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Tax Neutrality Between Capital Services Provided by Long-Lived and Short-Lived Assets

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I. INTRODUCTION

A major theme of economics is the need to use capital and labor efficiently. Neutrality, particularly tax neutrality, between long- and short-lived assets is an important aspect of this theme. Only if the tax system is neutral between capital services provided by long- and short-lived assets can capital and labor be efficiently combined.

Congress has provided a number of tax incentives, including tax depreciation more rapid than economic depreciation and the investment tax credit, aimed at stimulating additional investment. Attempts to stimulate investment should be done in a way which is evenhanded or neutral between capital services embodied in long- and short-lived assets. This paper focuses on the criterion for a neutral tax incentive (or disincentive) [1/] for investment. The paper is not concerned with neutrality between capital and labor. Rather it is assumed that, while we may want to tilt economic decisions towards capital or labor, we do not want to bias the source of capital services supplied by long- and short-lived assets.

Confusion concerning tax neutrality between long- and short-lived assets arises in part because there are two somewhat conflicting neutrality criteria--one based on the rental cost of capital and one based on the rate of return. The rental cost of capital criterion implies that a tax incentive should proportionately decrease the rental cost of all investments. The rate of return criterion requires that a tax incentive

should proportionately increase the rate of return of all investments. These two criteria are not consistent with each other, and it is the intention of this paper to demonstrate that the rate of return criterion must be used in order to achieve tax neutrality as to the source of capital services, whether provided by long- or short-lived capital assets.

II. RENTAL COST OF CAPITAL

The rental cost of capital is essentially the factor cost or social cost of using a unit of physical capital for one period. It is the price for the use of physical capital just as the wage rate is the price for the use of labor services. It includes an amount for capital recovery, a net after-tax return on the amount invested, and the tax on this income. Hall and Jorgenson [3] have defined the rental cost to be: 2/

$$c = q(r + \delta)\,\frac{1-uz}{1-u} \qquad (1)$$

where c = rental cost

q = price of new capital asset

r = after-tax "normal" rate of return

δ = economic decline rate

u = nominal tax rate

z = present value of tax depreciation per dollar of original cost.

Various commentators have suggested that neutrality between long- and short-lived assets requires a tax incentive that proportionately reduces the rental cost of capital for all investments [4]. For example, I asserted that an investment tax credit of k percent with a basis adjustment (for purposes of calculating depreciation allowances) is a neutral incentive [4]. Such a tax credit reduces the rental cost of capital by k percent. Its effect on the rental price is exactly the same as a k percent reduction in the price of all new capital goods. Economists are accustomed

to thinking that tax neutrality is achieved within any group of goods if their relative prices are not disturbed by the tax change. In this sense, an equal percentage reduction in the price of all capital goods appears to be neutral.

One way to see that an investment credit with a basis adjustment ensures a proportionate reduction in rental cost is to suppose that, on August 15, 1971, the President, instead of proposing restoration of the 7 percent tax credit (without a basis adjustment), had ordered an across-the-board 7 percent reduction in the prices of machinery and equipment (while freezing all other prices). Under this course of action, businesses would have found that the initial outlays required for capital investments in machinery and equipment were reduced by 7 percent. In addition, the basis for depreciation, and, thus, all future depreciation deductions would also have been reduced by 7 percent. Similarly, a 7 percent tax credit with a basis adjustment also reduces the initial outlays by 7 percent and the basis for all future depreciation deductions by 7 percent.

White and White [6, p. 110] concluded that a neutral tax incentive should reduce proportionately the rental cost of capital of all investments:

> To produce a stimulus to expand the capital stock in a manner that would be neutral as among assets depreciating at varying rates, the appropriate policy would be one that reduced the rental cost of capital proportionately for all types of assets covered. A tax resulting in such proportionate reductions would have no substitution effect among capital assets. That is, at a given size capital stock, there would be no cost advantage to substituting one type of capital service for another--which would be a form of neutrality. A uniform investment tax credit would provide such a neutral stimulus to investment, so long as the credit is deducted from the original cost of the asset for depreciation computation... Such a credit would not, of course, offset an unneutral depreciation policy, but it would not aggravate nonneutrality.

The proportionate reduction in the rental cost of capital does have considerable intuitive appeal as a neutrality criterion. Neutrality, as we generally think of it, requires that the tax system does not distort relative prices and the rental cost of capital is the price which a business firm must pay (or impute to itself) for the use of capital assets. However, in the short run, a proportionate reduction in the rental cost of all capital assets will tend to favor short-lived assets because a short-lived asset experiences more depreciation per unit of rental cost than a long-lived asset. If the price of beef, lamb and pork were all reduced by the same proportionate amount, there would be no tendency for consumers to substitute one type of meat for the other. But if the price of a one-year asset, a five-year asset and a fifty-year asset are all reduced by the same proportionate amount, producers will purchase relatively more of the one-year asset and relatively less of the fifty-year asset. The reason for the difference between types of meat and types of assets is that, while all types of meat are entirely "used up" during the period of purchase, only a portion--and, more importantly, a varying portion--of capital assets are "used up" each period.

The example in Table 1 illustrates the effect of a uniform proportionate reduction in the rental cost of assets. Each asset is combined with the same amount of labor and raw material to produce output. The assets differ only with respect to service life. In the short-run, when value added by machines is fixed, economic profit is what remains after the "normal" rate of return (here, an interest rate of 10 percent) and depreciation have been paid. With a uniform proportionate reduction in the

TABLE 1

Item of Expense	Service Lives (in years) 1	5	50
Cost of machine	109	400	1000
Interest or "normal" return (10%)	11	40	100
Economic profit (assumed zero in initial equilibrium)	0	0	0
Depreciation	109	80	20
Value added by machine (rental cost of machine)	120	120	120
REDUCE COST OF MACHINE BY 50 PERCENT - SHORT RUN RESULT			
Cost of machine	54. 5	200	500
Interest or "normal" return (10%)	5.5	20	50
Economic profit,before commodity prices change	60	60	60
Depreciation	54.5	40	10
Value added by machine, before commodity prices change (rental cost plus economic profit on machine)	120	120	120
Economic profit as percent of cost of machine, before commodity prices change	110%	30%	12%
REDUCE COST OF MACHINE BY 50 PERCENT - LONG RUN RESULT			
Cost of machine	54.5	200	500
Interest or "normal" return (10%)	5.5	20	50
Economic profit (assumed zero in new equilibrium)	0	0	0
Depreciation	54.5	40	10
Value added by machine, after commodity prices change (rental cost of machine)	60	60	60
Percent decrease in value added by machine, after commodity prices change	50%	50%	50%

price of all assets, and hence in their rental costs, in the short-run the economic profit as a percentage of the cost of the machine rises much more for the one-year asset than for the fifty-year asset. Thus, in the short-run, a proportionate reduction in the rental cost of all assets is not equivalent to a proportionate increase in the market return on all assets (defining market return as the "normal" return plus economic profit). Hence, as producers add to their capital stock in response to positive economic profits, short-lived assets will be favored and long-lived assets will be disfavored. Ultimately, in the long-run, commodity prices will adjust downward so that economic profits on all assets are zero. But in the process of reaching this new equilibrium, producers' choices will have been biased towards short-lived assets.

III. RATE OF RETURN

Economic theory suggests that investment occurs at the margin until the after-tax rates of return of alternative investments are equalized.[3/] Therefore, any incentive which increases the after-tax rate of return more for some investments will induce a shift towards those investments with the higher after-tax rates of return. Such a shift will occur until the rates of return on the favored investments and unfavored investments are again equalized.

If r is the equilibrium after-tax rate of return on an investment before the tax incentive, and r_s is the equilibrium after-tax rate of return after the incentive, the effective subsidy rate, s, can be defined as the proportionate increase in the rate of return:

$$s = \frac{r_s - r}{r} = \frac{r_s}{r} - 1 \qquad (2)$$

Only if the subsidy rate is the same for all investments will the incentive not induce an artificial shift towards favored investments.

A subsidy which increases proportionately the after-tax rate of return on all assets will increase the demand for capital services. As the quantity of capital increases, the marginal product of capital falls. When the marginal product of capital falls, the rental price of long-lived assets falls more than that of short-lived assets. This is so because interest is a greater proportion of the rental cost for long-lived assets than it is for short-lived ones. Thus, a tax incentive

which increases proportionately the after-tax rate of return of long- and short-lived assets has exactly the same impact on investment as a decrease in the interest rate. (At lower interest rates, long-lived assets will be favored relative to short-lived assets, as the investor/borrower becomes more willing to undertake long-term projects.)

As Table 2 illustrates, in the short-run with fixed commodity prices, the economic profit as a percentage of the cost of the machine remains constant for assets of all service lives, given a proportionate decrease in the interest rate. In this respect, investors would be temporarily indifferent between one-year and fifty-year assets. But in the long run, commodity prices will adjust downward so that the economic profit on all machines is zero. Since the value added by machines can decrease by a larger percentage, consistent with zero economic profit, for a fifty-year asset than for a one-year asset, the adjustment process clearly creates a competitive advantage for long-lived assets. Thus when we stimulate investment by proportionately increasing the after-tax rate of return on all assets, we also stimulate the use of long-lived assets which embody a larger capital services component.

TABLE 2

Item of Expense	Service Lives (in years) 1	5	50
Cost of machine	109	400	1000
Interest or "normal" return (10%)	11	40	100
Economic profit (assumed zero in initial equilibrium)	0	0	0
Depreciation	109	80	20
Value added by machine (rental cost of machine)	120	120	120
REDUCE INTEREST RATE OR "NORMAL" RETURN BY 50 PERCENT - SHORT RUN RESULT			
Cost of machine	109	400	1000
Interest or "normal" return (5%)	5.5	20	50
Economic profit, before commodity prices change	5.5	20	50
Depreciation	109	80	20
Value added by machine, before commodity prices change (rental cost plus economic profit on machine)	120	120	120
Economic profit as percent of cost of machine	5%	5%	5%
REDUCE INTEREST RATE OR "NORMAL" RETURN BY 50 PERCENT - LONG RUN RESULT			
Cost of machine	109	400	1000
Interest or "normal" return (5%)	5.5	20	50
Economic profit (assumed zero in new equilibrium)	0	0	0
Depreciation	109	80	20
Value added by machine, after commodity prices change (rental cost of machine)	114.5	100	70
Percent decrease in value added by machine, after commodity prices change	4.6%	16.7%	41.7%

IV. COMPARISON OF THE TWO CRITERIA

White and White [6, p. 110] contend that a proportionate reduction in the rental cost of capital "would have no substitution effect among capital assets". In fact, a proportionate reduction in the rental cost of all assets would bias the source of capital services towards assets with shorter lives and thus a small capital service component in their annual cost (as illustrated in Table 1). A neutral tax incentive designed to encourage the use of capital services should instead encourage the substitution of long-lived assets for short-lived assets. As Gaffney [2, p. 34] has indicated, long-lived assets are more capital-intensive than short-lived ones, and thus "the market solves the glut of capital by letting it be sequestered in long maturities". Bailey [1, pp. 140-44] has pointed out that the mix of investment naturally shifts towards long-lived assets during recessions when the interest rate falls. In conclusion, I believe that a neutral tax incentive designed to increase uniformly the use of capital services should <u>not</u> provide a proportionate reduction in the rental cost, but should <u>instead</u> provide a proportionate reduction in the "normal" rate of return.

One final way to see that the rate of return is the appropriate neutrality criterion is to examine what happens when an investment incentive is provided in a world where savings are completely inelastic and aggregate demand is maintained. In such a world an investment incentive increases investment demand, but there is no increase in total investment. Rather the interest rate is bid up until the demand for investment again equals the fixed amount of savings. Only if the investment incentive increases proportionately the rate of return on all investment will the bidding up of the interest rate just offset (or neutralize) the increase in the rate of return, thus insuring no change in the durability of investment. Clearly if total investment does not change, we do not want the durability of investment to change.

V. NEUTRAL INVESTMENT TAX CREDIT

If a proportionate decline in the rental cost were the appropriate criterion for a neutral tax incentive, then an investment tax credit with a basis adjustment would be neutral.[4/] However, if a uniform increase in the rate of return is the right criterion, then the tax credit, with or without a basis adjustment, should be lower for short-lived assets than for long-lived assets.

Given some assumptions, we can derive values for a neutral investment tax credit (defined with reference to the rate of return criterion) for assets of different lives, assuming there is no basis adjustment for purposes of calculating depreciation allowances.[5/] We need to solve for a tax credit, k, which has the same impact on the rental cost of capital as a reduction in the required after-tax rate of return from r to r'. Based on equation (1), the neutrality condition may be stated as:

$$q(r + \delta)\left(\frac{1-uz-k}{1-u}\right) = q(r' + \delta)\left(\frac{1-uz'}{1-u}\right) \qquad (3)$$

Equation (3) may be solved for k:

$$k = \frac{[(r + \delta)(1 - uz) - (r' + \delta)(1 - uz')]}{r + \delta} \qquad (4)$$

Note that if r were reduced to r', z would be increased to z', and the value of z' must therefore be used to calculate the appropriate level of k.

Assume the following values:

$r = .10$

$r' = .08$

$\delta = 2/n$

n = tax life in years

$u = .48$

$$z = \sum_{t=1}^{n} \frac{d_t}{(1+r)^t}$$

$$z' = \sum_{t=1}^{n} \frac{d_t}{(1+r')^t}$$

d_t = depreciation in year t per dollar of original cost, assuming the sum-of-years digits method of depreciation.

If an asset with a life of 5 years received a 4 percent credit, then a neutral credit, k, would have the rates shown in Table 3 for assets of different durabilities. Given the above assumptions, assets with a 10-year life (about the average tax life for machinery and equipment) would receive a 6.5 percent tax credit which is very close to the permanent rate of the investment tax credit, namely, 7 percent. The 2.7 percent rate for assets with a 3-year life would be slightly higher than the 2-1/3 percent rate permitted under present law (which reduces the credit for assets with useful lives of less than 7 years). Assets with a 5-year life would have a rate somewhat below the 4-2/3 percent rate permitted under present law.

TABLE 3

Life of asset in years	Neutral Investment Tax Credit (percent of asset cost)	"Permanent" Investment Tax Credit (percent of asset cost)	"Temporary" Investment Tax Credit (percent of asset cost)
3	2.7%	2.3%	3.3%
5	4.0	4.7	6.7
7	5.1	7.0	10.0
10	6.5	7.0	10.0
12	7.3	7.0	10.0
15	8.4	7.0	10.0
20	9.9	7.0	10.0

FOOTNOTES

Emil M. Sunley, Jr. is a Senior Fellow at the Brookings Institution. The views expressed are those of the author and are not necessarily those of other staff members, officers, or trustees of the Brookings Institution.

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1/ Most of the discussion which follows will be about neutral tax incentives for investment. The conclusions are equally applicable to neutral tax disincentives.

2/ This particular formulation of the rental cost is only valid if the loss in the value of the asset follows the pattern of geometric decay. A more general formulation of the rental cost would not change the argument of this paper.

3/ This statement and what follows assume that all investments are of equal risk and, therefore, the issue of differential riskiness is not addressed.

4/ As mentioned before, if one maintains the definition of tax neutrality as a tax change that does not disturb relative prices within any group of goods, then the rental cost criterion has considerable appeal as a neutrality criterion.

5/ This derivation follows Tideman [5].

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