TAXATION AND CORPORATE FINANCIAL POLICY*

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A model of corporate financial policy (debt-equity ratios and dividend payout rates) is included in the Harberger general equilibrium model of incidence of the corporate income tax. Illustrative calculations of the distortions of financial policy and increases in risk premiums induced by the corporate tax are provided. Because risk premiums on corporate securities would be reduced, eliminating the corporate tax or integrating it into the personal tax would increase the income of noncorporate investors relatively more than that of investors in corporate securities, and is therefore less regressive than is commonly thought.

I. INTRODUCTION

There has been growing interest in some form of integration of corporate and personal income taxes in the U.S.[1] At the same time, a fairly large body of literature, both theoretical and empirical, has recently appeared that examines the impact of the differential tax treatment of debt, equity, dividends, and retentions on corporate financial policy.[2] Since most types of integration, or even a simple reduction of the corporation income tax, would alter such differential taxation, the conclusions of that literature must form an integral part of an analysis of the incidence and other effects of integration. Such an analysis comprises the goal of this paper.[3]

We modify the two-sector incidence model developed by Harberger [1962] to allow for two distinct types of corporate securities—debt and equity. The return to the latter is composed of two components—dividends and retained earnings. As in the real world, corporate income (net of interest payments) is subject to the corporate income tax. Dividends and interest are subject to the personal tax rate;

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1. Much of this discussion is summarized in McLure [1979], Ch. 2.
2. See, for example, Tambini [1979], Feldstein [1970], Stiglitz [1973], King [1974], and Scott [1976].
3. After this paper was essentially completed, a paper by Feldstein, Green, and Sheshinski [1979] with similar goals, but a different approach, came to our attention.

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retentions are assumed to be taxed at some fraction of the personal rate, reflecting the preferential tax treatment of long-term capital gains. Capital income originating in the noncorporate sector is assumed to be subject to the personal income tax. For simplicity we assume that the personal income tax is proportionate.[4]

Because investors do not see corporate debt, corporate equity, and investment in the noncorporate sector as perfect substitutes, the net rates of return on these uses of capital need not be equal, or be affected equally by the corporate tax.[5] The principal conclusion of this paper is that *owners of corporate shares bear proportionately less of the long-run burden of the corporation income tax than do investors in the noncorporate sector.* That is, the corporation income tax is *overshifted* to noncorporate investors, rather than being borne by all capitalists in proportion to their capital income, as in Harberger's analysis.[6] Investors in corporate debt, like corporate shareholders, bear less of the tax burden than Harberger suggested.[7] The practical significance of these conclusions is, of course, that the corporation income tax is even less progressive than the Harberger analysis suggests—which itself is less progressive than if the tax were merely borne by shareholders.

In Section II we describe a simplified model of corporate financial

4. Under a proportionate income tax the case for integration based on vertical equity largely evaporates. But the arguments based on horizontal equity and distortions of resource allocation and financial policy retain their force. For a summary of these arguments, see McLure [1975a].

5. Harberger recognized that the presence of risk can give this result [1962, p. 137], but chose to abstract from risk in his analysis. While we also abstract from uncertainties involving price and output, a crucial part of our argument is that the corporation income tax has a significant impact upon corporate debt-equity ratios, which in turn alters investors' required risk premiums for investment in corporate securities. For analysis that considers price or output uncertainty, see Batra [1975] and Ratti and Shome [1977].

6. This result is suggested by the following quotation from Barzel [1976, p. 1185]: "The corporate income tax is fundamentally an ad valorem tax. When such a tax is imposed or raised, it can be evaded in part by switching to corporate financing based more on debt and less on equity. The risk borne by equity holders will then increase. The measured rate or return to equity, reflecting this risk, might exceed the change in the tax rate, giving the impression of more than 100 percent shifting." It seems unlikely that the return to equity would rise by enough to suggest more than complete shifting. (Our reference to overshifting should be interpreted as being relative to the Harberger result of diffusion to all capitalists.) Moreover, Barzel does not mention the increase in risk premiums paid to debt-holders also induced by the rise in the debt-equity ratio.

7. The increase in risk premiums may help to explain the extremely high estimate of shifting of the corporate tax by Krzyzaniak and Musgrave [1963]. Whereas K-M regressed the profit rate on the tax rate (and other variables), it might have been preferable to employ two-stage least squares to determine the influence of taxation on the corporate debt-equity ratio and then regress the profit rate on the tax rate *and the debt-equity ratio* resulting from the first stage (plus other variables). Of course, the speed of adjustment of risk premiums needed to make this a reasonable explanation may be unrealistically high.

policy in the presence of taxes and the risk of bankruptcy that is consistent with the main threads of recent literature in corporation finance. Section III describes how the model of corporate financial policy can be combined with the standard Harberger model, and Section IV presents some numerical simulations of the impact of various tax changes.

II. FINANCIAL POLICY AND TAXES

A substantial body of literature is devoted to the proposition that, under certain conditions, the value of the firm is independent of the firm's financial structure, i.e., that there is no optimal debt-equity ratio.[8] An important corollary of this proposition is that (at least at the margin) the firm will finance its operations entirely from that source of funds which bears the lowest rate of taxation; that is, that (at the margin) firms will be financed 100 percent from debt, given present patterns of taxation.[9]

Crucial to all demonstrations of the so-called Modigliani-Miller hypothesis of the irrelevance of corporate financial structure is the assumption that bankruptcy is impossible. As Stiglitz [1972] has shown, if there is a positive probability of bankruptcy, corporate financial structure is not irrelevant for the valuation of the firm and there *is* an optimal debt-equity ratio. Of more immediate relevance for present purposes, if bankruptcy is possible, Stiglitz [1973, p. 23] has noted, "... the tax advantages of debt would increase the debt-equity ratio from what it would have been otherwise, but would not result in the firm going to an 'all debt' position." The corporation income tax is not, therefore, irrelevant in a world in which bankruptcy is possible. (See also Scott [1976].)

Our description of the optimal debt-equity ratio is in the spirit of the analyses by Stiglitz and Scott. But it abstracts from many complexities in order to simplify the analysis and focus attention on our key purpose—integrating the corporation financial decision into a general equilibrium model of incidence.[10] We assume (a) that in-

8. See Miller and Modigliani [1958] for the initial statement of this theorem and Stiglitz [1974] for a restatement under less restrictive conditions.

9. See Stiglitz [1973] for an elegant demonstration of these conclusions.

10. In particular, Stiglitz and Scott use partial-equilibrium analysis to consider the implications of taxes or the risk of bankruptcy on the firms optimal debt-equity ratio; but because of the complexity of the problems, they have difficulty obtaining comparative-statics results, and they make no pretense at general-equilibrium analysis. By comparison, our description of the risk of bankruptcy is deliberately vague, and somewhat ad hoc, and is based ultimately upon empirical estimates of key parameters. But we are able to employ it in a general-equilibrium analysis from which we obtain comparative-statics conclusions about the incidence and financial effects of taxation.

vestors are not indifferent to the corporation's debt-equity ratio, demanding increasing risk premiums on both debt and equity as the debt-equity ratio rises, and (b) that the firm minimizes the cost of obtaining whatever quantity of capital it needs by adjusting its debt-equity ratio. In these two assumptions our approach is almost identical to that of Tambini [1969].

Corporate capital (K_x) can be financed from either debt or equity. Let E be that part of the capital stock in the corporate sector that is financed by equity and B the part financed by debt. Thus,

$$K_x = B + E. \tag{1}$$

There being no corporate tax on interest paid, the cost of debt capital in the corporate sector (P_{bx}) is given by the following simple expression:

$$P_{bx} = i_b(1 + t_p), \tag{2}$$

where i_b is the net of tax return on debt and t_p is the personal tax rate applied to interest payments.[11] At this point we do not distinguish between retentions and dividends and differences in their taxation. Thus, the analogous expression for the cost of corporate equity capital (P_{ex}), to be elaborated further below, is

$$P_{ex} = i_e(1 + t_e), \tag{3}$$

where i_e is the net of tax return on corporate equities and t_e is the aggregate (corporate and personal) tax rate applicable to the return to corporate equity capital.[12]

We can combine equations (1) to (3) to yield the cost of a given corporate capital stock:

$$K_x P_{kx} = i_b(1 + t_p)B + i_e(1 + t_e)E. \tag{4}$$

We assume that as the debt-equity ratio rises, investors require higher risk premiums on both debt and equity. We express this risk premium as the return on debt or equity *relative to the return on capital in the noncorporate sector.*[13] Thus, we write

11. In describing the financial sector, it will be convenient to use i, properly subscripted, to indicate *net returns* to various forms of investments and to build up *costs of capital* from the net returns and relevant taxes. Besides allowing us to avoid extremely messy notation, this convention helps to highlight the separation of the real and financial parts of the model discussed further below.

12. The tax rates on dividends and retentions and the dividend payout rate determine t_e; see also equation (14) and the discussion thereof.

13. By this we are not implying that the noncorporate sector is riskless, but that the risk in the noncorporate sector is independent of the debt-equity ratio in the corporate sector and that investors use the return paid in the noncorporate sector as a benchmark for determining the corporate return they require at different debt-equity ratios.

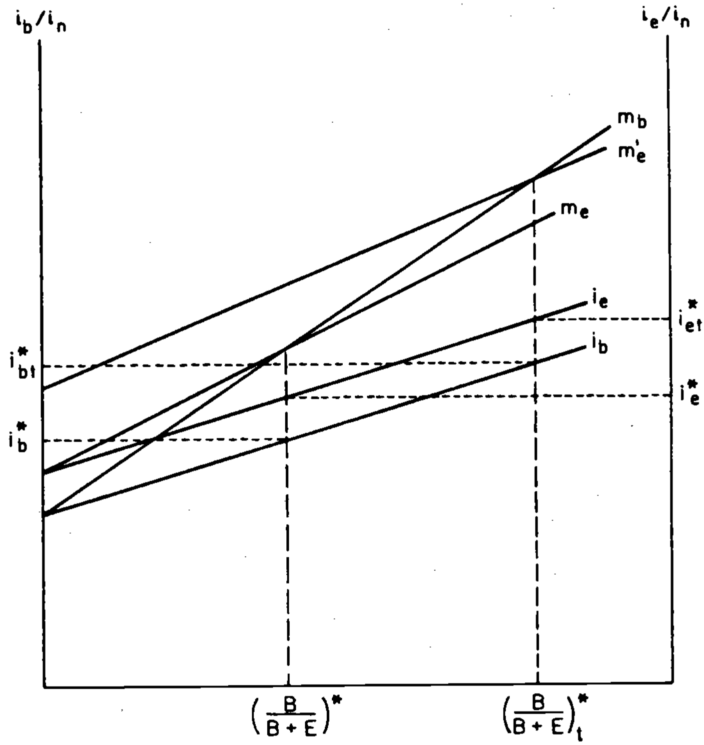

FIGURE I

$$(5) \qquad i_e/i_n = f(B/E), \quad f' > 0$$

and

$$(6) \qquad i_b/i_n = g(B/E), \quad g' > 0,$$

where i_n is the net rate of return in the noncorporate sector.[14]

We also assume that corporations attempt to minimize the cost of any given amount of capital by choosing an optimal debt-equity ratio. We assume that in doing so corporate firms take the rate of return paid in the noncorporate sector as being constant. Substituting

14. Because equations (5) and (6) relate relative returns to the aggregate debt-equity ratio, our description of optimal financial policy might best be thought of as being based on an assumption that there is a single firm in the corporate sector. Alternatively, one can assume that all corporate firms are identical, that each firm assumes that its cost of debt and equity depends only on its debt-equity ratio, and that each firm's assumption as to the effect of a rise in its debt-equity ratio on i_e/i_n and i_b/i_n is consistent with the aggregate relationship. In this case, equations (1)–(7) apply to each firm and can be aggregated to the whole sector.

from equations (1), (5), and (6) into equation (4) and differentiating with respect to B (which is essentially equivalent to differentiating with respect to B/E, since $B + E = K_x$ is constant), we obtain the following first-order condition:[15]

$$(7) \quad i_b(1 + t_p) - i_e(1 + t_e) + i_n (1 + B/E) [g'(B/E)(1 + t_p) + f'(1 + t_e)] = 0.$$

This expression has a ready explanation. A change in the amount of capital financed by debt, given the total corporate capital stock, raises the cost of capital by an amount equal to the cost of debt (the first term), but reduces it by an amount equal to the cost of equity (the second term). But the rise in the debt-equity ratio also induces a rise in the return that must be paid on both corporate securities. Thus, in total, the cost of capital rises by the difference in the first two terms *plus* the third term.

Figure I may assist in understanding our analysis of the firm's choice of optimal financial structure. In it we measure the fraction of the firm's capital stock that is debt financed $B/(B + E)$ along the horizontal axis from the left; the fraction financed by equity is measured from the right. For expositional ease suppose that $i_n = 1$. The curves labeled i_b and i_e indicate the returns that must be paid on corporate debt and equity at various debt-equity ratios.[16]

While i_e and i_b indicate the average cost of corporate equity capital and borrowing, they do not show the corporate sector's marginal costs of the two sources of finance. In order to illustrate the choice of an optimal debt-equity ratio, we must add m_e and m_b, the curves that show the marginal cost of equity and debt, respectively. In the absence of taxes the intersection of these two curves reveals the optimal debt-equity combination $B/(B + E)^*$. With that financial structure the return to equity is i_e^* and the interest rate on corporate debt is i_b^*.

In anticipation of the next section, we can note the effect of introducing a tax applied only to corporate equities. Such a tax would

15. Note that the level of corporate capital K_x does not enter this equation. This implies that the optimal debt-equity ratio in our model is invariant with respect to the level of output or capital employed.

16. Though we have drawn the left-hand intercepts of both i_b and i_e to exceed one (i.e., to exceed i_n), indicating a positive risk premium on both corporate securities at a zero debt-equity ratio, this has been done only to simplify the diagram; this placement has no other significance. (In fact, as mentioned in footnote 32 below, our data suggest that i_b will be less than i_n at a zero debt-equity ratio.) On the other hand, it is necessary for an interior solution that the left-hand intercept of i_e be above the left-hand intercept of i_b. Otherwise, in the absence of taxes the optimal debt-equity ratio would be zero.

cause the m_e curve to shift upward.[17] The intersection of the new marginal cost curve (m_e') and m_b occurs further to the right; that is, the tax increases the optimal debt-equity combination to $B/(B+E)_t^*$. Moreover, and of especial interest in the analysis of tax incidence, both i_e and i_b rise *relative to* i_n, as shown by their values at the new optimal debt-equity ratio i_{et}^* and i_{bt}^*. It is for this reason that we say that holders of corporate securities bear less of the corporation income tax than Harberger suggests.[18]

III. The Combined Models

In order to analyze the impact of integration of corporate and personal income taxes, we have combined the description of corporate financial policy presented in the previous section with the static two-sector general equilibrium model referred to in tax literature as the Harberger model. Because the Harberger model is well-known, we only sketch its assumptions and the nature of its solution. The model assumes that there are two sectors (a corporate sector X and a noncorporate sector Y), made up of perfectly competitive firms whose production functions exhibit constant returns to scale. There are two homogeneous factors of production—capital (K) and labor (L). Demand for the output of each sector is assumed to be a function of relative output prices and total income. In the usual formulation of the model, this last condition requires that consumers and the government divide their incremental expenditures between corporate and noncorporate output in the same manner. Since we explicitly recognize retained earnings, we must also add the assumption that corporations divide their incremental expenditures as do consumers and the government.[19]

For analysis of the incidence of the corporation income tax, the Harberger model typically assumes that there is a single tax on all corporate capital. The equations of the model are differentiated giving a linear system of equations that can then be solved to obtain the elasticity of the net-of-tax rate of return to capital (P_k) with respect

17. That upward shift is due to the fact that the marginal cost of equity now includes not only the increased payments to equity holders but also the tax payments on equity earnings. Note that when a tax on equity is imposed, the i_e curve does not depict the average *cost* of equity, since it does not include the tax payments.

18. While the net rate of return paid to corporate investors rises relative to that of noncorporate investors, this occurs only because corporate investors incur greater risk due to the increased debt-equity ratios. This is briefly discussed below.

19. This assumption allows us to perform balanced budget incidence analysis and yet to abstract from the expenditure effects of a change in government revenues.

to the tax on corporate capital (t_{kx}). Writing that elasticity as $\eta_{P_k,t_{kx}}$, we have[20]

$$\hat{P}_k = \eta_{P_k,t_{kx}}(1 \hat{+} t_{kx}), \quad (8)$$

where carets denote proportionate change (i.e., $\hat{P}_k = dP_k/P_k$). The formula for $\eta_{P_k,t_{kx}}$ is fairly complex and its properties have been discussed elsewhere. (See Harberger [1962] and Ballentine and Eris [1975].) For present purposes it suffices simply to note that the formula for $\eta_{P_k,t_{kx}}$ includes elasticities of demand and factor substitution, factor shares, and factor intensities in the two sectors. For reasonable values of these parameters, $\eta_{P_k,t_{kx}}$ is negative, indicating that an increase in the corporation income tax will reduce the rate of return to capital.

In addition to the derivation of $\eta_{P_k,t_{kx}}$, there has been some work simulating the effect of a finite tax change, as opposed to relying on linear approximations based on $\eta_{P,t_{kx}}$.[21] In particular, one can use Scarf's algorithm to compute the pre- and post-tax equilibrium values for all of the variables of the model.[22] Alternatively, when the model has only two sectors, as we assume in this paper, one can, using some rather tedious algebra, reduce the equations of the model to an excess demand function of the general form,[23]

$$F(P_k,(1 + t_{kx})) = 0. \quad (9)$$

Once one knows the value of P_k based on a value for t_{kx}, the values of all the other variables of the model are easily calculated. Solving F (through use of a computer) allows one to determine the impact of imposing a tax such as t_{kx}.

The discussion above has followed previous literature in assuming a single tax on corporate capital. That tax formally enters the model only as the ratio of the cost of capital in the corporate sector (P_{kx}) to that cost in the noncorporate sector (P_{ky}). Specifically, one

20. The derivation of $\eta_{P_k,t_{kk}}$ under the assumption that all tax rates including t_{kx} are zero is sketched in Harberger [1962] and developed in more detail in Shoven and Whalley [1972, pp. 315–20] and McLure [1975b]. The assumption that all tax rates are zero is quite restrictive, particularly for a model dealing with taxation. Ballentine and Eris [1975] present the general formula for $\eta_{P_k,t_{kx}}$, which is valid for any value of t_{kx}. A derivation of that formula is available upon request.

21. In order to perform such simulations, one must use slightly stronger assumptions concerning the form of production functions (e.g., that they are C.E.S. functions) and demand functions.

22. See Shoven and Whalley [1972] for a description of the application of Scarf's algorithm to a calculation of the effect of the corporation income tax.

23. This still assumes a single tax on corporate capital. Ballentine [1978] gives the specific formula for the function F and sketches its derivation. The complete derivation of F is available from the authors.

can write, instead of equations (8) and (9) above, the more general equations,[24]

(8a) $$\hat{P}_{ky} = \eta_{P_k,t_{kx}}(\hat{P}_{kx} - \hat{P}_{ky})$$

and

(9a) $$F(P_{ky},P_{kx}/P_{ky}) = 0.$$

In these equations the formulas for $\eta_{P_k,t_{kx}}$ and F are the same as discussed above. This result is important because it means that all we need do is solve our financial model for P_{kx}/P_{ky} and, thus, $\hat{P}_{kx} - \hat{P}_{ky}$. Such a solution can simply be inserted into the Harberger model to obtain the overall effects of any tax change in our model.

In what follows, we show that we can in fact solve our financial model for P_{kx}/P_{ky} in terms of the statutory tax rates. And thus we can consider hypothetical vales for those tax rates (e.g., values consistent with full integration) to calculate P_{kx}/P_{ky} and then use that value in the Harberger model as discussed in the above paragraph.

Since the only tax on capital income in the noncorporate sector is the personal income tax (t_p): $P_{ky} = i_n(1 + t_p)$. Dividing equation (4) by $P_{ky}K_x$ and remembering that $K_x = B + E$, we obtain

(10) $$\frac{P_{kx}}{P_{ky}} = \frac{i_b}{i_n}\frac{B/E}{1 + (B/E)} + \frac{i_e}{i_n}\frac{(1 + t_e)}{(1 + t_p)}\frac{1}{1 + (B/E)}.$$

From equations (5) and (6) i_b/i_n and i_e/i_n are functions of B/E; thus equation (10) states P_{kx}/P_{ky} as a function of B/E and the tax rates. But if equation (7), which determines the optimal debt-equity ratio, is divided by i_n, it is clear that B/E is itself an implicit function of t_p and t_e. This means that P_{kx}/P_{ky} is solely a function of the tax rates.

If P_{kx}/P_{ky} is a function of the tax rates, then $\hat{P}_{kx} - \hat{P}_{ky}$ is determined by the change in the tax rates. To understand the impact of a tax change, it will be useful to solve for $\hat{P}_{kx} - \hat{P}_{ky}$. Differentiating equation (1), we obtain

(11) $$\hat{P}_{kx} - \hat{P}_{ky} = \theta_b[\hat{i}_b + (1 \hat{+} t_p)] + \theta_e[\hat{i}_e + (1 \hat{+} t_e)] + \theta_b\left(\frac{E}{B + E}\right)\left[\frac{i_b(1 + t_p) - i_e(1 + t_e)}{i_b(1 + t_p)}\right](\hat{B} - \hat{E}) - \hat{i}_n - (1 \hat{+} t_n),$$

where θ_b is $Bi_b(1 + t_p)/(B + E)P_{kx}$, the fraction of the gross return

24. If t_{kx} is the only tax, then $\hat{P}_{kx} - \hat{P}_{ky} = 1 \hat{+} t_{kx}$, and $P_{kx}/P_{ky} = 1 + t_{kx}$. Further, $P_k = P_{ky}$, since in that case there is no tax in the noncorporate sector.

to capital in the corporate sector accruing to bondholders; θ_e is the share accruing to owners of corporate equities.

Differentiating (5) and (6) and inserting them into (11), we obtain

$$\text{(12)}\quad \hat{P}_{kx} - \hat{P}_{ky} = \theta_b(1 \hat{+} t_p) + \theta_e(1 \hat{+} t_e) - (1 \hat{+} t_n) + (\theta_b\eta_b + \theta_e\eta_e)(\hat{B} - \hat{E}) + \theta_b\left(\frac{E}{E+B}\right)\left[\frac{i_b(1+t_p) - i_e(1+t_e)}{i_b(1+t_p)}\right](\hat{B} - \hat{E}),$$

where η_b is the elasticity of i_b/i_n with respect to B/E and η_e is the elasticity of i_e/i_b with respect to B/E.

By combining the two terms that contain $(\hat{B} - \hat{E})$ and using the first-order condition for the optimal financial policy (equation (7)), it can be shown that those two terms drop out of the equation. This is as might be expected. Obviously, a change in B/E does not affect P_{ky}; thus, $\partial P_{ky}/\partial(B/E) = 0$. Further, since the firm is continuously choosing a debt-equity ratio that minimizes its cost of capital, the first-order condition $\partial P_{kx}/\partial(B/E) = 0$ always holds. Accordingly, our expression for $\hat{P}_{kx} - \hat{P}_{ky}$ becomes simply

$$\hat{P}_{kx} - \hat{P}_{ky} = \theta_b(1 + \hat{t}_p) + \theta_e(1 \hat{+} t_e) - (1 \hat{+} t_n).$$

The similarity between this expression and that obtained using the usual Harberger model,

$$\hat{P}_{kx} - \hat{P}_{ky} = (1 \hat{+} t_{kx}) - (1 \hat{+} t_{ky})$$

is apparent, and indicates that most of the analytical aspects of Harberger's model carry over to ours.[25] We can focus on the particular points where we differ, the most important being the distribution of the tax burden among capitalists as opposed to the more common issue of the distribution of the burden between capitalists and laborers.

Before proceeding, we must specify more precisely what is meant by t_e. Rather than being a statutory tax rate, t_e is the effective tax rate on the return to equity. Thus, its value depends upon the statutory tax rates on dividends and retentions and upon the dividend payout ratio. Therefore, to determine t_e in terms of statutory tax rates re-

25. More precisely, we know that if the corporate sector is capital-intensive, then a rise in t_e must cause the rate of return in the noncorporate sector to fall. Further, if both production functions are Cobb-Douglas and the elasticity of substitution in demand is −1, then the fall in total profits will be equal to the rise in government revenues as t_e, or any other tax on profits, is increased.

quires specifying the dividend-payout ratio as a function of tax rates. To this we now turn.

Why corporations pay dividends is a more difficult question than why they do not finance their capital needs entirely from debt. With perfect capital markets, retained earnings could be converted to cash, and shareholders would be more or less indifferent between dividends and retentions. Retentions would be preferred only because they are taxed more lightly than dividends; but given differential taxation, there would be no reason to pay dividends at all.

While it is, of course, possible to develop a dynamic model in which firms do pay dividends (e.g., Feldstein, Green, and Sheshinkski [1979]), in our model we have chosen a somewhat ad hoc approach. We assume that at least some investors prefer to take some of their returns in the form of dividends, while corporate managers prefer to retain earnings so as to avoid going to capital markets to obtain funds. As a result, we assume that corporations choose their dividend payout ratio on the basis of the cost of paying dividends in terms of foregone retentions. Letting t_d be the combined corporate and personal tax on dividends and t_r the combined tax on retentions, that opportunity cost is given by $(1 + t_d)/(1 + t_r)$. Thus, we write

$$D/(R + D) = \psi\, [(1 + t_d)/(1 + t_r)], \tag{13}$$

where D represents dividends net of all taxes, and R represents retentions net of all taxes.[26]

A particular advantage of this formulation is that Feldstein [1970] has estimated a similar equation. Further, the relationship is consistent with the findings of Brittain [1964].[27]

Since $i_eE = R + D$ and $i_e(1 + t_e)E = R(1 + t_r) + D(1 + t_d)$, we have

$$(1 + t_e) = [1 - D/(R + D)]\,(1 + t_r) + [D/(R + D)]\,(1 + t_d). \tag{14}$$

26. R is net of the corporate tax and the present value equivalent of the tax eventually to be collected on capital gains resulting from retentions. It should be noted that $D/(R + D)$ is not uniquely related to the corporate payout rate, as usually defined. Net dividends D differ from gross dividends by the amount of the personal tax. Similarly, R is retentions net of the personal tax on the gains they produce. We have chosen to employ equation (13), rather than an analogous expression in terms of gross dividends and retentions, because (1) optimal financial policy should be based on net dividends and retentions, and (2) the concepts of gross dividends and retentions become fuzzy once we admit the possibility of various schemes of integrating the income taxes. The second point can be clarified by considering two alternative but equivalent methods of providing dividend relief. Suppose that retained earnings are constant. If relief is provided at the shareholder level, gross dividends might appear not to be affected, even though net dividends rise. But if relief is provided at the firm level, both gross and net dividends would rise. The formulation of equation (13) avoids this ambiguity.

27. However, Bradford [1977] and Miller and Scholes [1979] have recently argued that optimal dividend policy is insensitive to a tax on distributions.

With equation (13) this allows us to state t_e in terms of statutory tax rates so that the model is fully determined.

IV. The Simulation Results

In the original formulation of the Harberger model, the change in the real income of capitalists on the side of sources of income could be expressed as

$$d(P_kK) = P_kdK + KdP_k = KdP_k.$$

Since $dK = 0$, by assumption, and capital receives the same rate of return in both sectors, the change in income on the sources side is determined entirely by the change in the net return to capital dP_k. Further, a rise (fall) in P_k represents a welfare gain (loss) to capitalists.

In the present model the interpretation of incidence is somewhat more complex. This is because the changes in the excess of i_b and i_e over i_n, being simply changes in the compensation for risk-taking needed to induce marginal investors to hold corporate securities, involve no change in welfare for such marginal investors.[28] Since i_n is assumed to be the rate of return on constant-risk investment, changes in i_n could be interpreted as indicating change in the welfare of capitalists, whether they invest in the corporate or noncorporate sector. However, this is not fully satisfactory because, for infra-marginal corporate investors who are not particularly risk-averse, a rise in i_b and i_e relative to i_n as B/E rises *does* represent a welfare gain. Here we follow Musgrave's classic definition of incidence: the "change in the distribution of income available for private use." (See Musgrave [1959], p. 207.) Under this interpretation, changes in capital income resulting from changes in risk premiums are counted like any other change in income. The true change in welfare will lie between the results obtained that ignore changes in risk premiums and results that include all risk premiums as income. However, calculating such changes in welfare would require a complete model of individual portfolio choice incorporating differences in individuals' attitudes toward risk. As the development of such a model goes beyond the scope of this paper, our calculations include all changes in risk pre-

28. Feldstein, Green, and Sheshinski [1979] recognize this same problem. While we chose to ignore welfare changes and concentrate on income changes, they assume that the debt-equity ratio is constant; thus risk premiums are constant, and income changes reflect welfare changes.

miums.[29] Our results and those using Harberger's approach of ignoring changes in risk premiums (as is done in our discussion of Table III below) bracket the true-incidence picture.

Of particular interest for our analysis is the distribution of the tax burden among capitalists, for it is here that our results differ from Harberger's. Harberger's conclusion is that corporate and noncorporate capitalists share the tax burden in proportion to their share in total profits. (That is, if noncorporate investors receive 40 percent of profits, they bear 40 percent of the tax burden on capitalists.) In presenting our results, we report the share of profits earned by equity owners, debt owners, and noncorporate capitalists and the share of the tax burden borne by the holders of each asset. For example, the share of net capital income earned by owners of equity is simply

$$i_eE/(i_eE + i_bB + i_nK_y). \tag{15}$$

Since this ratio changes as the tax rates change, we report the average of the pre- and post-tax value. The share of the tax burden borne by equity is

$$E\Delta i_e/(E\Delta i_e + B\Delta i_b + K_y\Delta i_n). \tag{16}$$

Again the averages of the pre- and post-tax values of E, B, and K_y are used.[30]

To obtain our numerical results involves solving our model step by step. First, we use equations (13) and (14) to solve for the effective tax on equity income t_e, based on the tax rates t_r and t_d. Second, we use a computer to solve equation (7) for the optimal debt-equity ratio, given $(1 + t_e)/(1 + t_p)$. Third, using the solution for the optimal debt-equity ratio, we solve for i_e/i_n and i_b/i_n from equations (5) and (6) and then (using the value of $(1 + t_e)/(1 + t_p)$) solve for the relative costs of capital P_{kx}/P_{ky}, using equation (10). Fourth, we solve for P_{ky}

29. As mentioned, one alternative approach is to calculate incidence using only changes in capitalists' income net of all risk premiums (i.e., changes in i_nK). While we chose to follow the traditional approach in our paper, it may be interesting to mention here a result that one obtains if one considers only changes in i_nK. Capital income taxes generate government revenues at the expense of all capital income, including risk premiums. As a result, even in the well-known Cobb-Douglas case, in which capitalists bear the full tax burden under the traditional incidence approach, the fall in capitalists' incomes *net* of risk premiums will be less than the rise in government revenues. The shortfall is the amount of tax revenues generated at the expense of risk premiums. Following such an approach, it is not clear who can be said to bear the burden of that shortfall and, hence, under what circumstances capitalists can be said to bear the whole burden of the tax.

30. Note that the denominator in this expression is not the total change in capital income (i.e., it is not the total burden on capital); it omits terms such as $(i_e - i_b)\Delta E$. This is because it is not clear how that part of the burden is to be allocated among capitalists. In our results the denominator of equation (16) is always fairly close to the change in total profits.

based on the value of P_{kx}/P_{ky} using a computer to solve equation (9a). Finally, using the computed value for P_{ky}, we can easily solve for all of the remaining variables of the model. This procedure is followed for different tax rates, allowing us to determine the impact of alternative tax schemes.

The data used for our simulation experiments are discussed in Ballentine and McLure [1978]. It should be stressed that those data are not meant to provide an exact description of the U. S. economy at any particular time; our numerical simulations are probably best considered as roughly suggestive of the pattern of corporate tax incidence in the United States, rather than as exact estimates.

In addition to our basic data, certain parameter values must be specified. We present two sets of results, one with the elasticities of factor substitution in both sectors (S_x and S_y, respectively) equal to 1, the other with $S_x = S_y = 0.5$. In both cases the elasticity of substitution in demand S_d is 1. The function relating the dividend payout rate to t_r and t_d is assumed to take the following form:

$$D/(R + D) = M[(1 + t_r)/(1 + t_d)]^{\rho}.$$

From Feldstein [1970] We take ρ as 0.9. (We have experimented with values as low as 0.5, which King [1971] argues is more appropriate. Our results were not significantly altered by such values.) Given the initial values of D, R, t_r, and t_d, the value of M is then determined.

The functions relating i_b/i_n and i_e/i_n to B/E are assumed to take the form,[31]

$$i_b/i_n = G(B/E)^{\varphi} + W$$

and

$$i_e/i_n = C(B/E)^{\alpha} + V.$$

We are not aware of any empirical work that would provide us with estimates for the parameters of these functions. Ballentine and McLure [1978] provide some sensitivity analysis using alternative values for the parameters. As shown there, the results reported in the text are not particularly sensitive to our choice of parameters. For the present we let $\varphi = \alpha = 1.4$, $G = 0.272$, and $C = 0.187$.[32] These values

31. The positive constants W and Y ensure that neither i_e nor i_b falls to zero at a zero debt-equity ratio.

32. With the initial data these imply values for W and V of 0.3985 and 1.186, respectively. While our data set is not intended to provide a precise description of the U. S. economy, but only to serve as a rough outline of that economy, these two values are not markedly unrealistic. At a zero debt-equity ratio an initial offering of corporate bonds is virtually riskless to bondholders and our value for W indicates that they would require a rate of return that is about 40 percent of the noncorporate return. Equity holders require a rate of return that is 18 percent above the noncorporate return. This value may be consistent with corporate-equity holders having less direct information on and control of the firm in which they buy stocks than noncorporate investors.

are consistent with the observed tendency for debt-equity ratios not to be radically affected by tax rate changes.

We consider three tax changes; the elimination of the corporation income tax, full integration of corporate and personal taxes (i.e., abolition of the corporate income tax and full taxation of retained earnings at the personal income tax rate), and dividends only integration. The last case involves abolishing the corporate income tax on dividends, but maintaining it (along with preferential personal income tax treatment) on retentions. The results of these experiments are shown in Tables I and II. Since the pattern of the results is similar for all three tax changes, we shall examine the results of abolishing the corporation income tax in depth and then summarize the results for the other two tax changes.

Because we examine the abolition (rather than the imposition) of the corporation income tax, Table I shows government revenues declining and the return to capital rising. The change in capital income as a proportion of the change in government revenues, which can be considered to be capital's share in the direct tax burden, is 100 percent for $S_x = S_y = S_d = 1$ and about 70 percent for $S_x = S_y = 0.5$ and $S_d = 1$. For the standard Harberger model the result in the former case is also 100 percent, while in the latter case Shoven [1976] calculates capital's share at about 67 percent. Thus, our model suggests about the same overall burden share for capitalists as does the Harberger model.

It is in our calculations of the distribution of the burden among capitalists that we differ from previous work. Whereas the traditional Harberger analysis would find all capitalists gaining the same relative amount from the elimination of the corporation income tax, we calculate that corporate bondholders would gain relatively little. That is, i_b rises by less—and perhaps substantially less—than 10 percent. Corporate shareholders would gain by a much larger fraction (i_e rises by 20–30 percent, depending on the elasticity assumptions), but investors in the noncorporate sector would gain most of all (i_n rises by about 30–40 percent, depending on the elasticity assumptions). This result, stated from the other side, says that the corporate income tax is borne mainly by shareholders and noncorporate investors, and relatively little by corporate bondholders.

Table II presents an effort to quantify the differences in the ways the various returns to capital are affected by elimination of the tax. The top part of the table presents, for three tax changes and two elasticity assumptions, the fraction of total net capital income accruing to corporate bondholders, holders of corporate shares, and investors in the noncorporate sector. The bottom part indicates the

TABLE I

CHANGES IN KEY VARIABLES UNDER ALTERNATIVE CORPORATE TAX POLICIES

	$S_x = S_y = S_d = 1.0$			$S_x = S_y = 0.5; S_d = 1.0$		
	No. corp. tax (a)	Full integ. (b)	Dividend relief (c)	No. corp. tax (d)	Full integ. (e)	Dividend relief (f)
Δ Tax revenues	−18.4	−10.4	−2.3	−19.2	−11.7	−2.9
Δ Capital income	+18.4	+10.4	+2.3	+13.5	+7.6	+1.7
% Δi_b	+9.3	+4.5	+0.7	+0.8	−0.6	−0.6
% Δi_e	+29.6	+17.1	+3.9	+19.8	+11.4	+2.5
% Δi_n	+41.5	+24.3	+5.7	+30.7	+18.1	+1.0
% $\Delta B/(B+E)$	−36.9	−23.3	−5.6	−36.9	−23.3	−5.6
% ΔD	+107.3	+84.2	+58.6	+81.3	+68.5	+54.6
% ΔR	+107.5	+55.1	+5.1	+81.6	+41.9	+2.5
% ΔR_g	+107.6	+59.5	+5.1	+81.7	+89.5	+2.5

TABLE II

PERCENTAGE SHARES OF TOTAL NET CAPITAL INCOME AND TAX BURDEN

	$S_x = S_y = S_d = 1.0$			$S_x = S_y = 0.5; S_d = 1.0$		
	No. corp. tax (a)	Full integ. (b)	Dividend relief (c)	No. corp. tax (d)	Full integ. (e)	Dividend relief (f)
	Percentage shares of total net capital income					
Corporate bonds	13.0	14.8	16.5	12.9	14.6	16.4
Corporate equity	52.3	47.7	42.6	50.2	46.5	42.4
Noncorporate	34.7	37.6	40.8	37.0	38.9	41.2
	Percentage share in tax burden					
Corporate bonds	4.4	4.0	2.7	0.5	−0.7	−3.3
Corporate equity	49.3	45.6	40.7	45.7	43.8	39.3
Noncorporate	46.3	50.5	56.6	53.7	56.9	63.9

TABLE III

EFFECTIVE TAX RATES FOR CORPORATE INCOME TAX BY INCOME CLASSES, USING TRADITIONAL, HARBERGER, AND SIMULATED ESTIMATES OF INCIDENCE

Income class ($000)	Traditional[a] (a)	Harberger estimate[b] (b)	Simulation estimate[c] (c)
0–3	5.6	8.4	9.5
3–5	1.5	2.4	2.7
5–7.5	1.7	2.3	2.5
7.5–10	2.7	3.1	3.3
10–15	2.9	3.1	3.2
above 15	10.6	8.6	7.8

a. Corporate tax is attributed to income classes in proportion to ownership of corporate shares.
b. Corporate tax is attributed to income classes in proportion to ownership of capital.
c. Half the corporate tax is attributed in proportion to income from corporate securities, half in proportion to noncorporate capital income. These results are consistent with the average of the results for columns (a) and (d) of Table II.
Source. Table I and Projector and Weiss [1966].

share in the tax burden experienced by investors in each type of capital. (See equations (15) and (16).) We see that risk premiums on corporate bonds fall enough with the elimination of the corporate income tax that bondholders gain little (perhaps 4–5 percent of the total gain, at most) from the elimination, though they receive some 13 percent of total net capital income. Even *corporate shareholders pay a share of the corporate income tax (46–49 percent) that is smaller than their share of net capital income (roughly 50–53 percent).* Finally, *investors in the noncorporate sector are the big gainers from the elimination of the corporate income tax.* Though they receive only some 35–37 percent of net capital income, they receive roughly 46–54 percent of the benefits of eliminating the tax.

Table III gives an indication of how much difference the modification presented here makes for the incidence of the corporate income tax. In columns (a) and (b) the corporate income tax is allocated among income classes in proportion to ownership of (a) corporate shares and (b) total capital. In column (c) half the tax is allocated in proportion to ownership of corporate securities and half in proportion to income from noncorporate capital.[33] While the differences in results

33. The capital ownerships series are from Projector and Weiss [1966]. Because separate series are not available for corporate debt and corporate equity, the burdens on these two forms of capital ownership were lumped together. "Noncorporate" is primarily housing and agricultural and nonagricultural businesses and professions. The 50–50 allocation is consistent with the average of results in columns (a) and (d) of Table II.

in columns (b) and (c) are not enormous, they do suggest that the corporate income tax is somewhat less progressive at the top of the income scale—and more regressive at the bottom—than commonly assumed on the basis of the Harberger analysis.

As mentioned above, our approach upon which the calculations in column (c) are based treats changes in risk premiums the same as other income changes. Clearly, some of those changes in risk premiums simply compensate an investor for increased risk without altering his welfare. But ignoring all changes in i_b and i_e relative to i_n, which is consistent with the Harberger-type calculations of column (b), omits the welfare changes of infra-marginal, relatively less risk-averse investors who gain (lose) as i_b and i_e rise (fall) relative to i_n. The safest conclusion to draw from Table III is that the true incidence of the tax lies between the results of columns (b) and (c). Thus, the qualitative conclusion that the corporate income tax falls more than proportionately on investors in the noncorporate sector obtains.

The incidence of the corporate income tax is, of course, only part of the story. In the absence of the tax only some 30 percent of corporate capital would be debt-financed, instead of 45 percent, as at present. Stated differently, the ratio $B/(B + E)$ is some 50 percent higher than in the absence of the tax. Finally, elimination of the corporation income tax does not affect net dividend-payout ratios.[34] But dividends and retentions (both net and gross of personal tax) would rise by 80–110 percent, depending upon elasticities.[35] This conclusion must, however, be qualified in at least two ways. First, we are ignoring completely how revenue would be recouped. Second, that part of our model dealing with dividend payout ratios—and any estimate based upon it—is less satisfactory than other parts of the model. Thus, this result should not be overemphasized.

The incidence results for full integration are essentially the same as those for the reduction in the corporation income tax, except that the changes are smaller in absolute value. This is as might be expected, since the major difference between the two cases is the higher effective tax on retained earnings in the case of full integration. That higher tax on retentions means that the effective tax reduction is less in the case of full integration. Of course, the original Harberger model does not deal with this case.

Effects on the debt-equity ratio are also smaller than in the case of eliminating the income tax. But, whereas eliminating the corporate

34. This is because eliminating the corporation income tax reduces the tax on both dividends *and* retentions without altering the cost of dividends in terms of retentions.

35. ΔR_g is the change in retentions gross of personal taxes.

income tax does not affect net dividend-payout ratios, full integration equalizes the tax treatment of dividends and retentions and causes the net dividend-payout ratio to rise. Indeed, $D/(R + D)$ rises from about 0.150 to 0.174. However, in spite of the rise in the dividend-payout ratio, net retentions actually rise by about 42 percent, because of the larger amount of net-of-tax equity earnings.

As our final experiment, we have considered integration for dividends only. Once again, the incidence results are basically a dampened version of the results for the abolition of the corporation income tax. Noncorporate capitalists enjoy some 55–65 percent of the benefits of dividend relief, despite accounting for only about 41 percent of net capital. Most of the remaining benefits accrue to owners of corporate equities; under one set of elasticity assumptions, corporate bondholders lose. Moreover, because integration is extended only to dividends, the net dividend-payout ratio rises to about 0.211. Even so (gross and net) retentions rise slightly, due to the increase in equity income net of corporate taxes.

VIII. EVALUATION

Overall the results show that full integration, dividend-only integration, and abolition of the corporation income tax all lower the cost of equity capital for corporations. This tends to raise the rate of return to capital in the economy. However, such tax reductions also lower the cost of equity capital relative to debt for corporations. In response, corporations lower their debt-equity ratios. This in turn reduces the risk premium that must be paid on corporate debt and equity and thus lowers the observed rate of return on such assets relative to the return on noncorporate capital. This latter effect tends to counteract the general rise in the rate of return to capital. Because the offset is almost complete for corporate debt, the interest rate on corporate debt remains virtually unchanged. It is less complete for corporate equity; thus the equity rate of return rises by almost as much as the noncorporate rate of return. The lesson for the incidence of the corporate income tax is that owners of noncorporate capital bear the greatest relative burden, owners of equity bear the next largest burden in relative terms, and owners of corporate debt pay very little.

While our model explicitly focuses on the functional distribution of income and on the distribution of capital income by asset type, the ultimate concern for incidence analysis is usually the impact of tax changes by income group. Prior to Harberger's work, many economists argued that the corporation income tax is paid by stockholders. Given the distribution of stock ownership by income class, this means that the tax was likely to be quite progressive. Since the distribution of ownership of noncorporate capital, mainly housing and real estate, is less skewed toward the rich than the distribution of stock ownership, Harberger's result implied that the tax is less progressive than previously thought. Our results, which indicate that the tax is "overshifted" to the noncorporate sector, imply that the tax is even less progressive than Harberger suggested, and that integration reduces progressivity less than is commonly assumed.

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