DEPRECIATION, INFLATION, & THE TAXATION OF INCOME FROM CAPITAL
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# TAX TREATMENT OF DEPRECIATION, CAPITAL GAINS, AND INTEREST IN AN INFLATIONARY ECONOMY

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## Introduction

Inflation complicates the measurement of capital income for tax purposes. Tax laws are written in terms of the U.S. dollar, not an abstract currency of constant purchasing power. Though my assignment is to discuss the definition and tax treatment of depreciation, I find I cannot write sensibly without bringing in the measurement and taxation of capital gains and interest as well. Depreciation, after all, is the supposed decline in value of assets as time goes by, yet current dollar prices of most assets today are rising, not falling. Nonetheless, depreciation is a genuine economic phenomenon requiring recognition by the tax laws. But capital gains and inflation-swollen nominal interest rates have their own, closely related issues for taxation.

This paper examines the taxation of the two most significant types of transactions between corporations and savers in the United States. In the

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first, an individual places savings in the hands of a corporation for the purpose of investment through the purchase of an equity share. The returns are taxed twice, once under the corporate income tax and again under the personal income tax when the individual receives dividends and capital gains. In line with the evidence on the typical owner of common stocks, the individual is assumed to be in the 40 percent marginal bracket for ordinary income. In the second type of transaction, the savings are made available through the purchase of corporate debt. Because interest payments are deductible under the corporate income tax, the corporate tax actually subsidizes the return to investment financed in this way. I further assume that the debt is held by an individual in such a way as to face low marginal rates under the personal income tax. Pension funds are an example of the mode of ownership of debt that I have in mind.

Even without inflation, the taxation of these transactions differs strikingly. The effective corporate rate on equity-financed investments in the more favorably-treated assets, equipment and intangibles, is roughly zero with stable prices. Equity-financed investment in plant, which receives no investment credit and limited benefit from fast depreciation, is taxed at an effective rate of 37 percent under the corporate tax. When the second round of taxation under the personal tax is added, total effective rates in the absence of inflation are 26 percent for equipment, 28 percent for intangibles, and 55 percent for plant. On the other hand, debt-financed investments in all three assets are heavily subsidized even under price stability—effective corporate tax rates are -89 percent for equipment, -85 percent for intangibles, and -16 percent for plant.

Under 10 percent annual inflation, the situation worsens dramatically. Taxation of equity-financed investment rises because of the adverse effect of historical-cost depreciation, while the subsidy of debt-financed investment rises because of the deductibility of the full nominal interest rate, including its inflation premium. Effective taxation of the earnings of equity-financed investment in equipment, plant, and intangibles under the combination of corporate and personal taxes with 10 percent inflation are 60, 65, and 28 percent respectively. Because the great bulk of corporate investment is financed from equity (mainly in the form of reinvestment of retained earnings), the high current rates of taxation of the returns to plant and equipment represent a worrisome disincentive. By contrast, incentives to invest in debt-financed assets are now absurdly excessive: effective tax rates at 10 percent inflation are -122 percent for equipment, -95 percent for plant, and -298 percent for intangibles.

Reform of depreciation rules is one way to solve the problem of excessive taxation of equity-financed investment under inflation. Indexing



depreciation in one way or another and permitting depreciation at economic rates would reduce the effective rates of taxation of equity-financed equipment to 17 percent and of plant to 46 percent. Further, these would remain the effective tax rates if inflation subsides or worsens. Another, less desirable reform is to adopt depreciation schedules based on historical cost which are sufficiently rapid to overcome inflation. Something like the "10-5-3" proposal would reduce effective tax rates to 19 and 42 percent for equipment and structures at 10 percent inflation. But under this approach, depreciation lifetimes need to be changed every time the inflation rate changes. If inflation dropped to zero under the 10-5-3 system, the corporate income tax would wind up paying a 48 percent subsidy to the earnings of equipment. Adoption of 10-5-3 would make sense only if coupled with a policy of stabilizing inflation at 10 percent per year, something hardly anybody favors.

Reforming depreciation will not solve the problem of subsidies to debt-financed investment. Neither significantly shorter lifetimes for depreciation purposes nor the adoption of replacement-cost depreciation would alter the basic pattern of heavy incentives for leveraged investments. As long as an important segment of taxpayers face zero or low marginal tax rates under the personal income tax, deductibility of interest payments under the corporate income tax will create a subsidy for investments financed by borrowing from those taxpayers. We need to abolish the deductibility of interest and reduce the effective rate of taxation to a sensible level for all investments, independent of the method of financing. The tax system proposed by Alan Auerbach and Dale Jorgenson, where a first-year allowance takes the place of the stream of deductions associated with an investment, provides a convenient way to do this. The most desirable reform, in my view, is immediate expensing of all investment (as is done for intangibles today) and elimination of all deductions for interest and depreciation. With this approach, the corporate income tax would become a tax on gross cash flow less investment. The administration of such a tax would be far simpler and it would eliminate the current absurd heavy taxation of unleveraged plant and equipment and distortion in favor of debt-financed investment.

## Definitions, Assumptions, and Analytic Technique

The analysis of capital taxation presented here appeared first in Hall and Jorgenson (1967); related aspects of the theory of depreciation appear in Hall (1968). The starting point is to consider the price of a capital good

as a function of time, t, and age, a: p(a, t). The price of new capital goods is established by their producers and is p(0, t). Markets for used capital goods determine prices p(a, t). As time passes, the price of a particular capital good changes. The total change can be decomposed into depreciation, d(a, t), defined as the rate of decline of the price as age, a, increases, and capital gains, f(a, t), defined as the rate of growth of the prices as time, t, increases (technically, these are the partial derivatives of p with respect to a and t). The pattern of depreciation can be inferred by comparing the prices of identical capital goods of different ages at the same time, as in Hall (1971) and Hulten and Wykoff (1981).

A central concept for what follows is the *rental price of capital goods.* Conceptually, it is the price charged by the owner to a renter who assumes responsibility for all operating and maintenance expenses. In the absence of taxes, the rental price bears a simple relation to the asset price: rental is the interest cost of the asset plus depreciation less capital gains:

$$c = np(a, t) + d(a, t) - f(a, t)$$

Here n is the firm's nominal cost of funds—the dollar compensation per year required by the stockholders and bondholders for each dollar tied up in the capital good. In a competitive rental market, this formula will describe the observed rental rate, where the owners are capturing their costs and no more. Further, as noted by Jorgenson (1963), the same expression appears in the analysis of the investment decision of a firm which chooses to own its capital. Such a firm should establish an internal rental price at this level and then push investment to the point where the marginal revenue product of capital equals its rental price.

Nothing will be lost in the ensuing discussion under the convenient simplifying assumption that both depreciation and inflation take place at smooth exponential rates, d and f, respectively, in which case the price of a capital good of age a at time t is

$$p(a, t) = p_0 e^{ft-da}$$

and depreciation and capital gains are simply proportional to the price:

$$d(a, t) = dp(a, t)$$

$$f(a, t) = fp(a, t)$$

This gives a simple expression for the rent,

$$c = (n + d - f)p$$



Generally, it will be convenient to deal with the rental-price ratio,

$$c/p = n + d - f.$$

For example, if the interest rate is 14 percent, depreciation is 10 percent per year, and capital goods prices are rising 11 percent per year, the rent is .14 + .10 − .11 = .13 dollars per dollar's worth of capital per year.

Taxation complicates the relation between capital goods prices, interest rates, and the rental price. First, I will assume that the gross earnings of capital are taxed at a rate u. This is the statutory marginal tax rate, currently 46 percent for most corporations.

Second, the law may impose taxation on the capital gains earned by a capital good. Under current U.S. law, capital gains are taxed only at realization, and, for individuals, at reduced rates. Taxation at realization is effectively a turnover tax; capital goods held until they are retired escape taxation for capital gains altogether. I will assume that capital goods are held long enough to make the capital gains tax irrelevant. I will not attempt to deal with the anomalies in depreciation rules that may make it attractive to realize capital gains on real estate. All investment decisions studied in this paper are of the "buy and hold" type.

Third, the law provides for deductions for depreciation. Investors may deduct the dollar amount of the original cost of a capital good according to a schedule defined in the law. For almost all assets, the schedule understates the number of years over which the decline in value actually takes place—lifetimes for tax purposes are shorter than true lifetimes. On the other hand, after the first year, the permissible depreciation deduction is depressed by the use of historical rather than market prices. Depreciation for tax purposes sums to the original purchase price, while actual depreciation sums to a much larger number at current rates of inflation. This feature of the tax system has been emphasized in most discussions of the harmful effect of inflation on the incentives to invest (which have concentrated on the case of equity financing); the implications of deductibility of interest are shown in this paper to be even more important for debt-financed investment.

Finally, the current tax law provides a tax credit for investment in equipment at a rate of 10 percent. Its effect is essentially to reduce the price of equipment by 10 percent and so reduce its rental price in proportion. However, the effect of the credit is somewhat stronger because the cost basis for depreciation is not reduced by the amount of the credit.

To quantify these various provisions, it will be convenient to let V(x) be the present value at real discount rate r of a stream of income that starts

this year at $1 and grows in nominal terms at annual rate x. The growth rate x should include the influence (if any) of inflation on the stream. Plainly, $V(x) = 1/(r - x + f)$, where f is the expected rate of inflation.

The strategy of this analysis rests on the principle that market forces will equate the price of a new capital good to the present discounted value of its future rental earnings less the present value of taxes plus the present value of deductions and credits. This is a condition of long-run equilibrium and will only hold after enough time has passed for investment to drive the rental price of capital to the market-clearing level. If capital goods prices are rising at rate f, then rental prices will be rising at the same rate. The rate of growth of the earnings of a particular capital good is $f - d$, so the present value of all its earnings is $cV(f - d)$, where c is the current rental price. In case the law is reformed so that some fraction, g, of capital gains is taxed on an accrual basis, I will include the term $ugfpV(f - d)$ as the present value of capital gains taxes. I assume that the law provides for an exponential pattern of depreciation (so-called declining balance depreciation, but without any switchover to other formulas) at a rate d'. Further, to evaluate reforms that would index depreciation to replacement cost, I let f' be the rate of growth of depreciation deductions permitted to account for inflation ($f' = 0$ for the current historical cost basis and $f' = f$ for fully indexed depreciation). Thus the present value of depreciation deductions is $ud'pV(f' - d')$. Finally, I let k be the rate of the investment tax credit, which adds a term kp to the value of earnings and tax effects but also reduces the amount of capital tied up in the investment by a factor of $1 - k$.

The relation between the price of a new capital good and the various components of its returns, after taxes, is

$$p = (1 - u)cV(f - d) - ugf(1 - k)pV(f - d) + ud'pV(f' - d') + kp$$

Inserting the formula for V() and solving for the rental-price ratio, c/p, gives

$$c/p = \frac{(1 - k)}{1 - u}r + \frac{ug(1 - k)}{1 - u}f + \frac{1 - k}{1 - u}d - u\frac{(r + d)}{(1 - u)(r + f - f' + d')}d'$$

Most of the rest of the paper is devoted to manipulation of this formula. Rising inflation brings about very different shifts in the rental-price ratio for assets with different tax treatments.



The rental formula tells us the equilibrium rental earnings of capital given the real after-tax interest rate, r, the rate of inflation, f, and the various parameters of the tax system. It can be put to use to compute the effective rate of taxation of capital income under the U.S. tax system. Here it is essential to distinguish between the tax rate imposed by the system in a given state of the economy and the effect of taxes on the general equilibrium of the economy. The apparatus of this paper can only do the first.

The conceptual basis for the measurement of tax rates is the following. Consider an economy in which corporations and households are in financial equilibrium. Corporations have equated the real, after-tax yields of all investments and borrowing opportunities to a common value, r. Each household has equated the real, after-tax yields for all of its opportunities to a common value, h. The household rate, h, differs from the corporate rate, r, because of the taxation of income flows between corporations and individuals. Different households have different values of h. The analysis of how the economy reaches this kind of equilibrium, and, indeed, whether it truly is in equilibrium, is the subject of much current controversy in finance theory but is not the subject of this paper.

In this setup, suppose first that a household provides one dollar of its wealth to a corporation through the purchase of equity, and the corporation invests in one or another productive asset. This asset earns the equilibrium after-tax return, r. It incurs corporate income taxes, $y_c$, in the amount

$$y_c = c/p - d - r \quad ;$$

this says that taxes are the only source of discrepancy between the earnings of capital net of depreciation, $c/p - d$, and the after-tax return, r. I define the effective corporate income tax rate in this case as $y_c/(c/p - d)$.

Corporate equity income is taxed again when it is paid to the household. I will assume that half of the income is paid as dividends and half as capital gains. The effective rate of personal taxation is an equally weighted average of the marginal tax rate for ordinary income and the rate for capital gains (here I ignore the extra taxation of capital gains arising from the taxation of nominal rather than real gains; the practical effect of this feature of the tax law is surprisingly small at current rates of inflation). Net of taxes, the household earns its return h. Thus the total tax from both corporate and personal taxes is

$$y = c/p - d - h \quad .$$

I define the total effective tax rate as $y/(c/p - d)$.

Now suppose that a household provides one dollar of its wealth to a corporation through the purchase of debt. The amount of the corporate income tax paid is drastically reduced because the corporations' interest payments are deductible. Further, when inflation has put a premium into nominal interest rates, this premium is deductible. On the other hand, the full nominal interest rate is taxable under the personal income tax. For a taxpayer whose marginal rate under the personal income tax equals the marginal corporate rate, the deduction and taxation of the inflation premium wash out. But the interesting and relevant case is where the individual has a much lower marginal tax rate than does the corporation. In this case, the corporate income tax provides an astonishingly large subsidy. The analytical details and computations are provided together in a later section of the paper.

The tax rates on debt and equity measure the amount of tax incurred when a household forgoes a dollar's worth of consumption and all of the resources are put into a productive asset. They are the relevant rates for appraising the distorting effect of taxation on the savings-consumption choice. Under inflation, effective tax rates on equity have risen, thanks mainly to historical-cost depreciation. But effective rates on debt owned by taxpayers with low marginal tax rates have fallen to extremely negative levels. The tax system as a whole functions to tax investments financed by equity in order to subsidize those financed by debt. This inefficiency clearly needs reform.

## Taxation of Equity-Financed Capital under Current Laws

The relevant features of current tax laws for corporations are as follows:

1. Accrued capital gains are never taxed. Because the rational corporation avoids realizing capital gains, I will assume that all gains escape taxation.

2. Depreciation is on the basis of historical cost, so the parameter $f'$ is zero. I will use actual depreciation rates of 10 percent per year for equipment and 3 percent per year for structures ($d = 0.1$ and 0.03, respectively). I assume that allowable depreciation rates for tax purposes are half again the economic rate for equipment and twice the economic rate for structures ($d' = 0.15$ and 0.06, respectively). For intangible investments, I assume actual depreciation at a rate of 10 percent per year, while the law permits expensing ($d = 0.1$ and $d' =$ Infinity).



3. An investment tax credit at a rate of 10 percent is provided for equipment only.

Table 1 presents results on the effective taxation of three equity-financed investments under current tax laws at two rates of inflation: zero and 10 percent. I have taken the real after-tax yield and borrowing cost, r, as 4 percent to approximate the measured after-tax earnings of capital. The effective tax rates in the table are quite sensitive to the assumption about r—for lower values, the negative rates are even more negative and the positive ones are even more positive.

The low-inflation rows of table 1 show serious problems in the taxation of capital even without inflation. The corporate income tax subsidizes the return to equipment slightly—the subsidy arises from the combination of depreciation rates in excess of economic depreciation and the investment credit. Intangible investments escape tax or subsidy. Plant, however, is taxed at an effective rate of 37 percent, not too far below the statutory rate of 46 percent. The only factor depressing the effective rate of taxation of plant below the statutory rate is depreciation at 6 percent instead of the

TABLE 1

RENTS AND EFFECTIVE TAX RATES UNDER EXISTING TAX LAWS FOR INVESTMENT FINANCED BY SELLING EQUITY TO A TAXPAYER IN THE 40 PERCENT BRACKET

| ASSET | INFLATION | RENTAL ($ PER $ OF CAPITAL PER YEAR) | EFFECTIVE TAX RATE (PERCENTAGE) | | ASSUMPTIONS | | |
|---|---|---|---|---|---|---|---|
| | | | Corporate | Total | d | d′ | k |
| Equipment | low | 0.139 | −2 | 26 | .10 | .15 | .1 |
| | high | 0.172 | 44 | 60 | | | |
| Plant | low | 0.094 | 37 | 55 | .03 | .06 | 0 |
| | high | 0.112 | 51 | 65 | | | |
| Intangibles | low | 0.140 | 0 | 28 | .10 | * | 0 |
| | high | 0.140 | 0 | 28 | | | |

NOTE: * means infinite depreciation—expensing of investment.
Low inflation is zero rate.
High inflation is 10 percent rate.
Marginal tax rates are 46 percent for corporate and 28 percent for personal (average of 40 percent on ordinary income and 16 percent on capital gains).

economic rate of 3 percent, and the extra three percentage points are not too important. If inflation were to end today and all the existing provisions for the taxation of capital were to remain, all of the revenue from the corporate income tax would come from the taxation of plant and none from intangibles or equipment. The tax would seriously distort investment decisions away from plant.

Total taxation of the return to capital under both taxes with zero inflation is 26 and 28 percent for equipment and intangibles, and 55 percent for plant. The latter figure represents a serious wedge in consumption-investment decisions.

The high-inflation rows of table 1 show that taxation of capital becomes even more perverse when prices are rising at a 10 percent annual rate. Effective tax rates under the corporate tax are 44 percent on equipment and 51 percent on plant—the adverse effect of historical-cost depreciation is responsible for the rise. Corporate investments in intangibles still escape taxation—instant write-off means that inflation has no depressing effect on the value of depreciation. Total effective tax rates under the corporate and personal taxes are clearly worrisome: 60 percent for equipment and 65 percent for plant. Only intangibles are taxed at reasonable total rates under 10 percent inflation.

## Depreciation Reform

By now it is widely known that the central problem with the depreciation provisions of the U.S. tax law is the use of historical rather than replacement cost as the basis for depreciation. Martin Feldstein (1979) has proposed the enlargement of depreciation deductions in line with the movements of official indexes of replacement costs. Alan Auerbach and Dale Jorgenson (1980) have proposed a reform in which the stream of deductions at replacement cost is restated as a first-year deduction with the same present value. The two proposals are economically equivalent; the choice between them is a matter of administrative convenience and political judgment about the transitory decline in revenue accompanying the shift to the first-year recovery system. This decline has no economic significance to the federal government—the present value of revenue is the same under the two proposals. I find Auerbach and Jorgenson's proposal much preferable on administrative grounds. In any case, the economic analysis given here treats the two proposals as equivalent and refers to them as indexed depreciation. In terms of the earlier formula for the rental



price of capital, indexed depreciation has the rate of inflation embodied in depreciation rules, $f'$, equal to the actual rate of inflation, $f$. Furthermore, because indexing accomplishes more effectively what the government has been trying to do rather crudely by permitting faster depreciation, it seems appropriate to examine the joint effects of indexing depreciation and using economic depreciation rates. For this reason, I will use $d' = d$ in the analysis as well.

As table 2 shows, indexing makes the effective corporate tax rate independent of the rate of inflation. For plant, the rate is exactly the statutory rate of 46 percent; for equipment, it is rather less, 17 percent, because of the investment tax credit. Were inflation to come to an end under current tax provisions, tax rates would be lower for both plant and equipment than they would be with indexed economic depreciation.

Table 2 shows only the effective corporate rates under indexing. The total effective rates including the personal tax would be 40 percent for equipment and 61 percent for plant. Again, taxation at such a high rate for plant creates a very significant wedge. Depreciation reform alone would not solve the problem of excessive taxation of capital income, especially income from plant.

## Accelerated Depreciation

There is considerable political impetus behind a number of proposals to raise the present value of depreciation deductions by further reducing lifetimes for tax purposes instead of indexing. Were we confident of the

TABLE 2

EFFECTS OF INDEXED ECONOMIC DEPRECIATION

| | | Rental | | Effective Corporate Tax Rate | |
|---|---|---|---|---|---|
| Asset | Inflation | Current | Indexed | Current | Indexed |
| Equipment | low | 0.139 | 0.148 | 2 | 17 |
| | high | 0.172 | 0.148 | 44 | 17 |
| Plant | low | 0.094 | 0.104 | 37 | 46 |
| | high | 0.112 | 0.104 | 51 | 46 |

NOTE: Assumptions are the same as in table 1.

continuation of inflation at a stable rate close to the current rate, then downward adjustment of lifetimes would be just as good as indexing depreciation to restore economically appropriate tax treatment of depreciation. But as a believer in the feasibility and desirability of ending inflation, I am reluctant to see a change made that will further contribute to the distortionary treatment of certain types of investment when inflation is controlled.

Table 3 indicates implications for rental and effective tax rates of a sharp acceleration of depreciation allowances. The depreciation rates are chosen to resemble the Conable-Jones 10-5-3 proposal—declining-balance depreciation rates of 33 percent per year for equipment (to approximate a 5-year lifetime) and 15 percent per year for buildings (to approximate a 10-year lifetime). Needless to say, accelerated depreciation on this scale would dramatically lower effective tax rates. At current rates of inflation, effective corporate tax rates would be almost exactly the same as with indexed economic depreciation—19 percent for equipment and 42 percent for plant. Again, the tax system would be biased in favor of equipment because of the investment credit, but the acceleration of depreciation would accomplish its task of offsetting the adverse consequences of inflation.

Table 3 shows that ending inflation would bring a substantial subsidy to income from equipment, if accelerated depreciation and all the other features of the tax system assumed in the table remained. The effective

TABLE 3

IMPLICATIONS OF ACCELERATED DEPRECIATION AT ZERO AND TEN PERCENT INFLATION

| | | RENTAL | | EFFECTIVE CORPORATE TAX RATE | |
|---|---|---|---|---|---|
| ASSET | INFLATION | Current | Accelerated Depreciation | Current | Accelerated Depreciation |
| Equipment | low | 0.139 | 0.127 | −2 | −48 |
| | high | 0.172 | 0.150 | 44 | 19 |
| Plant | low | 0.094 | 0.083 | 37 | 24 |
| | high | 0.112 | 0.099 | 51 | 42 |

NOTE: Assumptions are the same as in table 1.



corporate rate would be -48 percent, and even after positive taxation under the personal tax, the total effective rate would be -7 percent. There is no good economic case for subsidizing the return to equipment in this way. If accelerated depreciation is adopted to offset the adverse effects of inflation, then it should be removed once inflation is brought under control.

## Effective Tax Rates When Investment is Financed by Borrowing from an Untaxed Individual

The calculations presented so far apply to the bulk of investment by U.S. corporations, because most investment is financed from retained earnings, which amounts to the sale of equity to stockholders. But about 20 percent of the earnings of capital are paid out as interest, and a large fraction of this flows to individuals and institutions with zero or low tax rates. As this section will demonstrate, inflation has dramatically influenced the taxation of this type of investment, so that it is now heavily subsidized. Much of the worst distortions in the current tax system for capital income arise from the deductibility of full nominal interest payments under the corporate income tax, when the corresponding interest receipts escape taxation altogether or are taxed at low rates.

In this section I consider the case of a corporation in exactly the same equilibrium considered earlier, which finances a $1 increment in capital by selling a bond to an untaxed individual. Recall that the firm has a real, after-tax return of r. Let the nominal interest rate on the bond be n. Because the full amount of the nominal interest is deductible, the equilibrium condition relating r and n is

$$r = (1 - u)n - f \quad .$$

Solving for the nominal interest rate gives

$$n = (r + f)/(1 - u) \quad .$$

In the earlier case, the corporation paid taxes of $c/p - d - r$. It still pays this amount, but it receives a deduction for n. Net taxes are $c/p - d - r - un = c/p - d - (n - f)$. The effective corporate tax rate is this amount divided by $c/p - d$. No individual income tax is paid, so the effective corporate rate is the effective total rate as well.

TABLE 4

RENTS AND EFFECTIVE TAX RATES UNDER EXISTING TAX LAWS FOR INVESTMENT FINANCED BY SELLING DEBT TO AN UNTAXED INDIVIDUAL

| ASSET | INFLATION | RENTAL ($ PER $ OF CAPITAL PER YEAR) | EFFECTIVE TAX RATE (PERCENTAGE) | ASSUMPTIONS d | d′ | k |
|---|---|---|---|---|---|---|
| Equipment | low | 0.139 | −89 | .10 | .15 | .1 |
| | high | 0.172 | −122 | | | |
| Plant | low | 0.094 | −16 | .03 | .06 | 0 |
| | high | 0.112 | −95 | | | |
| Intangibles | low | 0.140 | −85 | .10 | * | 0 |
| | high | 0.140 | −298 | | | |

NOTE: The assumptions are the same as in table 1.

Table 4 shows the effective tax rates derived from these calculations. In all cases, tax rates are negative and subsidies are being paid. Even without inflation, equipment and intangibles are subsidized at rates in excess of 80 percent. Recall that both had effective corporate rates of close to zero even when the return to the individual was not deductible to the corporation. The rate of interest paid on the debt is nearly twice the after-tax return earned by the corporation (4 percent), so permitting its deduction amounts to a subsidy of close to 100 percent. Even in the case of plant, which is heavily taxed under zero inflation with equity financing, effective taxation is negative with debt financing.

Inflation worsens the inefficient subsidies. At 10 percent inflation, equipment is subsidized at 122 percent, plant at 95 percent, and intangibles at an outrageous 298 percent. The last figure has the following interpretation: for each dollar received as interest by the untaxed lender to a corporation investing in intangibles, 75 cents is paid by the taxpayers as a subsidy through the corporate income tax and 25 cents is the earnings of the investment itself.

The computations overstate the magnitude of the subsidy to debt-financed investments for two reasons. First, not every owner of a corporate bond is literally untaxed. Many bonds are held by pension funds on behalf of present and future retirees who will be paying some income tax on the retirement benefits when they are eventually paid. Still, the typical marginal income tax rate of the retired is far below the statutory corporate



marginal rate of 46 percent, so a substantial element of subsidy is involved in any loan from a retirement fund to a corporation.

Second, nominal interest rates have consistently been far below the level predicted by the equilibrium condition. With zero inflation and 4 percent after-tax return to corporations, bond rates should be around 8 percent. In fact, they were close to 4 percent in the 1950s, the most recent experience with zero inflation. With current inflation of 10 percent and the same 4 percent after-tax real return to corporations, nominal corporate bond rates should be around 25 percent. Again, actual rates have been about half this level. Bond-financed investments have indeed been heavily subsidized, but half of the subsidy has come from the lender, not the federal government. Even so, the government subsidy through the corporate income tax has been substantial. The tax treatment of interest and the disparity between the corporate marginal rate of 46 percent and the much lower rate imposed on lenders creates a major inefficiency.

Low levels of bond interest rates in the U.S. seem to stem from a general reluctance on the part of corporations to make leveraged investments. The equilibrium condition fails because firms do not pursue debt financing anywhere near as aggressively as the conditions calls for. But certain types of investment are typically leveraged at rates of close to 100 percent. These include highly fungible assets like airplanes, office buildings, and apartments. These investments are thus very substantially subsidized by the combination of favorable tax treatment and low nominal interest rates. When a pension fund finances an apartment complex with a 14 percent mortgage, much of the return comes from the value of the interest deduction to the owners of the complex (whether corporate or individual) and the failure to recapture much of the return through taxation of the interest receipts.

Moves to reduce the excessive current taxation of equity-financed investment are likely to worsen the inefficient subsidy of leveraged investment. Accelerated or indexed depreciation will only further raise the tax incentive to invest in those types of assets where leverage is customary and only worsen our over-supply of these assets.

## How to Avoid Subsidizing Leveraged Investments

Consider the following provisions of a revised tax law: (1) indexed depreciation at the economic rate ($f' = f$ and $d' = d$); (2) no investment

credit (k = 0); (3) taxation of accrued capital gains (g = 1). Then the taxes imposed upon capital (not counting interest deduction) are

$$c/p - d - r = \frac{u}{1-u}(r + f)$$

This is exactly the amount of the interest deduction, so the effective corporate income tax rate is zero under accrual taxation of capital gains. Thus one solution to the problem of current heavy subsidies of debt-financed investment is to abolish the investment credit, use indexed economic depreciation, and fully tax accrued capital gains. Together these would raise effective tax rates to zero.

A solution to the subsidy of leveraged investment based on accrual taxation of capital gains is both undesirable and impractical. It is inappropriate for equity-financed investment or investment financed by selling debt to taxpayers. It is administratively impractical because it rests on asset valuations not obtained from actual market transactions. There seems little potential role for capital gains taxation under the corporate income tax.

An alternative approach seems much more promising based on Auerbach and Jorgenson's proposed streamlining of the corporate income tax with a first-year capital recovery allowance extended to cover interest deductions for leveraged investments as well as depreciation. In this way the corporate income tax could be reformed to impose the same effective tax rate at all rates of inflation, all rates of depreciation, and all degrees of leverage. Auerbach and Jorgenson's original proposal accomplishes the first two but not the third.

If depreciation deductions and the investment credit are eliminated and a first-year allowance, a, is introduced, the equilibrium relation between the real rental rate and its determinants becomes

$$c/p = \frac{1-ua}{1-u}(r + d)$$

The effective corporate tax rate is

$$v = \frac{u(1-a)(r+d)}{(1-ua)r + u(1-a)d}$$

The formula for the allowance, a, that equates the effective tax rate, v, for all assets is



$$a = \frac{(u-v)r + u(1-v)d}{u(1-v)(r+d)}$$

If the effective rate is to be equal to the statutory rate (u = v), then this formula simplifies to

$$a = \frac{d}{r+d}$$

which is simply the present value of indexed economic depreciation. To achieve an effective rate of taxation which is comparable to current rates with some leveraging of investment, an effective rate somewhat below the statutory rate would be appropriate. For example, to achieve an effective rate of 35 percent for equipment with d = 0.1, use a = 0.82, as against a = 0.71 for economic depreciation and an effective rate of 46 percent. For structures with d = 0.03, use a = 0.64 instead of a = 0.43. In other words, denial of interest deductions ought to be coupled with a somewhat more generous first-year allowance than the one proposed by Auerbach and Jorgenson, else an actual increase in capital taxation will occur.

This proposal would eliminate the highly inefficient subsidy currently paid for leveraged investments. An even simpler proposal is to grant a first-year allowance in the full amount of the investment, in which case the corporate income tax would be a tax on gross cash flow less investment. Plant and equipment would be treated in the same way as intangibles. Of course, the effective rate of taxation under this proposal is zero; the corporate income tax would be a tax on pure rents earned by the corporation. In the steady state, the contribution of such a tax to total federal revenue would be small.

Though this is a paper about corporate taxation, I cannot help mentioning that no comparable reform of the provisions of the personal income tax for the treatment of capital is possible. Denial of interest deductions for investment is meaningless as long as interest earnings are taxed. All of the absurd subsidies identified in this paper are available to the individual investor who finances a business investment by borrowing from an untaxed individual. Permitting expensing of investment without eliminating deductibility of interest would only further increase the subsidy. The necessary reform is the abolition of the taxation of interest and other earnings of capital. This step is justifiable only if the consumption financed by capital income can be taxed with a suitable consumption tax.

To summarize, two items should be high on the tax reform agenda, im-

provement of depreciation through some kind of recognition of current replacement cost or its equivalent, and elimination of interest deductions together with a compensating increase in first-year allowances or tax credit. As it stands, we impose much too high taxes on the bulk of corporate income and use part of the proceeds to subsidize leveraged investments.

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# Discussion of Robert E. Hall, "Tax Treatment of Depreciation, Capital Gains, and Interest in an Inflationary Economy"

*John Kendrick, Discussant*

Before commenting on Professor Hall's paper I would like to make a few general remarks on the theme of this session, taking off from part II of the Hulten-Wykoff paper. When we speak of the *physical* efficiency or productivity of fixed capital I interpret this as a relationship between the real gross capital stock in use (valued by prices of the capital goods in a base period, or what it would have cost to produce the goods at base period prices and technology) and the physical volume of output produced, or the potential output at full utilization, valued at base-period prices. The relationship is obviously not purely physical, in that relative prices and the economic lives of capital goods are economic variables. But we can even dispense with relative prices in looking at one capital good, a machine, producing one output. Here I believe that the one-horse-shay analogy is applicable. Given adequate maintenance and repair, the machine should continue to have much the same output-producing capacity throughout its economic life. As it ages, the physical efficiency may decline a little, if more down-time for maintenance and repair is required. For an aggregation of capital goods, I would expect that aggregate output at full capacity would closely parallel the movements of the real gross capital stock, in the absence of technological change. With capital cost-reducing innovations the output would rise in relation to the real stock, indicating an increase in capital productivity.

In current value terms the picture is quite different. From the revenues derived from output sales must be deducted the labor compensation, intermediate purchases, and other operating costs to obtain the net capital income before interest

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