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Article *in* Journal of Political Economy · February 1962

DOI: 10.1086/258636 · Source: RePEc

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THE JOURNAL OF
POLITICAL ECONOMY

Volume LXX JUNE 1962 *Number 3*

THE INCIDENCE OF THE CORPORATION INCOME TAX

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I. INTRODUCTION

This paper aims to provide a theoretical framework for the analysis of the effects of the corporation income tax and, also, to draw some inferences about the probable incidence of this tax in the United States. It is clear that a tax as important as the corporation income tax, and one with ramifications into so many sectors of the economy, should be analyzed in general-equilibrium terms rather than partial-equilibrium terms. The main characteristic of the theoretical framework that I present is its general-equilibrium nature. It was inspired by a long tradition of writings in the field of international trade, in which the names of Heckscher, Ohlin, Stolper, Samuelson, Metzler, and Meade are among the most prominent. These writers inquired into the effects of international trade, or of particular trade policies, on relative factor prices and the distribution of income. Here we shall examine the effects of the corporation income tax on these same variables.

Our model divides the economy into two industries or sectors, one corporate and the other non-corporate, each employing two factors of production, labor and capital. The corporation income tax is viewed as a tax which strikes the earnings of capital in the corporate sector, but not in the non-corporate sector. Both industries are assumed to be competitive, with production in each governed by a production function which is homogeneous of the first degree (embodying constant returns to scale). We do not inquire into the short-run effects of the imposition of the corporation tax, on the supposition that it is the long-run effects which are of greatest theoretical and practical interest. In the very short run, the tax will necessarily be borne out of the earnings of fixed capital equipment in the affected industry, so long as our assumption of competition applies. But this will entail a disequilibrium in the capital market, with the net rate of return to owners of capital in the taxed industry being less than the net rate of return received by owners of capital in the untaxed sector. A redistribution of the resources of the economy will result, moving toward a long-run equilibrium in which the net rates of return to capital are equal in both sectors. In this long-run equilibrium the wages of labor will also be equal in the two sectors, and the available quantities of labor and capital will be fully employed.

I also assume that the available quantities of labor and capital in the economy are not affected by the existence of the tax. This assumption is rather innocuous in the case of labor, but in the case of capital it is surely open to question. It is highly likely that as a result of the imposition of the corporation tax, the net rate of return received by owners of capital will be lower than it would be in the absence of this tax. This reduction in the return to capital can influence savings in two ways: first, because now the owners of capital have less total income, and second, because the rate of return facing them is lower. On the first, we must bear in mind that any alternative way of raising the same revenue would entail the same reduction in income in the private sector; the impact on saving of the corporation tax would thus differ from that, say, of a proportional income tax yielding the same revenue, only as a result of such differences as may exist among economic groups in their savings propensities. On the second, we must inquire into the elasticity of the supply of savings with respect to the rate of interest. If this elasticity is zero, the alteration in the net rate of interest facing savers will not influence the size of the capital stock at any given time, or the path along which the capital stock grows through time. In the United States, the fraction of national income saved has been reasonably constant, in periods of full employment, for nearly a century. Over this time span, income levels have increased greatly, and interest rates have fluctuated over a rather wide range. We have no clear evidence, from these data or from other sources, that variations in the rate of interest within the ranges observed in the United States exert a substantial influence on the level of savings out of any given level of income. We shall therefore proceed on the assumption that the level of the capital stock at any time is the same in the presence of the tax as it would be in its absence; but in the conclusion of this paper we shall briefly consider how the results based on this assumption might be altered if in fact the corporation income tax has influenced the total stock of capital.

The relevance of this approach for the analysis of real-world taxes might also be questioned on the ground that the economy cannot reasonably be divided into a set of industries which are overwhelmingly "corporate," and another set which is overwhelmingly non-corporate. This objection has little validity, at least in the case of the United States. In the period 1953–55, for example, the total return to capital in the private sector of the United States economy averaged some \$60 billion per year, \$34 billion being corporate profits and \$26 billion being other return to capital. Of the \$26 billion which was not corporate profits, more than 80 per cent accrued to two industries—agriculture and real estate, in which corporate profits were negligible. In all but seven industries in a forty-eight-industry classification, corporation taxes averaged more than 25 per cent of the total return to capital, and one can, for all practical purposes, say that no industries except agriculture, real estate, and miscellaneous repair services paid less than 20 per cent of their total return to capital in corporation taxes, while the three named industries all paid less than 4 per cent of their income from capital as corporation taxes. Within the "corporate" sector, different industries paid different fractions of their total return to capital in corporation tax, owing partly to differences in their relative use of debt and equity capital, partly to the presence in some of these industries of a fringe of unincorporated enterprises, and partly to special situations such as loss-carryovers from prior years, failure of full use of current losses to obtain tax offsets, and so on. But these differences, in my view, are not large enough to affect seriously the validity of the main distinction made here between the corporate and the non-corporate sectors.[1]

The relevance of the approach taken in this paper might also be questioned on the ground that the capital market does not in fact work to equalize the net rates of return on capital in different industries. If this objection is based on the idea that the capital market might be poorly organized, or that participants in it might not be very adept at seeking the best available net return on their invested funds, I believe it must be rejected for the United States case, for in the United States the capital market is obviously highly organized, and the bulk of the funds involved are commanded by able and knowledgeable people. The objection may, however, be based on the idea that rates of return in different industries, and perhaps on different types of obligations, will differ even in equilibrium because of the risk premiums which investors demand for different kinds of investments. At this point we must make clear that the "equalization" which our theory postulates is equalization net of such risk premiums. So long as the pattern of risk differentials is not itself significantly altered by the presence of the corporation income tax, our theoretical results will be applicable without modification. And even if the pattern of risk premiums applying to different types of activities and obligations has changed substantially as a result of the tax, it is highly likely that the consequent modification of our results would be of the second order of importance.

[1] For the data from which the above figures were derived, see my paper, "The Corporation Income Tax: An Empirical Appraisal," in United States House of Representatives, Ways and Means Committee, *Tax Revision Compendium* (Washington: Government Printing Office, November, 1959), I, 231–50, esp. Table 20. That paper also contains a brief statement of the problem of the incidence of the corporation income tax (pp. 241–43), which in some ways foreshadows the work presented here. It is, however, principally concerned with the resource allocation costs of the corporation income tax rather than its incidence.

II. OUTLINES OF THE INCIDENCE PROBLEM: THE COBB-DOUGLAS CASE

So long as the capital market works to equilibrate rates of return net of taxes and risk premiums, and so long as the imposition of a corporation income tax does not itself have a significant effect on the (pattern of) risk premiums associated with different types of activities, it is inevitable that in the long run the corporation tax will be included in the price of the product. That is, of two industries, one corporate and one non-corporate, each using the same combination of labor and capital to produce a unit of product, the equilibrium price of the corporate product will be higher than the equilibrium price of the non-corporate product by precisely the amount of corporation tax paid per unit of product. This result is taken by some people as evidence that the burden of the corporation tax is borne by consumers, that is, that the tax is shifted forward. Such an inference is far wide of the mark.

Perhaps the easier way of demonstrating the error of the above inference is to present a simple counterexample. Consider an economy producing only two products—product X, produced by firms in the corporate form, and product Y, produced by unincorporated enterprises. Let the demand characteristics of the economy be such that consumers always spend half of their disposable income on X and half on Y. Let the production functions in both industries be of the Cobb-Douglas type, with coefficients of $\frac{1}{2}$ for both labor and capital: that is, $X = L_x^{1/2}K_x^{1/2}$, $Y = L_y^{1/2}K_y^{1/2}$, where L_x and L_y represent the amounts of labor used in the X and Y industries, and K_x and K_y the corresponding amounts of capital. The total amounts of labor and capital available to the economy are assumed to be fixed, at levels L and K, respectively.

Under competitive conditions, production in each industry will be carried to the point where the value of the marginal product of each factor is just equal to the price paid by entrepreneurs for the services of the factor. Thus, in the absence of taxes, we have $L_x p_L = \frac{1}{2}X p_x$; $K_x p_k = \frac{1}{2}X p_x$; $L_y p_L = \frac{1}{2}Y p_y$; $K_y p_k = \frac{1}{2}Y p_y$. If the total income of the economy is \$1,200, equally divided between X and Y, then labor in industry X will be earning \$300, labor in industry Y \$300, capital in industry X \$300, and capital in industry Y \$300. It is clear that both the labor force and the capital stock will have to be equally divided between industries X and Y. Choosing our units of labor and capital so that in this equilibrium position $p_L = p_k = \$1.00$, we have the result that without any taxes there will be 300 units of labor in industry X. and 300 in industry Y, and that the capital stock will be similarly distributed.

Suppose now that a tax of 50 per cent is levied on the earnings of capital in industry X, and that the government, in spending the proceeds of the tax, also divides its expenditures equally between the two industries. Labor in industry X will once again earn \$300, as will labor in industry Y. Since the price paid by entrepreneurs for labor is also the price received by the workers, and since equilibrium in the labor market is assumed, the equilibrium distribution of the labor force will be the same in this case as in the previous one, that is, 300 workers in each industry.

The situation is different, however, when we come to capital. The price paid by entrepreneurs for capital, multiplied by the amount of capital used, will again be \$300 in each industry. But the price paid by entrepreneurs in industry X will include the tax, while that paid in industry Y will not. With a tax of 50 per cent on the total amount paid, capital in industry X will be receiving, net of tax, only \$150, while capital in industry Y will be getting \$300. For equilibrium in the capital market to obtain, there must be twice as much capital in industry Y as in industry X. Thus, as a result of the tax, the distribution of capital changes: instead of having 300 units of capital in each industry, we now have 200 units in industry X and 400 units in industry Y.

Out of the total of \$600 which entrepreneurs are paying for capital in both industries, one-half will go to capital in industry Y, on which no tax will be paid, one-quarter will go to capital in industry X, net of tax, and one-quarter will go to the government as a tax payment. The price of capital will fall from \$1.00 to \$0.75.

A crude calculation suffices to suggest the resulting tax incidence. Out of a national income of \$1,200, labor obtained \$600 before the imposition of the tax and after it, but capital obtained (net of tax) only \$450 after the tax was imposed as against \$600 before the tax, the difference of \$150 going to the government. Capital is clearly bearing the brunt of the tax, in spite of the fact that in the tax situation, the tax is included in what consumers are paying for commodity X.

Of course, this does not tell the whole story of the incidence of the tax. Since the price of commodity X rises, and the price of commodity Y falls, consumers with particularly strong preferences for one or the other of the two goods will be hurt or benefited in their role as consumers, in addition to whatever benefit they obtain or burden they bear in their role as owners of productive factors. It is important to realize, however, that the price of Y does fall, and that this brings to consumers as a group a benefit which counterbalances the burden they bear as a result of the rise in the price of X.[2]

I would sum up the analysis of the incidence of the assumed tax on capital in industry X as follows: capitalists as a group lose in income earned an aggregate amount equal to the amount received by the government. This reduction in the income from capital is spread over all capital, whether employed in industry X or in industry Y, as soon as the capital market is once again brought into equilibrium after imposition of the tax. Insofar as individual consumers have the same expenditure pattern as the average of all consumers, they neither gain nor lose in their role as consumers. Insofar as individual consumers differ from the average, they gain if they spend a larger fraction of their budget on Y than the average, and lose if they spend a larger fraction of their budget on X than the average. The gains of those consumers who prefer Y, however, are counterbalanced by the losses of those who prefer X. If we are prepared to accept this canceling of gains and losses as the basis for a statement that consumers as a group do not suffer as a consequence of the tax, then we can conclude that capital bears the tax. Otherwise, we must be content to note that the gross transfers from individuals as capitalists and consumers of X exceed the yield of the tax by an amount equal to the gross transfer to consumers of Y.

The above example is representative of the entire class of cases in which expenditures are divided among goods in given proportions, and production of each good is determined by a Cobb-Douglas function. The exponents of the Cobb-Douglas functions can differ from industry to industry, and even the tax rates on the earnings of capital can be different in different taxed industries; yet the conclusion that capital bears the tax, in the sense indicated above, remains. It is easy to demonstrate the truth of the above assertion. Let A_i be the fraction of the national income spent

[2] The counterbalancing is not precise owing to the fact that the corporation income tax carries an "excess burden." In the post-tax equilibrium, the value of the marginal product of capital in industry X exceeds that in industry Y by the amount of the tax, whereas efficient allocation of capital would require these two values to be equal. Moreover, the pattern of consumption in the economy is also rendered "inefficient" by the tax, because the marginal rate of substitution of X for Y in consumption (which is given by the ratios of their prices gross of tax) is different from the marginal rate of substitution of X for Y in production (which is given by the ratio of their prices net of tax). The result of this twofold inefficiency is that the same resources, even though fully employed, produce less national income in the presence of the tax than in its absence. If, as is customary in discussions of incidence, we neglect "excess burden," we can treat the effects of changes in the prices of X and Y as having exactly offsetting influences on consumer welfare and can determine the incidence of the tax by observing what happens to the prices of labor and capital. This approach does not preclude the full burden of the tax being borne by consumers, for in cases in which the prices (net of tax) of labor and capital move in the same proportions as a result of the tax, it is just as correct to say that the tax is borne by consumers as it is to say that the tax burden is shared by labor and capital in proportion to their initial contributions to the national income; examples of such cases are given below.

on the product of industry i, B_i be the coefficient of the labor input in the ith industry (equal to the fraction of the receipts of the ith industry which is paid in wages to labor), and C_i $(= 1 - B_i)$ be the coefficient of the capital input in the ith industry (equal to the fraction of the receipts of the ith industry which is paid [gross of tax] to capital). Then $\Sigma A_i B_i$ will be the fraction of national income going to labor, both in the tax situation and in the case in which taxes are absent. Immediately one can conclude that labor's share in the national income will remain the same in the two cases. Moreover, the distribution of labor among industries will also remain unchanged since each industry i will employ the fraction $A_i B_i / (\Sigma A_i B_i)$ of the labor force in both cases. Likewise, capital will receive a fixed fraction of the national income (gross of tax) equal to $\Sigma A_i C_i$. When a tax is levied on capital, capital will receive $\Sigma A_i C_i (1 - t_i)$ net of tax, and the government will receive $\Sigma A_i C_i t_i$, where t_i is the percentage rate of tax applying to income from capital in the ith industry. Thus capital as a whole will lose a fraction of the national income exactly equal to that garnered by the government in tax receipts. As in the case presented in the above example, the distribution of capital among industries will change as a result of the imposition of the tax, the fraction of the total capital stock in the ith industry being $A_i C_i / (\Sigma A_i C_i)$ in the absence of the tax and $A_i C_i (1 - t_i) / [\Sigma A_i C_i (1 - t_i)]$ in its presence. Except when the tax rate on income from capital is equal in each industry, there will be effects on relative prices, and transfers of income among consumers, of the same general nature as those outlined above for the simpler case. But, as before, the gains of those consumers who do gain as a result of the changes in relative prices will, to a first approximation, be offset by the losses of those consumers who lose; thus, if we accept this offsetting as a canceling of effects as far as people in their role as consumers are concerned, we can say that capital bears the full burden of the tax.

III. THE CASE OF FIXED PROPORTIONS IN THE TAXED INDUSTRY

Returning now to an example in which there are only two industries, let us assume that the taxed industry is not characterized by a Cobb-Douglas production function, but instead by a production function in which the factors combine in strictly fixed proportions. Let us retain all of the other assumptions of the preceding example—that expenditure is divided equally between the two products, that production in industry Y is governed by the function $Y = L_y^{1/2} K_y^{1/2}$, that there are 600 units of each factor, and that the prices of the two factors are initially each \$1.00. These assumptions determine that the initial, pre-tax equilibrium will be the same as before, with 300 units of each factor occupied in each industry. The fixed-proportions production function for industry X which is consistent with these assumptions is $X = \text{Min}\,(L_x, K_x)$.

What happens when a tax of 50 per cent is imposed on the income from capital in industry X? It is clear that whatever reduction in output may occur in industry X, the two factors of production will be released to industry Y in equal amounts. Since industry Y is already using one unit of capital per unit of labor, it can absorb increments in these two factors in the same ratio without altering the marginal productivity of either factor in physical terms. The price of Y will have to fall, however, in order to create an increased demand for it. Whatever may be this fall in the price of Y, it will induce a proportionate fall in the price of each of the factors (since their marginal physical productivities are unchanged). We thus have the result that, in the final equilibrium after the tax, \$600 will be spent on the product of industry Y, with half going to capital and half to labor, and \$600 will be spent on the product of industry X, with \$200 going to labor, \$200 to capital (net of tax), and \$200 to the government. The price of labor will have fallen from \$1.00 to \$(5/6), and the price of capital will also have fallen from \$1.00 to \$(5/6). The tax will have fallen on capital and labor in proportion to their initial contributions to the national income.

It should be evident that the result just obtained, of labor and capital suffering the same percentage burden, depends critically on the fact that in the above example industry Y was in a position to absorb capital and labor in precisely the proportions in which they were ejected from industry X without a change in the relative prices of the two factors. If industry X had ejected two units of labor for each unit of capital, while industry Y had initially been using equal quantities of the two factors, the price of labor would have had to fall relative to the price of capital in order to induce the necessary increase in the proportion of labor to capital in industry Y. In such a case, labor would bear more tax, relative to its share in the national income, than capital. The following example will demonstrate that this is so.

Suppose that in the initial equilibrium 300 units of labor and 300 units of capital are engaged in the production of Y, and that the production function here is, as before, $Y = L_y^{1/2}K_y^{1/2}$. Suppose also, however, that 400 units of labor and 200 units of capital were initially dedicated to the production of X, with the production function for X requiring that labor and capital be used in these fixed proportions, that is, $X = \text{Min}\,[(L_x/2), K_x]$. Assume as before that the initial prices of labor and capital were \$1.00, and that national income remains unchanged at \$1,200 after the imposition of the tax. Likewise retain the assumption that expenditure is divided equally between goods X and Y.

The post-tax equilibrium in this case will be one in which the price of labor is \$0.83916, the price of capital \$0.91255. Industry X will use 171.25 units of capital and 342.5 units of labor; capital in industry X will receive a net income of \$156.274, and the government, with a 50 per cent tax on the gross earnings of capital in industry X, will get an equal amount; labor in industry X will receive \$287.412. These three shares in the product of industry X add up (but for a small rounding error) to \$600, the amount assumed to be spent on X. Industry Y will employ 328.75 (= 500 − 171.25) units of capital and 357.5 (= 700 − 342.5) units of labor, and the total receipts of each factor in industry Y will be, as before, \$300.[3]

[3] Let W be the net earnings of capital in industry X. Our other assumptions require that capital in industry Y must receive \$300. Therefore, in the post-tax equilibrium $[W/(\$300 + W)]$ (500) units of capital must be employed in industry X. Since \$600 is the total amount spent on X, and since the government's take is equal to the net amount (W) received by capital in industry X, labor in X must receive, in the post-tax equilibrium, an amount equal to \$600 − $2W$. Since labor in industry Y must receive, under our assumptions, \$300, total labor earnings will be \$900 − $2W$, and the number of units of labor in industry X must be $[(\$600 - 2W)/(\$900 - 2W)](700)$. (Recall that in this example there are 500 units of capital and 700 units of labor in the economy.) The production function for X requires that the industry employ twice as many units of labor as of capital. Hence we have that $(2)[W/(\$300 + W)](500) = [(\$600 - 2W)/(\$900 - 2W)](700)$ in the post-tax equilibrium. Solution of this

Since the price of capital has gone down from \$1.00 to \$0.91255, and the price of labor has gone down from \$1.00 to \$0.83916, it is clear that labor is roughly twice as heavily burdened by this tax (a tax on the earnings of *capital* in industry X!) than is capital, each factor's burden being taken relative to its initial share in the national income. The more labor-intensive is industry X, relative to the proportions in which the factors are initially used in industry Y, the heavier will be the relative burden of the tax upon labor. For example, if initially industry X had used 500 units of labor and 100 units of capital, while industry Y again used 300 of each with the same production function as before, the end result of a tax of 50 per cent of the earnings of capital in industry X would have been a fall in the price of capital from \$1.00 to \$0.9775, and in the price of labor from \$1 to \$0.8974. The burden on labor, relative to its initial share in the national income, would be more than five times that on capital.[4]

Whereas, in the Cobb-Douglas case discussed in Section II, capital bore the whole tax regardless of the proportions in which capital and labor combined in the two industries, we find in the present case that the relative proportions are of critical importance. The fact is that once fixed proportions are assumed to prevail in the taxed industry, it matters little whether the tax is nominally placed on the earnings of capital in X, on the earnings of labor in X, or on the sales of industry X. A tax on any of these three bases will lead to the ejection of labor and capital from industry X precisely in the proportions in which they are there use. If industry Y is initially using the factors in just these proportions, there will be no change in their relative prices, and they will bear the tax in proportion to their initial contributions to the national income. If industry Y is initially more capital-intensive than X, the price of labor must fall relative to that of capital in order to induce the absorption in Y of the factors released by X, and labor will bear a greater proportion of the tax than its initial share in the national income. If, on the other hand, industry Y is initially more labor-intensive than X, the opposite result will occur, and capital will bear a larger fraction of the tax burden than its initial share in national income.

IV. THE CASE OF FIXED PROPORTIONS IN THE UNTAXED INDUSTRY

When production in the taxed industry is governed by a Cobb-Douglas function, and fixed proportions prevail in the untaxed industry, the results of the tax are very different from those in the case just discussed. Now the normal result is for capital to bear more than the full burden of the tax, while labor enjoys an absolute increase in its real income. The degree of increase in labor's real income depends on the relative factor proportions in the two industries, but the fact

quadratic for W permits us to calculate the proportion of the capital stock $[W/(\$300 + W)]$ used in industry X. Applying this proportion to the total capital stock (500 units), we obtain the number of units of capital used in X. Likewise, we obtain the proportion $[(\$600 - 2W)/(\$900 - 2W)]$ of the labor force used in X, and from it the number of workers employed in X. Once we have these, we calculate the number of units of labor and capital employed in Y, and using these results, together with the fact that labor and capital in Y each earn a total of \$300, we calculate the prices of the two factors. (Although the quadratic in W that must be solved has two solutions, one of these is economically inadmissible.)

[4] The key equation for arriving at this solution is $(5)[W/(\$300 + W)](400) = [(\$600 - 2W)/(\$900 - 2W)](800)$. The solution is $W = 91$, $K_x = 93.1$, $L_x = 465.7$, $K_y = 306.9$, $L_y = 334.3$. Capital in industry X gets, net of tax, \$91, the government gets \$91, and labor in industry X earns \$418.

that labor will get such an increase is not dependent on these proportions.

The reason for this apparently anomalous result is that, in order for the untaxed industry to absorb any capital at all from the taxed industry, it must also absorb some labor, for it uses the two factors in fixed proportions. However, since in our example the fraction of national income spent on the taxed industry is given, and since the Cobb-Douglas function determines that the share of this fraction going to labor is fixed, it follows that any reduction in the amount of labor used in the taxed industry will carry with it a rise in the wage of labor.

A few examples of the type presented in the preceding sector will serve both to clarify this general result and to show how the degree of labor's gain depends on the relative factor proportions in the two industries. Assume first that the initial proportions in which the factors are combined are the same in the two industries. Let the production function for X be $X = K_x^{1/2}L_x^{1/2}$, and that for Y be $Y = \text{Min } (K_y, L_y)$, and let there be initially 300 units of each factor in each industry, earning a price of \$1.00. Once again let total expenditures be divided equally between the two products. It follows that, after a tax of 50 per cent is imposed on the earnings of capital in industry X, capital in X will be earning \$150 net of tax while labor in X will be getting \$300. Since there are just as many units of labor as of capital in the economy, and since industry Y uses one unit of labor per unit of capital, industry X must, in the final equilibrium, employ as many units of labor as of capital. Since the total earnings of labor in X must be twice the total after-tax earnings of capital in that industry, it follows that the unit price of labor must be twice the unit price of capital. Of the total national income of \$1,200, the government will get \$150, capital will get \$350, and labor will get \$700. The price of capital will have fallen from \$1.00 to \$0.5833, and that of labor will have risen from \$1.00 to \$1.1667. Capital will have lost a total of \$250 in income, of which \$150 will have gone to the government in taxes and \$100 will have been gained by labor.

Now consider a case in which the taxed industry is more labor-intensive than the untaxed industry. Let industry Y use twice as many units of capital as of labor, and let Y's initial levels of factor use be 400 capital and 200 labor, otherwise keeping the same assumptions as before. In this case, as a result of a 50 per cent tax on the earnings of capital in industry X, the price of capital will fall from \$1.00 to \$0.677855, and that of labor will rise from \$1.00 to \$1.15100. Capital will have lost a total of \$225.5 in income, of which \$75.5 will have been gained by labor.[5]

In a more extreme case, let industry Y use five times as many units of capital as of labor, and let Y's initial levels of factor use be 500 capital and 100 labor, again retaining our other assumptions. Now the price of capital falls from \$1.00 to

[5] Let Z stand for the (as yet unknown) total earnings of capital in industry Y in the new equilibrium. Our other assumptions determine that capital in X will be earning \$150 net of tax. Therefore the fraction of the capital stock employed in Y will be $Z/(\$150 + Z)$, and the number of units of capital in Y will be this fraction times 700, the total amount of capital in the economy. Labor in Y, in the final equilibrium, will be getting $(\$600 - Z)$, and labor in X \$300. Therefore the fraction of the labor force occupied in Y will be $(\$600 - Z)/(\$900 - Z)$, and the number of units of labor in Y will be this fraction times 500. Since the number of units of capital in Y must be twice the number of units of labor, we have as a necessary condition of equilibrium $[Z/(\$150 + Z)](700) = (2)[(\$600 - Z)/(\$900 - Z)](500)$. Z turns out to be \$324.5, $K_y = 478.714$, $L_y = 239.357$. K_x is, therefore, 221.286, and p_k is \$150 divided by this number. Likewise p_l ix \$300 divided by 260.643, the number of units of labor in X.

\$0.774393, and that of labor rises from \$1.00 to \$1.076272. Capital loses a total of \$180.5 in income from the pre-tax to the post-tax situation, of which \$30.5 is gained by labor.[6]

It is clear that the more capital-intensive is the untaxed industry, the less is the percentage reduction in income that capital must sustain as a result of the tax. If the untaxed industry is more labor-intensive than the taxed industry, capital is made even worse off by the tax than in the case of initially equal factor proportions. Where the untaxed industry is twice as labor-intensive as the taxed industry, for example, the price of capital falls from \$1.00 to \$0.528 as a result of the tax, capital losing some \$236 in total income, of which \$86 is gained by labor.[7]

V. A GENERAL MODEL OF THE INCIDENCE OF THE CORPORATION TAX

Although the examples presented in the three preceding sections give some insight into the nature of the incidence problem and into the factors which are likely to govern the incidence of the corporation income tax, they suffer from the defect of being based on particular restrictive assumptions about the nature of demand and production functions. In this section I shall present a model of substantially greater generality.

Let there be two products in the economy, X and Y, with their units of quantity so chosen that their prices are initially equal to unity. Demand for each product will depend on its relative price and on the level of income of demanders. The incomes of consumers will naturally fall as a result of the imposition of the tax, and through the consequent restriction of their demand for goods, command over resources will be released to the government. The ultimate demand position will depend on how consumers react to the change in their income and to whatever price change takes place, and on how the government chooses to spend the proceeds of the tax. Assume for the sake of simplicity that the way in which the government would spend the tax proceeds, if the initial prices continued to prevail, would just counterbalance the reductions in private expenditures on the two goods. This assumption, plus the additional assumption that redistributions of income among consumers do not change the pattern of demand, enable us to treat changes in demand as a function of changes in relative prices alone. Since full employment is also assumed, the demand functions for X and Y are not independent; once the level of demand for X is known, for given prices and full employment income, the level of demand for Y can be derived from the available information. We may therefore summarize conditions of demand in our model by an equation in which the quantity of X demanded depends on (p_x/p_y). Differentiating this function we obtain

$$\frac{dX}{X}=E\frac{d(p_x/p_y)}{(p_x/p_y)}=E(dp_x-dp_y) \quad (1)$$

(Demand for X),

where E is the price elasticity of demand for X, and where the assumption that initial prices were unity is used to obtain the final expression.

[6] The key equation in this case is $[Z/(\$150+Z)](800)=(5)[(\$600-Z)/(\$900-Z)](400)$.

[7] This assumes that initially there were 400 units of labor and 200 units of capital occupied in industry Y. The key equation is $(2)[Z/(\$150+Z)](500)=[(\$600-Z)/(\$900-Z)](700)$. Though the amount of the induced transfer from capital to labor is in this case less in total than it was in the case of equal factor proportions (\$86 vs \$100), the transfer amounts to a greater fraction of capital's initial income, which in this case is \$500 as against \$600 in the equal-proportions case treated earlier.

Assume next that the production function for X is homogeneous of the first degree. This enables us to write

$$\frac{dX}{X}=f_L\frac{dL_x}{L_x}+f_K\frac{dK_x}{K_x} \qquad (2)$$

(Supply of X),

where f_L and f_K are the initial shares of labor and capital, respectively, in the total costs of producing X.

In an industry characterized by competition and by a homogeneous production function, the percentage change in the ratio in which two factors of production are used will equal the elasticity of substitution (S) between those factors times the percentage change in the ratio of their prices. Thus we have, for industry Y,

$$\frac{d(K_y/L_y)}{(K_y/L_y)}=S_y\frac{d(p_k/p_L)}{(p_k/p_L)}. \qquad (3)$$

If we choose units of labor and capital so that their initial prices are equal to unity, this can be simplified to

$$\frac{dK_y}{K_y}-\frac{dL_y}{L_y}=S_y(dp_k-dp_L) \qquad (3')$$

(Factor response in Y).

(Note at this point that the elasticity of substitution, like the elasticity of demand, is here defined so as to make its presumptive sign negative.)

We may follow an analogous procedure to obtain an equation for factor response in industry X, but we must realize here that the return to capital is being subjected to a tax in X, but not in Y. If (dp_k) is the change in the price of capital relevant for production decisions in industry Y, it is clearly the change in the price of capital net of tax. The change in the price of capital including the tax will be (dp_k+T), where T is the amount of tax per unit of capital. The factor response equation for X will therefore be

$$\frac{dK_x}{K_x}-\frac{dL_x}{L_x}=S_x(dp_k+T-dp_L) \qquad (4)$$

(Factor response in X),

where S_x is the elasticity of substitution between labor and capital in industry X.[8]

The four equations, (1), (2), (3′), and (4), contain the following nine unknowns: dX, dp_x, dp_y, dL_x, dL_y, dK_x, dK_y, dp_L, and dp_k. These can be reduced to four by the use of the following five additional equations:

$$dK_y=-dK_x \qquad (5)$$

$$dL_y=-dL_x \qquad (6)$$

$$dp_x=f_L dp_L+f_k(dp_k+T) \qquad (7)$$

$$dp_y=g_L dp_L+g_K dp_k \qquad (8)$$

$$dp_L=0. \qquad (9)$$

Equations (5) and (6) come from the assumption of fixed factor supplies: the amount of any factor released by one of the two industries must be absorbed by the other. Equations (7) and (8) come from the assumptions of homogeneous production functions in both industries, and of competition. These assumptions assure that factor payments exhaust the total receipts in each industry. Thus, for industry Y, we have $p_ydY+Ydp_y=p_LdL_y+L_ydp_L+p_kdK_y+K_ydp_k$, to a first-order approximation. Since the marginal product of labor in Y is (p_L/p_y),

[8] It is convenient in this exercise to treat the tax on capital as a fixed tax per unit of capital employed in X. The analysis, however, is equally applicable to a tax expressed in percentage terms. If t is the percentage rate of tax on the gross income from capital, then in the post-tax equilibrium the absolute tax T can be obtained from the equation $t=T/(1+dp_k+T)$. Thus a case in which the tax is expressed in percentage terms can be analyzed by substituting for T in equation (4) the expression $[t(1+dp_k)(1-t)]$.

and that of capital (p_k/p_y), we have, also to a first-order approximation, $p_y dY = p_L dL_y + p_k dK_y$. Subtracting, we obtain $Y dp_y = L_y dp_L + K_y dp_k$, which, dividing through by Y and recalling that the initial prices of both factors and products are assumed to be unity, we find to be equivalent to (8), where g_L and g_k represent the initial shares of labor and capital, respectively, in the product of industry Y. An exactly analogous procedure applied to industry X yields equation (7); here, however, it must be borne in mind that the change in the price of capital as seen by entrepreneurs in industry X is not dp_k but $(dp_k + T)$.

Equation (9) is of a different variety than the others. The equations of the model contain absolute price changes as variables, while in the underlying economic theory it is only relative prices that matter. We have need of some sort of *numeraire*, a price in terms of which the other prices are expressed, and equation (9) chooses the price of labor as that *numeraire*. This choice places no restriction on the generality of our results. The government invariably will gain $K_x T$ in tax revenue. If the price of capital, net of tax, falls by $TK_x/(K_x + K_y)$ as a result of the tax, we can conclude that capital bears the entire tax. The change in national income, measured in units of the price of labor, is $K_x T + (K_x + K_y)dp_k$, so the result assumed above would leave labor's share of the national income unchanged, while capital's share would fall by just the amount gained by the government. If the solution of our equations told us that dp_k was zero, on the other hand, we would have to conclude that labor and capital were bearing the tax in proportion to their initial contributions to the national income. The relative prices of labor and capital (net of tax) would remain the same as before, hence both factors would have suffered the same percentage decline in real income as a result of the tax. The case where labor bears the entire burden of the tax emerges when the percentage change in the net price of capital (measured in wage units) is equal to the percentage change in the national income (also measured in wage units). Since dp_k is already in percentage terms because the initial price of capital is unity, this condition can be written $dp_k = [K_x T + (K_x + K_y)dp_k]/(L_x + L_y + K_x + K_y)$, which in turn reduces to $dp_k = K_x T/(L_x + L_y)$. Thus the choice of the price of labor as the *numeraire* by no means predestines labor to bear none of the burden of the tax, as might at first be supposed; in fact this assumption in no way restricts the solution of the incidence problem.

Substituting equations (5)–(9) into equations (1), (2), (3′), and (4), we obtain:

$$\frac{dX}{X} = E\,[f_k(dp_k + T) - g_k dp_k] \qquad (1')$$

$$\frac{dX}{X} = f_L \frac{dL_x}{L_x} + f_k \frac{dK_x}{K_x} \qquad (2)$$

$$\frac{K_x(-dK_x)}{K_y K_x} - \frac{L_x(-dL_x)}{L_y L_x} = S_y dp_k \qquad (3'')$$

$$\frac{dK_x}{K_x} - \frac{dL_x}{L_x} = S_x(dp_k + T)\,. \qquad (4')$$

Equating $(dX)/X$ in equations (1′) and (2), and rearranging terms, we have the following system of three equations:

$$E f_k T = E(g_k - f_k)\,dp_k + f_L \frac{dL_x}{L_x} + f_k \frac{dK_x}{K_x} \qquad (10)$$

$$0 = S_y dp_k - \frac{L_x}{L_y}\frac{dL_x}{L_x} + \frac{K_x}{K_y}\frac{dK_x}{K_x} \qquad (3'')$$

$$S_xT = -S_x dp_k - \frac{dL_x}{L_x} + \frac{dK_x}{K_x}. \quad (4')$$

The solution for dp_k, which gives us the answer to the incidence question, is

$$dp_k = \frac{\begin{vmatrix} Ef_k & f_L & f_k \\ 0 & \dfrac{-L_x}{L_y} & \dfrac{K_x}{K_y} \\ S_x & -1 & 1 \end{vmatrix}}{\begin{vmatrix} E(g_k - f_k) & f_L & f_k \\ S_y & \dfrac{-L_x}{L_y} & \dfrac{K_x}{K_y} \\ -S_x & -1 & 1 \end{vmatrix}} \cdot T. \quad (11)$$

Alternatively, (11) can be written:

$$\frac{Ef_k\left(\dfrac{K_x}{K_y} - \dfrac{L_x}{L_y}\right) + S_x\left(\dfrac{f_LK_x}{K_y} + \dfrac{f_kL_x}{L_y}\right)}{E(g_k - f_k)\left(\dfrac{K_x}{K_y} - \dfrac{L_x}{L_y}\right) - S_y - S_x\left(\dfrac{f_LK_x}{K_y} + \dfrac{f_kL_x}{L_x}\right)} \cdot T = dp_k. \quad (12)$$

In solving the determinant in the denominator of (11) to obtain the expression in the denominator of (12), use is made of the fact that $(f_L + f_k) = 1$.

Before turning to an examination of some of the economic implications of this solution, let us establish the fact that the denominator of (12), or of (11) is necessarily positive. S_x is necessarily negative; the expression in brackets which it multiplies in the denominator of (12) is necessarily positive; and S_x is preceded by a minus sign; therefore, the whole third term in the denominator of (12) is positive. $(-S_y)$ is also positive. In the first term, E is negative, so that if it can be shown that $(g_k - f_k)[(K_x/K_y) - (L_x/L_y)]$ is negative or zero, it will be established that the whole denominator is positive (or, in the limiting case, zero). If g_k is greater than f_k, industry Y is more capital-intensive than industry X and therefore $[(K_x/K_y) - (L_x/L_y)]$ must be negative; therefore, the indicated product must be negative. Likewise, if $(g_k - f_k)$ is negative, industry X will be the more capital-intensive of the two industries, and $[(K_x/K_y) - (L_x/L_y)]$ will be positive. The whole first term in the denominator of (12) is therefore positive, and the denominator also.

VI. DETAILED EXAMINATION OF THE GENERAL SOLUTION

In this section, I shall set out certain general conclusions which can be drawn on the basis of the solution given in (12).

1. *Only if the taxed industry is relatively labor-intensive can labor bear more of the tax, in proportion to its initial share in the national income, than capital.* Recall that when dp_k is zero, labor and capital bear the tax precisely in proportion to their initial shares in the national income. For labor to bear more than this, dp_k must be positive. Since the denominator of (12) is positive, the sign of dp_k will be determined by the sign of the numerator of (12). The second term in the numerator is necessarily negative, so dp_k can be positive only if the first term is positive and greater in absolute magnitude than the second term. Since E is negative, the first term can be positive only if $[(K_x/K_y) - (L_x/L_y)]$ is negative, and this can occur only if industry X is relatively more labor-intensive than industry Y. Q.E.D.

2. *If the elasticity of substitution between labor and capital in the taxed industry is as great or greater in absolute value than the elasticity of demand for the product of the taxed industry, capital must bear more of the tax than labor, relative to their initial income shares.* In this case the

term $Ef_k(-L_x/L_y)$, which is the only term which can give the numerator of (12) a positive sign, is dominated by the term $S_x f_k(L_x/L_y)$.

3. *If the elasticity of substitution between labor and capital in the taxed industry is as great in absolute value as the elasticity of substitution between the two final products, capital must bear more of the tax than labor, relative to their initial income shares.* This holds a fortiori from the above, since the elasticity of substitution between X and Y must be greater in absolute value than the elasticity of demand for X. The formula relating the elasticity of substitution between X and Y, which I shall denote by V, and the elasticity of demand for X, E, is $E = V[Y/(X + Y)]$.[9]

4. *The higher is the elasticity of substitution between labor and capital in the untaxed industry, the greater will be the tendency for labor and capital to bear the tax in proportion to their initial income shares.* This elasticity, S_y, appears only in the denominator of (12). It changes not the sign but the magnitude of the expression for dp_k. The larger is S_y in absolute value, the smaller will be the absolute value of dp_k. In the limit, where S_y is infinite, dp_k must be zero: in this case the relative prices of labor and capital are determined in the untaxed industry; the tax cannot affect them.

5. *The higher the elasticity of substitution between labor and capital in the taxed industry, the closer, other things equal, will be the post-tax rate of return on capital to the initial rate of return less the unit tax applied to capital in industry* X. This elasticity, S_x, appears in the numerator and the denominator of (12) with equal coefficients but with opposite signs. When S_x is infinite, and the other elasticities finite, the expression for dp_k is equal to $-T$. The price of capital in the taxed industry, gross of tax, must in this case bear the same relationship to the price of labor as existed in the pre-tax situation. The net price of capital must therefore fall by the amount of the tax per unit of capital in X. Since this fall in price applies to capital employed in Y as well as in X, the reduction in the income of capital must exceed the amount of revenue garnered by the government; labor's real income must therefore rise. When S_x is not infinite, its contribution is to move the value of dp_k toward $-T$, from whatever level would be indicated by the other terms in (12) taken alone.

6. *When factor proportions are initially the same in both industries, capital will bear the full burden of the tax if the elasticities of substitution between labor and capital are the same in both industries, will bear less than the full burden of the tax if the elasticity of substitution between labor and capital is greater in the untaxed than in the taxed industry, and will bear more than the full burden of the tax if the elasticity of substitution is greater in the taxed industry.* When $(K_x/K_y) = (L_x/L_y)$, the first terms in both the numerator and denominator of (12) vanish, and the expression simplifies to $dp_k = -TS_xK_x/(S_yK_y + S_xK_x)$. When, additionally, $S_x = S_y$, this reduces to $-TK_x/(K_y + K_x)$, which was indicated earlier to be the condition for capital's bearing exactly the full burden of the tax. When S_x is greater than S_y, capital's burden will be

[9] One of the many places in which the derivation of this relationship is presented is my paper, "Some Evidence on the International Price Mechanism," *Journal of Political Economy*, LXVI (December, 1957), 514. The relationship applies when the relevant elasticity of demand is one which excludes first-order income effects. This is the concept relevant for the present analysis, because we are treating government demand for goods on a par with consumer demand. The presentation of this relationship at this point may seem a bit out of context; I bring it in because it will be used later.

greater than in the case where the two elasticities are equal, and conversely.

7. *When the elasticity of demand for the taxed commodity is zero, the results are somewhat similar to those just reached. In this case, however, capital does not necessarily bear precisely the full burden of the tax even when the elasticities of substitution are equal in the two industries. It bears somewhat more if the taxed industry is labor-intensive and somewhat less if the taxed industry is capital-intensive.* When E is zero, the first terms in both the numerator and denominator of (12) again vanish, but now the expression for dp_k reduces to $-Tf_LK_xS_x/(g_LK_yS_y + f_LK_xS_x)$.[10] It is clear that, even when $S_x = S_y$, this is equal to $-TK_x/(K_y + K_x)$ only when $f_L = g_L$, that is, when the two industries are initially equally labor-intensive. The fall in the price of capital will be greater or less than this according as f_L is greater than or less than g_L.

8. *When the elasticity of substitution between labor and capital is zero in both industries, the incidence of the tax will depend solely on the relative proportions in which the factors are used in the two industries, labor bearing the tax more than in proportion to its initial contribution to national income when the taxed industry is relatively labor-intensive, and vice versa.* In this case (12) simplifies to $dp_k = f_kT/(g_k - f_k)$, which will be positive when g_k is greater than f_k (taxed industry relatively labor-intensive) and negative when f_k is greater than g_k (taxed industry relatively capital-intensive). A somewhat anomalous aspect of this solution is that the absolute value of dp_k varies inversely with the difference in factor proportions in the two industries. When f_k is $\frac{1}{4}$ and g_k is $\frac{1}{2}$, $dp_k = T$; but when f_k is $\frac{1}{4}$ and g_k is $\frac{3}{4}$, dp_k is only $\frac{1}{2}T$. To see the reason for this, it is useful first to recognize that when there are only two industries, each of which uses the two factors in different proportions, there is only one set of outputs of X and Y which will provide full employment. So long as the full-employment condition is not violated, demand conditions require that the relative prices of the two products must remain unchanged. In our notation, $dp_x - dp_y$ must be zero. Since $dp_x = f_k(dp_k + T)$, and $dp_y = g_kdp_k$, it is clear that this condition on the relative prices of final products is sufficient to give the solution $dp_k = f_kT/(g_k - f_k)$. If, for example, capital initially accounts for one-tenth of the value of output in X and one-half in Y, a rise in the price of capital by $0.25T$ will permit relative product prices to remain unchanged. Recalling that the price of labor is the *numeraire*, and therefore is assumed to remain unchanged, one can see that the rise in the price of X would be $(0.1)\ (0.25T + T) = 0.125T$, while the rise in the price of Y would be $(0.5)\ (0.25T)$, also equal to $0.125T$. Suppose, however, that capital initially accounts for four-tenths of the value of product in X, and one-half in Y. Then the price of capital will have to rise by $4T$ in order to yield the equilibrium ratio of product prices. The rise in the price of X would then be $(0.4)\ (4T + T) = 2T$, and the rise in the price of Y would be $(0.5)\ (4T)$, which is also equal to $2T$. In the limit, where the factor proportions are the same in both industries, and where the production functions are such that these proportions cannot be altered, the model does not give sufficient information to determine the prices of

[10] Since $f_L = L_x/(L_x + K_x)$ and $f_k = K_x/(L_x + K_x)$, it is clear that $f_LK_x = f_kL_x$. The coefficient of S_x in the numerator of (12) can therefore be written $f_LK_x[(1/K_y) + (1/L_y)] = f_LK_x[(L_y + K_y)/(L_yK_y)] = f_LK_x/g_LK_y$. Setting $E = 0$ in (12), and multiplying numerator and denominator by g_LK_y, one obtains the expression given above for dp_k.

capital and labor, either in the pre-tax or in the post-tax equilibrium.

9. *Where the elasticity of substitution in demand between goods* X *and* Y *is equal to* -1, *and the elasticities of substitution between labor and capital in the two industries are also equal to* -1, *capital will bear precisely the full burden of the tax.* This is the Cobb-Douglas case treated in Section II above. The easiest way to demonstrate this proposition is to substitute the solution for dp_k, dL_x/L_x, and dK_x/K_x directly into equations (10), (3''), and (4'). Since the determinant of this system of equations is non-zero, we know that there can be only one solution; thus, if we find one that works, we know we have the right one. The correct solution is $dp_k = -TK_x/(K_x + K_y)$; $(dL_x/L_x) = 0$; and $(dK_x/K_x) = -TK_y/(K_x + K_y)$. Substituting this solution, and $S_x = -1$, into (4'), we obtain $-T = [-TK_x/(K_x + K_y)] + [-TK_y/(K_x + K_y)]$. Equation (4') is therefore satisfied. Substituting into (3''), with S_y set equal to -1, we obtain $[K_xT/(K_x + K_y)] + [-K_xT/(K_x + K_y)] = 0$. Equation (3'') is therefore satisfied. Recalling that when the elasticity of substitution between X and Y is -1, the elasticity of demand for X will be $-Y/(X + Y)$, we substitute this value for E in (10), together with the solution values for the three unknowns, obtaining

$$\frac{-f_kYT}{X+Y} = \frac{YK_xg_kT}{(X+Y)(K_x+K_y)} - \frac{YK_xf_kT}{(X+Y)(K_x+K_y)} - \frac{f_kK_yT}{K_x+K_y}.$$

First, add $YK_xf_kT/(X + Y)(K_x + K_y)$ to both sides of the equation, to obtain

$$\frac{-f_kYK_yT}{(X+Y)(K_x+K_y)} = \frac{YK_xg_kT}{(X+Y)(K_x+K_y)} - \frac{f_xK_yT}{K_x+K_y};$$

here we use the fact that

$$\frac{K_x}{K_x+K_y} + \frac{K_y}{K_x+K_y} = 1\,.$$

Now add $f_kK_yT/(K_x + K_y)$ to both sides of the equation, to get

$$\frac{f_kXK_yT}{(X+Y)(K_x+K_y)} = \frac{YK_xg_kT}{(X+Y)(K_x+K_y)};$$

here we use the fact that $[X/(X + Y)] + [Y/(X + Y)] = 1$. Now, noting that $f_k = K_x/X$ and $g_k = K_y/Y$ under our assumption that all prices are initially equal to unity, we make the corresponding substitutions to obtain

$$\frac{K_xK_yT}{(X+Y)(K_x+K_y)} = \frac{K_xK_yT}{(X+Y)(K_x+K_y)}\,.$$

Equation (10) is therefore satisfied, and the solution has been verified to be the correct one.

10. *In any case in which the three elasticities of substitution are equal (and non-zero), capital will bear precisely the full burden of the tax.* We have shown that when $S_x = S_y = V = -1$, the solution for dp_k is $-KT_x/(K_x + K_y)$, which is what is required for capital to lose precisely what the government gains. Recalling that $E = VY/(X + Y)$, we see from (12) that multiplying S_x, S_y, and V by any positive constant would change the numerator and denominator of (12) in the same proportion, leaving the solution for dp_k unchanged.

VII. APPLICATION TO THE UNITED STATES CASE

If we divide the United States economy into two broad sectors, one corporate and the other non-corporate, the most plausible broad division is between agriculture, real estate, and miscellaneous repair services on the non-corporate side, and the remainder of United States industries on the other. As was indicated in the introduction, the industries here classified as corporate all paid some 20 per cent or more of their total income from capital in corporation tax; and one may add at this point that two thirds of them paid corporation taxes amounting to more than 40 per cent of their return to capital.[11]

On this classification, the corporate sector, in 1953–55, earned roughly \$40 billion in return to capital, and paid roughly \$20 billion in corporation income taxes. Its wage bill averaged around \$200 billion per year. The non-corporate sector, on the other hand, contributed some \$40 billion per year to the national income, of which some \$20 billion was return to capital and \$20 billion return to labor; this sector paid practically no corporation income taxes (less than \$500 million).[12] These data are sufficient to enable us to estimate some of the key elements in formula (12).

If the corporation income tax were of small magnitude, the pre-tax values of (L_x/L_y), (K_x/K_y), f_L, f_k, and g_k would all be very close to their post-tax values, and the post-tax values could be inserted into equation (12) without fear of significant error. However, the tax is in fact substantial in the United States. I have accordingly decided to use two alternative sets of values for these elements in the formula: Set I is derived from the observed values in the period 1953–55, and Set II represents the values that would

[11] In making the computations that follow, I have eliminated from consideration the government and rest-of-the-world sectors, together with the financial intermediaries (banking, brokers, finance, insurance), and certain of the services (private households, commercial and trade schools, medical, health, legal, engineering, educational, and other professional services, and non-profit membership organizations). The industrial classification used was that given in the official statistics on national income by industry. Because net interest and income of unincorporated enterprises are not given in so detailed an industrial breakdown as national income, corporate profits, corporate profits taxes, and so forth, it was necessary to estimate the industrial breakdown for them independently. The methods used, and the tests applied to check the consistency of the resulting figures with official data available for broader aggregates, are given in the appendix to my earlier paper, "The Corporation Income Tax: An Empirical Appraisal," *op. cit.*

[12] Readers of my earlier paper may recall that I reported there on a set of calculations in which the national output was divided into two sectors, and that the two sectors turned out to have roughly equal factor proportions. That division differs from the present one because it was based on the assumption that in each of the many industries considered, fixed factor proportions prevailed. In such a case, a tax on the earnings of capital in each industry is equivalent to an excise tax on the value added to that industry at a rate equal to the ratio of corporation tax receipts to value added. In my example I compared the results of such a pattern of excises with the results of a flat-rate excise tax on the value added of all industries, the rate being so chosen as to yield the same revenue as the present corporation tax. I then divided industries into two groups according to whether their ratios of corporation tax payments to value added were greater or less than this calculated flat rate. Under the assumption of no substitutability between capital and labor, those industries whose actual rate was higher than the flat rate would presumably contract, as a result of substituting the flat-rate excise for the present tax. Those that would contract would eject labor and capital, and the others would expand their use of both factors. The calculation I made was of the total amounts that would be demanded by the expanding industries, assuming unit elasticities of substitution among final products and also that relative factor prices did not change as a result of the alteration in tax provisions. It turned out that the expanding industries would demand new labor and capital in almost precisely the same amounts as contracting industries would eject them and that therefore the relative prices of the factors would remain substantially unchanged. I note this merely to explain the difference in concept between my earlier calculation of factor proportions and the present one. In the earlier case, the ratio of corporate tax payments to value added was the basic variable considered; here the basic variable is the ratio of corporate tax payments to total income from capital.

have emerged in 1953–55 in the absence of the tax if each sector were characterized by a Cobb-Douglas production function and if the elasticity of substitution between the products of the two sectors were unity. In both cases $(L_x/L_y) = 10$. This is the ratio of the wage bill in the taxed sector to the wage bill in the untaxed sector that was observed in 1953–55, and it will be recalled from the analysis of the Cobb-Douglas case in Section II that the pre-tax and post-tax distributions of the labor force are the same. Likewise, $g_k = 0.5$ in both cases, this being the share of capital in the untaxed industry in 1953–55; under Cobb-Douglas assumptions this fraction also is invariant between the pre-tax and post-tax situation. The observed value of (K_x/K_y) is 1, the after-tax receipts of capital being the same in the two sectors in 1953–55. The hypothetical initial value, however, is 2 under Cobb-Douglas assumptions, for these assumptions imply that in the absence of the tax the capital stock would be distributed between the industries in the same proportions as the gross-of-tax earnings of capital in the two industries after the tax had been imposed. Since under Cobb-Douglas assumptions the shares of the gross earnings of the factors in the total product of the industry are constant, we have for this case $f_k = (1/6)$ and $f_L = (5/6)$. For our alternative assumptions (Set I) we shall take the observed net-of-tax ratios in 1953–55: $f_k = (1/11)$ and $f_L = (10/11)$. The assumed initial values for these magnitudes are summarized below:

	(K_x/K_y)	(L_x/L_y)	f_k	f_L	g_k
Set I......	1	10	1/11	10/11	0.5
Set II.....	2	10	1/6	5/6	0.5

Substituting these figures into equation (12), we obtain expressions for dp_k in which the incidence of the corporation tax is expressed directly in terms of the elasticities of substitution and of demand:

$$dp_k = \frac{T[-9E + 20S_x]}{-40.5E - 11S_y - 20S_x} \quad (13)$$

(based on Set I);

$$dp_k = \frac{T[-8E + 20S_x]}{-16E - 6S_y - 20S_x} \quad (14)$$

(based on Set II).

We have evidence which I believe permits us to estimate the order of magnitude of E reasonably well, albeit by an indirect route. The untaxed sector, Y consists overwhelmingly of two industries—agriculture and real estate—and the activity of the latter is principally the provision of residential housing services. We know that the elasticity of demand for agricultural products lies well below unity, and recent evidence suggests strongly that the price elasticity of demand for residential housing in the United States is somewhere in the neighborhood of unity, perhaps a bit above it.[13] It is thus highly unlikely that the price elasticity of demand for the products of our non-corporate sector (which would be a weighted average of the price elasticities of the component commodities, adjusted downward to eliminate the contribution of substitutability among the products in the group) would exceed unity in absolute value; in all likelihood it is somewhat below this figure. This evidence permits us to use unity as a reasonable upper bound for the elasticity of substitution between X and Y. A value of unity for this elasticity of substitution implies a value of $-\frac{6}{7}$ for the elasticity of demand for the products of the non-

[13] See Richard F. Muth, "The Demand for Nonfarm Housing," in A. C. Harberger (ed.), *The Demand for Durable Goods* (Chicago: University of Chicago Press, 1960), pp. 29–96.

corporate sector, and a value of $-\frac{1}{7}$ for the elasticity of demand for the products of the corporate sector.[14] Only if one feels that the elasticity of demand for the non-corporate sector's product is higher than $\frac{6}{7}$ in absolute value can he place a higher value than $\frac{1}{7}$ on the elasticity of demand for the corporate sector's product.

Evidence on the elasticity of substitution (S_x) between labor and capital in the corporate sector is both more meager and less reliable than the evidence on elasticities of demand. However, two recent studies, one by Solow and the other by Minasian, suggest rather strongly that the elasticity of substitution between labor and capital in manufacturing industries in the United States tends to be near unity. Of nineteen elasticities of substitution measured by Solow for two-digit manufacturing industries, ten were greater than and nine less than unity. Of fourteen elasticities of substitution measured by Minasian for two-digit industries, six were greater than and eight less than unity. Of forty-six elasticities measured by Minasian for three-digit and four-digit industries, twenty-two were greater and twenty-four less than unity. Only in a small fraction of the cases were the differences between the estimated elasticities and unity statistically significant; and the majority of the estimated elasticities for which this difference was significant were greater than unity.[15]

We can be still less sure about the elasticity of substitution, S_y, between labor and capital in the untaxed sector. We may recognize the relative success that agriculture economists have had in fitting Cobb-Douglas production functions to data for different components of agriculture and perhaps tentatively accept an elasticity of substitution of unity as applying there. However, close to half the contribution of the non-corporate sector to national income comes from real estate and not from agriculture. It is difficult to see how the elasticity of substitution between labor and capital in the provision of housing services could be very great. Very little labor is in fact used in this industry (compensation of employees is only one-tenth of the value added in the industry), and it is hard to imagine that even fairly substantial changes in relative prices would bring about a much greater relative use of labor. Taking the non-corporate sector as a whole, I think it is fair to assume that the elasticity of substitution between labor and capital in this sector is below, and probably quite substantially below, that in the corporate sector.

We may now attempt to assess the burden of the corporation income tax in the United States. Let us take as a first approximation the Cobb-Douglas case, in which all three elasticities of substitution are unity. We have seen that this case

[14] Recall that V, the elasticity of substitution between X and Y, is related to the own-price elasticities of demand for those commodities by the formulas: $E_x = V[Y/(X+Y)]$, and $E_y = V[X/(X+Y)]$. In our 1953–55 data $[X/(X+Y)] = \$240/\$280$, and $[Y/(X+Y)] = \$40/\$280$.

[15] See R. M. Solow, "Capital, Labor, and Income in Manufacturing" (paper presented at the Conference on Income and Wealth, April, 1961, sponsored by the National Bureau of Economic Research [to be published]), and Jora R. Minasian, "Elasticities of Substitution and Constant-Output Demand Curves for Labor," *Journal of Political Economy*, LXIX, June, 1961), 261–70. Both of these studies were based on cross-section data, Solow's data being classified by regions and Minasian's by states. Though the over-all statistical significance of the conclusion that the substitution elasticity between labor and capital in most manufacturing industries is not far from unity is good, there is the possibility of bias toward unity in the results due to errors of measurement or to differences in the quality of labor among states or regions. It is on this ground that I regard these results as less firm than those on elasticities of demand.

implies that capital will bear precisely the full burden of the tax. This means, using Set I of initial conditions, that $dp_k = -\frac{1}{2}T$, and using Set II that $dp_k = -\frac{2}{3}T$. Inserting the values $E = -\frac{1}{7}$; $S_x = S_y = -1$ in equations (13) and (14), we find that, under Set I, $dp_k = -0.509T$, while under Set II $dp_k = -\frac{2}{3}T$.[16]

The most plausible alteration to make in the above assumptions is to reduce the value of S_y. This will clearly operate to increase the burden on capital. To see how sensitive is the incidence of the tax to a reduction in S_y, let us assume $E = -\frac{1}{7}$; $S_x = -1$; $S_y = -\frac{1}{2}$. Here we find that under Set I $dp_k = -0.598T$, while under Set II $dp_k = -0.746T$. Comparing these results with the levels of dp_k, which would mean capital's just bearing the tax, we find that in this case capital's burden is 120 per cent of the tax under Set I and 112 per cent under Set II.

The results are even less sensitive to changes in the assumed demand elasticity than to changes in S_y. If we assume the elasticity of substitution between X and Y to be only $-\frac{1}{2}$ (which is implausibly low, since it implies an elasticity of demand for the non-corporate sector's product of only -0.42, even though we have strong evidence that this magnitude is much higher), while the elasticities of substitution in production are both -1, capital turns out to bear 114 per cent of the burden of the tax under Set I and 107 per cent under Set II of initial values. Raising the elasticity of substitution between X and Y to -1.5 (implying an elasticity of demand for the non-corporate sector's product of around -1.25), we obtain the result that capital bears 91 per cent of the tax under Set I and 93 per cent under Set II.

Raising S_x to -1.2 (which is perhaps a rather high value in the light of the Solow-Minasian evidence), and leaving the other elasticities of substitution at unity, gives the result that capital bears 111 per cent of the tax under Set I and 106 per cent under Set II of initial conditions. If we set S_x at $-.8$, we find that capital bears 90 per cent of the burden of the tax under Set I, and 92 per cent under Set II.

To reduce S_x below unity while not reducing S_y appears unrealistic, since our evidence suggests that S_x is near -1, while evidence and presumption suggest that S_y is lower. Let us accordingly test the consequences of a substantial reduction of S_x and S_y simultaneously, say, to $-\frac{2}{3}$, while leaving the elasticity of substitution between X and Y at -1. This gives the same relationship among the elasticities as existed when we assumed the elasticity of substitution between X and Y to be -1.5, and the elasticities of substitution in production to be -1; again we find that capital bears 91 per cent of the tax under Set I and 93 per cent under Set II of initial conditions.

It is hard to avoid the conclusion that plausible alternative sets of assumptions about the relevant elasticities all yield results in which capital bears very close to 100 per cent of the tax burden.[17] The

[16] Set I does not yield exact results because the assumed initial conditions are inconsistent with the assumed values of the three elasticities. However, the error is so small as to be negligible for practical purposes.

[17] Actually, the method used to estimate the percentages of the tax borne by capital in the above examples is biased away from this conclusion. The method was to divide the estimated value of dp_k by the value that dp_k would have if capital bore the whole tax. This method would tell us that capital bore none of the tax if the estimated dp_k were zero; yet we know that when $dp_k = 0$ the tax is shared by labor and capital in proportion to their initial contributions to total income. The method is precise only when $dp_k = -K_xT/(K_x + K_y)$. If p_k falls more than this, with the price of labor con-

most plausible assumptions imply that capital bears more than the full burden of the tax.

Let us now consider how this result would be modified if, as a result of the existence of the tax, the rate of saving was less than it would have been in the absence of this particular tax. I shall assume that, in the absence of the corporation income tax, the government would have raised the same amount of revenue by other means, and hence that there is no "income effect" of the tax on the volume of saving. However, our analysis implies that the net rate of return on capital is lowered as a result of the tax, and this would have an effect on capital accumulation if the elasticity of savings with respect to the rate of interest were not zero. Let the capital stock that we now observe be called K_1, and the capital stock that we would have had at the present time in the absence of the corporation tax be K_2. Let R be the percentage excess of K_2 over K_1. An increase in the capital stock from K_1 to K_2 would have caused an increase in output of h_kR per cent, where h_k is the fraction of the national income earned by capital. If, as is probably true, Cobb-Douglas assumptions apply, the shares of capital and labor in the national income will remain constant. Therefore, of the increase in output stemming from the increase in capital stock, a fraction h_L would accrue to labor, where h_L is the share of labor in the national income. Thus in the absence of the tax there would have occurred a transfer of h_Lh_kR per cent of the national income to labor. This transfer does not take place because of the existence of the tax; hence in a sense it may be said that the potential amount of this unrealized transfer is a burden imposed on labor by the tax.

How large is the amount of the potential transfer relative to the burden of the tax itself? Using our 1953–55 data, we find that h_k is about 0.22 and h_L is about 0.78, while the tax represents 1/14 of the total income produced in the two sectors considered. In order for (0.22)(0.78) R to equal 1/14 of the national income, R would have to be about 0.42. That is to say, the capital stock that would have existed in the absence of the corporation tax would have had to be some 42 per cent greater than the capital stock we now have.

It is quite implausible that the influence of the corporation tax on the capital stock could have been this great. If the tax did not influence the capital stock at all, it would have reduced the net rate of return on capital by a third; to the extent that it did influence the capital stock, the reduction in the net rate of return would have been less than this. K_2 is made different from K_1 by the influence of the reduction in the rate of return upon the rate of saving. If there is such an influence, its effect increases through time. In the first few years after the tax is imposed, only small differences between K_2 and K_1 can emerge. As time goes on, and the capital stock comes to consist more and more of capital accumulated after the imposition of the tax, the difference becomes larger. The percentage excess of K_2 over K_1 can, however, never be greater than the percentage excess of the savings rate that would have existed in the absence of the tax over the savings rate in the presence of

stant, the general price level will fall somewhat; capital will not suffer in real terms by as much as our approximation indicates. If p_k falls by less than this, the general price level will rise, and capital will suffer a greater burden (will come closer to bearing the full weight of the tax) than our approximation indicates. Correcting the above percentages for this bias would accordingly strengthen the conclusion stated above. The corrections would, however, be minor in the cases presented in the text.

the tax. Thus, if one thinks that in the absence of the corporation tax the net savings rate in the United States might be 20 per cent higher than it is now, he may set the maximum value for R at 0.2. This would mean that a maximum of half the burden of the corporation tax would be "shifted" to labor. If one thinks that the savings rate in the absence of the tax would be no more than 10 per cent higher than at present, a maximum of one-quarter of the burden of the tax would be "shifted" to labor. The observed constancy of the savings rate in the United States in the face of rather wide variations in the rate of return on capital suggests that the effect of the tax on the rate of saving is probably small. Moreover, no more than half of the present capital stock of the United States is the result of accumulations made after corporation tax rates became substantial in the mid-thirties. Thus even if savings in this period would have been 20 per cent greater in the absence of the tax, the current capital stock would be only 10 per cent less than it would have been in the absence of the tax. And if the effect of the tax was to reduce savings by 10 per cent, the current value of R would be only 5 per cent.

I conclude from this exercise that even allowing for a rather substantial effect of the corporation income tax on the rate of saving leads to only a minor modification of my over-all conclusion that capital probably bears close to the full burden of the tax. The savings effect here considered might well outweigh the presumption that capital bears more than the full burden of the tax, but it surely is not sufficiently large to give support to the frequently heard allegations that large fractions of the corporation income tax burden fall on laborers or consumers or both.

APPENDED NOTES

At the presentation of this paper at the 1961 meetings of the International Association for Research in Income and Wealth, and in other discussions of its content, some questions have been raised that clearly merit treatment, yet that do not quite fit as integral parts of, or as footnotes to, particular statements in the main text. These notes discuss two of these points.

1. OTHER SPECIAL TAX PROVISIONS RELATING TO CAPITAL

In this paper I have tried to get at what might be called the partial or particular effects of the corporation income tax. In the simple models presented, the corporation income tax was the only tax in the system, but the analysis can easily be adapted to cases where other taxes exist. In such cases the effects of adding the corporation income tax to a set of pre-existing taxes will be essentially the same as those derived in this paper for the case where there were no pre-existing taxes. Differences of detail in formulas such as equation (12) may appear as one considers different patterns of pre-existing taxes, but the basic roles played by relative factor proportions, by substitutability between corporate and non-corporate products in demand, and by the relative degrees of substitutability between labor and capital in producing the two classes of products will remain the same.

One may, however, accept the approach presented in the text as appropriate for analyzing the effects of the corporation income tax and may have no quarrel with the empirical exercise of Section VII as indicating the particular effect of the corporation income tax in the United States, and yet may doubt that capital is as heavily discriminated against in the corporate sector, or that capital as a whole bears as heavy a weight of "special" taxation, as is indicated in Section VII. Such doubts have been expressed to me on several occasions, the argument being that other "special" provisions of our tax laws operate to offset, to some extent, the particular effects of the corporation income tax.

The capital gains provisions of the personal income tax are a case in point. Capital gains in the United States are taxed only upon realization, and then (except for short term gains) at a preferential rate that cannot exceed 25 per cent. Accrued gains that have not been realized before the death of the owner escape capital gains tax altogether and are subject only to the estate tax. These provisions operate to make the tax load on owners of capital lighter than it would be in their absence. They also operate to attract capital to the corporate sector, for it is here that capital gains can be expected to accrue in the normal course of events (as a result of corporate saving), whereas in the non-corporate sector capital gains come mainly from less normal causes such as general price inflation or relative price changes.

To get an idea of how taking capital gains provisions into account would alter the results of Section VII, let us assume that corporate saving of a given amount tends to generate an equal amount of capital gains, and that no capital gains normally accrue in the non-corporate sector. Let us, moreover, assume that the special provisions regarding capital gains lead to a reduction in personal income-tax liabilities (as against a situation in which capital gains would be taxed as ordinary income) equal to half the amount of the gains themselves. This last assumption implies a "typical" marginal income-tax rate for corporate shareholders somewhere between 50 per cent (what it would be if no capital gains tax were in fact paid on the gains generated in the corporate sector) and 75 per cent (what it would be if the maximum long-term capital gains tax of 25 per cent were actually paid on all the gains generated in the corporate sector). These assumptions are meant to be extreme rather than realistic, so that we may see how large the possible offsetting effects of the capital gains provisions may be.

In the period 1953–55, from which the data used in Section VII were taken, corporate savings averaged slightly less than $10 billion per year. The assumptions above imply a personal tax offset, due to the capital gains provisions, of about $5 billion per year. Thus, in analyzing corporation-tax-cum-capital-gains-provisions we would set up an example in which corporate capital paid $15 billion in special taxes and non-corporate capital nothing, as compared with the $20 billion and nothing, respectively, used in the example of Section VII. The argument would run along precisely the same lines, and we would come to the conclusion that the $15 billion in special taxes was borne predominantly by capital.

Two other special tax provisions relating to income from capital deserve notice here. One consists of the property taxes levied by state and local governments. These averaged about $10 billion per year during 1953–55, with about three-quarters of this amount falling upon residences and farms, and about one-quarter falling on commercial and industrial property.[18] The other provision is the exclusion from personal income subject to tax of the imputed net rent on owner-occupied dwellings. The official national income statistics of the United States estimate the value of this net rent to have been slightly over $5 billion per year in the period 1953–55.[19] We may estimate that at least $1 billion of potential tax yield is foregone by the government as a result of the failure to tax imputed rent.

Taking all four special provisions together, we may estimate that non-corporate capital is liable in the first instance to no more than $6.5 billion ($7.5 billion of property taxes minus at least $1 billion of

[18] United States Bureau of the Census, *Statistical Abstract of the United States*, 1960 (Washington: Government Printing Office, 1960), p. 417.

[19] United States Department of Commerce, *U.S. Income and Output* (Washington: Government Printing Office, 1958), p. 229.

tax forgiveness on net rent) of special taxes. Corporate capital, on the other hand, is liable to at least \$17.5 billion (\$20 billion of corporation income tax plus \$2.5 billion of property taxes minus at most \$5 billion in personal tax offsets due to the capital gains provisions). Since there are roughly equal amounts of capital in each of the two sectors, it is clear that corporate capital is taxed substantially more heavily than non-corporate capital. To get at the incidence of the roughly \$24 billion accruing to the government on account of all four special provisions taken together, we can break up the problem into two parts. The \$6.5 billion paid by non-corporate capital together with the first \$6.5 billion paid by corporate capital function in roughly the same way as would a flat-rate, across-the-board tax on all capital. So long as the total supply of capital is not sensitive to changes in the net rate of return in the relevant range, capital will bear the full burden of this \$13 billion. The remaining \$11 billion paid by corporate capital is not matched by any corresponding tax on non-corporate capital. This can be treated as a special levy on corporate capital, over and above the flat-rate levy on all capital represented by the \$6.5 billion figure above. The analysis of the incidence of this special levy would follow exactly the same lines as my analysis in the main body of this paper of the incidence of the corporation income tax. This leads to the conclusion that the bulk of the \$11 billion is probably also borne by capital.

To sum up this survey of the impact of other tax provisions relating to capital we can say that no more than a quarter of the burden of the corporation income tax is offset as a result of the capital gains provisions. The fact that property taxes strike non-corporate capital more heavily than corporate capital mitigates, to a limited extent, the tendency induced by the corporation tax for capital to be driven out of the corporate sector. This fact also, however, practically assures us that half or more (represented by the \$13 billion figure above) of the total burden resulting from all four provisions taken together is solidly borne by capital. There remains a substantial amount of corporation tax (represented by the \$11 billion figure above) that is neither offset by the capital gains provisions nor matched by the higher property taxes on non-corporate capital. It is to study the incidence of this residual amount of corporation tax that the methods outlined in this paper would apply, and I want to emphasize that the amount is substantial even when possible offsets are taken into account. In all likelihood, the proper figure would be greater than \$11 billion, for I have consciously overstated the offsetting effect of the capital gains provisions and understand the amount by which the imputed rent provisions reduce the tax burden on non-corporate capital. Adjusting either of these in the appropriate direction would raise the amount of "special" taxation striking corporate capital above \$11 billion. I would therefore claim that the analysis presented in the text is relevant not only for estimating the incidence of the corporation income tax itself, but also for understanding the effects of the combination of special provisions with regard to income from capital that prevails in the United States.

2. MONOPOLY ELEMENTS IN THE CORPORATE SECTOR

Several readers of the original draft of this paper have been disturbed by the assumption of competition in the corporate sector. Rather than attempt to argue for the applicability of this assumption, I propose here to outline how the analysis of the paper can be adjusted to accommodate the presence of monopoly elements in the corporate sector. I shall leave untouched as much of the basic model as possible: production functions, demand functions, the equalization of returns to labor and to capital in the two sectors all remain as before. Monopoly elements are introduced by means of a "monopoly markup," M, which represents the percentage by which the price charged by the monopoly firm exceeds unit cost including the equilibrium return on capital.

It is important to realize at this point that I am not treating the entire corporate sector as one huge monopoly firm. If it were such, it could surely extract a huge monopoly markup from consumers in the economy, to say nothing of the gains it could achieve through the monopsony power that such a great aggregate could wield in the markets for labor and capital. M is kept down to modest size by the existence of many independent firms within the corporate sector; by the availability, elsewhere in the corporate sector, of reasonably close substitutes for the products of any one firm; and by the perennial threat of new entry into any field in which the monopoly markup is large. The strength of these forces, which determine what M will be, is not likely to be altered by the imposition or removal of a corporation income tax. Thus M is assumed to be the same in the pre-tax and the post-tax situations.

The effects of introducing monopoly elements can be seen quite clearly in a simple example similar to that of Section II above. Suppose that consumers always spend 50 per cent of their income on X, the corporate product, and 50 per cent on Y, the non-corporate product, and that production of both X and Y is governed by Cobb-Douglas production functions in which the exponents applying to labor and capital are each one-half. Suppose, moreover, that the monopoly markup in X is 25 per cent. These assumptions dictate that 50 per cent of the national income is spent on Y, of which half goes to labor and half to capital; and that 50 per cent of the national income is spent on X, of which $\frac{2}{5}$ goes to labor, $\frac{2}{5}$ to capital, and $\frac{1}{5}$ is monopoly profit.

Imposing a corporation income tax of 50 per cent on the profits of industry X (including the monopoly profits, of course), will not alter the fractions of the national income spent on X and Y, nor the shares earned by labor in X and Y, and by capital in Y. It will also not alter the gross earnings of capital in X, or the gross amount of monopoly profit. But net earnings on capital in industry X will be reduced by the tax from 20 per cent to 10 per cent of the national income, and net monopoly profits will be reduced by the tax from 10 per cent to 5 per cent of the national income. The distribution of capital between the two industries will change so as to equalize net returns. Whereas before the tax $\frac{4}{9}$ of the capital stock was located in industry X, after the tax only $\frac{2}{7}$ of the capital stock would be occupied there.

The only difference between this example and that of Section II is that here the tax bites into monopoly profits as well as into the return on capital as such. It is no longer quite proper to say that the tax is exclusively borne by capital, but it is proper to say that the tax is exclusively borne by profits (in the broad sense of the term which includes interest, rent, return on equities, and monopoly profits).

It is also quite straightforward to incorporate the monopoly markup into the more general model of section V. Of the basic equations (1) through (9), only (7) is altered. It becomes:

$$dp_x = [f_L dp_L + f_k(dp_k + T)](1+M). \tag{7'}$$

In the reduction of the system to equations (10), (3″) and (4′), only (10) is altered. It becomes:

$$Ef_k(1+M)T = E[g_k - f_k(1+M)]\,dp_k + f_L \frac{dL_x}{L_x} + f_k \frac{dK_x}{K_x}. \tag{10'}$$

Finally, the solution for dp_k, given in equation (12), now becomes:

$$dp_k = \frac{Ef_k(1+M)\left(\frac{K_x}{K_y} - \frac{L_x}{L_y}\right) + S_x\left(f_L \frac{K_x}{K_y} + f_k \frac{L_x}{L_y}\right)}{E[g_k - f_k(1+M)]\left(\frac{K_x}{K_y} - \frac{L_x}{L_y}\right) - S_y - S_x\left(f_L \frac{K_x}{K_y} + f_k \frac{L_x}{L_y}\right)} \cdot T. \tag{12'}$$

Comparison of (12′) with (12) reveals that the determinants of the incidence of the corporation income tax play essentially the same roles in the "monopoly" case as they did in the competitive case treated in the text. And for plausible values of the key parameters and ratios, the magnitude of dp_k/T is not likely to be very sensitive to a change in the value of M from zero to something like 0.05 or 0.1 or 0.2.

A word should be said, however, about the interpretation of T in the monopoly case. Recall that the basic model treats T as a specific tax per unit of capital. If such a tax were in fact levied, it would not strike monopoly profits as such. If, however, a tax of a given percentage, t, is levied on all profits in the corporate sector, it will strike monopoly profits as well as the normal return to capital. Its total yield will be $t(MXp_x + K_x p_k')$, where the magnitudes in parentheses are measured in the post-tax situation, and p_k' represents the gross-of-tax price of capital in industry X. To fit such a tax into our model, it is convenient to view it as two different taxes: one, a direct tax taking a percentage t of all monopoly profits, and the other, a specific tax at the rate $T = tp_k'$ per unit of capital in industry X. The incidence of the first tax is purely upon monopoly profits. Equation (12′) gives us the answer to the incidence of the second tax.

We may summarize the results of this note as follows: the main effect of introducing monopoly elements in the corporate sector is that now a corporation income tax of the usual type will fall on monopoly profits as well as on the ordinary return to capital. The part that falls on monopoly profits will be borne by them. The part, however, that falls on the ordinary return to capital in the corporate sector will introduce a disequilibrium in the capital market. To restore a full equilibrium in factor and product markets, the distribution of factors of production between the corporate and noncorporate sectors, the relative quantities of the two classes of products, and the relative prices of factors and products will all typically change. The ultimate resting place of the part of the burden of the tax that is not directly borne by monopoly profits will be determined by a mechanism that differs only in minute detail from that which determines the incidence of the corporation income tax in the competitive case.