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# Tax Neutrality in Investment Incentives

IN THIS PAPER various alternative schemes of tax incentives for investment are examined with respect to a criterion of neutrality.[1] Obviously when a society gives such incentives it expects additional investment projects to be undertaken—ones that would not have come into existence without the tax incentive. I define as neutral an investment tax incentive that does not induce new "covered" investments with low rates of social yield, while failing to induce other "covered" investments with higher rates of social yield.

The only differences between private and social yield that I shall consider are taxes and tax offsets (for example, credits). In these circumstances the social rate of yield of an investment is the internal rate of return of its before-tax cash flow. The private rate of yield is the internal rate of return of its after-tax cash flow.[2]

To take a numerical example, suppose that in the absence of a tax incentive, corporate investments at the margin typically yielded a 20 percent rate of return gross of tax and a 10 percent rate net of tax. The introduction of a tax incentive would cause more investments to become "interesting" from the private standpoint. Neutrality requires

1. The basic ideas in this paper developed out of my work for the Fiscal Reform Mission to Bolivia in 1976. An early version of them is set out in "Tax Incentives to Investment in Bolivia," in Richard A. Musgrave, ed., *Fiscal Reform in Bolivia* (Cambridge: Harvard International Tax Program, 1977), chap. 22.

2. I consider only "normal" investment projects, that is, those whose cash flow starts with an "investment" sequence of one or more periods of negative net flows followed by a number of periods with positive net flows.

that an investment stimulus would make acceptable all investments with gross-of-tax yields above a critical level (say 18 percent), but not any with gross-of-tax yields less than that level. Making the incentive more generous would admit all investments with gross-of-tax yields of, say, 17 percent or more, but none with yields of less than 17 percent. For each level of stimulus, then, neutrality requires some social rate of return, such that all independent investment projects meeting that rate will tend to be privately accepted, while no project failing to meet that rate will be privately accepted.

The next section shows that the investment tax credits, fixed-period (for example, four-year) accelerated write-offs, and accelerated depreciation over half the normal economic life of an asset all fail to meet my neutrality test. The following section shows that the neutrality criterion is fully met by an alternative scheme, permitting the immediate expensing of a given fraction, $a$, of the investment outlays of a project, while the remaining fraction $(1 - a)$ is required to be written off following the normal pattern of true economic depreciation of the asset.

## Tax Credits and Accelerated Depreciation

The 30 percent investment tax credit that I encountered in Bolivia during my work there in 1976 served to underscore the wisdom of the dictum "If you want to quickly see the fundamental effects of a given type of disturbance, assume that the disturbance is *big*." A 30 percent tax credit clearly reveals the fundamental conceptual weakness of the tax credit idea—a weakness that would be harder to discern if the tax credit were one of 5 or 7 percent.

Table 1 compares two investment projects under the assumption that the private discount rate used for comparing investments is 10 percent. The first project summarized in table 1 entails investment of 1,000, with returns of 300 a year for the next three years. The internal rate of return of the before-tax cash flow of this sequence is almost exactly −5 percent and its net present value (at $r = 10$ percent) is −100. If the project is undertaken, however, the government puts up 30 percent of the funds, and in addition the project later generates tax losses that reduce tax liabilities on income from other sources. The result is an after-tax cash flow profile with an internal rate of return of 17 percent and a net present value (at 10 percent) of 89. If the private after-tax discount rate is 10 percent, the project will undoubtedly be undertaken. A project that is worse than worthless from the social yield point of view has been brought into existence solely because of a tax credit.



Table 1. Comparison of Privately Acceptable and Unacceptable Projects, Each with 30 Percent Tax Credit

| Item | Year 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| *Privately acceptable project*[a] | | | | |
| Gross-of-tax cash flow | −1,000 | 300 | 300 | 300 |
| Tax credit | 300 | 0 | 0 | 0 |
| Depreciation | 0 | 333 | 333 | 334 |
| Taxable income | 0 | −33 | −33 | −34 |
| Tax at 50 percent (cash flow) | 0 | −16 | −17 | −17 |
| Private cash flow | −700 | 316 | 317 | 317 |

| Item | Year 0 | 1 | 2 | 3 | ... | ∞ |
|---|---|---|---|---|---|---|
| *Privately unacceptable project*[b] | | | | | | |
| Gross-of-tax cash flow | −1,000 | 120 | 120 | 120 | ... | 120 |
| Tax credit | 300 | 0 | 0 | 0 | ... | 0 |
| Taxable income | 0 | 120 | 120 | 120 | ... | 120 |
| Tax at 50 percent (cash flow) | 0 | −60 | −60 | −60 | ... | −60 |
| Private cash flow | −700 | 60 | 60 | 60 | ... | 60 |

a. Internal rate of return: social, −5 percent; private +17 percent. Private net present value at 10 percent is 89.
b. Internal rate of return: social, 12 percent; private 8 4/7 percent. Private net present value at 10 percent is −100.

The second project in table 1 has a *much* higher social yield than the first; yet it would be rejected by private investors even in the presence of a 30 percent tax credit. In this case the investment of 1,000 yields 120 annually in perpetuity, gross of tax. This project, in spite of its social rate of return of 12 percent, would be rejected by private investors because its private yield, 8.57 percent, is less than the private after-tax discount rate.

The fact that private investors would choose to accept the first project, which has a social yield of −5 percent, and reject the second, with a social yield of 12 percent, demonstrates that the investment tax credit fails to meet the neutrality criterion.

### *Four-Year Accelerated Depreciation*

One type of accelerated depreciation that has been used with some frequency consists of permitting assets to be written off over a prespecified, usually quite short, period. I shall use a four-year period to

Table 2. Comparison of Privately Acceptable and Unacceptable Projects, Each with a Four-Year Write-off

| Item | Year 0 | 1 | 2 | 3 | 4 | 5 | 6 | ... | 50 |
|---|---|---|---|---|---|---|---|---|---|
| *Privately acceptable project*[a] | | | | | | | | | |
| Gross-of-tax cash flow | −1,000 | 130 | 130 | 130 | 130 | 130 | 130 | ... | 130 |
| Depreciation | 0 | −250 | −250 | −250 | −250 | 0 | 0 | ... | 0 |
| Taxable income | 0 | −120 | −120 | −120 | −120 | 130 | 130 | ... | 130 |
| Tax at 50 percent (cash flow) | 0 | −60 | −60 | −60 | −60 | 65 | 65 | ... | 65 |
| Private cash flow | −1,000 | 190 | 190 | 190 | 190 | 65 | 65 | ... | 65 |

| Item | Year 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| *Privately unacceptable project*[b] | | | | | | |
| Gross-of-tax cash flow | −1,000 | 350 | 320 | 290 | 260 | 230 |
| Depreciation | 0 | −250 | −250 | −250 | −250 | 0 |
| Taxable income | 0 | 100 | 70 | 40 | 10 | 230 |
| Tax at 50 percent | 0 | −50 | −35 | −20 | −5 | −115 |
| After-tax cash flow | −1,000 | 300 | 285 | 270 | 255 | 115 |

a. Internal rate of return: social, approximately 13 percent; private, approximately 10.5 percent. Private net present value at 10 percent is 200.
b. Internal rate of return: social, 15 percent; private, 8 percent. Private net present value at 10 percent is −37.

illustrate the nonneutrality of this procedure, but similar results could be obtained for any other period that is significantly shorter than the normal economic life of many investments.

The first investment project in table 2 has a fifty-year operating lifetime and a 13 percent social rate of yield. With a four-year write-off of the investment cost, it is made acceptable from the private point of view, using any after-tax discount rate below 10.5 percent. The second project of table 2 has a 15 percent social rate of return. But it would be rejected by private investors using a 10 percent after-tax discount rate because its private rate of yield is only 8 percent. The examples in table 2 demonstrate that fixed-period accelerated depreciation does not meet the neutrality criterion that I have imposed.

### *Depreciation over Half the Normal Life of Assets*

This particular incentive scheme is representative of a broad class characterized by a general shortening of depreciation periods without distorting the ordinal ranking of asset lives. That is, the long-lived assets end up with longer depreciation periods than do the short-lived assets.

Cutting in half the depreciable life of assets appears to distort the process of project selection significantly less than do the two schemes already discussed. Nonetheless, it is still possible to find examples that violate my neutrality criterion. The pair of projects shown in table 3 is a case in point. The first project, with a $16\frac{2}{3}$ percent social rate of return, would be privately acceptable, while the second project, with a 17 percent social rate of return, would be rejected at a 10 percent private after-tax discount rate.

## A Neutral Incentive Scheme

This section is a report of a neutral incentive scheme, discovered on the basis of key clues offered by Paul A. Samuelson and Richard A. Musgrave. I shall first summarize their contributions and then show how the incentive scheme suggested here really amounts to a linear combination of two neutralities that I characterize as "Samuelson neutrality" and "Musgrave neutrality."

### *Samuelson Neutrality*

In a brief but important contribution in the mid-1960s, Samuelson showed that a proportional income tax left undistorted the choice

Table 3. Comparison of Privately Acceptable and Unacceptable Projects, Each with Depreciation over Half the Normal Life of the Project

| | Year 0 | 1 | 2 | 3 | ... | 20 | 21 | ... | 40 |
|---|---|---|---|---|---|---|---|---|---|
| *Privately acceptable project*[a] | | | | | | | | | |
| Gross-of-tax cash flow | −1,200 | 200 | 200 | 200 | ... | 200 | 200 | ... | 200 |
| Depreciation | 0 | 60 | 60 | 60 | ... | 60 | 0 | ... | 0 |
| Taxable income | 0 | 140 | 140 | 140 | ... | 140 | 200 | ... | 200 |
| Tax at 50 percent | 0 | −70 | −70 | −70 | ... | −70 | −100 | ... | −100 |
| Private cash flow | −1,200 | 130 | 130 | 130 | ... | 130 | 100 | ... | 100 |

| | Year 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| *Privately unacceptable project*[b] | | | | | | | |
| Gross-of-tax cash flow | −1,200 | 524 | 470 | 400 | 148 | 100 | 77 |
| Depreciation | 0 | 400 | 400 | 400 | 0 | 0 | 0 |
| Taxable income | 0 | 124 | 70 | 0 | 148 | 100 | 77 |
| Tax at 50 percent | 0 | −62 | −35 | 0 | −74 | −50 | −39 |
| Private cash flow | −1,200 | 462 | 435 | 400 | 74 | 50 | 38 |

a. Internal rate of return: social, approximately 16½ percent; private, approximately 10.3 percent. Private net present value at 10 percent is 53.
b. Internal rate of return: social, 17 percent; private, 9.2 percent. Private net present value at 10 percent is −23.



among projects or assets of different economic lives and time profiles so long as taxable income was calculated by deducting from the gross income accruing to capital the true economic depreciation (TED) of the assets in question.[3] Samuelson took monetary income as a measure of real income (that is, he did not address the question of indexing for inflation), and I shall follow him in that assumption.

Samuelson showed that the ranking of investments using a discount rate of $r = \rho(1 - t)$ to evaluate the after-tax returns, where $r$ is the after-tax and $\rho$ the before-tax rate of return on the project, is the same as it would be if one used the rate $\rho$ as the discount rate for the gross-of-tax flows, *provided that* true economic depreciation has been allowed for in determining the gross-of-tax flows.

Samuelson's point becomes intuitively clear if one imagines that the alternative "projects" are different financial instruments (notes, bonds, mortgages, and the like). In a steady-state equilibrium with a constant before-tax interest rate, $\rho$, the market value of each asset that paid interest at this rate on the unpaid balance would fall in each period by exactly the amount of amortization. In this case the true economic depreciation of the instrument *is* the amortization payment of the period, the before-tax income is the interest (equal to $\rho$ times the outstanding balance) and an equal percentage tax on these interest payments will be neutral among assets.

Suppose, however, that in the same economy there is some asset whose stated interest rate is different from $\rho$. For such assets the true income in a period would be the cash payment received minus the fall in the market value of the asset. In the extreme case of a note that simply promises to pay $1,000 at the end of $n$ years, with no stated interest or annual payment at all, the market value of the note at the beginning of a period $k$ years after the note is issued would be $\$1,000\,(1 + \rho)^{k-n}$, and its rise in value during the period would be $\rho$ times this figure. True economic depreciation is here negative, and Samuelson's principle of neutral taxation would call for tax to be paid on the appreciation of value—that is, $\$1,000\,\rho\,(1 + \rho)^{k-n}$.

For corporate investment projects like those reviewed in the preceding sections, Samuelson's proposition holds simply that with an after-tax rate of discount of 10 percent and a tax rate of 50 percent,

3. Paul A. Samuelson, "Tax Deductibility of Economic Depreciation to Insure Invariant Valuations," *Journal of Political Economy*, vol. 72 (December 1964), pp. 604–06.

only projects with gross-of-tax yields equal to or greater than 20 percent would pass the private test, so long as taxable income was computed using true economic depreciation. Anomalies like those presented in the preceding section (where an independent project with a low yield would be accepted while another with a higher yield would be rejected) would not exist.[4]

### *Musgrave Neutrality*

In his classic treatise, *The Theory of Public Finance*, Musgrave discusses the case of instantaneous depreciation (immediate expensing) of capital outlays.[5] He rightly concludes that with full and immediate loss offsets, an income tax would be totally neutral among assets or projects with different economic lives and differently shaped time profiles of net benefits. "It is a perfectly neutral solution—so neutral, in fact, as to be a zero tax."[6]

With a 50 percent tax rate, the government in effect becomes a 50 percent partner in the venture. It puts up half of the amount invested, either as an offset to taxes that the company would otherwise pay or as a direct payment in the case the capital outlays exceed other taxable income. And as a stream of gross income is generated the government takes exactly half of it, period by period. The time profile of net costs and benefits that is relevant for the government is in this case absolutely identical with that facing the private owners of the company. In general, with a tax rate, $t$, the government pays a fraction $t$ of costs and gets the same fraction $t$ of benefits; for the private owners the corresponding fractions are $(1 - t)$. The profiles facing the government and the private owners are identical in shape and differ only by a constant multiple.

4. I emphasize independent projects because it is easily possible for a lower-yield project to be accepted and a higher-yield project to be rejected when they are alternatives. For example, a high dam costing \$2 billion and giving a perpetual stream of benefits of \$500 million has a net present value at 20 percent of \$0.5 (=\$2.5 minus \$2.0) billion. A low dam on the same site costing \$1 billion and giving a perpetual stream of benefits of \$280 million has a net present value of \$0.4 billion (\$1.4 billion minus \$1.0 billion). If 20 percent is the "right" discount rate, the larger dam is the right choice even though its yield is lower (25 percent versus 28 percent). Net present value, not yield, is the relevant general criterion, but for independent projects the two come down to the same thing. All independent projects with yields greater than the relevant opportunity cost of capital should be undertaken, so if the two dams were on different rivers, each being of the best economic design for its site, both should be undertaken.

5. Richard A. Musgrave, *The Theory of Public Finance: A Study in Public Economy* (McGraw-Hill, 1959), p. 343.

6. Ibid.



In these circumstances the internal rate of return of the private profile must be identical with that of the gross-of-tax profile. In the numerical example, assuming the private after-tax rate of discount still to be 10 percent, investment projects would be undertaken up to the point where for marginal investments the before-tax yield was exactly equal to 10 percent.

### *A Neutral Investment Incentive*

From what has just been said it should be evident that Samuelson neutrality and Musgrave neutrality are two quite different things. Samuelson neutrality occurs when the government is truly taxing; Musgrave neutrality comes when the government is in effect a true partner in the enterprise. But the interesting point is that a combination of expensing part of the investment and depreciating the rest (using true economic depreciation) is also neutral. In particular, the immediate expensing of a fraction $\alpha$ of investment outlays, while the remaining fraction $(1 - \alpha)$ is left to be depreciated over the full lifetime of the asset according to the pattern of true economic depreciation—the actual deduction each year being $(1 - \alpha) \cdot$ (TED) —preserves neutrality as I have defined it.

I showed above (1) that with a 10 percent after-tax discount rate and a tax of 50 percent, all independent projects yielding 20 percent or more, and none yielding less than 20 percent, would be undertaken; and (2) that if full expensing of investment outlays were allowed, the criterion rate for projects would become 10 percent. I show here that if a fraction $\alpha$ of investment outlays is allowed to be expensed, with normal depreciation of the remainder, the criterion rate will lie somewhere between 10 and 20 percent, its precise location being, in this example, $20(1 - 0.5\alpha)$ percent.[7]

Consider an investment whose yield is precisely 16 percent and suppose that 40 percent of the investment can be expensed ($\alpha$ = 0.40). Of 1,000 invested, 400 is expensed, leading to a tax credit of 200. Divide the entire investment profile into two parts, in the proportions 60/40. On the 600 that was not expensed consider the re-

7. The general formula, defining $\rho_0$ as the required gross-of-tax yield of an investment without any special incentive, and $r$ as the required after-tax yield of all investment, is

$$\rho_\alpha = \alpha r + (1 - \alpha)\rho_0 = \alpha r + \frac{(1 - \alpha)r}{(1 - t)} = \frac{r(1 - \alpha t)}{(1 - t)}$$

Here $\rho_\alpha$ is the criterion gross-of-tax rate of return on an investment for which the fraction $\alpha$ of investment outlays is allowed to be expensed.

quired gross-of-tax yield to be 20 percent and the full tax to be applicable. On the 40 that was expensed consider the government to be a 50 percent partner and the required yield to be 10 percent. In that event the project as a whole must yield 16 percent to be undertaken.[8] The first part will be precisely sufficient to provide a 20 percent yield on the 600 that is hypothetically subject to "Samuelson tax treatment," while the second part will provide a 10 percent yield on the 400 that is hypothetically subject to "Musgrave tax treatment."

The division is apparent for the cases of perpetuity and a one-year investment. For both cases the 1,000 of investment is broken into two parts, 600 and 400. For the perpetuity the yield of 160 a year may be divided into a perpetual flow of 120, which gives a 20 percent return on 600 of investment, and another perpetual flow of 40, which gives a 10 percent yield on 400 of investment. For the one-year project the profile of −1,000, +1,160 is divided into two parts, (1) −600, +720, and (2) −400, +440. Again there is a 20 percent return on the first part and a 10 percent return on the second.

The demonstration for a one-year project is critically important because any multiyear project profile can be decomposed into a sequence of one-year profiles. Thus the two-year investment profile of −1,000, +560, +696, which has an internal rate of return of 16 percent, can be decomposed into

| | Year | | |
|---|---|---|---|
| | *0* | *1* | *2* |
| a. | −1,000 | +1,160 | |
| b. | | − 600 | +696 |
| Total | −1,000 | + 560 | +696 |

Similarly a three-period project whose profile is −1,000, +560, +196, +580 can be broken down into

| | Year | | | |
|---|---|---|---|---|
| | *0* | *1* | *2* | *3* |
| c. | −1,000 | +1,160 | | |
| d. | | − 600 | +696 | |
| e. | | | −500 | +580 |
| Total | −1,000 | + 560 | +196 | +580 |

8. The required yield of 16 percent can be derived from the relation in footnote 7: $a = 0.4$, $r = 0.1$, $\rho_e = 0.2$; hence $\rho_n = 0.16$.



The original projects (−1,000, +560, +696) and (−1,000, +560, +196, +580) each had an internal rate of return of 16 percent. They have been broken down into sequences of one-year projects—(a, b) and (c, d, e) respectively—each of which also has an internal rate of return of 16 percent.

In a similar fashion, *any* multiyear profile can be broken down into a sequence of overlapping one-year profiles, each of which has the same internal rate of return as the original project. This fact makes it possible to use the proof presented above for the case of a one-year project as the basis for a general statement concerning the neutrality of the incentive scheme under review.

## Tax Neutrality in the Presence of Debt

Up to now the analysis has dealt with investments that included only equity capital. In this section the analysis is broadened to accommodate cases where debt as well as equity capital is present, either in fixed proportions between debt and equity or in variable proportions, with optimizing behavior on the part of equity owners.

### *Fixed Proportions between Equity and Debt Capital*

The assumption that debt and equity are used in fixed proportion makes little economic sense but has the great virtue of simplifying an otherwise knotty set of problems; for this reason it has become almost the standard assumption in empirical analyses of the efficiency effects of corporation income taxes (as well as other taxes on the income from capital).[9]

In empirical applications this assumption boils down to combining interest payments along with gross-of-tax profits (and possibly other

9. Arnold C. Harberger, "The Corporation Income Tax: An Empirical Appraisal," in *Tax Revision Compendium: A Compendium of Papers on Broadening the Tax Base*, Committee Print, House Committee on Ways and Means (Government Printing Office, 1959), pp. 231–50; Arnold C. Harberger, "Efficiency Effects of Taxes on Income from Capital," in Marian Krzyzaniak, ed., *Effects of Corporation Income Tax: Papers Presented at the Symposium on Business Taxation, Wayne State University* (Wayne State University Press, 1966), pp. 107–17; John B. Shoven, "The Incidence and Efficiency Effects of Taxes on Income from Capital," *Journal of Political Economy*, vol. 84 (December 1976), pp. 1261–83; and Don Fullerton, John B. Shoven, and John Whalley, *General Equilibrium Analysis of U.S. Taxation Policy*, 1977 Conference on Tax Research, Office of Tax Analysis, U.S. Treasury Department (GPO, 1978).

taxes falling on capital, such as property taxes) into one global gross-of-tax return to capital for each industry or sector being analyzed. The corporate (and possibly other) tax payments made by the industry or sector are then expressed as a fraction of this total, the resulting fraction being the effective tax rate striking the income from capital in that sector.

In this framework, even though the only tax being dealt with is the corporation income tax and even though its nominal rate as a fraction of taxable profits is uniform, substantial differences arise in effective tax rates on income from capital. These differences depend principally on differences in debt-equity ratios but also on differences in nominal interest rates paid, or in profit rates earned across industries and sectors. Typically, however, the applications assume that the net-of-tax return to equity and to debt capital is the same (so that net income accruing to capital can be used as a measure of the amount of capital itself). Thus it could be true that in an industry with 100 percent equity the effective tax rate would be 50 percent, while in another with 75 percent equity it would be 37.5 percent, and in yet a third with 25 percent equity the effective tax rate would be only 12.5 percent.

In these circumstances the corporation income tax would not itself, even within the corporate sector, meet the neutrality criterion used in this paper. Projects in industry three could have a 12 percent yield and could pay a 12.5 percent effective tax rate and still be acceptable at a 10 percent after-tax discount rate, while projects in industry two would have to be rejected, using a 10 percent after-tax rate, even if they yielded as much as 15 percent before tax.

If the real world comes close to approximating the model of debt-equity ratios that differ among industries and activities but are more-or-less fixed for each such industry or activity, then what can be said for the "neutrality" of the investment incentive scheme presented above?

It certainly does not restore a "neutrality" that was not there in the first place. There still is an element of rationality about the "neutral investment incentive," however, that is not shared by the investment tax credits, fixed-period accelerated depreciation, or accelerated depreciation over a specified fraction of each asset's normal life. The easiest way to describe this element of rationality is as follows:

If $\tau$ is the general rate of corporation income tax, $\beta_i$ is the (fixed) ratio of equity to total capital in industry or activity $i$, and $\tau_i'$ is the effective rate of corporation income tax in the absence of any tax incentive scheme, then $\tau_i' = \beta_i \tau$. By comparison, if $\alpha_i$ is the fraction of investment costs in industry or activity $i$ that can be immediately expensed (with the remainder being depreciated over the normal pattern and normal life of the asset), and $\tau_i^*$ is the effective rate of corporation income tax in the presence of such partial expensing, then $\tau_i^* = (1 - \alpha_i)\tau_i' = (1 - \alpha_i)\beta_i \tau$.

What it all amounts to is this: the investment tax incentive by itself does nothing to modify, correct, or ameliorate the "favoritism" toward debt-intensive activities that is implicit in a fixed rate of corporation income tax in the presence of different, fixed debt-equity ratios among activities and equal rates of after-tax return to all forms of capital. What it does is to cause a "shrinkage" of the effective tax rate, whatever it may be, the degree of shrinkage being proportional to $\alpha_i$, the fraction of investment costs that can be expensed.

Perhaps the best adjective to apply to the $\alpha$-incentive scheme is that it is *calibrated*. The incentive reduces the effective tax rate that would have prevailed in the absence of the incentive ($\tau_i'$) by exactly the fraction $\alpha_i$. If one grants a constant incentive, $\alpha$, to all industries and activities, the result is a radical reduction of the vector of distortions $(\beta_i \tau)$ introduced by the corporation income tax ($\tau$). Thus it can be said that for any set of investments for which $\tau_i'$ and $\alpha_i$ are the same my criterion of neutrality is fully satisfied.

### *Variable Ratios of Equity and Debt Capital*

Needless to say, the assumption that debt-equity ratios are fixed for each industry or activity but differ among them is a gross oversimplification. Its convenience as an assumption lies in the fact that it permits one to treat the corporation income tax as a tax on the income from capital employed in an activity, rather than as a tax that falls just on the income from equity capital. Under this simplification the distorting effects of the corporation income tax are principally of two kinds, the first stemming from an expansion of noncorporate activities at the expense of (actual or potential) corporate ones, and the second arising out of the substitution of labor for capital within corporate-sector activities.

In fact, the corporation income tax is a tax on the earnings of corporate *equity* capital. For that reason there is, in addition to the effects just mentioned, a third: a shift from equity to debt financing in the corporate sector.

If one thinks in terms of "welfare triangles," the simplified measure is

$$\tfrac{1}{2} \sum_i \tau_i' \rho_i \Delta K_i,$$

where $\tau_i'$ is the effective rate of tax on capital in activity $i$, $\rho_i$ its rate of marginal productivity in the presence of the tax, and $\Delta K_i$ the tax-induced change in the amount of capital in activity $i$. The more subtle measure is

$$\tfrac{1}{2} \sum_i \tau \pi_i \Delta E_i,$$

where $\tau$ is the rate of corporation income tax, $\pi_i$ is the rate of profit on equity in the presence of the tax, and $\Delta E_i$ is the tax-induced change in the amount of equity capital in activity $i$. $\Delta E_i$ includes the three main components listed above: less equity is used in sector $i$ (1) because of a reduction in the level of the sector's output, (2) because of a decrease in its capital intensity, and (3) because of its greater reliance on debt financing.[10]

The assumption of variable debt-equity ratios has encountered difficulties in studies of the efficiency effects of taxation when it comes to measuring or somehow estimating the quantitative effect of the substitution of debt for equity. Happily for my present purpose there is no need to estimate such an effect. All that is required is an assumption of optimizing behavior by (or on behalf of) the owners of equity. This assumption leads to the notion of a debt-equity ratio that is optimal from the point of view of the owners of the firm. At the margin they should be indifferent between financing a small increment to their real capital stock by way of increased debt or by the use of additional funds of their own. If, then, their "required" after-tax rate of return on their own funds is 10 percent a year and if the tax rate is 50 percent, the required rate of gross-of-tax yield will be 20 percent a year if an increment of investment is financed by equity. Optimization requires that if the "true" marginal cost of debt financing is less than

10. If there is a change in the rate at which income flows are capitalized, the change in the value of preexisting equity capital stemming from this source is *not* a part of $\Delta E_i$. No welfare cost is generated by a simple revaluation, which could occur even in a world where completely inelastic supply or demand functions precluded any *real* change, hence any real welfare cost.



this, debt financing must be increased until the point is reached where its marginal cost is also 20 percent a year.

Once this point is reached a tax incentive permitting the expensing of 30 percent of investment costs will reduce the required gross-of-tax yield of an incremental investment from 20 to 17 percent a year, *regardless* of the particular level of the optimal debt-equity ratio. Thus a 30 percent expensing provision will have the same effect on the criterion rate of return on an incremental investment, regardless of whether the optimal debt/equity ratio is 50 percent, 20 percent, or 80 percent. Unlike the result obtained when each activity was assumed to have its own *fixed* debt-equity ratio, the required gross-of-tax rates of return here do not differ (to a first approximation) among different activities within the corporate sector.[11]

Thus, perhaps paradoxically, it turns out that an investment incentive of the form here recommended—the expensing of a fraction $\alpha$ of investment costs, together with the depreciation of the remaining fraction $(1 - \alpha)$ over the normal lives of the different assets involved—looks even better under the microscope of a more subtle approach (variable debt-equity ratios) than it does under the cruder assumption of debt-equity ratios that are fixed for each activity but vary among them.[12]

11. At a second level of approximation, issues associated with differential "security" or "risk" of different activities could lead to a situation in which activity A has a gross-of-tax criterion rate of return of 20 percent, while, say, activity B has one of only 18 percent. This could come about because different people were the equityholders in the two activities, or because those who simultaneously held positions in both had preferences such that they equated (in terms of their own utility) a 10 percent after-tax yield in activity A with a 9 percent after-tax yield in activity B.

12. See note 21 of David Bradford's paper in this volume, which relates my findings to his complementary results.