satisfied with the risk premium he does receive: $\bar{g}_i + \alpha d_i - \max(\frac{r_f}{1-c}, \alpha r_z)$, where $\alpha = \frac{1-n}{1-c}$. The behavior of this expression as a function of α provides the justification for the statements in the text.

the return on their portfolio as a whole, leading to a larger risk premium at the margin. Individuals in higher tax brackets will find that equity tends to be relatively more attractive than bonds, because these investors obtain tax advantages from the relatively favorable treatment of capital gains. Those in low tax brackets have a relative tax disadvantage in equity since the higher capital gains component in equity carries little advantage for them. Those in the highest tax brackets also have a relative tax disadvantage in equity since tax exempt bonds have such a high return after tax in comparison. Thus, the condition for efficient risk spreading is not achieved. Indiviuals demand different risk premiums for holding additional limits of equity on the margin.

In summary, when we allow for both uncertainty and costly bankruptcy, the implications for the firm's equilibrium financial policy are:

1) Each firm will have its own optimal debt equity ratio, with firms with riskier investments choosing a lower debt-equity ratio. The debt-equity ratio is no longer indeterminate, nor is there an incentive to increase it without limit.

2) Individuals will hold diversified portfolios, with those in the lowest tax brackets owning relatively little equity, and those in the highest tax brackets specializing in tax exempt bonds. Unlike in Miller (1977) there is no specialization of portfolios.

3) Excess burden costs now arise from a) bankruptcy costs, and b) inefficient spreading of risk across investors. The magnitude of these costs is further explored in Section III. These implications are much more realistic than those from the previous model without costly bankruptcy. The elimination of many of the earlier counterfactual conclusions makes us more confident in the other forecasts from this model we will make below.

C. A Note on Dividends

So far in our analysis including corporate and personal taxes we have taken the payout rate as given even though the firm has complete control over the dividends it pays. If we allow the firm to choose an optimal dividend payout rate, what do the models imply? When there are no taxes, we showed that the dividend payout rate is irrelevant. Unfortunately, the above models, seem to imply that, contrary to fact, no dividends ought to be paid.[31] While a few attempts have been made to rationalize the payment of dividends, the size and stability of dividends remains a puzzle.

When the firm considers the payout of available funds as dividends, it faces the alternatives of using the funds for repurchase of equity, new investment, or retirement of debt. Let us look first at the equity repurchase option. Assume that

[31]Alternatively, the implication is that dividends are more valued relative to capital gains than one would have expected given their relative tax treatments.

one dollar will be paid out by the firm this period either for dividends or for repurchases, and that N shares exist initially. If the firm chooses to pay dividends, then each shareholder receives $\frac{1-n}{N}$, after personal taxes. If the firm decides publicly to repurchase shares, then the remaining shareholders experience a capital gain of $\frac{1}{N}$, while the shareholders who sold out experience a capital gain of the same relative size. This amounts to $\frac{1-c}{N}$ after capital gains tax, which we assume is imposed on accrued gains.[32] Shareholders for whom $c < n$ would prefer repurchase to dividends and conversely.[33]

If instead of using the dollar to repurchase shares the firm were to retain the dollar using it for new investment or for repurchase of debt (equivalent at the margin), then the total value of the equity would increase by an amount that we shall denote by q. Optimal equity finance of investment implies that the stock market ought to be willing to pay a dollar at the margin for the returns from an additional dollar of equity-financed real investment. Profit maximization thus implies that $q = 1$. Each share would experience a capital gain of $\frac{1-c}{N}$ after tax, so in equilibrium retentions are equivalent to repurchases.[34]

---

[32] The algebra is somewhat messier with a tax only at realization.

[33] We abstract from transactions costs in this example.

[34] If the debt-equity ratio is not in equilibrium, at that moment, $q \neq 1$. After-tax capital gains on each share are then $\frac{q(1-c)}{N}$. An investor now prefers retentions if and only if $q > \frac{1-n}{1-c}$. However, repurchases continue to dominate dividends as long as $c < n$.

How then does c compare with n ? The presumption of course is that $c < n$. It is this presumption which leads to the conclusion that firms ought not to pay dividends. However, not all investors will favor repurchases. For example, for married couples filing jointly with under $200 in dividends, $n = 0$ so $c > n$. Also, for corporations owning shares in other corporations, 85% of dividends received are deductible, so $n = .072$, assuming a marginal corporate tax rate of 46 percent. The statutory tax rate on capital gains is .28, so that even with the gain from postponement of the payments until realization, one would expect $c > n$ for corporations. In addition, tax exempt institutions are sometimes constrained against spending capital gains and so may prefer dividends.

What incentives does the firm face, given this disagreement among shareholders? We assume that the firm's objective, and implicitly that of a majority of its shareholders, is to maximize the value of its shares, although such an assumption may be questioned. What dividend policy then will maximize the value of the shares? Under the assumptions of the capital asset pricing model, the market weights dividends relative to capital gains by a factor α which is just a weighted average of the ratios $\frac{1-n}{1-c}$ across investors.[35] The relative weight on any investor's

[35] See Gordon and Bradford (1979) for a derivation.

ratio $\frac{1-n}{1-c}$ in determining α is larger for investors who are less risk averse at the margin (infinite if risk neutral), probably giving corporations and institutions relatively more weight in the determination of α.

If, in spite of the extra weight on the less risk averse, $\alpha < 1$, then the firm can increase the value of its equity by repurchasing shares rather than paying dividends. The presumption that firms ought not to pay dividends is equivalent to the hypothesis that $\alpha < 1$. Fortunately, it is possible to estimate the value of α statistically by comparing the average returns on equity in firms with similar riskiness but different dividend payout rates. Black and Scholes (1974) find α to be statistically indistinguishable from one, while Gordon and Bradford (1979) find that while α varies above and below one over time, on average it is fairly close to one.

Though these empirical results are consistent with firms paying dividends since the stock market seems to value dividends and capital gains equally, they raise the question of how the market α can be around one when for so many investors, α is well below one. We have shown that taxes do not affect all investors the same way, however. Moreover, taxes are not the only factor affecting the relative value to investors of dividends vs. capital gains. Transactions costs for example will favor dividends for many shareholders intending to consume the income. Small investors, for example, those with $5,000 or less

invested in a sample security, would face transactions costs of well in excess of 10 percent were they to liquidate small pieces of their investment in lieu of receiving dividends. Alternatively, Black (1976) hypothesizes that investors have an irrational preference for dividends.

Even if α is accepted to be around one on average, because the estimates of α wander over time, another problem is created. Only if $\alpha = 1$ will the firm find it profitable both to retain or repurchase and to pay dividends. While $\alpha \neq 1$ it ought to cease completely one activity or the other. Yet dividend payments are extraordinarily stable over time. Some factor clearly is being ignored by the models. To the extent that dividend recipients, such as tax-exempt institutions, use dividends to fund consumption, one can rationalize some desire for stability in payments. However, many recipients do not consume out of dividends, yet virtually all firms have very stable dividend payments.

An alternative explanation for the stability of dividend payments, explored in Bhattacharya (1979), is that the level of dividends is used as a signal to investors concerning the financial strength of the firm. This use of dividends as a signal seems intuitively very appealing. Firms have such latitude in areas such as inventory valuation, depreciation, writing off or capitalizing certain expenses, etc., that it is not always possible to obtain

a good estimate of corporate earnings with either reported data or earnings figures adjusted on the basis of publicly available accounting information. A dollar of earnings for one company may not be equivalent to a dollar of earnings for another. No such ambiguity exists with a dollar of dividends, however. Hence, dividends can be used in the financial community as a proxy for true earnings.

While the signalling role provides an explanation of how dividend payments may benefit the firm, through creating more favorable expectations of future profits,a given dividend payout rate also creates additional costs. In addition to higher personal taxes, dividends increase the firm's need to seek outside funding, or to cut back on investments, in order to offset the loss of internal funds. The firm itself must pay substantial transactions costs such as underwriters' fees in order to float new issues of debt or equity. Moreover, substantial new issues can usually be sold only at a discount from prevailing market prices. The firm is assumed to trade off these benefits and costs created by additional dividends when choosing its dividend payout rate. More profitable firms, everything else equal, will find any given level of dividends relatively less costly since they will use outside funding less frequently or at lower costs. As a result, they will choose a higher payout rate, enabling dividends to be useful as a signal.

One implication of such a model is that the level of dividends is now much less sensitive to the value of α, as now $(1-\alpha)$ is only part of the net costs in paying dividends. This provides an alternative explanation for the stability of dividends, given that α has wandered above and below one in recent years. Once dividends are used as a signal of "normal" earning power, one would expect firms to be quite reluctant to cut dividends in response to a temporary drop in earnings (or to finance a large investment) since the dividend cut might be misinterpreted by the market.

For this signalling argument to be convincing, however, several questions must be answered. First, are there cheaper ways to signal profits than paying dividends? For example, commitments to repurchase equity or debt would put the same financial pressure on the firm, so provide the same signal, yet appear to investors to be cheaper/since they imply lower tax costs. However, when the tax costs of the signal are lower, firms have to signal more aggressively in order to distinguish themselves from each other, implying extra costs resulting from a drop in retained earnings. It is not necessarily true that the total costs of the signal are lower when the tax costs are lower. There is a second problem with the argument in that increases in dividends/result that signal higher profits in an immediate capital gain, yet the costs occur gradually and in the future./there may be incentive for current shareholders Thus, to signal falsely to induce a jump in share price, then to sell

out before the costs must be paid. The taxation of capital gains at realization could dampen incentives for such speculation. More importantly, the threat of legal sanctions undoubtedly provides a strong disincentive against such manipulation.

In spite of the progress made, we still lack a full explanation for the nature of dividend payments. However, there seem to be enough possible approaches that the overall model of the firm is not undermined by the existence of dividends.

D. Inflation and Corporate Financial Structure

In the previous analysis, we implicitly assumed a stable price level. What effect will the introduction of inflation have on our results? The tax system is certainly not neutral with respect to the inflation rate. In analyzing the effect of inflation, let us first return to the certainty setting of section 1.A and introduce a constant rate of inflation π. We will first look at the new equilibrium conditions, and then investigate the effect of an unexpected change in the inflation rate. Using the latter results, we will then explore the effects of an uncertain but neutral inflation rate.

In the presence of a steady inflation rate, the firm's investment incentives change for two primary reasons. First, the real after tax interest rate will normally drop since the inflation premium in the interest rate is tax deductible under the corporation tax. If the nominal market interest rate is $r + \pi$ (so that r represents the real market interest rate), then the real after tax interest rate is $(r+\pi)(1-\tau) - \pi = r(1-\tau) - \pi\tau$.

For example, if $r = .03$ with or without inflation, and $\tau = .5$, the introduction of a ten per cent inflation rate causes the real after tax interest rate facing the firm to drop from .015 to -.035, a very dramatic change. A sufficient rise in r could offset this drop. However, Feldstein and Summers (1978) provide empirical evidence that inflation does not much affect r. Incentives for real investment increase as a result.

While it is true that individual taxes may tend to rise with inflation since individuals pay tax on the inflation premium, this disadvantage will only be conveyed to the firm through a change in the market rate of interest, i.e. through a rise in the real before tax interest rate. There is no evidence, however, that this occurs.

There is, of course, an offsetting increase in effective tax rates on the firm since depreciation allowances decline in real value due to inflation when depreciation is based upon historical costs.[36] In addition, for firms not using LIFO (last in first out) accounting procedures for their inventories, expenses in production will be understated for tax purposes--the cost of goods drawn out of inventory would be assessed at the dollar price from an earlier date. These factors discourage real investment.

---

[36] One might view the shift towards more accelerated depreciation formulas for tax purposes as an attempt to alleviate this effect of inflation.

Expressing the combined effects in the notation used previously, whereas without inflation optimal debt finance of investment would imply $s(1-\tau) = r(1-\tau)$,[37] with inflation firms invest until $s(1-\tau) + \tau(D-D_a) = r(1-\tau) - \pi\tau$, where D is the depreciation allowance per dollar of capital in the tax law, and where D_a is the actual replacement rate per dollar of capital.[38] Inflation causes D to be less than D_a.

If the same percent of the capital stock depreciates both in fact and in the tax law, but depreciation allowances are based on historical costs, and if the capital stock has been growing at g percent per year, then it can be shown that $\tau(D-D_a) = -\pi\tau \frac{D_a}{D_a+g+\pi}$.[39] If we again assume a ten percent inflation rate, $r = .03$, and $\tau = .5$, along with $D_a = .1$ and $g = .02$, then having depreciation allowances based on historical costs causes the real after-tax interest rate faced by the firm to rise by two percent. Since inflation also caused the real interest rate to drop by five percent, there is a net drop of three percentage points in the real cost of capital to the firm.

---

[37] The effects of deviations in tax formula for depreciation from actual depreciation when there is no inflation continue to be included in the definition of s. Modifications discussed below, when uncertainty and costly bankruptcy exist, are ignored.

[38] There are now several distortions in the composition of investment. First, assets with different depreciation rates will have different net rates of return in equilibrium. In addition, marginal investments in the noncprorate sector will satisfy $s(1-m) + m(D-D_a) = r(1-m)-m\pi$, implying in equilibrium a different net rate of return than in the corporate sector.

[39] In order to estimate the net effect of a marginal change in the inflation rate on $\tau(D-D_a)$, we approximate the messy

Let us now look at the implications of inflation for the equilibrium debt-equity ratio when there is no uncertainty in the inflation rate. The condition for an optimal debt-equity ratio in equation (3.), on the assumption that $\alpha = 1$, implies:

$$c(D/E) = r(\tau-(1-\alpha_b)) .$$

How does this change when inflation exists?

(footnote 39 continued)

accelerated depreciation formulas in the tax law by an exponential depreciation formula. We also assume that actual depreciation is exponential, and that, without inflation tax depreciation and actual depreciation are equal. Let us also assume that the firm's capital stock has been growing at the rate g over time. This implies that t periods ago, the real rate of investment (in current dollars) was $(D_a + g)e^{-gt}dt$ per dollar of the current capital stock. Of this investment, $(D_a +g)e^{-(g+D_a)t}dt$ still exists. Tax savings this period for depreciation allowances on the investment t periods ago is $\tau D_a e^{-\pi t}(D_a+g)e^{-(g+D_a)t}dt$ in current dollars. Total tax savings this period from depreciation allowances per dollar of the current capital stock is then $\int_0^\infty \tau D_a e^{-\pi t}(D_a+g)e^{-(g+D_a)t}dt = \tau d_a(\frac{D_a+g}{D_a+g+\pi})$. By definition, this equals τD. As a result, $\tau(D-D_a) = \tau D_a(\frac{D_a+g}{D_a+g+\pi} - 1) =$

$$-\tau\pi(\frac{D_a}{D_a+g+\pi}) .$$

If we use the same line of arguments as before, and continue to assume $\alpha = 1$, we find that:[40]

$$c(D/E) = (r+\pi)(\tau-(1-\alpha_b)) .$$

Therefore, the equilibrium debt-equity ratio increases when the inflation rate increases, as long as $\tau > (1-\alpha_b)$, since the inflation premium on bonds is less heavily taxed than that on equity.[41]

Let us now look at the immediate wealth redistribution effects of an unexpected rise in the inflation rate, focusing first on the equity holders. As a result of earlier investments, the firm faces a schedule of depreciation allowances and interest payment obligations fixed in dollar terms. Due to the unexpected change in the inflation rate, the tax savings from depreciation allowances drop while the real value of interest payment obligations also drops. Back of the envelope calculations suggest that the two effects roughly offset.[42] If a firm had not been

---

[40] The use of the capital asset pricing model in nominal terms when there is inflation is justified in Gordon and Bradford (1979).

[41] The change in the real after tax interest rate facing the firm may have a small direct effect on the function $c(D/E)$ which is the flow equivalent to the present value of bankruptcy costs. However, if the expected costs are equal in all periods, then $c(D/E)$ will not change.

[42] In calculating the gain from a drop in the real value of debt, let us assume that one-third of the value of the firm is funded by debt, and that the average lifetime of debt outstanding is ten years. The drop in the present value of debt payment obligations is therefore:

$$\frac{1}{3}V\left[\int_0^{10} r(1-\tau)e^{-r(1-\tau)t}dt + e^{-10r(1-\tau)}\int_0^{10} r(1-\tau)e^{-(r+\pi)(1-\tau)t}dt - e^{-10(r+\pi)(1-\tau)}\right]$$

In calculating the loss in present value of depreciation allowances, let us assume that exponential depreciation is a reasonable approximation to actual accelerated depreciation formulas. If D is the percent

using LIFO accounting, shareholders would experience an additional (though largely avoidable) loss through a real increase in corporate taxes.

In addition to this small net effect of inflation on the profitability to equity holders of prior investments, there may also be a change in the future prospects of the firm. If the real interest rate does not rise too much accompanying the change in the inflation rate, then it seems that the firm's investment incentives will have increased. This effective drop in the real after-tax interest rate (even taking into account the less accelerated depreciation allowances) makes all new inframarginal investments more profitable. The value of the firm's equity would tend to increase by the present value of these extra profits. Therefore, as long as the real interest rate does not rise too much, existing equity holders would tend to gain from an unexpected increase in the inflation rate, at least under the circumstances we have been examining.

Even though existing equity may well rise in value in response to an unexpected increase in the inflation rate,

---

write-off of remaining capital allowed per year, then the fall in value of depreciation allowances would then be:

$$V\left[\int_0^\infty \tau D e^{-(D+r(1-\tau))t}dt - \int_0^\infty \tau D e^{-(D+(r+\pi)(1-\tau))t}dt\right] .$$

If we let $r = .03$, $\pi = .06$, $\tau = .5$ and $D = .10$ for a sample calculation, then the gain in the value of the debt would be .08V. With the same parameters, however, shareholders lose .09V as a result of the smaller real depreciation allowances, giving a net loss of only .01V. While both effects individually are large, the net effect is small.

existing bonds will surely drop in value. As a result, the debt-equity ratio (each measured at market, not book, value) will fall. Since this fall causes a drop in the wealth of individuals who for tax and other reasons prefer bonds, this fall will to a degree be maintained in equilibrium.[43] Conversely, were the inflation rate to fall unexpectedly, there would be a tendency for the equilibrium debt-equity ratio to rise.

When we allow the inflation rate to be stochastic, but assume no uncertainty in relative prices, equity and bond holders will face a distribution of possible wealth transfers resulting from the stochastic inflation rate, with the relative magnitudes of the distributions that described above. For a given unexpected change in the inflation rate, it appears that bond holders will be more strongly affected than equity holders. This increase in the relative riskiness of bonds ought to result in a drop in the equilibrium debt-equity ratio.

These conclusions about an increased investment rate and an immediate drop in the debt-equity ratio,[44] with perhaps even a rise in equity prices, seem very much at odds with actual observations. For example, several studies (e.g. Body (1975)) indicate a negative correlation between the inflation rate and

---

[43] One complication is that the rise in real tax revenues resulting from the inflation may result in selective decreases in tax rates or selective transfer payments which also alter the distribution of wealth.

[44] In equilibrium, though, the debt-equity ratio will rise unless the redistribution of wealth is sufficient.

stock market returns. What we have found is that it does not seem to be inflation per se that is the cause of the observations. Other factors must have accompanied changes in the inflation rate, whether by necessity or just historically, which have caused a drop in the stock market and in investment. For example, inflation tends to induce more restrictive government monetary and fiscal policies, possibly leading to a rise in the real interest rate and a fall in both investment and in the stock market. A threat of price controls, imposed so as to lower profit margins, could also induce these effects. In addition, the degree of uncertainty will normally increase beyond that due to a stochastic overall inflation rate. For example, relative prices are more variable when the inflation rate is higher, as documented by Vining and Elwertowski (1976), making business more risky.[45] A strengthened OPEC could also have increased the uncertainty in the economy. This higher uncertainty also reduces the investment rate and the level of the stock market.

The fact that the tax structure is not indexed does not in itself lead to any unambiguous loss. One effect is to cause an increase in the investment rate, reducing the gap between the marginal return on capital and the marginal time preference rate.[46]

---

[45] Some of this risk may be fairly easy to diversify away, however.

[46] We showed above that in equilibrium, under simplifying assumptions, $s = r - (\frac{\pi\tau}{1-\tau})(\frac{g+\pi}{D_a+g+\pi})$. In contrast, individuals save until $\rho = r(1-m) - m\pi$, where ρ is their marginal time preference rate. As long as $m < (\frac{\tau}{1-\tau})(\frac{g+m}{D_a+g+\pi})$, as it normally will be, the distortion between savings and investment incentives is reduced when π increases.

However, we noted above (in footnote 38) that the composition of investment is distorted due to inflation, given the tax law. In addition, there may be a rise in the equilibrium debt-equity ratio, leading to higher bankruptcy costs. There is no presumption, though, that indexing the tax structure, leaving it otherwise unchanged, will be beneficial.

E. Incentives for Savings and Investment

In the models with no uncertainty, we concluded that corporations would invest until the marginal return on capital equalled the market interest rate, even though a corporate tax exists. The corporate tax therefore did not distort savings decisions, unlike the personal income tax. Noncorporate firms would also invest until the marginal return on capital equalled the market interest rate, implying an efficient allocation of capital between the corporate and the noncorporate sectors. To what degree do these conclusions change when there is uncertainty and costly bankruptcy?

Let us first examine the equilibrium marginal return on capital in the corporate sector. Assume that the firm is considering an extra dollar of real investment, financing γ percent of it with debt and the rest with equity. The firm chooses γ so that the debt-equity ratio will continue to be optimal after the investment. The firm will be indifferent to proceeding with the investment if the expected rate of return on the investment is just sufficient to compensate the bond and equity holders for the use of their funds, given the risk that they bear.

In the context of the capital asset pricing model, assuming $\alpha = 1$ as found in Gordon and Bradford (1979), the indifference condition implies

$$(E.1)\quad (\bar{s} - \gamma r)(1-\tau) + \gamma\alpha_b r = \alpha_b r_z + \beta_i(r_m + d_m - \alpha_b r_z) + C_D\gamma + C_E(1-\gamma)$$

Here, r is the coupon rate on the bonds. The terms C_D and C_E capture the effect on bankruptcy costs of a dollar of debt-financed investment and a dollar of equity financed investment respectively.[47] We have assumed that returns on bonds and on the riskless asset receive the same tax treatment so that the α weight on each is the same.

Equation (E.1) states that the return received by equity holders and debt holders (the left hand side) must equal the risk free rate plus the appropriate risk premium plus compensation for any change in expected bankruptcy costs. Rearranging the equation gives an expression for the equilibrium marginal rate of return on capital:

$$(E.2)\quad \bar{s} = r_z\left(\gamma + (1-\gamma)\frac{\alpha_b}{1-\tau}\right) - \gamma(r-r_z)\left(\frac{\tau-(1-\alpha_b)}{1-\tau}\right) +$$

$$\frac{\beta_i(r_m + d_m - \alpha_b r_z)}{1-\tau} + \frac{C_D\gamma + C_E(1-\gamma)}{1-\tau}$$

In interpreting this equation, let us focus first on the first term on the right hand side. Several earlier results in the literature are special cases of this term, and ignore the

---

[47] These terms will be influenced by the nature of the distribution of the return on the new investment, and its covariance with the firm's existing investments.

other terms. In Miller's (1977) model, at the equilibrium debt-equity ratio, $\alpha_b = 1-\tau$, implying here that $\bar{s} = r_z$. In Stiglitz (1973), optimal finance of new investment is all debt, so that $\gamma = 1$, again implying $\bar{s} = r_z$. In Harberger (1962), Feldstein (1974), and Shoven and Whalley (1972), there are no personal taxes and no debt, so $\gamma = 0$ and $\alpha_b = 1$, giving $\bar{s} = \frac{r_z}{1-\tau}$.

Here, the story is much more complicated. The first term embodies aspects of all the previous models. The second effect captures the fact that for debt holders, τ percent of the risk is absorbed by the government through risky corporate tax revenues yet only $(1-\alpha_b)$ percent of the risk premium is captured by the government. The third term captures the size of the market risk premium, while the last term captures the effect of this expansion of the firm on expected bankruptcy costs.

To what degree do taxes distort the investment decisions of firms, conditional on the optimal form of finance, which we noted above is also distorted by taxes? For no distortion to exist, the marginal investment ought to earn the risk free rate plus just enough so as to compensate for the social costs of the risk and possible bankruptcy costs created by the investment. If the marginal costs of risk bearing by the government were the same as the marginal costs of risk born by the private sector (as would be the case if risk is allocated efficiently across investors), then the third term will measure the social costs

of risk bearing.[48] There is no presumption, however, that the last term will capture properly the social costs of increased bankruptcy risk, though we might assume that the effect of pure expansion of the firm on bankruptcy costs would not be very important. If the expansion per se does not affect bankruptcy costs, then the distortion created by the tax structure is measured by the deviation of the first term from r_z. Simple algebra implies that this deviation equals: $\frac{\tau-(1-\alpha_b)}{1-\tau}(r_z - \gamma r)$. The equivalent distortion in Harberger (1962) is $\frac{\tau}{1-\tau} r_z$. The distortion here is less than a third as large.[49]

Our results differ from those in Harberger (1962) because we explicitly allow for debt finance as an alternative to equity finance, and take into account the effects of the personal income tax. As Stiglitz (1973) noted, when a marginal investment is financed by debt, there is essentially no corporate tax paid, so no distortion.[50] Here, with γ percent financed by debt, the distortion is cut by γ percent. As Miller (1977) noted, the heavier personal tax on debt than on equity may offset the effect of the corporate income tax, leaving equity as attractive as debt on tax considerations, so implying no net distortion to

---

[48] Mayshar (1977) derives the appropriate Pigouvian subsidy for the case when this assumption is not valid.

[49] For example, for $\tau = .48$, $\gamma = .3$, $r_z = .063$ and $r = .08$, and $\alpha_b = .75$, the distortion as measured here is .017 in contrast to a distortion of .058 in Harberger.

[50] If $r = r_z$ in the formula, this claim follows precisely. However, since τ percent of the risk is absorbed in corporate tax revenues while only α_b of the risk premium to bondholders, the treatment under debt is slightly even more favorable.

investment. Here the tax rate on debt is implicitly $(1-\alpha_b)$ compared with the tax rate τ on equity, and need not be equal. The tax disadvantage to equity now depends only on the difference between these two rates. The total distortion is smaller because of a compounding of these two effects.

We will examine the excess burden costs implied by this distortion in section III. It is apparent, however, that these results imply a much smaller distortion in investment and savings decisions created by the corporate tax than those found in many earlier papers.

II. Debt-Equity Ratios in Practice

We have described the theoretical considerations influencing debt ratios in the economy. Tax implications suggest that high debt ratios will be favored while the possibility of costly bankruptcy pushes in the opposite direction. In this section, we look at the facts both to gain some understanding of the development of actual debt ratios in the economy and to examine their consistency with the theory. The first task is to develop a time series of debt-equity (or debt to total capital) ratios for nonfinancial corporations.

A. Construction of a Time Series of Debt Ratios

The construction of a time series of debt to total capital ratios at book value was relatively straightforward. The total sample of companies chosen was the 2,000 companies available on the Standard & Poor's Compustat tapes. Only nonfinancial corporations were included in our time series, however. Debt consisted of the sum of long term debt plus short term debt reported in current liabilities. Equity consisted of the sum of the common stock and surplus accounts. In addition, the book value of preferred stock was treated as equity. The debt ratios in the table are the ratios $D_B/(D_B+E_B)$. It should be noted that not all of the companies on the Standard & Poor's tape had data available for all years. Hence, the ratios shown in the table are not for the same number of companies in all years.

The market value calculations presented much more of a problem. It is simple enough to construct a series for common equity at market value. The year's closing price for each company can simply be multiplied by the number of shares outstanding to arrive at the market value of equity. Serious estimation problems, however, arose in attempting to arrive at a market value for debt and preferred stocks since market prices of preferred and debt instruments are not available on the Compustat tapes. Fortunately, an unpublished study by von Furstenberg, Malkiel and Watson (1980), sponsored by the American Council of Life Insurance (ACLI), was available from which market values

could be estimated. In the ACLI study a market value to book-value ratio was estimated for each two-digit industry in each year by means of a sampling of actual bond prices for companies in each industry from the year-end editions of Moody's Bond Survey. We converted from book to market values by multiplying the book value figures by the appropriate year's MV/BV ratio estimated in the ACLI study for the two-digit industry to which the company belonged. Since the MV/BV ratios were estimated from a sample of actual market prices, we believe that this technique gives us a close approximation to the true market value of debt.

Similar techniques were used to estimate the value of preferred stock. The ACLI study had estimated an average preferred dividend yield by industry in each year. These estimates were also arrived at by sampling actual price quotations each year. We then estimate the value of the preferred stock for each of the companies in our sample by multiplying that company's preferred dividends as recorded on the Compustat tape by the reciprocal of that year's dividend yield for the industry to which the company belonged as estimated in the ACLI study. The resulting debt to total capitalization ratios at market were estimated as $D_M/(D_M+E_M)$. The book and market value estimates are shown in columns 1 and 2 of Table 1.

We have already noted that the data in columns 1 and 2 are not based on the same numbers of observations. This could produce seriously misleading estimates of the change in debt ratios over time. For example, data may have become available for an increasing number of high debt firms over time leading to an

upward bias in the time trend of recorded debt ratios. In an attempt to deal with this problem, columns 3 and 4 present adjusted debt ratios.

In performing the adjusted calculations we took as a base year the period for which the maximum number of companies with both debt and equity measures were available. Then we looked at each pair of consecutive years to find the maximum number of firms for which all data were available in both years. For this common set of firms, we calculated the aggregate change (growth) in debt and total capitalization. This calculation was repeated for each consecutive set of years. Using the base year for the level and the pairwise series of growth rates to record changes in that level, we obtained the adjusted measures of aggregate debt and total capitalization. From these we obtained the debt to total capitalization ratios in columns 3 and 4. They embody the changes in debt-equity ratios for the largest common set of firms available in each pair of years. The adjusted series provides a better estimate of changes in debt-equity ratios in that in comparing debt-equity ratios across time, it assumes merely a common rate of change in debt and total capitalization across firms at any date, rather than a common value of debt-equity ratios across firms. It will be noted that these columns reveal a somewhat smaller increase in debt-equity ratios than are shown in the first two columns.

A further adjustment was made in column five. Since 1973, the Compustat tapes include data on the present value of non-capitalized

TABLE 1

Debt Ratios Over Time

	$D_B/(D_B+E_B)$ Unadjusted	$D_M/(D_M+E_M)$ Unadjusted	$D_B/(D_B+E_B)$ Adjusted to Common No. of Firms	$D_M/(D_M+E_M)$ Adjusted to Common No. of Firms	$D_B/(D_B+E_B)$ Adjusted to Common No. of Firms and Includes Leases and Pensions After 1973	$D_B/\Sigma A_{RC}$	$D_M/\Sigma A_{RC}$
1957	0.219	0.158	0.241	0.212			
1958	0.218	0.123	0.243	0.171		.203	.187
1959	0.213	0.112	0.237	0.156		.209	.197
1960	0.225	0.124	0.242	0.168		.208	.193
1961	0.230	0.116	0.244	0.158		.219	.205
1962	0.234	0.173	0.249	0.180		.229	.214
1963	0.234	0.160	0.246	0.165		.237	.225
1964	0.239	0.158	0.247	0.157		.245	.233
1965	0.258	0.157	0.262	0.159		.248	.236
1966	0.286	0.191	0.288	0.192		.256	.244
1967	0.310	0.181	0.311	0.181		.267	.247
1968	0.328	0.179	0.330	0.179		.279	.248
1969	0.348	0.213	0.349	0.213		.279	.231
1970	0.370	0.228	0.372	0.224		.286	.233
1971	0.367	0.234	0.369	0.234		.291	.225
1972	0.367	0.227	0.367	0.226		.300	.235
1973	0.367	0.280	0.367	0.279	0.497	.302	.249
1974	0.381	0.363	0.381	0.362	0.511	.307	.267
1975	0.375	0.316	0.374	0.316	0.499	.306	.260
1976	0.362	0.293	0.362	0.293	0.485	.300	.248
1977	0.358	0.321	0.358	0.321	0.473	.286	.258
1978	0.350	0.313	0.358	0.325	0.462	.293	.270
						.295	.255

leases and unfunded pensions which, in effect, represent debt not included in the balance sheet. Column five presents debt to total capitalization ratios adjusted not only for a common set of companies but also to include noncapitalized leases and unfunded pension liabilities as debt from 1973 on. Thus, at least from 1973 through 1978, it is possible to judge if accounting for lease financing and pensions would materially change any observations that could be made on the unadjusted figures.

The sixth and seventh columns of the table present a somewhat different series of debt ratios. Here we measured corporate debt as a percentage of the replacement cost of corporate assets. These columns differ from the first columns in several respects. First, the company coverage is more inclusive in that all non-financial corporations are included, not simply those included in the Compustat tapes. Secondly, the debt measure is slightly different from the earlier one in that all short and long term interest bearing liabilities are included less interest bearing liquid assets. These data were estimated from the flow of funds accounts (by George M. von Furstenberg (1977)). Finally, the debt ratio is figured not against the total value of debt and equity but rather against the replacement cost of assets including net fixed capital stock, land, and inventories. The latter figures were obtained from the U.S. Bureau of Economic Analysis and were also included in the von Furstenberg (1977) study. Finally, the debt at market value measure was obtained by a somewhat more crude adjustment than that done in the first columns. The adjustment was accomplished by assuming an average maturity of corporate liabilities and imputing a capital change from recorded changes in market interest rates.

B. Consistency of the Data with the Theory

The table shows a fairly consistent pattern, irrespective of the method by which the debt ratios were measured. Debt ratios rise over the period until the early 1970s and then stabilize or fall. The market value series tends to rise somewhat less than the book value series until 1973. In 1974, however, the debt to market value ratio rises sharply because of the collapse in the equity market. While some of the sharp rise in market debt ratios was reversed as equity markets recovered during the late 1970s, it is still the case that aggregate debt ratios at market were almost double their 1957 level in 1978. We find in columns 3 and 4, however, that when the series are adjusted to a common number of firms, the rise in debt ratios is slightly smaller. Columns 6 and 7 show an even smaller increase in debt burden. This is so because debt is compared with the replacement value of corporate assets, which rose sharply with the high inflation rates of the 1970s. In all the series, however, there is evidence that the rise in debt-equity ratios is arrested by 1974 and tends to stabilize or fall slightly in the later years.

The calculations in column 5 deserve special note. Here the data are adjusted for leases and pensions after 1973. It will be noted that the fall in debt ratios since 1974 is much sharper in this lease-and pension- adjusted series than in the other book value series in columns 1 and 3. Apparently, lease financing became far less desirable in the late 1970s following a ruling of the Financial Accounting Standards Board changing the reporting requirements for

leases. Thus, firms tended to cut back leases more sharply than ordinary debt. This conjecture is confirmed by examining the behavior of the subset of Compustat companies reporting leases. From 1974 to 1978 there was little change in the (D_B/D_B+E_B) ratio not including leases and pensions. The 1974 ratio was .393 while the 1978 ratio was .384. When leases and pensions are included however the ratio falls sharply from .511 in 1974 to .462 in 1978. The major cause of the decline was the behavior of the lease accounts. In other words, the major factor causing a decline in the lease- and pension-adjusted debt ratios was a cutback in lease financing rather than retirement of straight debt. These calculations suggest that there was a sharper cutback in debt than is revealed by the reported figures which do not include lease financing.

These data are consistent with the predictions of the theory when we allow for taxes, uncertainty, and costly bankruptcy. The gradual increase in debt ratio over the early period can reasonably be explained as follows:

During the post-war period, corporate income taxes were set at levels considerably higher than those of the 1930's and were generally expected to remain at these higher levels. Moreover, during the 1950's and into the 1960's, it became more and more generally accepted that deep depressions such as occurred in the 1930's were highly unlikely. Indeed, by the mid-1960's financial analysts probably became overconfident about the general stability of the United States economy and about our ability to "fine tune" away even mild recessions. In short, during the post-war period, analysts came to believe both that the economy had become more stable and that corporate taxes would remain at higher levels.

The theory developed above suggests that on both counts the debt-equity ratios should increase. Higher corporate taxes (relative to the prewar period) /increase the tax advantages of debt financing. An increasing recognition that the economy had become more stable suggests that the probability of bankruptcy involved in a given amount of debt is lower and thus that expected bankruptcy costs/have declined. Thus, for both reasons we would expect debt-equity ratios to increase over the period, as indeed they did, according to the table.

The cutback in debt-total capitalization ratios following the 1973-74 shocks to the economy also seems consistent with the theory. Certainly few people believed in the 1960's that the economy would suffer a 9 percent unemployment rate or that the inflation rate would be measured in double digits. Fewer still believed that both events could exist simultaneously. The sharpness of the 1974-75 recession made it clear that the economy was not as stable as had formerly been believed. Moreover, the higher inflation rates of the 1970's further increased risk perceptions. High levels of inflation are associated with greater variance in the rate of inflation and with a greater dispersion of relative prices as has been shown by Vining and Elwertowski (1977). On both counts one would expect that a given debt-equity ratio would carry an increased probability of bankruptcy. Hence it is possible that the debt-equity ratios existing in 1973-74 were considered higher than optimal for the more unstable economic environment. Certainly such a story is consistent with the data showing some pull back in debt ratios during recent years.

Our conjectures concerning changes in expectations about the stability of the economy are consistent with data on actual default rates for corporate bonds. The table below presents default data from 1900 through 1977. The default rates listed are percentages of the par values of bonds not in default at the beginning of a given year that went into default during the year.

AVERAGE ANNUAL DEFAULT RATES FOR CORPORATE BONDS, 1900-77 (percent)

DATE	RATE
1900-09	0.9
1910-19	2.0
1920-29	1.0
1930-39	3.2
1940-49	0.4
1950-59	0.04
1960-69	0.03
1970-77	0.21

Source: T.R. Atkinson, Trends in Corporate Bond Quality, 1966 for data through 1965, Smith Barney, Harris Upham & Co., "Trends in Corporate Bond Quality," 1966-1977, for subsequent data.

The experience of the 1950s and 1960s demonstrated that default rates fell considerably below those recorded early in the century. During the 1970s, however,

default rates did rise suggesting more instability than was experienced during the 20 preceding years, although default rates remained considerably below those of the earlier years.

C. A Cross-Sectional Examination of Debt Ratios

We have explained changes in debt ratios over time in terms of the tax advantage of debt financing pushing debt ratios up and the risk of bankruptcy and its associated costs restraining leverage. It is interesting to ask whether the risk explanation is consistent with the cross-sectional pattern of debt ratios observed in the market. Our theory suggests that individual companies with the greatest inherent risk of bankruptcy ought to have the lowest debt ratios. In our empirical work, we hypothesized that the companies with the largest instability of cash flow will be the ones most likely to experience liquidity problems and thus to face an inability to meet debt service requirements, at any given debt-equity ratio.

The specific hypothesis tested was $D_{i,t}/(D_{i,t}+E_{i,t}) = f(\sigma^2_{CF,t-(t-X)}/(\bar{D}+\bar{E})_{t-(t-x)})$, $f' < 0$, where σ^2_{CF} is the variance of cash flow measured over the period from t back to t-x and $(\bar{D}+\bar{E})$ is the average value of the firm over the period during which the variance was measured. The sample consisted of all nonfinancial corporations on the Standard & Poor's Compustat tape. Cash flow was defined as earnings available for common equity plus interest plus depreciation and other noncash charges. The variance of cash flow was measured by taking the standard error of the estimate from an equation $CF_i = a_i + b_i t$, fit to either ten or fifteen years of data. Division by the average value of the firm was performed so as to normalize the instability measure. Debt ratios were calculated at both book and market.

The table below gives some representative results. In general, debt ratios are negatively related to the variance of cash flow.[50a] The table indicates that firms with greater instability of cash flow do have lower debt to total capitalization ratios. The (book value) equations suggest a range of variation in D/V ratios of about .05 for deviations of σ^2/V plus or minus one standard deviation from its mean. The relationship was a bit stronger in the ten years to 1977 than in the ten years to 1972. The relationship is also stronger when debt ratios are measured at book rather than at market values. While the small "t" values and low correlations indicates that our proxy for default risk is undoubtedly inadequate, the results are at least consistent with the theory developed above.

Time Period	Coefficient of $\sigma^2_{CF}/(\bar{D}+\bar{E})$ (and T value)	Debt Ratio Measure	No. of Observations	Correlation Coefficients
15 years to 1977	- 0.97 (-3.66)	Book Value	1501	.09
15 years to 1977	- 0.43 (-2.00)	Market Value	1730	.05
10 years to 1977	- 2.24 (-5.10)	Book Value	1096	.15
10 years to 1972	- 1.02 (-3.91)	Book Value	1069	.12

[50a] We realize that the variance of cash flow is measured with error, resulting in a bias towards zero in its coefficient. Our concern here is to confirm the direction of the relationship rather than to measure precisely the size of the effect.

III. Measurement of Efficiency and Equity Implications of the Existing Tax Structure

In Part I, we described how the tax structure causes both firms and investors to alter their behavior in various ways. However, when we consider various tax reform proposals in Part IV, we will want to know the order of magnitude of the efficiency costs when individuals change their behavior in response to taxes. In particular, we will want to know how sensitive the size of the excess burden is to various tax parameters. In this part, we will attempt to estimate the costs resulting from the distortions affecting debt-equity, investment, dividend payout, and individual portfolio decisions. We will not, however, examine the costs of distortions affecting savings decisions, viewing these as beyond the scope of this paper.

In the final section of Part III, we explore briefly how various tax parameters affect the degree to which the tax system is equitable, as defined by either a comprehensive income tax or by an expenditure tax. While these considerations are not quantified, requiring too many arbitrary assumptions, they are certainly as important when evaluating tax reform proposals.

A. The Costs of Bankruptcy

1. Direct Measures of Bankruptcy Cost

It is not surprising that reliable economic studies estimating the costs of bankruptcy do not exist. The main problem is that data are generally not available. The Securities

and Exchange Commission does not keep track of total bankruptcy costs in any way that is generally accessible. Some private lenders have records that show some, but not all, the costs of a limited number of bankruptcies with which they have been associated. Even if full data were available, however, there are several conceptual difficulties in deciding what costs ought to be included. For example, should the costs of a consultant who was called in to liquidate a number of stores in the bankruptcy of one supermarket chain be included as an administrative cost? This consultant may have added sufficiently to the liquidation value of the stores so that his net value added was positive rather than negative.

a) Estimating the Costs of Bankruptcy

In the hopes of shedding at least some light on the issue of bankruptcy costs, we have examined four recent bankruptcies in exhaustive detail. The data were collected from the Securities and Exchange Commission (SEC) and from the files of two large institutional lenders. In those files we could obtain the legal and administrative costs of the two institutional lenders as well as the costs of other institutional lenders in cases where a consortium of institutions joined together in pursuing settlement negotiations. We will refer to the costs of the i'th private lender as C_{pi}. In addition, certain general legal and administrative costs (C_G), such as trustees fees and fees of outside legal counsel, were available in the files of the private lenders or the SEC. However, costs incurred by other private

lenders were in general not available. We therefore assume that the identifiable costs incurred by these two lenders (both the C_{pi} and their share of the C_G) as a percent of their holdings, L_{pi}, of the firm's liabilities equal the total legal and administrative costs, C_T, as a percent of the firm's total liabilities, L_T, so that:

$$\frac{C_T}{L_T} = \frac{\sum_i C_{pi} + \frac{\Sigma L_{pi}}{L_T} C_G}{\sum_i L_{pi}}$$

Table 2 below shows these cost estimates as a percentage of total liabilities.

Table 2

Estimates of Bankruptcy Costs

Business	Dates	Type	Pre-petition Liabilities	Estimated Identifiable Legal and Administrative Costs as a Percentage of Liabilities
Manufacturer of Steel Products	June 77-*	ChXI	$184,000,000	2.48%
Manufacturer of Ice Cream and Furniture	June 70-Aug. 78	ChX	43,000,000	8.90%
Manufacturer of Phototypesetting Equipment	Nov. 74-*	ChXI	32,800,000	2.65%
Discount Department Stores Operator	Nov. 73-May 75	ChXI	90,800,000	6.25%

*Not yet complete

For a number of reasons the cost estimates in the above table are biased downward. First, the cost data are incomplete. Not every disbursement is included and in some cases continuing litigation is involved and substantial additional legal fees are anticipated. Moreover, the time and expenses of the private lenders' internal legal and financial staff is not included in the estimates. In many cases the properly imputed costs of the internal staff far exceeds the cost of outside expert counsel. Finally, the pre-petition liabilities significantly overstate the true worth of the companies. Assuming the value of the settlements are only about one-third the value of pre-petition liabilities (a reasonable assumption in these cases), the estimates of percentage costs would be three times that shown in the table.

It is interesting to note the circumstances involved in the bankruptcy case showing the highest cost percentage in the table. It illustrates that firms in bankruptcy often do not opt for an early liquidation even when it is in the best interest of the bondholders to do so. In this case, the private lenders believed it was in their interest to liquidate the firm immediately in order to maximize the recovery for the holders of the senior securities. The trustee refused to formulate a plan of reorganization until certain litigation against the company was resolved. This took three years and resulted in a $2 million liability. About two years later, the Trustee filed a plan that was rejected by the creditors. At the end of almost seven years, an acceptable plan was finally

approved. As a result, legal fees ate up a substantial share of the value of the assets that were available at the time the firm went into bankruptcy. One might speculate whether there was any significance in the fact that the Trustee was a man in his 60's who was receiving $100,000 a year in trustee fees, the highest salary he had ever received.

A detailed examination of these cases reveals that the legal and administrative costs may have been only a small fraction of the total costs involved. Examination of the individual cases showed that in some cases the bankrupt firm was unable to obtain trade credit and found its normal sources of supplies of inventories shut off. Moreover, these cases reveal that the companies themselves were often judged to be unreliable suppliers with an attendant unfavorable effect on sales. Moreover, the onset of financial difficulty often led to a loss of key personnel who preferred to work for a company whose long term outlook seemed more secure. Finally, in the cases in the table involving retail establishments, there was a tendency for assets to shrink drastically during the period of financial distress.

The case of the operator of discount department stores illustrates the typical pattern when discount chains go into bankruptcy. First, charge account customers stop paying their bills impairing the quality of the receivables. Second, employees walk off with the merchandise on the shelves.

Third, the chain typically finds it impossible to obtain trade credit, which severely impairs its ability to finance its inventories. The very fact of bankruptcy can thus cause a dramatic change in the stream of income and cash flow available for the firm. Finally, a review of these cases revealed that the management of firms in or near bankruptcy generally found it almost impossible to devote its time and energy to business matters.

We therefore conclude that while the identifiable legal and administrative costs for a bankruptcy seem to be less than ten percent of the par value of a firm's liabilities, this estimate is often much too low. First, the firm is often worth much less than its par value. In addition, omitted internal legal costs and the disruptions in operation of a firm facing bankruptcy can easily be very large. It would be very difficult to measure these other costs directly, however.

There is another important aspect to bankruptcy proceedings that bears on the cost issue. Court reorganizations, in contrast to liquidations, often involve in addition a substantial transfer of claims from senior bondholders to subordinated bondholders and equity holders. Reasons offered for this court bias are, for example, that the equity holders (and the trade creditors) and the trustees are usually local people, while the senior debt holders are not from the local community. Moreover, management typically owns substantial amounts of the equity and the courts often decide that it is necessary to give management a continuing stake in the company after reorganization

so as to give them an incentive to perform well. An additional reason for bias may be that the courts often feel the lender can afford to sustain some of the loss in order to permit the debtor to survive.

While we could not estimate independently the magnitude of this transfer, we were able to assemble conclusive evidence that such a transfer does in fact exist in court ordered reorganizations in bankruptcy proceedings. We were able to find a sample of recent bankruptcies where the estimated value of the securities distributed to the senior debtholders was substantially less than the total claim of those senior bondholders. Strict applications of "me first" rules would imply that, in such a case, the senior debtholders should receive everything of value the corporation is able to distribute. The following table shows that in fact subordinated debtholders received substantial settlements even though the senior debtholders were not paid in full. Moreover, since the equity holders received whatever equity was not distributed to the bondholders, it is clear that even the equity owners received some recovery.

of Claim Received Notes	% of Claim Received in Equity	% of Equity in Post Plan Company	Interest Allowed	Rate	Completion of Payment Per Plan	Value of Securities Paid to Senior Bondholders if Riskless
00%	0%	0%	No	8%	1984	95%
0%	60%	51% (Voting)	No	N.A.	N.A.	
0%	0%	0%	Yes	N.A.	1978	80%
0%	0%	0%	Yes	N.A.	1978	
65%	0%	0%	No	9% *	2025	68%
100%	0%	0%	Yes	4% *	1990	
76%	13%	15%	Yes	8%	1999	N.A.
21%	79%	53%	Yes	8%	1999	
0%	76%	39%	Yes	N.A.	N.A.	N.A.
0%	32%	23%	Yes	N.A.	N.A.	
40%	0%	0%	Yes	8%	1985	97%
0%	100%	27.5% (Voting)	Yes	N.A.	N.A.	

While the table does not show the estimated market value of the securities received by the senior bondholders, we do have prima facie evidence that the senior bondholders did receive far less than the nominal amount of their claim. The table does show the interest rate received by the senior bondholders and, in some cases, the date when interest payments are to commence. Even if we assume that the securities received were of the highest quality and discount the interest payments to be received at the AA for newly issued securities, long term corporate bond rate/ we find that the senior bondholders in fact have received far less in present value than they were due. The last column in the table does precisely that calculation for the cases in which the senior bondholder received debt securities in settlement of their claims. It will be noted that even under the polar assumption that the securities received were riskless, it is clear the senior bondholders did not receive full payment. Since the securities received were in fact risky the argument holds a fortiorti.

The United Merchants case, for example, represents a clear departure from the "me first" axiom. The senior debt-holders received 35 percent of its claim in cash and 65 percent in notes. The subordinated debtholders received no immediate cash but were paid 100 percent of their claim in debt securities. The terms of the debt securities received by the holders of subordinated debt were substantially more favorable than those delivered to the senior debtholders. The subordinated debtholders received their original interest rate and were entitled to full amortization by 1990, while the notes delivered to the senior lenders accrued no interest

until July 1, 1985 and did not finally mature until 2025. In addition, the restructured subordinated debt was elevated to rank pari passu with the restructured privately held senior debt in the event of a subsequent bankruptcy proceeding.

These cases illustrate that in most instances subordinated debt has enjoyed subsequent recoveries even though the senior debt was not paid in full. One might wonder why the senior debtholders would agree to such reorganizations where their recoveries were far less than complete. A major consideration is uncertainties regarding the timing and settlement of a future plan. For example, in the United Merchants' case a majority of the senior lenders felt that, as unsatisfactory as the plan in the table was, it was preferable to the unknown terms and timing of a plan that might be arrived at by independent trustee under Chapter 10 of the Bankruptcy Act. Particularly, since the settlement would involve immediate payment of 35 percent in cash, the senior debtholders feared they could do even worse later. Another reason for acceptance of "uncertainty" settlements is the acceptance of a compromise plan of reorganization to resolve a highly complex litigation which, if prosecuted, might have taken many years to resolve and would have impaired the business operations and growth prospects of the company. This was the situation in the Equity Funding case.

In sum, senior lenders have been persuaded to "give up" recoveries to subordinated lenders primarily because of the combined effects of the high administration expenses of extremely long bankruptcies, concern about the delay, expense and

potential adverse results of litigated resolution of disputes over the relative entitlements of holders of senior and subordinated debt, the benefits of "cash now" in a "quick compromise plan" as compared with more speculative recoveries from litigation of "unknown cash x years from now," and a desire in some cases to avoid other risks perceived to exist in long Chapter X cases. Finally, it should be noted that the legal foundations for subordination has in recent cases been perceived to be sufficiently cloudy that senior lenders have approved substantial concessions rather than attempt to establish the full benefits of senior debt status through litigation.

Since the priority of senior bondholders' claims on the firm are more systematically recognized in a liquidation than in a reorganization, they also have an incentive to push for liquidation, even when this is not efficient.[51] Compounding this tendency is the fact that senior bondholders are due the par value of their bonds in liquidation even if the market value of the bonds is much smaller due to a general rise in interest rates since the bonds were issued. In contrast, other security holders would often have an incentive to avoid liquidation even when economic efficiency would call for it.

---

[51] In principle, each security holder ought to receive in a reorganization at least what he would have received in a liquidation. However, the courts seem systematically to underestimate the liquidation value of a firm.

Thus in addition to the direct costs of bankruptcy mentioned previously, there are two further costs. First, since the ownership share in the reorganized firm is very uncertain, there are large financial risks for each security holder in a bankruptcy proceeding. In addition, the choice concerning whether to liquidate or reorganization, and in fact investment decisions more generally, will often be made inefficiently because the sizes of the transfers among security holders can be affected by their decisions.

b) The costs of reorganizations

Because of the legal and administrative costs involved with bankruptcy, firms and their lenders do prefer informal reorganizations so as to keep the company out of the courts and to avoid the heavy costs of bankruptcy itself. Indeed, the reluctance of private lenders to force bankruptcy implies a substantial dead weight loss from the bankruptcy proceeding. The rule of thumb used by one major institutional lender is "We'll be happy to give up 20 percent of what we should get on our bonds in order to keep the company out of the courts, in which case we might lose 30 percent or more." This 30 percent estimate is made up of 10 percent in administrative and legal fees and 20 percent via transfers from the bond holders to the equity holders.

Court practices with respect to reorganizations during bankruptcy thus influence informal reorganizations. In informal as well as formal reorganizations there is typically a substantial "give-up" from the senior bondholders to subordinated bondholders and equity owners. Sometimes, reorganizations can be arranged with little cost other than the aforementioned "give-up" by the

bondholders. This could happen if all parties will agree to a settlement. In many cases, however, it is not possible to arrange a relatively costless and simple reorganization because it is not possible to get the different securities holders with different claims and interest to agree, given the legal ambiguity in the relative priorities of their claims. These disagreements can often lead to protracted negotiations and even to litigation involving heavy legal fees.

Thus in a reorganization, the security holders collectively face potentially heavy legal bills, and in addition each faces much uncertainty (costly in itself) concerning the size of his ownership share in the reorganized firm. Thus, reorganizations and bankruptcies are often quite similar--the principal cost in both cases is the time and effort spent in negotiating a "work out." Moreover, in many cases it is impossible to arrange an informal reorganization because it is not possible to identify the public bond holders and to find anyone who speaks for them.

Even when a reorganization is easily effected without a bankruptcy proceeding, substantial legal costs may still later be incurred. A case in point is one concerning a manufacturer of men's clothing. This company's banks and major institutional lender entered into an intercreditors' agreement in 1977 that reorganized the various creditors' claims and provided for additional bank financing. Bankruptcy was not involved. The group is now being sued for allegedly controlling the company's board of directors and operating the company in a manner deleterious to the interests

of the company's shareowners. The suit claims damages almost three times as large as the total liabilities and capital of the company at the time the intercreditors' groups was formed. Thus far, the total legal expenses incurred and committed by the major institutional lender amount to close to 10 percent of the total loan of that lender. It is clear that even if the intercreditors' group is successful in the litigation, the legal costs will amount to a substantial percentage of whatever is ultimately recovered on the investment.

In summary, reorganizations are typically less costly than bankruptcy and, if the parties agree, the reorganizations can be carried out with minimal transactions cost. However, the terms of the settlement typically involve the bondholders giving up/a significant percentage of the face value of the bonds to obtain the agreement of the management and equity holders. Moreover, when disagreements arise as to the work out of the settlement, reorganization may be as costly as bankruptcy proceedings. Finally, with different classes of public bondholders, it is often impossible to carry out an informal reorganization. Sometimes bondholders will have a preference for bankruptcy over reorganization despite the former's additional costs because the firm in financial distress may find that it can obtain additional financing only by going through a formal bankruptcy procedure. The reason is that the only way a new lender can get a priority lien is by lending to the bankrupt estate. The creditors of a bankrupt estate do get paid first and this priority arrangement cannot be made in an informal reorganization.

It appears then that by increasing the likelihood of financial distress, a highly levered capital structure imposes the possibility of large and unpredictably variable costs on the firm and its security owners. Moreover, a highly levered capital structure imposes considerable extra monitoring costs on the part of lenders. These considerations may help explain the current practice of bondholders to set fairly stringent debt limits. Thus, in many cases, even if the firm was willing to increase its leverage ratio, it would be unable to do so either because of covenants imposed by current bondholders or by the unwillingness of prospective bondholders to lend to the company.

2. Indirect measure of bankruptcy cost

Detailed examination of the experiences of firms while in bankruptcy, as done above, provides information about certain types of bankruptcy costs. However, not all efficiency costs created by a high debt-equity ratio occur during formal bankruptcy. Firms in financial distress experience a variety of impediments that hinder their business activity and affect the stream of operating earnings. These include difficulties in purchasing inventory, selling products and retaining key employees. Even before any signs of financial distress occur, however, the firm may find its flexibility limited. For example, a firm that has borrowed up to the limits imposed by its lenders could be forced to pass up a profitable investment opportunity because of an inability to obtain timely financing. This is so because equity financing generally involves long delays since registration is

normally required by the Securities and Exchange Commission. In addition, when a firm's debt-equity ratio is high, the managers, acting in the interests of shareholders, face distorted investment incentives because of the opportunity to pass on possible losses to debt holders, to the degree that the covenants in the debt contract do not explicitly prevent such behavior. (Shareholders themselves pay this efficiency cost, to the extent that bondholders anticipate such behavior and charge an appropriate interest rate.) Substantial costs can then arise even if the firm never experiences a liquidity crisis. There is little possibility of measuring such costs directly.

However, we can approximate indirectly the total efficiency costs through use of the first order conditions for an optimal debt-equity ratio. In Section II, B.3, we showed that a firm, when considering marginal debt vs. equity finance, will compare $(1-p)r(1-\tau) + \alpha pr(1-\tau) - \alpha r_f$ with $\alpha_b r - \alpha r_f - c(D/E)$, where $c(D/E)$, the extra costs (measured as a flow) arising from having a dollar more debt instead of equity, captures all considerations other than tax effects, which enter into the debt-equity decision.[52] As such, $c(D/E)$ includes efficiency costs beyond those occurring during a formal bankruptcy.

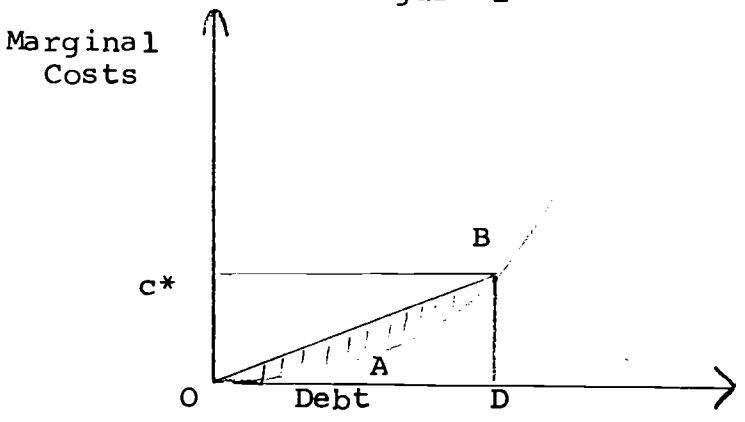
---

[52] However, costs incurred by existing bondholders, since ignored in the marginal debt-equity decision, are also omitted from $c(D/E)$. To this extent, our estimate of marginal efficiency costs will be too low. Our estimate will also be too low to the extent that other social costs of bankruptcy (disruption in trade or employment) are not passed on to equity holders through appropriately higher prices.

When the debt-equity ratio is in equilibrium, these two expressions will be equal, implying $c(D/E) = r(\tau-(1-\alpha_b) + (1-\alpha)(1-\tau)p)$. If we can measure the right hand side of this equation (let us denote it by c*), then we can infer the marginal efficiency cost at equilibrium of a dollar shift between debt and equity.

Though the marginal efficiency cost at a point is not sufficient to measure the total cost, we can still derive a rough approximation to the total cost. To begin with, we presume that $c(0) \approx 0$--the marginal efficiency costs of adding the first dollar of debt would be very small. In addition, we presume that $\frac{\partial c(D/E)}{\partial D} > 0$. Given these assumptions, the value of $c(D/E)$ as D increases (with offsetting changes in E), appears as curve OAB in Figure 1. The area OABD then describes the total efficiency costs created by a levered financial structure with debt = D. Let us approximate the area OABD by a triangle, so that its area is

Figure 1



$\frac{1}{2}c^*D$. One would normally expect the curve OAB to be convex, since for relatively unlevered capital structures the firm runs little risk of bankruptcy. Thus, this approximation will undoubtedly be biased upwards by the shaded area in Figure 1.

In order to get an idea of the quantitative importance of the efficiency costs, we need values for c^* and D. In measuring c^*, let us assume that $\alpha = 1$ (a figure consistent with our theory basically consistent with the estimates in Gordon and Bradford (1979)). We have no similar estimate of α_b. However, in appendix A, we find that the interest rate on tax free bonds is only 75% of that on taxable bonds with comparable risk. This implies that α_b ought to be around .75.[53] If we then assume the corporate borrowing rate to be 6.3% (the commercial paper rate in 1975),[54] then $c^* = .014$. Given von Furstenberg's (1977) estimate for corporate debt of 440 billion dollars in 1975, our estimate of $\frac{1}{2}c^*D$ is then 3.2 billion dollars. This represents the annual efficiency costs arising from the existence of risky debt.

In Part V, we will want to forecast how this efficiency cost will vary if particular tax rates are changed. Our assumption that $\alpha = 1$, while supported by the estimates in Gordon and Bradford (1979) under existing tax rates, is also implied by an internal optimum for the dividend payout rates as shown in Section II.C. We therefore assume it will continue to hold. If we then continue to assume a triangular approximation to area OAD, then our

---

[53] If the risk is the same on these bonds, then the risk premium ought to be the same. If $\alpha_b r_b$ represents the expected return on taxable bonds and $\alpha_f r_f$ represents the expected return on tax free bonds with comparable risk (each as valued relative to the equivalent amount of capital gains), then it must be that $\alpha_b r_b = \alpha_f r_f$. Since $r_f \simeq .75\, r_b$, we find that $\alpha_b \simeq .75\, \alpha_f$. However, it is reasonable to suppose that $\alpha_f \simeq 1.$, since α_f represents the value in the market of tax free interest relative to a dollar of capital gains, and capital gains are at worst relatively lightly taxed. It follows that $\alpha_b \approx .75$.

[54] In section I.D on inflation, we found that this use of the nominal interest rate is appropriate when measuring the size of the tax distortion favoring debt finance.

measure of the efficiency cost is proportional to the square of $r(\tau-(1-\alpha_b))$. If r is not much affected by τ or α_b, as would be the case with the free flow of capital across international financial markets, then efficiency costs are proportional to $(\tau-(1-\alpha_b))^2$.

Let us reemphasize that this estimate of the annual efficiency costs is very rough. Due to the triangular approximation in Figure 1, our figure probably overestimates the area OABD. In addition, however, area OABD represents only the costs born by the coalition of equity holders and the junior bond holders. True social costs of bankruptcy, and the moral hazard costs associated with risky debt, may well be quite a bit larger than this area OABD. Finally, the parameter estimates for α and α_b used in constructing our estimate of bankruptcy costs, are imprecise.

Whatever the precision of our estimate, however, we find that direct legal and administrative costs of bankruptcy seem to be a small fraction of the total efficiency costs of risky debt. In 1975, for example, the total liabilities of bankrupt firms were 4.4 billion dollars. For any plausible fraction of this total that is lost through bankruptcy costs, which we estimate to be no larger than 10% in the previous section, these direct costs are very small relative to our estimates of the total efficiency costs. Our indirect estimate ought to be much larger, though, since it includes many costs of risky debt described earlier in addition to legal expenses in bankruptcy. For example, firms that never quite go bankrupt may spend resources to avoid bankruptcy. Also, investment incentives are inefficient when debt is risky. We have no direct evidence on these costs to compare with the indirect estimates presented here.

For purposes of comparison, our estimates of the total costs are under half a percent of GNP in 1975, so they are small in an aggregate sense. However, corporate tax revenues in 1975 were only 40.6 billion dollars, so the excess burden costs could be on the order of 10% of corporate revenues. We explore below how sensitive our estimates are to changes in the various tax parameters.

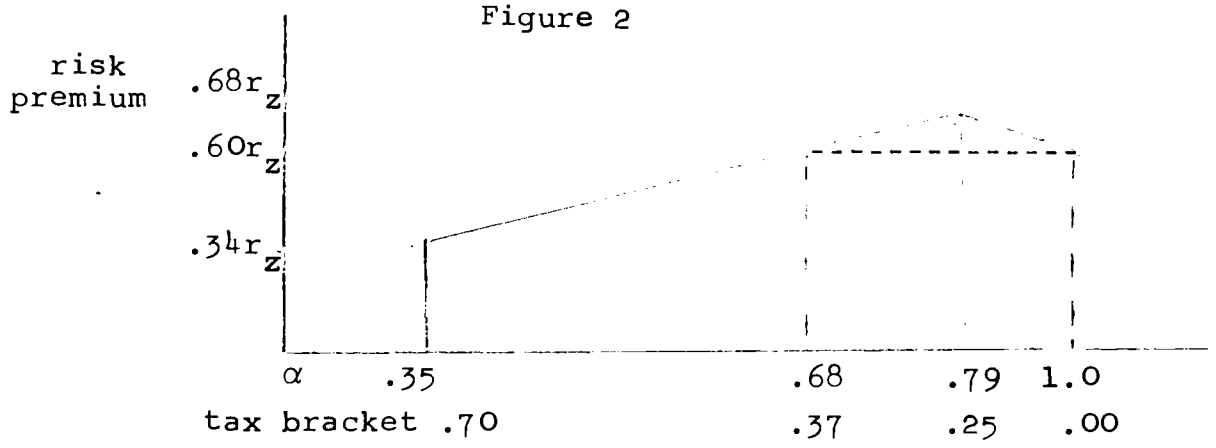
B. Efficiency costs arising from inefficient risk bearing

In Section II.B.3, we noted that variation in individual tax rates implies an inefficiency in the allocation of risk across investors. Here we attempt to approximate the order of magnitude of these costs.

Efficiency in the allocation of marketed lotteries would imply that each person at the margin would demand the same risk premium in return for absorbing a given risk. With the current tax structure, in equilibrium, in return for absorbing (1-c) per cent of the uncertainty in a dollar of equity in a given firm, each investor would just be willing to accept the after tax risk premium $(1-c)\,\bar{g} + (1-m)\bar{d} - \max((1-m)r_z, r_f)$. The risk premium per unit of risk, $\bar{r} + \frac{(1-m)}{1-c}\bar{d} - \frac{1}{1-c}\max((1-m)r_z, r_f)$ will vary across investors, implying the possibility of a Pareto improving reallocation of risk from those charging a large risk premium to those charging a small one.

Let us plot the marginal risk premium as a function of $\alpha = \frac{1-m}{1-c}$ making the simplifying assumptions: 1) $c = .2m$, 2) $r_f = .75r_z$,[55] 3) $\bar{d} = .6r_z$, and 4) $\bar{g} = r_z$. Recall that when risk is distributed efficiently, all investors would have the same marginal risk premium. Figure 2 indicates that those with the lowest risk premium (those holding "too little" equity) are those in the highest tax brackets, for whom tax free bonds are extremely attractive. Those in the zero tax bracket also have little equity (have a low risk premium) as they receive no gain from the relatively high capital gains component in equity. Those who are just indifferent between taxable and tax free bonds have the largest risk premium.

Figure 2



---

[55] The evidence for this figure in Appendix A is derived from longer term interest rates. It may be that were we to have compared shorter term interest rates, the relative rates would be different, with r_f presumably being smaller relative to r_z since those holding shorter term bonds are mainly commercial banks.

How costly is this variation in the marginal risk premium across investors? Theoretically, this cost is very complicated to derive. For a marginal reallocation of a given risk from an individual with a high risk premium to an individual with a low risk premium, the efficiency gain is the difference in their risk premia. In the example in Figure 2, the maximum such gain would be $.34r_z$. The total efficiency gains from reallocation would be the sum of all such marginal gains, when this reallocation from the initial equilibrium continues until all individuals charge the same risk premium for each security.

In order to approximate the order of magnitude of these efficiency costs, we derive in Appendix B the size of the costs under a set of simplifying assumptions. There we find that annual efficiency costs resulting from the inefficient distribution of corporate risks across investors can be approximated by $.01r_z^2V$, where V is the total amount of risky securities outstanding. If r_z is assumed to be .08, and we set V equal to the value of corporate equity outstanding in 1975 (630 billion dollars according to von Furstenberg), then this expression equals $.00007V$ = 44 million dollars per year. To the extent that the parameters and model chosen are reasonable, efficiency costs due to inefficient risk bearing would appear to be very small.

C. Efficiency costs induced by the distortion in dividend payout rates

Another major distortion created by the current tax structure is that it discourages the payment of dividends by corporations.

While the corporate income tax includes no such distortion, since dividends and retained earnings are treated equivalently, the effective personal income tax on dividends is much higher than that on capital gains for individual investors. As a result, individuals are led to alter their portfolio composition towards assets with a higher capital gains component, and corporations are induced to cut their dividend payout rate. Unfortunately, it is not even clear whether these changes in behavior have efficiency costs or efficiency benefits, let alone what the magnitude of the effect on efficiency is. The problem is that our theory explaining the payment of dividends is still very incomplete.

In Section I.C, we provided three possible explanations for why dividends are paid: 1) since some equity investors, particularly corporations, will prefer dividends to capital gains because 85 percent of dividends are excluded from tax, it may be that the value of dividends in the market just equals that of capital gains, 2) dividends have the advantage over capital gains of providing a means with lower transactions costs to fund consumption offsetting their tax disadvantage, and 3) dividends carry a signalling benefit, again offsetting the tax disadvantage. Unfortunately, each explanation for dividends has different implications for the effect on efficiency of the tax distortion discouraging dividends.

Under the first explanation, individuals are indifferent, tax reasons aside, between dividends and capital gains. Therefore,

the fact that their portfolios are shifted towards securities with a higher capital gains component has in itself no cost. Risk spreading will be inefficient as a result of this shift, but we have already measured that effect.

Under the second explanation, any reduction in the cash component of the return on the portfolio of an individual who used the proceeds to fund consumption will result in higher transactions costs for that individual who then must incur the brokerage costs involved in selling shares to replace lost dividends. To the extent that firms reduce their dividend payout rate, resulting in an increase in their internal funds, the transactions cost of firms will decrease if in response they are able to avoid some underwriting expenses involved in new issues of debt or equity. On the other hand, the transactions costs of firms will increase if in response they increase their repurchases of debt or equity. Of course firms of the former type will be much more inclined to reduce their dividends than the others. Without taxes, in equilibrium, the various transactions costs would be traded off against each other. Introducing taxes then results in a tradeoff between extra taxes and extra transactions costs. Measuring the net increase in transactions costs induced by the tax distortion would be very complicated.

When dividends play a signalling role, as discussed in Section I.C., the firm, when choosing a dividend payout rate, trades off the induced improvement in investor expectations resulting from higher dividends with the higher tax rate for investors on dividends and the implied increase in costs for the firm resulting from a decrease in its retained earnings. Here, investors may well be indifferent between dividends and capital gains. The only efficiency costs involving the dividend payout rate are then the costs to

the firm of a reduced level of retained earnings. These costs would be smaller were the equilibrium dividend payout rate smaller. Therefore, any further tax distortion discouraging dividends would decrease the efficiency costs. Even if the total costs to the firm of using dividends as a signal go up as a result of this increase in the tax distortion, the real costs, in contrast to the tax costs, go down.

Thus, depending on our explanation for why dividends are paid, the tax distortion discouraging dividends may have no direct efficiency effect, an efficiency cost, or an efficiency benefit. There is no a priori presumption which direction of effect is more important.

D. Distortion favoring noncorporate vs. corporate uses of capital

Another frequently measured distortion created by the corporate income tax is the implied disincentive to invest in corporate rather than noncorporate businesses.[55a] According to Shoven (1976), the annual excess burden costs created by the distortion in capital allocation between corporate and noncorporate uses is on the order of six to fifteen percent of corporate revenues, or about 4.26 billion dollars in 1975. What do our models imply, in comparison?

In section I.E, we showed that when we allow for uncertainty and bankruptcy, the equilibrium rate of return on capital in the corporate

---

[55a] Ignored here as elsewhere is the fact that a business may shift from a corporate to a noncprorate status as a result of the corporation tax.

sector (correcting for the risk premium and the bankruptcy premium) will exceed the equilibrium rate of return in the noncorporate sector by $\frac{\tau-(1-\alpha_b)}{1-\tau}(r_z-\gamma r)$. Using plausible parameter values for 1975, this implies that the rate of return on capital in the corporate sector will be 27.4% higher than in the noncorporate sector.[55b] Shoven (1976), in contrast, assumes that as a result of differential taxation on the returns to capital in the two sectors, the equilibrium rate of return on capital in the corporate sector will be 53.0% higher than in the noncorporate sector.[55c]

The excess burden costs implied by such a distortion should be approximately proportional to the square of the size of the distortion. Our results then imply excess burden costs only $(\frac{27.4}{53.0})^2 = .267$ the size of the distortion costs found in Shoven (1976).[55d] In 1975, we then forecast excess burden costs due to the misallocation of capital between corporate and noncorporate uses of 1.1 billion dollars. Note that this distortion, which has been the standard distortion considered in the public finance literature, seems to be only about a third as costly as the distortion in debt-equity decisions.

[55b] We assume $\tau = .48$, $\alpha_b = .75$, $r_z = .063$, $r = .08$, $\gamma = .3$.

[55c] In Table 2, he shows that the tax rate on noncorporate capital is 31% while that on corporate capital is 55%. If the after tax rates of return are to be equal, the before tax rates of return must differ as asserted.

[55d] This approximation is very rough. Had we measured the rate of return in the noncorporate as a percent of the return in the corporate sector throughout instead of the converse, the excess burden implied by our results would be .386 the size of that in Shoven.

Since this estimate of the excess burden costs is approximately proportional to the square of the size of the tax distortion, it is proportional to $[(\frac{\tau-(1-\alpha_b)}{1-\tau})(r_z-\gamma r)]^2$. When considering the effects of tax changes in the next section, we will use this approximation.

E. Progressive taxation and taxation of corporate earnings

So far, we have explored only the efficiency effects of the tax treatment of corporate earnings. To what degree does the existing tax structure also create horizontal and vertical inequities?

Let us assume first that a comprehensive income tax is the normative model in judging horizontal and vertical inequities. Under this tax, the relative net of tax rates of return on any security for two individuals ought to be $\frac{1-m_1}{1-m_2}$, where m_1 and m_2 are the marginal tax rates on labor income for the two individuals. This condition is implied by equal tax rates on all forms of income. The condition is essentially met for taxable bonds, ignoring any capital gains component in the return. For equity, however, the relative rates of return are $\frac{d(1-m_1)+g(1-c_1)}{d(1-m_2)+g(1-c_2)}$, where d is the dividend yield and g the capital gains rate

on that security, and c_1 and c_2 are the effective tax rates on capital gains for the two investors. This ratio will not equal $\frac{1-m_1}{1-m_2}$, implying that the current tax is not a comprehensive income tax. Moreover, a comprehensive income tax would presumably require that capital gains be taxed on accrual at the tax rate on labor income.

Similarly, the current tax is not consistent with a consumption or expenditure tax. Under a consumption tax, the net of tax rate of return on any security ought to be the same for all investors (and equal to the pre-tax rate of tax). Yet as long as individuals invest directly in corporate securities rather than invest through pensions or Keogh plans, the net of tax rates of return will not be equal.

If the tax system is to be consistent with either a comprehensive income tax or with a consumption tax, it is necessary that the ratio of pre-tax rates of return on debt and equity equal the ratio of post-tax rates of return--under a comprehensive income tax, both would be taxed at rate m, while under a consumption tax neither would be taxed. Does the corporation tax also create inequities? When individuals purchase a share of stock, their income is the return on this financial security--dividends and capital gains. An equitable individual tax would be concerned just with this income, not with the income of the corporation necessary to support these payments. Under this view, the corporation tax is not an equity issue.[56] An ambiguity arises when comparing closely held corporations to partnerships. Here, a legal re-classification will change the definition of the

[56] Writers frequently argue to the contrary. Claims that the "double taxation" of dividends is inequitable would be an example.

individual's income while no substantive change has occurred in the individual's position. The corporation provides a device for postponing the receipt of income through retentions, unavailable in a partnership. If capital gains were taxed fully on accrual, this would not be an issue, however,[57] so the corporation tax is not inequitable per se. However, by discouraging incorporation, the corporation tax diminishes use of the corporation as a device to exploit the lower tax rates on capital gains.

IV. Evaluation of Proposals for Tax Reform

A. Criteria for evaluation

We have shown in the previous sections that the current procedures for taxing corporate earnings create non trivial excess burden costs and deviate from an equitable tax, as defined either

by a comprehensive income tax or by a consumption tax. In light of these efficiency and equity problems with the current tax structure, many proposals for tax reform have been suggested.

In this part, we will compare briefly the relative merit of several possible directions of change in the tax code. In most cases, we estimate the efficiency gains and revenue costs created by a small change in a tax rate. Were the tax structure optimal, then the efficiency gains relative to the revenue costs ought to be the same for all taxes. When this ratio is different for two different taxes, then there is an opportunity to change the two tax rates so as to maintain tax revenues yet lower the excess burden created by the tax structure. That tax rate with the highest ratio of efficiency gain relative to revenue cost is then a prime candidate for reduction. Our results will point out which directions of change in the tax structure ought to be most favorable. However, they will not indicate how large a change would be appropriate.

In comparing the effects of different tax changes, we will focus on the distortions in corporate financial policy, and in the allocation of capital between the corporate and the noncorporate sectors.[58] Omitted most prominently is the distortion in savings behavior. To include this would require a theory of the market interest rate, a theory which is clearly beyond the scope of this

---

[58] Inefficiency in the allocation of risk across investors is too small to merit attention.

paper. We also ignore distortions affecting the dividend payout rate, as even the direction of change in excess burden costs here is unknown. In addition, we explore solely partial equilibrium efficiency effects, ignoring any secondary effects through shifts in demand among commodities. Thus the story told is incomplete and must be supplemented with other findings. The effects we do capture, though, are large enough to merit close attention.

In addition to comparing efficiency gains with revenue costs for each tax change, we will also point out how each tax change will affect the equity of the taxation of income, and how each tax change may result in windfall transfers of wealth across individuals. We will not attempt to compare, though, the relative importance of effects on the equity vs. the efficiency of the tax structure.

B. Proposal Evaluation

In this section we will evaluate alternative tax proposals. Each of the tax changes we will compare is listed in Table 1 along with the implied effects on the excess burden and on tax revenues. In calculating effects on efficiency, we focus on distortions in corporate uses, and distortions in the allocation of risk across investors. Other distortions are ignored, however. In particular, we make no attempt to measure the inefficiency in savings decisions, nor can we measure the efficiency effects of distorted dividend payout rates. The results are therefore incomplete. However, they are also dramatic.

Table 1

Estimates of
Efficiency and Revenue Effects of Selected Tax Changes

	Tax Change	Efficiency Gain	Revenue Loss
1.	1% decrease in τ	171 million	123 million
2.	.01 decrease in c	238 million	193 million
3.	1% of dividends deductible under the corporate tax	0	70 million
4.	1% of interest payments taxable under the corporate tax	45 million	-245 million

From the first line in Table 1, we see that a small cut in the corporate tax rate, τ, would result in an efficiency gain almost half again as large as the revenue loss. In other words, the last dollar collected under the corporate income tax effectively costs the private sector 2.4 dollars, one dollar in lost income and 1.4 dollars in increased inefficiency. Were distortions in savings decisions included, the efficiency effect would be even larger. Either this tax is much more expensive than other taxes, in which case it ought to be reduced, or it is more equitable, which we find unconvincing. Alternatively, marginal government expenditures ought to be more than twice as "valuable" as marginal private expenditures.

The implications of cutting the effective capital gains tax rate, c, are very similar. This change lessens the degree to which taxes discourage equity finance. Again, a dollar of government revenue effectively costs the private sector more than two dollars.

In spite of the discussion concerning the double taxation of dividends, we find no clear efficiency gain from allowing corporations to deduct part of their dividend payments, and yet clear revenue costs. One way to understand this result is to recognize that corporations can avoid this tax by repurchasing shares instead of paying dividends. To the extent they pay dividends, it must result from compensating advantages to dividends. As we discussed in section IV.D, it is unclear whether the resulting changes in dividend payout rates produce efficiency gains or efficiency losses.

In the fourth line of the table, we find the even more dramatic result that by eliminating to a small degree the deductibility of interest payments under the corporate tax, there would be both an efficiency gain and a revenue gain. Though the distortion in savings decisions may be increased by this change, the cost of this further distortion would have to be very large to undermine the attractiveness of this tax change.

Each of these computations describes the effect of a small tax change. For larger tax changes, the efficiency gains would be smaller relative to the revenue losses. This occurs since the excess burden varies as the square of the distortion while tax revenue changes approximately linearly with the distortion.

In the rest of this section, we present our derivation of the figures in Table 1, and discuss some of the equity implications of these tax changes. In addition, we present a brief discussion of the effects of shifting entirely to a partnership treatment of corporate income or to an expenditure tax.

1. Reduction in the corporate tax rate

The principal efficiency effect of reducing the corporate tax rate is to lower the distortion favoring debt over equity finance and the associated costs. The size of the initial excess burden is proportional to $(\tau-(1-\alpha_b))^2$, as was argued in Section III.A.2. We have estimated α_b to be .75 using the results in Appendix A, and assume that this value will remain unaffected by the change in the corporate tax rate. A one percent reduction in τ would then lead to a 4.1% drop in the excess burden or a gain of 132 million dollars per year.

The size of the excess burden from the distortion of investment decisions was proportional to $[(\frac{\tau-(1-\alpha_b)}{1-\tau})(r_z-\gamma r)]^2$. If τ drops by one percent, then, according to the triangular approximation to Figure 1, D will drop by 2.1 percent. This change together with the change in τ implies that the excess burden on investment will fall by 3.4%, or by 39 million dollars. The total efficiency gain is therefore 171 million dollars.

What equity considerations would enter into this tax change? As noted above, changing the corporate rate does not directly affect the degree to which the personal tax approximates an equitable tax. Since debt equity ratios will fall, however, more of savings will be invested in equity, where the tax treatment is relatively less equitable than under a CIT. (Consumption tax advocates might view this shift towards equity as an improvement, though.) In addition, more partnerships may incorporate, further shifting ordinary income into capital gains.

Who will receive the windfall transfers implicit in the cut in the corporate tax rate? On first glance, one would expect substantial capital gains on equity. However, if equity outstanding is initially in equilibrium (q = 1), this may not be the case. When the amount of equity outstanding is again in equilibrium, it must be that equity holders still value the returns (after corporate tax) from a dollar of marginal real investment at a dollar. Equity may rise in price immediately, but firms will expand the supply of equity, cutting back on the supply of bonds, until the price falls

back towards
/ its original level. Anticipation of this eventual drop may restrain the initial rise. Even though in equilibrium the new marginal holder of equity values the returns from a dollar of real investment at a dollar, the increased intramarginal holdings of equity will be valued at more than a dollar, so consumer surplus will have increased. There could / be no substantial windfall changes in price, but there will be windfall gains in utility. Since those in higher tax brackets have relatively stronger preferences for equity over corporate bonds, it is this group which will mainly experience these windfall gains in utility. In addition, existing bondholders, having a lower probability of bankruptcy, will also experience windfall gains.

How large would the revenue loss be from such a tax change? In 1975, a one percent cut in the corporate income tax rate, if corporate behavior did not change, would have caused a drop of 406 million dollars in corporate tax revenues. The resulting 406 million dollar increase in corporate revenues would accrue to shareholders. If their average marginal tax rate is .157 (the figure used by Feldstein and Summers (1979)), then taxes on share holders would increase by 64 million dollars. In addition, however, tax revenues will increase due to the shift towards equity finance. According to the triangular approximation to Figure 1, a one percent drop in τ will lead to a 2.1 percent drop in D. Given the availability of tax free bonds with $r_f = .75r_z$, the marginal tax rate on bonds ought to be 25%. In contrast, the marginal

tax rate on equity income would be (1-(1-.48)(1-.157)) = .56, a level /.31 higher than that on debt. The shift in financial structure towards equity would then imply a revenue gain of .31r (.021D) = 180 million dollars . We assume r = .063 and D = 440 billion dollars (as in von Furstenberg (1977)). In addition, capital will shift slightly towards the corporate sector, where it is taxed more heavily. The change in the excess burden of 39 million dollars is approximately $t\Delta K$, where t is the tax distortion and ΔK is the amount of capital shifted to the corporate sector. Therefore, 39 million dollars also measures the increase in tax revenue resulting from this shift in capital. Thus the net revenue loss would be about 123 million dollars, compared with a decrease in the excess burden of 171 million dollars.

On net, there appear to be large efficiency gains from a cut in the corporation tax rate, although there may also be some equity costs. Larger /changes in the corporate tax rate will not appear as favorable, however, since the excess burden declines as the square of the existing distortion.

2. Increases in the capital gains tax rate

Advocates of a comprehensive income tax argue that an increase in the effective capital gains tax rate would be desirable on equity grounds. What efficiency implications would such a change have?

An increase in the capital gains tax would cause an increase in debt-equity rates, increasing the excess burden created by a levered financial structure. In Section III.A.2, we showed

that the excess burden was proportional to $(\tau-(1-\alpha_b))^2$.[63] Here, α_b is a weighted average of the values $\frac{1-m}{1-c}$ for each investor. A uniform .01 increase in the effective tax rate c implies an approximately one percent change in α_b, given that c is small. This change in α_b then implies a 6.6% increase in excess burden costs, given our assumption that $\alpha_b = .75$, or a loss of 212 million dollars.

This one percent change in α_b also implies, according to the triangular approximation to Figure 1, that D will increase by 3.3% . This change, together with the change in α_b, implies that the cost of the investment distortion will increase by 2.4%, or by 27 million dollars.

Counter balancing these costs is the fact that the distortion in the dividend payout decision is diminished. Unfortunately, it is not clear whether this reduction in the distortion is an efficiency gain or loss if we assume that dividends are used as a signal.

In addition the increase in the capital gains tax rate cuts the size of the inefficiency in private risk bearing. Inspection of the argument in Section III.B shows that these excess burden costs will drop approximately two percent as a result of a one percent rise in the capital gains rate. Nevertheless, such a rise in capital gains taxes implies an efficiency gain of just .8 million dollars. However, the amount of risk born by the government increases, while costs of bearing this risk will be ignored by the firm in its investment decisions.

---

[63] We assume that the dividend payout rate readjusts so as to maintain $\alpha=1$ at the new equilibrium.

If the capital gains tax were maintained as a tax on realizations, then there would be an additional cost resulting from this tax increase due to an even stronger lock in effect in securities holdings. This is so because an investor can postpone payment of tax on his accumulated capital gains without penalty by postponing the sale of the asset.

Increasing the capital gains tax through including part of corporate retained earnings in individual income, and thus taxing capital gains on accrual to the extent that retained earnings equal capital gains, is one procedure which would not have this extra cost.

An unexpected increase in c will make equity less attractive. However, in equilibrium the returns from a dollar of real investment will continue to be worth a dollar on the stock market. Intra-marginal holdings of equity will drop in value, implying a loss in utility for those with the strongest relative preference for equity. In addition, existing bond holders will be worse off due to the increased chance of default.

How much revenue will be raised by a .01 increase in the effective tax rate c? If the stock market grows normally at 8% a year on a base of 630 billion (as reported in von Furstenberg (1977) for 1975), then the extra revenue, assuming no change in behavior, would be 50.4 million dollars. However, individuals will tend to shift towards debt. Assuming the triangular approximation in Figure 1, the amount of debt will increase by 3.5% when $\alpha_b = .75$. If the combined tax rate

on equity exceeds that on debt by .31 (as argued above), then the drop in revenue due to this shift towards debt would have been in 1975 $.31r(.033D) = 284$ million, assuming $r = .063$. In addition, due to the rise in α_b capital will flow to a degree to the non-corporate sector. As noted before, the size of the revenue loss due to this movement will approximately equal the efficiency loss, which we measured to be 27 million dollars. The net revenue gain would therefore be 193 million. This is to be compared with the 238 million increase in the excess burden, ignoring any effect on dividends.

We should note, however, that achieving a .01 increase in the effective tax rate c may not be easy. Increasing the statutory rate might cause little increase in the effective rate due to further postponement of realizations. It may be that constructive realization at death or partial taxation on accrual, however feasible, would be necessary in order to raise the effective tax rate.

3. Partial deductibility of dividends under the corporate tax

It would seem that an alternative way to lower the tax disincentive to equity finance would be to allow corporations to deduct at least part of their dividends from their taxable income. Let us assume only one percent of dividends is made deductible. What efficiency and equity effects would this tax change have? If the tax rate on dividends is lowered by this device, then the amount of dividends and new issues of equity will increase until again $\alpha=1$, so that dividends and retentions are valued equally, and $q=1$. There is no necessity that α_b change at all in this

process. If it does not, then the equilibrium debt-equity ratio does not change. Also, the equilibrium allocation of capital between the corporate and noncorporate sectors will not change. The tax disincentives to dividends drop slightly due to this change. However, by the arguments in Section III.C, it is not clear whether this is an efficiency gain or loss.

How much will tax revenues change as a result of this tax change? If there were no change in dividend payout rates, then corporate revenues would drop by $.01\tau Div$ = 154 million dollars in 1975 when corporate dividends were 32.1 billion dollars. However, shareholders will be taxed at an average marginal rate of .157 (according to Feldstein and Summers (1979) on this income, implying an offsetting revenue gain of 24 million dollars. In addition, the dividend payout rate will presumably increase in response to the tax change. According to Feldstein and Summers (1979), the average personal marginal tax rate on dividends is higher than that on capital gains by .24, while with this change, the corporate rate is lower by .005.[64] Our only estimate of the responsiveness of dividends to the relative tax rate is in Feldstein (1970), based on English data, where the elasticity of dividends to the opportunity cost in retained earnings was .9. Under this proposal, the opportunity cost in retained earnings declines by .9%, implying a forecasted increase in dividends of .8%. Tax revenues would then increase by (.235)(.008)(32.1) = 60 million dollars in 1975, when dividends were 32.1 billion dollars. This gives us a total

[64] We ignore here for lack of information the decrease in corporate tax revenues due to different relative tax rates on dividends and capital gains for corporate holdings of equity.

revenue loss of 70 million dollars. In contrast, there is no presumed effect on efficiency, ignoring any effects on the dividend payout rate or on savings decisions.

Are there any important equity considerations raised by such a change? We argued above that changes in the corporate tax structure do not affect the equity of the tax system per se. However, an increase in the dividend payout rate implies that a higher percent of the return to corporate shares is taxed at ordinary rates, pushing the tax treatment closer to that in a comprehensive income tax.

4. Limited deductibility of interest payments under the corporation tax

If the tax on equity is high compared with that on debt, another possible change to reduce this difference is to lower the degree to which interest payments are deductible under the corporation tax. Let us assume that one percent of such payments are no longer deductible. What efficiency and equity effects would ensue?

If we rederive the expression in Section III.A.2 for marginal excess burden costs from debt finance, we find that it now equals $(r(\tau-(1-\alpha_b(1-.01\tau)))$. When $\alpha_b = .75$, the distortion drops by 1.6%, and the excess burden by 97 million dollars. However, when we reexamine the conditions for an equilibrium capital stock in the corporate sector, we find that $s-r_z$ increases by $\frac{.01\gamma r\tau}{1-\tau}$ due to the heavier taxation of debt financed capital. In addition, the amount of debt will drop by 1.6%, using the triangular approximation to Figure 1, causing γ to drop. These changes cause a further shift of capital to the noncorporate sector, increasing the cost of this distortion by 4.6% or by 52 million dollars.

How much revenue would be gained by this change? If the market value of corporate debt is 440 billion dollars and the average long term interest rate is about .09, figures taken from 1975, then, with no change in behavior corporate tax revenues will increase by 190 million dollars. Since corporate revenues drop by this amount, tax payments by shareholders drop by 30 million dollars, assuming their average marginal tax rate is .157. However, due to the drop in the distortion favoring debt, the amount of debt will drop. By our triangular approximation to Figure 1, the debt decreases by 1.6% when $\alpha_b = .75$. If the tax rate on equity is .31 higher than that on debt, then revenues increase by 137 million dollars. However, the shift of capital from the corporate to the noncorporate sectors causes a revenue loss comparable to the efficiency loss, or about 52 million dollars. Thus, not only is there a total revenue gain of 245 million dollars, but, in addition, efficiency costs drop by 45 million dollars.

Are there any offsetting equity costs? Since debt equity ratios drop, somewhat more income will appear as capital gains, making the tax system less equitable from the point of view of a comprehensive income tax. In addition, the higher corporate taxes may make the firm seem more risky to existing bondholders, resulting in a capital loss for them. Of course we must also remind the reader that we continue to ignore the resulting increase in the inefficiency of savings decisions.

5. Partnership treatment of corporate income

So far, we have examined just marginal changes in the tax law. A more comprehensive proposal would be to eliminate the corporate income tax entirely and attribute all profits proportionately to shareholders to be included in their taxable income, taxable at

ordinary rates. This treatment would be equivalent to the treatment of partnership income under the current laws. To the extent that share prices rose by an amount different from the proportional share of retained earnings, then the difference would be treated as a capital gain and taxed accordingly. This proposal is developed in great detail in McLure (1979). What effects would this proposal have?

To the extent that share prices do rise by the proportional share of retained earnings, then all income derived from corporate earnings, whether arising from bonds or equity, would be taxed at ordinary rates, as required under a comprehensive income tax. However, inspection of firm accounts suggests that capital gains and retained earnings do differ substantially. In any case, a much smaller share of the income from owning corporate shares ought to take the form of capital gains, an improvement from the point of view of a comprehensive income tax.

What efficiency gains would arise? Since the tax treatment of income from debt and equity is identical under this proposal, the tax distortion in financial policy would be eliminated, implying a drop of 3.2 billion dollars in excess burden costs. Also, there would no longer be a difference in the tax treatment of corporate vs. noncorporate capital, implying that the 1.1 billion dollar distortion cost from the inefficient allocation of capital would be eliminated. Since $c = m$, ignoring the deviation between capital gains and retained earnings, private

risk bearing will also be efficient, a gain of 44 million dollars per year.[65] In addition, the distortion in the dividend payout decision would be eliminated. However, by the arguments in Section III.C, it is not clear whether this is an efficiency gain or loss, when dividends are used as a signal. However, savings decisions may be further distorted, as those with high tax rates find one relatively desirable asset (equity) less desirable.

To get a very crude revenue estimate, we continue to assume that the average marginal tax rate on equity is .31 above that on bonds. Under this proposal, the tax rate on equity will become just equal to that on bonds for those currently holding equity. In addition, other individuals will shift from debt to equity, to avoid bankruptcy costs, but this will have no tax consequence. Therefore, the revenue loss ought to be on the order of 31% of the return on corporate equity, or 23.[illegible] billion dollars in 1975, assuming 630 billion in equity (as in von Furstenberg (1977)) and a before tax total rate of return of 12%. This is to be compared

[65] However, the risk born by the government through its tax revenues will increase, implying inefficiency in investment decisions since the firm will ignore the costs to the government of bearing this risk.

with a 4.3 billion dollar reduction in excess burden costs. This figure, though, omits any efficiency effects of the change in the size of the distortion affecting dividend payout and, more importantly, savings decisions. Our discussion also ignores possible difficulties in implementing such a proposal.

6. An expenditure tax

An alternative major change in the tax system would be to eliminate any personal taxes on the return to savings, whether from interest receipts, dividends, or capital gains. Such a tax has been advocated on both efficiency and equity grounds by a number of economists. Its most important advantage is undoubtedly its elimination of the distortion in savings decisions created by the taxation of the returns to savings, an aspect not developed in this paper. Let us explore, however, what implications this change would have in the areas we have explored.

Optimal corporate financial policy implies, according to Section III.A.2, that $c(D/E) = r(\tau-(1-\alpha_b))$. If an expenditure tax were imposed and the corporation tax repealed, then this distortion will disappear. However, if the corporation tax were left in place, and $\alpha_b < 1.0$ initially, then the distortion would increase by $(1-\alpha_b)r$. If $\alpha_b = .75$ initially, we would extrapolate the additional excess burden costs to be 3.5 billion dollars. This suggests that proposals for an expenditure tax, if not accompanied by a repeal of the corporation tax, ought to be accompanied at least by a reduction in the distortion favoring debt finance within the corporate income tax.

If the corporate income tax were left in place, then there would also remain a distortion between investment in corporate and noncorporate uses. Due to the increased use of debt finance under this situation, the distortion might well be smaller than it is currently. However, it would be eliminated entirely if the corporate income tax were also eliminated.

Adoption of an expenditure tax would also imply an elimination of the distortion in risk bearing. However, since the efficiency costs here were only on the order of 44 million dollars, this effect is small in comparison.

The distortion in the dividend payout decision would also be eliminated under an expenditure tax. Whether this is an efficiency gain or loss is unclear, however.

Further analysis of an expenditure tax is beyond the scope of this paper. However, it is clear that tax reformers must worry simultaneously about the corporation tax when advocating a movement towards an expenditure tax.

V. Conclusions

In this paper, we have developed a model of corporate financial decisions when there is both uncertainty and the possibility of costly bankruptcy. We then used this model to measure the nature of the distortions in behavior induced by the existing tax structure, and their excess burden costs. We finally explored the effects on efficiency costs and revenues of various possible modifications of existing taxes.

Our major conclusions are:

1) As long as firms are competitive, explicit incorporation of bankruptcy costs is essential if a model is to explain the observed corporate financial structure.

2) Debt-equity ratios historically increased steadily since World War II until 1974, and have only declined slightly since then. We might infer from this rise an increasing optimism (or decreasing pssimism) about future prospects until the early 1970's.

3) The efficiency costs arising from tax incentives to increase debt-equity ratios are substantial, being on the order of 3 billion dollars a year, or approximately 10% of corporate tax revenues.

4) However, distortions in the allocation of capital between corporate and noncorporate uses do not appear to be as large as previously thought. In particular our estimate is one-quarter to one-third the size of previous estimates.

5) As a result of the distortions affecting debt-equity decisions, any of several directions of tax change aimed at lessening the distortion in debt-equity ratios would appear attractive.

BIBLIOGRAPHY

Auerbach, Alan J., "Wealth Maxmization and the Cost of Capital," Quarterly Journal of Economics, 93 (Aug., 1979), pp. 433-446.

Auerbach, Alan J. and Mervyn A. King, "Corporate Financial Policy, Taxes, and Uncertainty: An Integration," N.B.E.R. Working Paper #324, March 1979.

Baumol, William J. and Burton G. Malkiel, "The Firm's Optimal Debt-Equity Combination and the Cost of Capital," Quarterly Journal of Economics, 81 (Nov., 1967), pp. 547-578.

Bhattacharya, Sudipto, "Imperfect Information, Dividend Policy, and 'The Bird in the Hand' Fallacy," The Bell Journal of Economics, 10 (Spring, 1979), pp. 259-270.

Black, Fischer, "The Dividend Puzzle," Journal of Portfolio Management, 2 (Winter, 1976), pp. 5-8.

Black, Fischer and Myron Scholes, "The Effects of Dividend Yield and Dividend Policy on Common Stock Prices and Returns," Journal of Financial Economics, 1 (May, 1974), pp. 1-22.

Body, Zvi, "Common Stock as a Hedge Against Inflation," Boston University School of Management Working Paper, January, 1975.

Boskin, Michael J., "Taxation, Saving and the Rate of Interest," Journal of Political Economy, 86 (April, 1978), pp. 53-528.

Bradford, David F., "The Incidence and Allocative Effect of a Tax on Corporate Distributions," Discussion Paper #7738, Center for Operations Research and Econometrics, Universite Catholique de Louvain, Belgium, August, 1977.

Bradford, David F., "Tax Neutrality and the Investment Tax Credit," N.B.E.R. Working Paper #269, August, 1978.

Brennan, Michael J., "Taxes, Market Valuation and Corporate Financial Policy," National Tax Journal, 23 (1970), pp. 417-427.

Bulow, Jeremy I. and John B. Shoven, "The Bankruptcy Decision," The Bell Journal of Economics, 9 (Autumn, 1978), pp. 437-456.

Chen, Andrew H. and E. Han Kim, "Theories of Corporate Debt Policy: A Synthesis," Journal of Finance, 34 (May, 1979), pp. 371-384.

Ciccolo, John H., "Four Essays on Monetary Policy," Unpublished doctoral dissertation, Yale University, 1975.

Diamond, Peter A., "The Role of a Stock Market in a General Equilibrium Model with Technological Uncertainty," American Economic Review, 57 (Sept., 1967), pp. 759-76.

Fama, Eugene and Merton Miller, The Theory of Finance (New York: Holt, Reinhart and Winston, 1972).

Feldstein, Martin S., "Corporate Taxation and Dividend Behavior," Review of Economic Studies, 37 (January, 1970), pp. 59-72.

Feldstein, Martin S., "The Welfare Cost of Capital Income Taxation," Journal of Political Economy, 86 (April, 1978), pp. 529-552.

Feldstein, Martin S. and Lawrence Summers, "Inflation and the Taxation of Capital Income in the Corporate Sector," National Tax Journal, 32 (Dec., 1979).

Feldstein, Martin S. and Lawrence Summers, "Inflation, Tax Rules, and the Long-Term Interest Rate," Brookings Papers on Economic Activity, 1978:1, pp. 61-99.

Gordon, Roger H., "Tobin's q and the Rate of Investment: A Reappraisal in a World with Debt as Well as Equity Finance," mimeo, February, 1979.

Gordon, Roger H. and David F. Bradford, "Taxation and the Stock Market Valuation of Capital Gains and Dividends: Theory and Empirical Results," September, 1979.

Haugen, R. A. and L. W. Senbet, "The Insignificance of Bankruptcy Costs to the Theory of Optimal Capital Structure," Journal of Finance, 33 (May, 1978), pp. 383-393.

Harberger, Arnold C., Taxation and Welfare (Boston: Little, Brown and Company, 1974).

Hirschleifer, Jack, Investment, Interest and Capital (Englewood Cliffs: Prentice-Hall, 1970).

Jensen, M. C. and W. H. Meckling, "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," Journal of Financial Economics, 3 (Oct., 1976), pp. 305-360.

Kim, E. Han, "A Mean Variance Theory of Optimal Capital Structure and Corporate Debt Capacity," Journal of Finance, 33 (March, 1978).

Kim, E. Han, Lewellen, Wilbur G. and John J. McConnell, "Financial Leverage Clienteles: Theory and Evidence," Journal of Financial Economics, 7 (March, 1979), pp. 83-110.

King, Mervyn A., Public Policy and the Corporation (London: Chapman and Hall Ltd., 1977).

King, Mervyn A., "Taxation and the Cost of Capital," Review of Economic Studies, 41 (January, 1974), pp. 21-36.

Mayshar, Joram, "Should Government Subsidize Risky Private Projects," American Economic Review. 67 (March, 1977), pp. 20-28.

McCulloch, J. Huston, "The Tax-Adjusted Yield Curve," Journal of Finance, 30 (June, 1975), pp. 811-830.

McLure, Jr., Charles E., Must Corporate Income Be Taxed Twice (Washington, D.C.: The Brookings Institution, 1979).

Miller, Merton H., "Debt and Taxes," Journal of Finance, 32 (May, 1977), pp. 261-275.

Miller, Merton H. and Franco Modigliani, "Dividend Policy, Growth and the Valuation of Shares," Journal of Business, 34 (October, 1961), pp. 411-33.

Miller, Merton H. and Myron Scholes, "Dividends and Taxes," mimeo, University of Chicago Graduate School of Business, August, 1978.

Modigliani, Franco and Merton H. Miller, "The Cost of Capital, Corporation Finance, and the Theory of Investment," American Economic Review, 48 (June, 1958), pp. 261-97.

Myers, Stewart C., "Determinants of Corporate Borrowing," Journal of Financial Economics, 5 (Nov., 1977), pp. 147-175.

Rosenberg, Barr and James Guy, "The Prediction of Systematic Risk," University of California at Berkeley Graduate School of Business Administration Working Paper #33, 1975.

Ross, Stephen A., "The Determination of Financial Structures: The Incentive Signalling Approach," The Bell Journal of Economics, 8 (Spring, 1977), pp. 23-40.

Shoven, John B. and John Whalley, "A General Equilibrium Calculation of the Effects of Differential Taxation of Income from Capital in the U.S.," Journal of Public Economics, 1 (Nov., 1972), pp. 281-321.

Shoven, John B., "The Incidence and Efficiency Effects of Taxes on Income from Capital," Journal of Political Economy, 84 (December, 1976), pp. 1261-1283.

Stiglitz, Joseph E., "A Re-Examination of the Modigliani-Miller Theorem," American Economic Review, 59 (Dec., 1969), pp. 784-93.

Stiglitz, Joseph E., "On Some Aspects of the Pure Theory of Corporate Finance, Bankruptcies and Take-Overs," The Bell Journal of Economics, 3 (Autumn, 1972), pp. 458-82.

Stiglitz, Joseph E., "On the Irrelevance of Corporate Financial Policy," American Economic Review, 64 (Dec., 1974), pp. 851-866.

Stiglitz, Joseph E., "Taxation, Corporation Financial Policy, and the Cost of Capital," Journal of Public Economics, 2 (Jan., 1973), pp. 1-34.

Tobin, James, "A General Equilibrium Approach to Monetary Theory," Journal of Money, Credit, and Banking, 1 (February, 1969), pp. 15-29.

U.S. President, Economic Report of the President (Washington, D.C.: U.S. Government Printing Office, 1977).

Vining, Daniel R. and Thomas C. Elwertowski, "The Relationship Between Relative Prices and the General Price Level," American Economic Review, 66 (Sept., 1976), pp. 699-708.

von Furstenberg, George M., "Corporate Investment: Does Market Valuation Matter in the Aggregate?", Brookings Papers on Economic Activity, 1977:2, pp. 347-397.

von Furstenberg, George M., Malkiel, Burton G., and Harry S. Watson, "The Distribution of Investment Between Industries: A Micro-economic Application of the 'q' Ratio," in Capital, Efficiency, and Growth, edited by George M. von Furstenberg (Washington, D.C.: American Council of Life Insurance, forthcoming).

White, Michelle J., "Public Policy Toward Bankruptcy: Me-First and Other Priority Rules," mimeo, July, 1979.

Glossary of Symbols

Symbol	Definition
c	implicit accruals tax rate on capital gains
$c(D/E)$	increase in annual bankruptcy costs resulting from an increase in the firm's debt/equity ratio via replacement of equity with debt.
C_D	increase in annual bankruptcy costs resulting from a dollar of debt financed real investment
C_E	increase in annual bankruptcy costs resulting from a dollar of equity financed real investment
d_i	rate of return on the ith security through dividends, taxable to the individual at ordinary rates
d_M	rate of return on the market portfolio through dividends, taxable to the individual at ordinary rates
D	tax depreciation allowance per dollar of capital
D_a	actual replacement rate per dollar of capital
g	yearly rate of growth of the capital stock
g_i	return on the ith security taxable at capital gains rates
g_M	return on the market portfolio taxable at capital gains rates
m	marginal tax rate on interest income for an individual
n	marginal tax rate on dividends for an individual
N	number of shares of equity outstanding
p	percent of a firm's after-tax profits paid out as dividends

q	stock market value of the present value of returns from a dollar of marginal real investment
r	market interest rate on corporate bonds
r_f	market interest rate on tax-exempt bonds
r_z	riskless market interest rate
s	pretax marginal return on capital (after depreciation and expenses)
α	relative value of a dollar of dividends compared with a dollar of capital gains in the stock market
α_b	relative value of a dollar of interest receipts compared with a dollar of capital gains in the stock market
β_i	riskiness of the ith security measured as $\rho_{iM}\sigma_i\sigma_M/\sigma_M^2$
γ	percent of debt finance used to finance new investments
ϵ	stochastic element, with mean zero, of the return on a dollar real investment
δ	before tax risk premium on the uncertain returns from a dollar of real investment
τ	corporate tax rate

APPENDIX A

Comparison of Taxable and Tax-Free Interest Rates

In this Appendix, we attempt to estimate the relationship between equivalent taxable and tax-free long-term bonds and, implicitly, the marginal tax rate of marginal buyers of taxable issues. We do so by comparing the equilibrium yields of two securities of the same corporate issuer: one taxable and one tax exempt. If two securities are identical in all respects except that of taxability of interest returns, we can write the following equilibrium relationship: Letting r and r_f stand for the taxable and tax-exempt yields of bonds of the same quality, an investor will be indifferent between the two issues if

$$r(1-\tilde{m}) = r_f, \text{ thus, } \tilde{m} = 1 - \frac{r_f}{r},$$

where $\tilde{m}$ is the marginal tax rate on bond interest for the investor. Since r and r_f are assumed to be equilibrium yields in the market, then $\tilde{m}$ must be the marginal tax rate of the marginal investor. All investors with higher marginal tax rates will be investing in tax-exempt bonds, while all investors in lower brackets will buy taxable bonds. At the margin, the tax bracket of the investor indifferent between the two securities determines the equilibrium yields. That investor pays the highest tax rate of all investors who own the taxable bond.

The usual difficulty with such an exercise is the difficulty of finding comparable taxable and tax-free issues.

Fortunately, it is possible to find a sample of several corporate issuers who simultaneously sell tax-exempt and taxable bonds. In recent periods, corporations have often been able to finance part of the expenditure for a particular plant with tax-exempt industrial revenue bonds. These bonds are issued by the local municipality, but all debt service requirements are the responsibility of the corporation. Since the bond interest is exempt from personal income taxes, these bonds yield less than equivalent taxable securities. Obviously, the firm would choose to do all of its borrowing with these types of securities, but the total amount of each issue is limited by the U.S. Treasury to $5,500,000. Thus, firms will often finance a new plant with industrial revenue bonds (up to the maximum limit) and then finance the remainder with regular taxable securities. This gives us a chance to see how corporate bonds are priced in the market when they differ only with respect to the tax status of the interest paid.

During 1978, we could find 5 such joint issues, where the terms of two issues were sufficiently similar to rule out any other influence on the yields of the bonds. The data are presented in Table 1. The data suggest that $r_f = .775r$ and that the tax bracket of the marginal investor, was approximately 22 1/2 percent in 1978.

Table 1

Simultaneous Taxable and Tax-Exempt Issues

Date	Company	Yields to Maturity r	Yields to Maturity r_f	r_f/r
3/14/78	Exel Ind	9.25	7.125	.770
4/25/78	Carolina Frt. Carriers Corp.	9.875	7.50	.759
7/25/78	Haverty Furniture	10.0	7.75	.775
8/3/78	Luchenby Furniture	9.75	7.75	.795
10/10/78	Perini Corp.	9.5	7.375	.776
Mean				.775

A second method to estimate the tax bracket of the marginal investor in taxable (corporate) bonds is to compare the yields of taxable and tax-exempt issues of the same quality. Here we compared the yields of taxable and tax-exempt long-term issues of equivalent rating during calendar year 1978. Of course, this comparison controls less well for quality and other variations. For example, an AA bond quality rating may not imply the same for the two types of securities. Moreover, while an attempt was made to control for equivalence of call protection, it was simply not possible to ensure that the bonds compared were equivalent in all respects. Nevertheless, the estimates obtained were similar to those described above although they suggest a somewhat higher tax

bracket for the marginal investor. During 1978 the ratio r_f/r generally ranged between .65 and .70.

Finally, it is interesting to note that J. Huston McCulloch (1975) has produced estimates for the tax bracket of the marginal investor in taxable government bonds. McCulloch's methodology is quite different--he estimates marginal tax rates by looking at how yields differ on long-term government bonds selling at par and at discounts. The former bonds give all of their promised yield in fully taxable coupon payments while the latter give some of their yield in favorably taxed capital gains (the difference between the market and redemption prices of the bonds). McCulloch estimates the effective tax rate that best explains the prices of U.S. Treasury securities lies somewhere in the range .22 to .30 implying a range for r_f/r of .70 to .78.

Taking all the evidence into account and giving special weight to our estimates based on the issues in Table A1, where the best control was exercised over quality and terms of the two issues compared, we estimate that r_f is approximately equal to 3/4 of r for long-term securities.

It should be noted, however, that these estimates apply only to long-term bonds. It appears that the tax rate for the marginal buyer of short-term issues is considerably higher than 25 percent. Comparing short-term prime housing notes (the highest quality government-guaranteed, tax-exempt security available) with U.S. Treasury bills of comparable maturity over year-end periods from 1961 through 1968 produced an average effective tax rate of 42 percent.

APPENDIX B

Approximation of the Excess Burden From Inefficient Risk-Bearing

In section III.B, we noted that the marginal risk premium on a security for a given investor would be

$$\bar{g} + \frac{(1-m)}{(1-c)}\bar{d} - \frac{1}{(1-c)}\max((1-m)r_z, r_f) .$$

This will vary systematically across investors due to the variation in tax rates across investors. In this appendix, we would like to approximate the efficiency gains from redistributing risk among investors until all investors have the same risk premium at the margin.

In order to do this, we first make the following simplifying assumptions on relative magnitudes:

(1) $c = .2m$, (2) $r_f = .75r_z$, (3) $\bar{d} = .6r_z$, (4) $\bar{g} = r_z$.

With these assumptions, we can express an investor's risk premium as a function of his $\alpha = \frac{1-m}{1-c}$. This relationship is plotted in Figure 2.

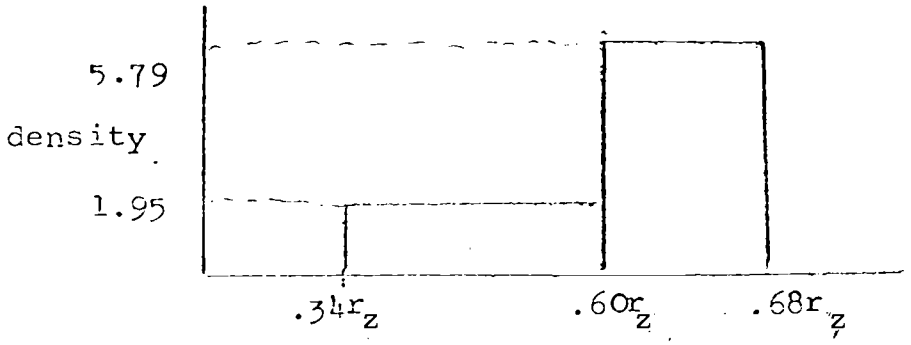
We now would like to estimate the total efficiency gains resulting from a reallocation of risk across investors. In order to approximate the order of magnitude of these efficiency gains, let us make the following assumptions: 1) the distribution of investors (weighted by their equity portfolio) across values of α is uniform between .35 and 1.0,[66] and 2) each individual's risk premium is proportional to his holdings of risky

[66] In the TAXSIM file, the distribution of individual's marginal tax rates is slightly heavier at the higher tax rates, but introducing tax-free investors ought to at least offset this.

securities.[67]

Assumption 1, along with our earlier assumptions, then implies that the distribution of the marginal risk premia assigned to each share takes the simple form shown in Figure B-1. Taxpayers with a value of α greater than .68 have a risk premia between $.60r_z$ and $.68r_z$ while those with a value of α less than .68 have a risk premia between $.34r_z$ and $.60r_z$.

Figure B-1



Assumption 2, applied to Figure 3, implies that at the new equilibrium when all individuals have the same risk premium,

[67] This assumption essentially follows from the capital asset pricing model. To see this, let the individual's utility function be $f(\mu, \sigma^2)$ where μ, the mean return on the portfolio, equals $r'x$ and where σ^2, the variance of the return on his portfolio, equals $x'\Omega x$. Here r is a vector of expected after tax returns on the available assets, x is a vector of the dollars invested in each security by the individual, and Ω is a matrix of covariances of after tax returns among the securities. Manipulation of the first-order conditions then gives

$x = \frac{-f_1}{2f_2} \Omega^{-1}(r-\alpha r_z)$, where $r-\alpha r_z$ represents the after tax risk premium. As asserted, x is proportional to the after tax risk premium. The qualification is that f itself depends on x.

this common risk premium will be $.53r_z$.[68]

By assumption 2, the efficiency gain when an individual trades from an initial risk premium of x to the market equilibrium risk premium of ρ is just $\frac{1}{2}|(\rho - x)(\Delta A)|$, where ΔA measures the difference in the number of securities the individual owns between the two equilibria -- the marginal efficiency gain declines from $\rho - x$ to zero, giving an average of $\frac{1}{2}(\rho - x)$ per unit change in holdings. Also by assumption 2, we have that $\Delta A = (\frac{\rho}{x} - 1)A$, where A is the initial holdings. Combining these results and summing over individuals, we find that the total efficiency gain from spreading risk efficiently would be

$$V[1.95 \int_{.34r_z}^{.60r_z} \frac{1}{2}|(.53r_z - x)(\frac{.53r_z}{x} - 1)|dx + 5.79 \int_{.60r_z}^{.68r_z} \frac{1}{2}|(.53r_z - x)(\frac{.53r_z}{x} - 1)|dx]$$

$= .0.01r_z^2V$, where V is the total amount of risky securities outstanding.

---

[68] Let ρ represent the new equilibrium risk premium. Then it must be that the number of securities that individuals with an initial risk premium below ρ will buy will just equal the number that those initially above ρ will want to sell. Assumption 2 implies that if the initial risk premium were x, then the desired change in holdings will be $(\frac{\rho}{x} - 1)A$, where A is the amount of initial holdings. Summing this expression over all individuals, we have that $1.95 \int_{.34r_z}^{.60r_z} (\frac{\rho}{x} - 1)dx + 5.79 \int_{.60r_z}^{.68r_z} (\frac{\rho}{x} - 1)dx = 0$, where the amount of initial holdings is replaced by the density of initial holdings. Simple algebra implies $\rho = .53r_z$.

[55] This number is too large by about five percent since what is being traded is risk in units equal to those in a share before tax, yet the government has absorbed about five percent of the original risk through the capital gains tax.