Impact of the Changing Tax Environment on Investments and Productivity: Financial Structure and the Corporation Income Tax

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This paper explores the consequences of the corporation income tax when firms face financial constraints; that is, they are either credit- or equity-rationed. (These financial constraints can, in turn, be explained as the natural consequences of informational asymmetries that are pervasive in the capital market.) The paper shows that the effect of such taxes may be more related to average tax rates than to the marginal effective tax rates on which recent literature, analyzing the incidence of such taxes in neoclassical firms, has focused. For firms that are equity- (but not credit-) constrained, the reduction in retained earnings reduces their willingness to undertake risky investments, including R&D expenditures which enhance productivity in the long run. More generally, the impact of the tax depends on the structure of taxes as much as it does on the level (the provisions for tax deductibility of interest, the tax treatment of capital gains, and so forth), and an analysis requires taking into account the combined effects of the corporation and individual income tax structures. For instance, for firms that are neither equity- nor credit-constrained, the fact that interest payments are tax-deductible implies that there are no marginal distortions with respect to the level of investment. Higher differential taxes on equity may induce some firms to decide not to issue equity. This financial decision will be accompanied by a discrete reduction in the level of investment.

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1. Prelude

This paper is concerned with the impact of the corporation income tax on a wide range of firm decisions, including its effect on output and on investment in plant and equipment, in R&D, and in inventories.

Understanding the effect of a change in taxation requires understanding the determinants of firm behavior. In recent years, we have been exploring a theory of firm behavior that is an alternative to the standard neoclassical model. This alternative theory is based on an explicit recognition of the importance of financial constraints (what we call equity and credit rationing) on firm behavior. Much of our work has been concerned with understanding the sources of those financial constraints. This paper is concerned with investigating the consequences of those constraints. We believe our model of the financially constrained firm provides a much better description of firm behavior than the alternative neoclassical theory, many of whose predictions are simply inconsistent with observed behavior.

2. Introduction

Perhaps no question in public finance is so unsettled as the incidence of the corporation tax. Yet few questions are of greater importance. For instance, the Tax Reform Act of 1986 shifted some of the burden of taxation ($120 billion over five years) from the Individual Income Tax to the Corporation Tax; whereas the provisions of the individual income tax were designed to maintain distributional neutrality, the full distributional consequences of the tax bill depend on who bears the burden of the increased corporation tax. Until we answer that, we cannot tell whether the Tax Reform Act was, overall, distributionally neutral, progressive, or regressive.

There are many reasons for the uncertainty about the incidence of the corporation income tax, but among the more important reasons is the differential treatment of debt and equity. Accordingly, how the firm finances its investment makes a difference; but, at least until recently, our understanding of the determinants of firms' financial structures has remained, to put it mildly, incomplete.

Fifteen years ago, Stiglitz (1973) showed that as long as firms could finance their investment at the margin by debt, since interest on debt was tax-deductible, the corporation tax was nondistortionary. That is, in the absence of taxation, the firm set the level of investment so that the value of the marginal product of capital (MPK) equaled the user cost, the rate of interest, r, plus the depreciation rate δ:

$$MPK = \tau + \delta. \quad (1)$$

The firm does exactly the same thing with taxation.[1]

This view implies that the corporation income tax is not, in effect, a tax on capital, at least at the margin. What, then, *is* the corporation income tax? Stiglitz suggested that it was an infra-marginal tax on the return to capital, a tax on the original equity investors in the firm; since these were, at least in many cases, the original entrepreneurs, the tax could be thought of as largely a tax on entrepreneurship. If this view were accepted, it would have strong implications for the consequences of the tax. It might serve to depress the long-run growth of the economy, and whether labor or capital bore the brunt of the tax would depend on the effect that entrepreneurship had on the relative returns to these two factors.[2]

In spite of the seeming persuasiveness of the arguments, this view has not been widely adopted, for instance, in the empirical studies of the incidence of the corporation and capital taxation of Auerbach (1983), Fullerton and King (1984), or Shoven and his co-authors (for instance, Shoven [1976]). These authors, while recognizing that the marginal financial structure need not equal the average, have tended to assume either that marginal investments are financed by a ratio of debt to equity reflecting the firm's current debt–equity ratio or that in fact marginal investments are financed out of equity.

Although they have not articulated clearly their objections to Stiglitz's earlier analysis, there seem to be three concerns:

1. Stiglitz incorrectly calculated the cost of borrowing: As firms borrow more, the interest rate they must pay increases, and this discourages them from borrowing. Accordingly, they use equity to finance their marginal investments.
2. There are other costs to borrowing (other than the increases in interest rates paid) and these too induce the use of equity at the margin.

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1. This is true as long as the corporation income tax is proportional with full loss offsets. Auerbach and Poterba (1987) have argued persuasively that limitations on loss deductibility, even with current provisions for carry forward and carry back, may have significant effects. It also assumes that depreciation allowances equal true economic depreciation. The effects of accelerated depreciation are by now reasonably well understood. Accordingly, to isolate the effects we are interested in in this paper, we assume full loss offsets and true economic depreciation.

2. Thus, if entrepreneurship is thought of as increasing the productivity of capital and labor, it would depend both on the elasticity of substitution between capital and labor and on the extent to which entrepreneurship was "capital" versus "labor" augmenting. Of course, if the long-run supply curve of capital is perfectly elastic (as it would presumably be either in a small open economy or with the standard utility functions with constant discount factors), then the long-run burden of the tax must be on the remaining factors—labor and entrepreneurship.

3. Firms are constrained in the amount they can borrow, and hence they must use equity.[3]

We will argue in this paper that although the criticisms of Stiglitz's paper are partially (but only partially) correct, the incidence of the corporation tax is in fact markedly different from that implied by currently fashionable models.

In particular, we will show the following:

1. Even if the interest rate charged increases with the amount borrowed, taxation may leave unaffected the basic equation describing the optimal amount of borrowing; but whether taxation affects the amount of borrowing and the level of investment depends critically on whether firms are constrained in the amount of equity they can issue.
2. Stiglitz (1973) argued that different firms would be in different *regimes*. Firms would first finance investments out of retained earnings. Only if retained earnings were insufficient would they borrow additional funds. Even for firms for which retained earnings exceeds investment, however, equation (1) (or the analogue, where the interest rate charged increases with the amount borrowed) would still hold, as long as firms used retained earnings not invested in capital goods to retire debt. If firms were constrained in the amount they could borrow (new firms) or lend (tax laws adversely treat investment holding companies), then equation (1) would not hold; for these firms, a separate calculation of the effect of taxation on investment must be made.

Firm behavior in Stiglitz's model was driven by tax considerations and arbitrarily specified financial constraints. Here, we discuss how those constraints can be derived from underlying considerations of imperfect information. The results thus derived, however, are similar to those obtained by Stiglitz in his original analysis.

3. In particular, for firms that are both equity- and credit-constrained, average tax rates are critical in determining the incidence of taxation, not the conventionally calculated marginal tax rate; for firms that are equity-constrained but not credit-constrained, the corporation tax is nondistortionary if the only costs associated with additional borrowing are the increased interest rate they must pay, but not if there are other costs; but for firms that choose to enter the equity market (a decision that can be modeled endogenously), the corporation tax

3. Stiglitz (1973) briefly considered this possibility.

discourages investment, but by an amount that is greater than that suggested by the conventional effective marginal tax analysis.

3. A Simple Heuristic Model

In this section we consider a simple model of the corporate sector, in which there is a representative firm attempting to make investment and financial decisions in the interests of current shareholders. Capital markets are perfect, in the sense that the firm can borrow at a rate of interest reflecting its true bankruptcy probability. The rate of interest charged will, of course, increase as it borrows more, since that will normally increase the likelihood of a default. There is a tax rate of τ on corporations, of t on interest payments to individuals, and of t_e on distributions to equity owners. Interest on debt is, however, deductible by the firm. For simplicity, we use a two-period model, and in this section we focus only on the consequences of borrowing and investment decisions for the second period.

Firms are assumed to have a return of θ from previous investments; current investments K yield a return of $\epsilon Q(K)$ where ϵ is a random variable with mean 1 and finite variance. Investment can be financed either by retained earnings R or by borrowing B or by issuing new equity E. Thus, by assumption

$$K = R + B + E. \tag{2}$$

For simplicity, we assume that there cannot be negative equity issues, that retained earnings not invested in capital can be lent out at a safe interest rate of ρ, and that there is no preexisting debt.[4]

3.1 Risk Neutrality

We begin our analysis by assuming that all individuals are risk-neutral. Investors will insist on the same after-tax return to equities as on bonds. Thus, denoting by ρ_e the before-tax return on equities, we have

$$(1 - t_e)\rho_e = (1 - t)\rho$$

or

4. These assumptions allow us to focus on the consequences of the financial and investment decisions on the final period.

$$\rho_e = \frac{(1 - t)\rho}{1 - t_e}. \tag{3}$$

Given our risk-neutrality assumption, then, in the absence of any bankruptcy costs, it can be shown that the expected return to current shareholders is[5]

$$(1 - \hat{\tau})\theta + (1 - \tau)(Q(K) - \rho B) - \rho_e E \tag{4}$$

where $\hat{\tau}$ is the effective tax rate on the return on earlier investments,[6] K is given by equation (2), where we assume R is fixed. The firm chooses B and E to maximize its expected return; that is, for an interior solution[7]

$$Q' = \rho \tag{5a}$$

and

$$(1 - \tau)Q' = \rho_e. \tag{5b}$$

We have thus reestablished, in somewhat more general terms, the result of Stiglitz (1973) that the basic formula for equilibrium investment is unaffected by the corporation income tax. This result holds even when there is a finite probability of bankruptcy, so that the nominal interest rate charged, r exceeds ρ and increases with B. The reason for this is obvious: As long as investors and firms have the same expectations about the distribution of returns, lenders will insist on receiving an interest rate that is high enough to generate an expected return ρ. Hence, it is only this return that is of relevance, not the nominal (promised) return r_o.

On the other hand, substituing equation (3) into (5b), we obtain

$$Q' = \mu\rho \tag{5b'}$$

where

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5. The actual return to shareholders is 0 if the firm goes bankrupt, and $Q(K) - (1 + r_o)B$ if it does not, where r_o is the nominal (promised) interest payment on a loan, r_o is set so that the expected payment, per dollar lent, to bondholders (who receive r_o if the firm does not go bankrupt, and $\frac{Q(K)}{B}$ if it does) is just ρ. After some manipulation, it can be shown that:

$$E\{max\{O, Q(K) - (1 + r_0)B\}\} = Q(K) - \rho B$$

when r_o is determined in the manner described. This, of course, assumes that "bankruptcy" costs are zero, but a similar result applies as long as bankruptcy costs can be fully offset against corporate taxes.

6. $\hat{\tau}$ may differ from τ because of capital gains tax treatment (under the pre-1986 tax law).

7. There are problems with the definitions of ρ, ρ_0, ρ_e, etc. If these are interpreted as rates of interest, then implicitly we are assuming that capital does not depreciate. With depreciation, the first-order condition on capital investment, equation (5a), becomes:

$$(1 - \delta) + Q'(k) = 1 + \rho \tag{5'a}$$

which reduces to (5.a) only if $\delta = 0$. Similarly for other equations.

$$\mu = \frac{1 - t}{(1 - \tau)(1 - t_e)} \tag{6}$$

represents the relative tax advantage of debt over equity. It is thus apparent that we cannot be interior in both B and E; at least one of the two equations must be replaced by an inequality. In particular, it is not difficult to see that if

$$\mu > 1 \tag{7}$$

that is,

$$1 - \tau < \frac{(1 - t)}{1 - t_e}$$

debt financing is preferable; E will be set equal to zero. More accurately, the firm will finance its investment first out of retained earnings, and the remainder by borrowing. (If retained earnings exceed investment, then the residue is lent at the return ρ.)[8] If (7) is satisfied, investment is given by (5.a), or inverting:

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8. If negative equity issues are allowed, then whether such issues are desirable depends on their tax treatment. Share repurchases entail a tax in the first period. Thus, repurchasing a dollar of equity, financed by borrowing, engenders a current tax liability of t_e. The corporation's tax liability next period is reduced by $\tau\rho$, ignoring certain technicalities associated with default. Individuals' interest receipts after tax are increased by $(1 - t)\rho$; equity receipts are reduced by $(1 - t_e)(1 - \tau)\rho$. Thus, net receipts are increased by $\rho[(1 - t) - (1 - t_e)(1 - \tau)]$. If individuals' marginal rate of substitution is equal to

$$\rho(1 - t)$$

then the refinancing becomes desirable if and only if

$$1 - (1/\mu) \geq \hat{t}_e$$

or

$$t_e + \tau - t - t_e\tau \geq \hat{t}_e(1 - t).$$

For a security whose basis is close to zero, $\hat{t}_e$ is approximately equal to t_e. Under current legislation, with full taxation of capital gains, this reduces to

$$\tau \geq t_e.$$

The refinancing is desirable, but only marginally so. If capital gains are taxed at the ordinary rate, then refinancing becomes desirable if the corporate rate exceeds the individual rate. Note that if the individual plans to die, then $\hat{t}_e$ can be much greater than t_e, and refinancing becomes clearly undesirable. If, for instance, $t_e \approx 0$, $t \approx \hat{t}_e$, then refinancing becomes desirable only if

$$1 - \tau \leq (1 - t)^2.$$

With $\tau = .34$, $t = .28$, the condition is not satisfied ($.66 \geq .5184 = (.72)^2$).

The importance of these tax costs of refinancing have been stressed in Stiglitz (1988).

$$K = Q'^{-1}(\rho). \tag{8}$$

If returns are distributed to equity owners subject to full taxation, condition (7) will always be satisfied. With favorable treatment of capital gains, it may not be. Assume that equity distributions escape taxation completely. Then the condition becomes simply

$$t < \tau.$$

Those with tax rates below the corporate rate prefer all debt financing (at the margin); those with tax rates in excess of the corporate tax rate prefer equity financing. Prior to 1981, there were some individuals for whom equity financing was clearly superior; from 1981 to 1986, most investors were almost indifferent; under the new tax bill, with full taxation of capital gains, there should be a stronger preference for debt.

3.2. Risk Aversion

The analysis is not much changed in the presence of risk aversion. For simplicity, we assume a representative individual. For him (or her) to be willing to hold both debt and equity, the risk equity must give a higher return. We thus assume that the mean required return on equity ρ_e^* is given by an equation of the form

$$\rho^*_e = \frac{\gamma\rho(1 - t)}{1 - t_e} \tag{10}$$

where

$$\gamma > 1 \tag{11}$$

if individuals are risk averse.[9] $\gamma - 1$ represents the risk premium on the risky equity. If we assume that the risk premium is relatively unaffected by

9. We can derive γ and its properties from the representative individual's utility function. If U is the individual's utility function and $\tilde{\rho}$ is the random return on equity, then the absence of taxation

$$EU'(\tilde{\rho} - \rho) = 0$$

or

$$\frac{EU'\tilde{\rho}}{EU'} = \rho.$$

With taxation, we have

$$\frac{EU'\tilde{\rho}}{EU'} = \frac{\rho(1 - t)}{1 - t_e}.$$

This equation can be thought of as defining either the price of equity or the mean required return on equity ρ^*_e.

the actions of the firm, then the earlier analysis with risk-neutral shareholders remains applicable with only trivial modifications.[10] But the assumption of a constant γ is not plausible. More generally, γ will be a function of both the level of debt and investment (which together imply a particular level of equity). We postulate that an increase in debt (keeping the amount of equity fixed) increases the required return (risk premium) on equity:

$$\frac{\partial \gamma}{\partial B} > 0 \tag{12}$$

An increase in E, keeping K constant (that is, substituting equity for debt) lowers the risk premium required:

$$\frac{\partial \gamma}{\partial E} < 0 \tag{13}$$

For simplicity, we assume the firm still maximizes (4), but it recognizes that its financial policy has an effect on the cost of raising funds.[11] We obtain as our first-order conditions for E and K:[12]

$$Q' = \rho \left(1 + E\mu \frac{\partial \gamma}{\partial B}\right) \tag{14}$$

and (for an interior solution)

$$(1 - \tau) = \frac{1 - t}{1 - t_e} \left(\gamma + E \frac{\partial \gamma}{\partial E}\right) \tag{15}$$

or

$$1 = \mu \left(\gamma + E \frac{\partial \gamma}{\partial E}\right). \tag{15a}$$

Two important results emerge from (14) and (15). First, taxes affect only the equilibrium conditions to the extent they affect μ, the bias of the

10. In particular, our earlier result that firms will either wish to invest entirely in equity or debt will continue to hold.

11. This objective function can be motivated by assuming that the controlling shareholders are wealthy and act in a risk-neutral manner. We also assume here no bankruptcy costs. For a discussion of what we view to be the more plausible case of risk-averse firm behavior, see Greenwald and Stiglitz (1989).

12. Substituting equation (10) into (4) and rearranging, we obtain the result that firms seek to maximize (with respect to K and E)

$$(1 - \hat{\tau})\theta + (1 - \tau)[Q(K) - \rho(K - R - E) - \mu\rho\gamma E]$$

where now retained earnings depend on taxes.

tax structure for debt. Second, issuing more debt does have a cost *when firms are issuing equity* beyond the increased interest rate that must be paid. Firms will take this into account, and this will reduce their level of investment, below the level at which the value of marginal product equals (ρ), i.e., $K < Q'^{-1}(\rho)$.

Moreover, we now may obtain an interior solution for the debt–equity ratio, for as firms substitute debt for equity, the marginal cost of an increase in debt (from additional substitution of debt for equity) increases.

There thus may exist some firms that, as before, issue no equity, and for which the equations (and inequalities) describing the equilibrium remain unchanged. But there may exist other firms with E greater than zero; for these firms, an increase in B has an indirect cost in terms of an increased cost of equity.

Though the equilibrium conditions as we wrote them in (14) and (15) reflect the tax structure only through the parameter μ, there is a hidden direct effect of tax structure. Taxes affect R, the supply of funds available for reinvestment. Thus, at a fixed value of K and E, B must increase; but then, under reasonable conditions, the marginal cost of debt will increase. Hence, the LHS of (14) exceeds the right. The firm responds by cutting back investment.[13]

The effect of a change in the tax *structure* is captured in this model through the parameter μ.[14] Totally differentiating equations (14) and (15) with respect to μ, we can solve for the effect of a change in μ on both the level of equity and, at any given level of equity, on the level of investment. It appears plausible that an increase in μ, which measures the relative attractiveness of debt, will result in a decrease in E; debt will be substituted for equity. From (14), then, there are three effects associated with the increase in μ. First, there is a direct effect (the RHS of (14) is increased), which discourages investment. Second, there is the indirect effect on the marginal increase in the risk premium from an increase in debt; since equity has been reduced, the risk premium (at any given B) is higher, and it is plausible to assume that, correspondingly, the marginal effect of an increase in debt is larger. This too serves to reduce investment. Finally, there is the direct effect of the decrease in E, which serves to increase investment. For firms issuing almost no equity, then, the third effect dominates, and the

13. See footnote below for a full calculation. In Greenwald and Stiglitz (1989), we explicitly derive the increase in the marginal cost of debt, relating it to bankruptcy costs. In that paper, we assume bondholders are risk-neutral and have rational expectations concerning default.

14. Though taxes could have a direct effect on γ as well; this would be the case, for instance, if attitudes toward risk depended on wealth, and the tax had a significant effect on wealth. In the subsequent discussion, we ignore this direct effect.

change in tax structure represented by an increase in μ leads to an increase in investment. But for most firms, we would expect the first two effects to dominate, and hence an increase in μ—the tax preference for debt—to reduce investment.[15]

In short, when the effects of tax structure on financial structure and of financial structure on investment are taken into account, then the corporate income tax appears to be more than just an infra-marginal tax. What is relevant is not so much marginal tax rates, but the tax structure, summarized

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15. Totally differentiating (14) and (15), we obtain

$$[Q'' - \rho E\mu\frac{\partial^2\gamma}{\partial B^2}]dK - \rho\mu[\frac{\partial\gamma}{\partial B} + E\frac{\partial^2\gamma}{\partial B\partial E}]dE = \rho\mu E\frac{\partial\gamma}{\partial B}dln\mu - \rho E\mu\frac{\partial^2\gamma}{\partial B^2}dR$$

$$-\mu[\frac{\partial\gamma}{\partial B} + E\frac{\partial^2\gamma}{\partial E\partial B}]dK - \mu[E\frac{\partial^2\gamma}{\partial E^2} + 2\frac{\partial\gamma}{\partial E}]dE = dln\mu - \mu(\frac{\partial\gamma}{\partial B} + E\frac{\partial^2\gamma}{\partial B\partial E})dR.$$

The second-order conditions ensure that

$$[Q'' - \rho E\mu\frac{\partial^2\gamma}{\partial B^2}] < 0$$

and

$$-\mu[E\frac{\partial^2\gamma}{\partial E^2} + 2\frac{\partial\gamma}{\partial E}] < 0.$$

We assume further that

$$\frac{\partial^2\gamma}{\partial B\partial E} > 0.$$

Under these conditions, it is easy to verify that, for E near zero,

$$\frac{dE}{d\mu} < 0$$

and

$$\frac{dK}{d\mu} > 0$$

whereas for the more general case where E is not small and, in particular, where

$$E \geq -\frac{\mu\frac{\partial\gamma}{\partial B}}{\frac{\partial^2\gamma}{\partial B\partial E}}$$

$$\frac{dK}{d\mu} < 0.$$

$$\frac{dK}{dR} > 0,$$

as long as

$$-E\frac{\partial^2\gamma}{\partial B^2}\left(E\frac{\partial^2\gamma}{\partial E^2} + 2\frac{\partial\gamma}{\partial E}\right) \geq \left(\frac{\partial\gamma}{\partial B} + E\frac{\partial^2\gamma}{\partial B\partial E}\right)^2.$$

If the cross term is small, we would expect this condition to be satisfied.

in the parameter μ and the effect of taxes on R, which is related to the *average* tax rate. Normally, investment will be discouraged when μ is increased (though for some firms with small equity bases, just the opposite may happen); and to the extent that investment is reduced, real wages are (at least in the long run) likely to be lower. The tax will be borne at least partly by labor.[16]

3.3 Risk-Averse Firms

These results are reinforced if the firm is risk-averse. The reduction in retained earnings means that at any value of $\{K, E\}$ borrowing must be greater, so the risk of bankruptcy is greater. Hence K will be reduced even more than our earlier calculation suggests.

Furthermore, if firms are equity-constrained (Greenwald, Stiglitz, and Weiss [1984]), the bankruptcy effects will be particularly strong, since the only way to raise capital is to borrow (Greenwald and Stiglitz [1989]).

This analysis is intended to be heuristic, and a careful reader will immediately object: We have ignored the basic lesson of the Modigliani–Miller theorem. A change in the debt–equity ratio does not necessarily entail a change in the risk premium. But there is an objection to that objection; the Modigliani–Miller theorem holds only in the absence of bankruptcy and with perfect information. Financial structure is important precisely because of bankruptcy and imperfect information.

Still, more broadly, one of the lessons to emerge from the capital asset pricing literature is that what is relevant for assessing the riskiness of an asset is not variance, but correlation with the market; increasing the probability of default increases the "riskiness" of equity only to the extent that those bankruptcy probabilities are correlated with the business cycle.

In fact, of course, when businessmen use the term *riskiness* in judging alternative courses of actions, they *are* concerned with bankruptcy, whether or not those bankruptcy probabilities are correlated with the business cycle. The reason for this is that they bear undiversifiable risks associated with bankruptcy, and their concern is likely to be reflected in the actions firms take.

Thus, the reason firms are averse to undertaking actions that significantly increase their bankruptcy probability is not only that doing so would increase the cost of raising equity and the interest rates they pay on debt, but also that such actions increase the risks they face. If this is so, taxation will have

16. This assumes that, at least in the long run, ρ remains unchanged.

effects on firm borrowing and investment, even—and particularly when—firms do not issue equity.

In Greenwald and Stiglitz (1989) we extend the Greenwald–Stiglitz–Weiss (1984) model of the corporate financial structure based on informational asymmetries to analyze the effects of the corporation income tax on investment.

We categorize firms into three categories:[17]

1. Those that are both equity- and credit-constrained. These firms' investment is limited by the availability of funds. The only aspect of the tax code that matters for these firms is the average tax rate. Increases in the average tax rate get reflected directly in reductions in the level of investment.
2. Those that are equity-constrained but not credit-constrained. For these firms, marginal investments are financed by borrowing, which is tax-deductible. Thus, since the returns to investing are reduced in proportion to the costs, the major effect is the increased risk—the increased probability of bankruptcy associated with any level of investment—as firms must borrow more to maintain the same level of investment when retained earnings are reduced.

   For these firms, again, it is the average tax rate that matters.
3. Those that issue equity. For these firms, the average tax rate effect discussed in connection with equity-constrained firms remains valid, but possibly with somewhat less force, as new equity issues can partially offset this effect. Whether firms will wish to issue more—or less—equity depends in part on how the tax structure changes.

4. Other Consequences of the Asymmetry of Information

The principal consequence of the asymmetries of information on which we have focused in this paper is that funds do not flow freely, either among firms or between firms and households, as they do in the standard neoclassical model. Our tax system also serves to impose barriers on the flow of funds. It is on the interaction of these two barriers that we have particularly focused our attention.

In this section we briefly take up two other sets of consequences.

17. There is a fourth possible category—those that are credit-constrained but not equity-constrained. For reasons explained in Greenwald–Stiglitz—Weiss, not too much importance is attached to this category. For these firms, the earlier analyses assuming all marginal investment is equity-financed is appropriate; and marginal tax rates become more important than average tax rates.

The Dividend Paradox

The first is a comment on the long-standing dividend paradox. Assume that some firm has earned an extraordinary return. If the firm distributes those funds to the shareholders, a tax is imposed on the transfer. Moreover, further costs are imposed on the manager if he wishes to recover these funds from the household sector. Thus, there are, in effect, heavy penalties from transferring funds out of the firm, when subsequently funds are to be transferred back into the firm. But limited managerial capacities may imply that the best management of those funds does not entail having those funds invested in "real" investment in the firm. The (temporary) transfer of resources to other firms, through the purchase of equity, may be desirable. But then, when that firm distributes funds to its owners, dividends receive preferable treatment compared to capital gains. Thus, consider a wealthy owner of a firm, who does not want the capital today, but rather wishes to leave a bequest to his children. If the funds were redistributed to him, he would have invested them in firm X. If firm X were regularly buying back shares, the returns would compound at the rate $(1 - t_e)$ times the return, say ζ. Thus, a distribution today would yield in Z years $(1 - t_e)e^{\zeta(1-t_e)Z}$. If the funds are retained inside the firm and the firm in which the funds were invested distributed its returns as dividends, he would have $e^{\zeta \cdot 85(1-\tau)Z}$. If the funds were retained inside the firm and the firm in which the funds were invested distributed its returns in the form of capital gains (share repurchases), he would have at the end $e^{(1-\tau)Z\zeta}$. Clearly, for reasonable values of the parameters, it pays to retain, and to have the firm in which the funds are invested distribute its returns by means of dividends. A firm concerned with maximizing its stock market value (either today or tomorrow) in deciding whether to increase dividends and reduce share repurchases would balance out the decreased valuation on the part of individual shareholders with the increased valuation on the part of corporations.

This explanation, although suggestive, suffers from one major problem: Firms should be able to construct specialized financial instruments, tailored for different clientele. Thus, the firm could issue two classes of shares, M and N; returns to shares M would be in the form of dividends, those to shares N in the form of share repurchases. To some extent firms can do this, for example, with preferred shares. The problem is that were the two categories of shares' returns explicitly linked, the common shares might not receive the favorable treatment of share repurchases normally afforded; and if they are not explicitly linked, they will have different risk characteristics or there will be an obvious opportunity for one class of claimants to take advantage of another.

Choice of Technique

We have limited our attention here to the effect of taxation on the form of financing and the level of investment. Taxation has other effects, for instance, on the level of risk taking, the extent of credit rationing, and interest rates charged for loans. Consider, for instance, the Stiglitz–Weiss credit rationing with collateral model (1986, 1987), and assume that losses are not fully deductible. It can be shown that taxes will induce less risk taking (at any given interest rate–collateral combination); the reduced risk taking may result in banks' charging higher rates of interest. That is, if there are two projects, the critical rate of interest (above which individuals switch to the risky project) is increased. This increase in the rate of interest charged will, in turn, have further ramifications for the level of investment.

5. Concluding Comments

Popular discussions, in assessing the effects of the corporation tax and its fairness, have focused on average tax rates. In recent years it has become fashionable for economists to look down on these naive views, arguing that what is relevant is marginal tax rates. They have interpreted the goal of making a "level playing field" to imply making sure that all investments are taxed at the same marginal rate, regardless of what average tax rates may be.

Our analysis should at least cast some skepticism concerning this view. Our analysis has two parts: First, we argued that, as long as interest payments were tax-deductible and firms could finance their marginal investments through debt, marginal tax rates that did not distort the relative tax burden of debt and equity had no direct effect on investment. Earlier analyses focusing on the effect of marginal tax rates simply made some ad hoc (and probably incorrect) assumption, such that the marginal debt–equity ratio equaled the average debt–equity ratio, or that new investment was financed, at the margin, entirely by equity.

If it is argued that firms do not finance their marginal investments by borrowing, one must have an explanation for why that is so. Any coherent theory of the incidence of the corporation income tax must be based, then, on a model of the determinants of a firm's financial structure, and an explanation of how taxes affect financial structure.

The second part of our analysis was accordingly devoted to presenting a simple heuristic model, in which risk aversion plays an important role. Debt and equity are different, in part at least because of the risks they impose on the firm (there is no bankruptcy probability with equity) and the con-

sequent incentives to which they give rise. Under the plausible assumption that an increase in indebtedness increases the risk premium required for investment, we are able to show that increases in the *average* tax rate discourage investment; and it is only the average tax rate that matters. As long as there is no change in tax structure, that is the relative preference for debt versus equity.

More generally, we have argued that as long as firms are either equity- or credit-constrained, average tax rates will be important. The magnitude of the effect of the tax will depend precisely on the nature of the constraints facing firms. Since these financial constraints are likely to be particularly important for new, entrepreneurial firms, the concern[18] that the corporation tax discourages entrepreneurship may be well founded.

Appendix A

Finite Bankruptcy Costs and Loss Offset Provisions

The firm maximizes

$$(1 - \hat{\tau})\theta + (1 - \tau)\,(Q(K) - \rho^B) - \rho_e E - (1 - \tau)\pi_B \cdot c \quad (A.1)$$

where π_B is a function of θ; B, K, and ρ^c the rate of interest promised on debt. In particular, bankruptcy occurs when

$$\theta + \epsilon Q(K) \leq \rho\, B^c \text{ or } \epsilon \leq \frac{\rho^c B - \theta}{Q(K)}.$$

Let $F(\epsilon)$ be the distribution function of ϵ. Then

$$\pi_B = F\left(\frac{\rho^c B - \theta}{Q(K)}\right), \text{ with } K = R + E + B.$$

Now consider the first-order condition,

$$(1 - \tau)\,[Q'(K) - \rho] - (1 - \tau)c\frac{\partial \pi B}{\partial K} = 0$$

or

$$(1 - \tau)\,[Q'(K) - \rho] - (1 - \tau)cf'\left[\frac{\rho^c + B\, d\rho^c/dK}{Q(K)} - \frac{\rho^c B - \theta}{Q(K)^2}\,Q'(K)\right] = 0$$

or

18. Expressed, for instance, in Stiglitz's earlier paper (1973).

$$[Q'(K) - \rho] - \frac{cf'}{Q}\left[\rho^c + \frac{Bd\rho^c}{dK} - \left(\frac{\rho^c B - \theta}{Q(K)}\right)Q'(K)\right] = 0.$$

Thus, the first-order condition with a finite "cost of bankruptcy" that can be offset against taxes is unaffected by the tax rate.

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