4 INVESTMENT VERSUS SAVINGS INCENTIVES: THE SIZE OF THE BANG FOR THE BUCK AND THE POTENTIAL FOR SELF-FINANCING BUSINESS TAX CUTS

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Introduction

In closed economies, saving and investment represent, respectively, the supply of and demand for new domestic capital. Saving incentives shift the supply curve for new domestic capital, while investment incentives shift the demand curve. The basic public finance equivalence theorem—the real effects of a tax (subsidy) are independent of who nominally pays the tax (receives the subsidy)—applies equally well to the market for new capital.

We are grateful to the National Bureau of Economic Research and the National Science Foundation for financial support. Andrew Myers provided excellent research assistance. The views expressed are solely those of the authors.

increases in capital income tax rates (e.g., corporate or dividend tax rates) will generally stimulate, rather than retard, capital formation, while requiring an immediate decline in wage taxes to avoid running surpluses. Finally, our third simulation shows that the government, through a policy of partial expensing, can raise investment and generate a surplus without ever raising either the capital income tax or the labor income tax.

The last section of the paper summarizes major findings and relates these results to recent economic events.

Investment Incentives—Structural Relationship to Other Fiscal Policies

A simple two period life cycle model of economic growth provides a convenient framework for examining the underlying nature of investment incentives. Consider such an economy with a tax $\tau_{w,t}$ on labor income, a tax $\tau_{r,t}$ on business profits, and an expensing rate for new capital of e_t. The subscript t denotes the period in which the three instruments are applied. To simplify the analysis further, assume individuals work only when young and that the depreciation rate, the rate of population growth, and the rate of technological change are zero.

Equations 4.1 and 4.2 characterize the economy's process of capital formation:

$$K_t = (W_{y,t-1} \; (1 - \tau_{w,t-1}) - C_{y,t-1}/q_{t-1} \tag{4.1}$$

$$C_{0,t} = q_{t-1} \; K_t \; (1 + r_t) \tag{4.2}$$

In equation 4.1, $W_{y,t-1} \; (1 - \tau_{w,t-1}) - C_{y,t-1}$ is the saving of the young in period $t-1$, their after tax wages in period $t-1$ less their consumption in period in $t-1$. The net price of a unit of capital in period $t-1$ is given by q_{t-1}. Dividing the financial saving of the young by q_{t-1} determines their purchase of physical capital. The physical capital acquired by the young at the end of period $t-1$ equals the economy's capital stock at the beginning of period t, K_t; the old generation in period t (those young in $t-1$) hold claims to all the economy's capital, since the young in period t have no beginning of period assets.

For the old in period t, consumption, $C_{0,t}$, equals the return of principal, $q_{t-1}K_t$, plus the after tax return on the investment, $q_{t-1} \; K_t \; r_t$. The after tax return, r_t, includes capital gains and losses:

$$r_t = \frac{F_{K,t}(1 - \tau_{r,t}) + q_t - q_{t-1}}{q_{t-1}} \tag{4.3}$$

In equation 4.3 $F_{K,t}(1 - \tau_{r,t})$ equals marginal after tax profits per unit of capital. In combination, (4.2) and (4.3) imply:

$$C_{0,t} = q_t K_t + K_t F_{K,t}(1 - \tau_{r,t}) \tag{4.4}$$

This new expression is also intuitive: the consumption of the old in period t (the young of period $t - 1$) equals after tax business profits plus the value of the sale of their capital at the prevailing asset price q_t.

Equation 4.5 expresses q_t, the net price of purchasing a unit of capital, in terms of $\tau_{r,t}\, e_t$:

$$q_t = 1 - \tau_{r,t}\, e_t \tag{4.5}$$

For new capital the net acquisition cost is 1, the price of new capital, less the tax rebate from expensing, $\tau_{r,t}\, e_t$. Equation 4.5 also determines the price of old capital. Since old capital and new capital are perfect substitutes in production, their net acquisition costs must be identical in equilibrium; hence, old capital sells for $\tau_{r,t}\, e_t$ less than new capital because the purchaser of new capital receives $\tau_{r,t}\, e_t$ from the government, while the purchaser of old capital receives no tax rebate. Since the value of old capital depends on the product of $\tau_{r,t}\, e_t$, the price of old capital falls not only when expensing is increased (and $\tau_{r,t}$ is positive), but also when the rate of business profits taxation rises, given an expensing policy.

Equations 4.1, 4.4, and 4.5 may now be combined to indicate the lifetime budget constraint of the young in period $t - 1$,

$$C_{y,t-1} + C_{0,t}\frac{(1 - \tau_{r,t-1}\, e_{t-1})}{(1 - \tau_{r,t}\, e_t) + F_{K,t}(1 - \tau_{r,t})} = W_{y,t-1}(1 - \tau_{w,t-1}) \tag{4.6}$$

and the old in period $t - 1$:

$$C_{0,t} = K_{t-1}(1 - \tau_{r,t-1}\, e_{t-1}) + K_{t-1} F_{K_{t-1}}(1 - \tau_{r,t-1}) \tag{4.7}$$

These equations suffice to describe the relationship of savings and investment incentives to other tax structures. First, consider the case of zero expensing ($e_{t-1} = e_t = 0$). This assumption produces an economy with period t capital income and wage tax rates of $\tau_{r,t}$ and $\tau_{w,t}$ respectively. In such an economy, the return to new capital, capital produced in period $t-1$ and old capital, capital produced prior to period $t-1$, are taxed at the same effective rates in period t and beyond. With zero expensing, there is no discrimination in favor of newly produced capital; the relative price of new and old capital is always unity. Changes in the time path of $\tau_{r,t}$ and $\tau_{w,t}$ that satisfy the government's long-term budget constraint (see Auerbach and Kotlikoff, 1983) are classified, in our taxonomy, as savings incentives. The fifth section indicates that lowering capital income tax rates will typically depress rather than stimulate long-term capital formation if such savings incentives are deficit-financed.

The essential feature of investment incentives can be illustrated most simply by assuming zero wage taxation, permanent capital income taxation at rate τ_r, zero expensing prior to period $t-1$, and a permanent move to 100 percent expensing starting at time $t-1$. Under these assumptions, all tax terms drop out of equation 4.6; the young of period $t-1$ and all future generations face zero effective taxation over their lifetimes. While the young and future generations nominally pay business profits taxes in their old age, the reduced cost of purchasing capital when they are young exactly offsets the present value cost of this taxation. Stated differently, new generations starting in year $t-1$ are subsidized when young to purchase capital and taxed when old on its return. The subsidy and tax cancel in present value and the young face no net taxation on their capital investments.

While this new tax structure effectively exempts the young of period $t-1$ and all future generations from paying any taxes over their lifetime, elderly individuals at time $t-1$ suffer a capital loss on their assets equal to $K_{t-1}\tau_r$. According to equation 4.7, the consumption of the elderly falls by this amount; the $K_{t-1}\tau_r$ capital loss constitutes a one time wealth tax on the old of period $t-1$. Considering the tax treatment of the young and old together, this new tax system is equivalent to the government's collecting $K_{t-1}(1+F_{k_{t-1}})\tau_r$ in taxes from the old period in $t-1$ and abolishing taxation thereafter.[1]

This example highlights the special feature of investment incentives, namely that they tax initial holdings of wealth. A second important feature is that they lower the effective tax on the return to saving of young and future generations. With 100 percent expensing the effective capital income tax rate is reduced to zero.

The presence of wage taxation alters the analysis somewhat. Let us now assume positive and permanently fixed values of τ_r and τ_w. In this case moving to full expensing leaves young individuals facing a lifetime wage tax, or equivalently a lifetime consumption tax, since equation 4.6 can now be rewritten as:

$$C_{y,t-1}\,(1+\tau_C) + C_{0,t}\left(\frac{1+\tau_C}{1+F_{K,t}}\right) = w_y \qquad (4.6')$$

where

$$1+\tau_C \equiv \frac{1}{1-\tau_w}$$

The elderly in period $t-1$ again face an additional wealth tax of $K_{t-1}\,\tau_r$ in addition to business profits taxes of $K_{t-1}\,F_{K_{t-1}}\,\tau_r$. If τ_r equals τ_w, the case of a proportional income tax, equation 4.7 becomes:

$$C_{0,t-1}\,(1+\tau_C) = K_{t-1}\,(1+F_{K_{t-1}}) \qquad (4.7')$$

Equations 4.6′ and 4.7′ demonstrate that the movement to full expensing in the presence of a proportional income tax produces a consumption tax, or equivalently, a wage tax plus a one time wealth tax on the elderly where the wage and one time wealth tax rates are identical. Other proposals, which are billed as "providing consumption tax treatment" of income flows, such as unlimited use of IRAs and abolition of the corporate income tax, produce wage tax rather than consumption tax structures. In the case of unlimited IRAs, the initial owners of capital can place all their holdings of capital into IRAs, receiving tax deductions that equal in present value the taxes on withdrawals of principal plus interest from the IRA. Thus the owners of existing capital face no effective taxation on the conversion of their capital into consumption expenditures; a policy of unlimited IRAs effectively eliminates the capital income tax component of the income tax with no effective wealth tax on existing assets. For those with no initial assets, wage taxation and consumption taxation are structurally equivalent. Hence, a policy of unlimited IRAs and a zero corporate income tax replicates a wage tax. It does not replicate a consumption tax.

Another complication of the foregoing analysis is that the actual US tax law permits existing assets to qualify for new tax incentives, if they are sold by the existing owner. For example, the 1981 Accelerated Cost Recovery System (ACRS) does not explicitly exclude old capital, though application of ACRS to old capital requires a change in the capital's ownership. It is important to distinguish here between direct capital ownership and indirect ownership through firms. One normally thinks of life cycle transfers of assets as being accomplished by the sale of shares in firms owning capital goods. This is not considered to be a change in the ownership of the capital goods themselves, which would require the sale of the actual goods by one firm to another. Thus, we may imagine that in selling off their assets the elderly can choose whether to transfer ownership of assets or ownership of firms, with the only resulting difference being whether sale of the capital goods themselves is recognized for tax purposes. We refer to the former case as turnover of assets.

If old capital is eligible for new investment incentives (expensing) subject to recapture taxation, the budget constraint facing the elderly is no longer equation 4.7, but rather:

$$C_{0,t-1} = K_{t-1}(1 - R_{t-1}) + K_{t-1} F_{K_{t-1}} (1 + T_{r,t-1}) \qquad (4.7'')$$

where R_{t-1} is the recapture tax per unit capital.

A comparison of equations 4.7 and 4.7″ implies that the sale of old capital to acquire eligibility for current investment incentives available to new capital will only occur if $\tau_{r,t-1}\, e_{t-1}$ exceeds R_{t-1}. If these two terms are equal, the elderly are indifferent between selling their capital as old capital, e.g., selling equity title to previously expensed capital, or selling the actual capital at its replacement cost of unity and paying recapture taxes.

If turnover is advantageous, equation 4.7″ indicates that recapture taxes are equivalent to lump sum taxes of equal size on the initial generation of elderly. For the young in period $t - 1$, the lifetime budget constraint is no longer equation 4.6 but:

$$C_{y,t-1} + \frac{C_{0,t}\,(1 - \tau_{t-1}\, e_{t-1})}{1 - R_t + F_K\,(1 - \tau_{r,t})} = W_y\,(1 - \tau_{w,t-1}) \qquad (4.6'')$$

For given values of F_K, $\tau_{r,t-1}$, $\tau_{r,t}$ and e_{t-1}, values of R_t that make turnover profitable imply a larger effective after tax return on the saving of the young. In the case of a zero recapture tax, expensing implies no additional taxation of the elderly, and an effective subsidy on capital income to the young.

Recapture Taxes and the Exclusion of Old Capital From the Accelerated Cost Recovery System

The extent to which recapture taxation inhibits turnover is an empirical question that depends on the size of changes in investment incentives. The set of new incentives considered here are those provided by the Accelerated Cost Recovery System. Though the business tax provisions have again been altered by the Tax Equity and Fiscal Responsibility Act of 1982, the more recent legislation represents a small change from previous law, and introduces no additional incentives to turn over old assets to obtain the tax treatment accorded new assets. This is because the 1982 Act maintains current depreciation allowances indefinitely.

The 1981 Act introduced a sharp increase in the present value of depreciation allowances for a new asset purchased under pre-1981 law, we increase in the expensing fraction restricted to newly produced capital, accelerated depreciation can lower the value of existing assets. While the new ACRS provisions are available to owners of old assets provided they sell (turn over) their old assets, the sale of these assets generates recapture taxes that may exceed the net increase in depreciation allowances. To the extent that such a sale is attractive, the fraction of the loss in value that the seller recoups represents a leakage to old capital of the investment incentive embodied in ACRS.

The recapture treatment of structures and equipment differs and they must be considered separately. For structures, the seller must pay a tax on the difference between the sale price and the depreciated basis, with the difference between sale price and hypothetical straight line basis taxed as a capital gain, and the additional difference between straight line basis and actual basis (positive if a more accelerated depreciation method has been used), taxed as ordinary income. Thus, the total tax due on an asset with a one dollar sale price is:

$$R = c(1 - B_{SL}) + \tau(B_{SL} - B) \tag{4.8}$$

where c is the capital gains tax rate (equal to .28 for corporations) and τ is the income tax rate (.46 for corporations). The basis B and hypothetical straight line basis B_{SL} depend on the age of the asset, which determines the extent to which depreciation allowances have been taken, and the asset's initial purchase price. If a t year old asset physically depreciates at a constant exponential rate δ, and the inflation rate is π, then its initial purchase price was $e^{(\delta-\pi)t}$. Thus, letting b_{SL}^t and b^t be the straight line basis and actual basis for an asset aged t per initial cost, we have from equation 4.8

$$R_t = c(1 - b_{SL}^t\, e^{(\delta-\pi)t}) + \tau e^{(\delta-\pi)t}\,(b_{SL}^t - b^t) \tag{4.9}$$

In return for this recapture tax, the potential seller receives one dollar times the number of units of capital (at replacement cost) for his asset rather than the value it would command with its old depreciation allowances. Since investors must be indifferent between old and new capital, the price of an asset not turned over must reflect the differences in depreciation allowances afforded new capital and those available to old capital.

$$q^t = 1 - \tau(Z_{ACRS} - Z_0^t e^{(\delta - \pi)t}) \tag{4.10}$$

where Z_0^t is the present value of remaining depreciation allowances for an asset of age t initially purchased for a dollar and Z_{ACRS} is the present value of allowance per dollar of new capital under *ACRS*. Equation 4.10 corresponds to the earlier equation 4.5 derived for the case of expensing. Here, the expensing fraction e is replaced by the more general expression of the difference between the values of prospective depreciation allowances on new and old assets.

Using equations 4.9 and 4.10, we may now ask whether the turnover tax R_t exceeds the increase in sale price $(1 - q^t)$ that the seller can obtain ɪy opting for recapture. In addition, letting Z_0 be the present value of epreciation allowances for a new asset purchased under pre-1981 law, we ıay calculate what fraction of the capital loss generated by ACRS is avoided hen turnover is profitable. Since the price of an asset of age t would have en

$$q_0^t = 1 - \tau(Z_0 - Z_0^t e^{(\delta - \pi)t}) \tag{4.11}$$

l there been no change in tax regime, the capital loss caused by ACRS for sting assets not turned over is

$$q_0^t - q^t = \tau(Z_{ACRS} - Z_0) \tag{4.12}$$

dollar of age t capital.

ʼur calculations require parameter values for δ and π, the depreciation inflation rates, and prior depreciation provisions. For purposes of tration, we set $\delta = .03$ and $\pi = .08$. We assume an after tax nominal ɔunt rate of .10 and that prior tax depreciation followed the 150 percent ning balance formula with optimal straight line switchover, based on a ifeline of 35 years. These estimates of both actual and tax depreciation neant to correspond roughly to a typical structures investment (see nson and Sullivan, 1982). We assume assets are purchased six months he tax year and that tax payments are made annually, midway through x year as well. Post-1981 tax depreciation follows the 175 percent declining balance formula with optimal straight line switchover, based on a tax lifetime of 15 years, as dictated by ACRS.

Table 4–1 shows the results of calculations of q^t and R^t for structures purchased t years before the enactment of ACRS. The last column shows the fraction of the capital loss caused by ACRS (equal to 12.1 cents per dollar of capital) that could be recouped by turnover. Though turnover would not be useful for structures already completely written off, it appears advantageous for the bulk of structures. Because of growth and depreciation, a large fraction of the structure's capital stock is represented by assets purchased in recent years. For those assets, recoupment is substantial. For structures purchased within four years of the 1981 tax change, turnover allows a recoupment of over half the capital loss caused by ACRS. This figure is 85 percent for assets only one year old. Overall, if we assume a constant real rate of annual investment growth of three percent, this recoupment from turnover amounts to about one third of the capital loss on structures, given our parameterization. This result also suggests that, absent transaction costs,

Table 4–1. The Incentive to Resell Assets (Structures)

	Per Dollar of Age t Capital			
Age (t)	*Recapture Tax* $- R^t$	*Value without Resale* $- q^t$	*Gain from Resale* $(1 - q^t - R^t)$	*Fraction of Capital Loss Recovered*
1	.021	.876	.103	.85
2	.046	.864	.090	.74
3	.069	.853	.078	.64
4	.090	.843	.067	.55
5	.107	.834	.059	.49
6	.124	.825	.051	.42
7	.139	.818	.043	.36
8	.153	.811	.036	.30
9*	.164	.805	.031	.26
10*	.174	.800	.026	.21
.	.	.	.	
.	.	.	.	
.	.	.	.	
> 35	.280	.727	−.007	—

*Once an asset is 100 months old, the fraction of $(B_{SL}-B)$ subject to ordinary income taxation declines by one percent per month until it reaches zero at 200 months. This is accounted for in these calculations.

a large fraction of the structures capital stock ought to have been turned over upon the enactment of ACRS. However, such costs are clearly substantial for certain assets, such as factories and buildings, complementary to other productive factors in a company's production process. However, one would expect to see a greater turnover activity in commercial structures, such as apartment buildings and office buildings.

We turn next to the recapture treatment of equipment. Here, the analysis is complicated by the fact that most equipment qualifies for the investment tax credit, but only if the asset is new. The law greatly restricts the ability of an investor in used property to obtain the ITC. Moreover, the credit obtained by the original purchaser is also subject to recapture if the number of years the asset has been held is less than the minimum number of years required to qualify for such a credit. For example, equipment purchased before 1981 needed a tax lifetime of at least seven years to qualify for the full ten percent credit. Assets with lifetimes of between five and seven years received only a 6⅔ percent credit, and those with lifetimes between three and five years received a 3⅓ percent credit. If an asset with a lifetime exceeding seven years were sold after, say, six years, the seller would have to repay one third of the original credit received; if the sale were after four years, two thirds of the original credit would be repaid, and so on.

A second difference in recapture treatment of equipment is that the entire differential between sale price and basis is taxed as ordinary income, unless sale price exceeds initial purchase price, in which case the gain on purchase price is taxed as a capital gain. These two differences in the recapture treatment of equipment make turnover less attractive than in the case of structures.

As long as the sale price of the asset is less than original purchase price, the total recapture tax on one dollar of equipment aged t is

$$R_t = \tau(P - b^t e^{(\delta-\pi)t}) + (k - k^t)\, e^{(\delta-\pi)t} \qquad (4.13)$$

where b^t, δ, π and T are defined as before, k is the investment tax credit claimed originally, and k^t the credit that, *ex post*, the asset lifetime t would have dictated for the asset. P, less than unity, is the sale price. It accounts for the fact that, unlike a dollar of new capital, this asset will only receive the ACRS depreciation deductions and not the investment tax credit. Thus:[2]

$$P = 1 - (k + \tau Z_{ACRS} - \tau P Z_{ACRS}) \qquad (4.14)$$

or

Table 4–2. The Incentive to Resell Assets (Equipment)

	Per Dollar of Age t Capital		
Age (t)	Recapture Tax – R^t	Value without Resale – q^t	Gain from Resale ($P - q^t - R^t$)
1	.054	.847	–.062
2	.135	.796	–.092
3	.167	.753	–.081
4	.215	.718	–.103
5	.220	.690	–.071
6	.255	.667	–.083
7	.246	.645	–.052
.	.	.	.
.	.	.	.
.	.	.	.
>10	.386	.521	–.068

$$P = \frac{1 - k - \tau Z_{ACRS}}{1 - \tau Z_{ACRS}}$$

If the asset is not sold, then the value of the t year old capital per dollar of replacement cost is:

$$q^t = 1 - (k + \tau Z_{ACRS} - \tau Z_0^t e^{(\delta-\pi)t}) \qquad (4.15)$$

which differs from the equation for structures 4.10 only in the inclusion of the investment tax credit.

The seller of an asset will gain from turning the asset over if $P - q^t$ exceeds R^t. However, for representative parameters for equipment, this will not occur. Table 4–2 shows the values of R^t and q^t for an asset that depreciates at a rate of .12 and under old law was written off over a tax lifetime of ten years using the double declining balance method with a switchover to straight line. The value of P is .839, and the inflation rate and discount rates are, as above, set at .08 and .10. As the results show, the prospective seller would always lose by turning assets over on resale. Thus, owners of equipment can escape none of the capital loss induced by the liberalization of depreciation allowances for new capital goods. This loss is described by equation 4.12 and equals 10.5 cents of capital (measured at replacement cost).

Thus no equipment, but a substantial fraction of structures, could gain by being brought under ACRS. In the case of structures, a large fraction of the capital loss induced by ACRS could be avoided in this way. However, the presence of transaction costs of unknown magnitude makes it difficult to know how much of this turnover would take place. We may place upper and lower bounds on the size of the capital loss induced by the introduction of ACRS. With no turnover, the loss equals approximately 10.5 cents per dollar of existing equipment and 12.1 cents per dollar of existing structures. With the maximum gain from turnover, about one third of the loss on structures is recouped. Using estimates of the equipment/structures breakdown of 44.4 percent and 55.6 percent, respectively, obtained from data for 1975,[3] and with an estimate of 2.56 trillion dollars for the value in 1980 of the replacement cost of the business capital[4] stock, we obtain a range of 233 to 292 billion dollars as the effective wealth tax induced by the introduction of ACRS.

This result is only a rough calculation, and ignores the actual heterogeneity of the capital stock. Moreover, in the presence of adjustment costs (see below), the prices of all capital goods, including old ones, may rise with a surge in demand induced by an investment incentive such as ACRS. This would act to offset part of the capital loss induced by the more generous tax treatment of new capital versus old. However, the losses just calculated still are meaningful in that they represent the drop in value of existing capital relative to the value such capital would have had, had the additional tax benefits of ACRS applied to all capital.

The Simulation Model and Its Parameters

The Auerbach-Kotlikoff simulation model calculates the equilibrium growth path of an economy consisting of government, household, and production sectors. The life cycle version of the model used in this study incorporates expensing of new capital and costs of adjusting the level of the capital stock. In addition to expensing, the government's policy instruments include capital income, consumption, and wage taxes, the level of government consumption, and the choice of a deficit policy.

The household sector consists of fifty-five overlapping generations, with the total population growing at a constant rate. The fifty-five period life span corresponds roughly to the life span of an adult. In each generation there is a single, representative individual, and generations differ only with respect to their opportunity sets. The production sector is characterized by firms maximizing the present value of their profits by choosing both annual levels of labor input and annual rates of investment.

Each household chooses life cycle labor supply and consumption by maximizing an intertemporally separable CES utility function (Auerbach, Kotlikoff, and Skinner, 1983) with a constant static elasticity of substitution between consumption and leisure at a point in time and a constant intertemporal elasticity of substitution between consumption at different points in time, leisure at different points in time, and consumption and leisure at different points in time. The simulation presented below incorporates a one percent population growth rate, a static elasticity of substitution of .8, and an intertemporal elasticity of substitution of .25. These elasticities are suggested by recent empirical studies of saving and labor supply.[5]

The production function used here is Cobb-Douglas, with capital's income share equal to twenty-five percent. The costs associated with investment are quadratic as in the simulation model of Kotlikoff, Leamer, and Sachs (1981); that is, the marginal cost of a new dollar of capital, including installation costs, is:

$$\phi(I) = 1 + b\left(\frac{I}{K}\right) \tag{4.16}$$

where I is investment and K is existing capital. The term b is the adjustment cost coefficient. Larger values of b imply greater marginal costs of new capital goods for a given rate of investment.

The government choice of policy instruments is constrained by an intertemporal budget that holds over infinite time. This budget constraint requires that the present value of government capital income, wage, and consumption tax receipts be sufficient to pay for the present value of government consumption, the present value of expensing deductions, and the value of existing government net debt. The assumption that government debt (surplus) per capita cannot grow infinitely large is sufficient to generate this constraint on the time path of government policies.

The constraint implies that government policies are necessarily interdependent. A corollary is that certain deficit policies are not feasible. For example, the government cannot permanently change its expensing policy and permanently meet the consequent change in its receipts by simply altering its issue of debt. Such a policy would lead, over the long term, to either an infinite debt or an infinite surplus per capita. The probability that the change in the present value of tax receipts exactly equals the present value loss in revenues from changes in expensing is zero. Hence, to meet its budget constraints, the government must eventually raise or lower a tax instrument or its level of consumption in response to changes in its expensing policy. The next section indicates that, for certain expensing policies, the government need never raise any tax rate and, indeed, must lower tax rates at some point in the future to bring government finances into long-term balance. Investment incentives that require no increases in current or future tax rates or reductions in current or future government consumption are described here as self-financing.

Investment versus Savings Incentives—Illustrative Simulations

No single comparison of policies that do and do not discriminate against old capital can meaningfully summarize all differences in economic growth paths associated with investment versus savings incentives; the government's intertemporal budget constraint requires adjusting other government policies in response to these incentives in order to maintain a present value equality between its receipts and expenditures (including interest and principal repayments on debt). The differences in capital formation arising from the implementation of investment rather than savings incentives depends on the choice and timing of these other necessary policy adjustments.

Contrast, for example, two policies that begin with a proportional income tax, one introducing permanent, 100 percent expensing, and the other permanently removing the tax on capital income. The reduction or possible increase in revenues from either of these policies could be financed by immediate or future changes in the tax rate on labor income, current or future changes in government consumption, or some combination of changes in these and/or other available instruments. Given the range of possible concommitant adjustments in other policies, statements such as "investment incentives stimulate more capital formation than savings incentives" are meaningless. Comparisons of investment and savings incentives for explicitly specified policies of adjusting to the associated revenue changes do, however, permit meaningful conditional comparisons of investment and savings incentives.

The first simulation we present involves a permanent removal of capital income taxes, with debt policy used to maintain the wage tax rate at thirty percent for five years, and wage taxes adjusted thereafter to maintain a constant level of debt per capita. This simulation also assumes that there are no adjustment costs involved in changing the capital stock.

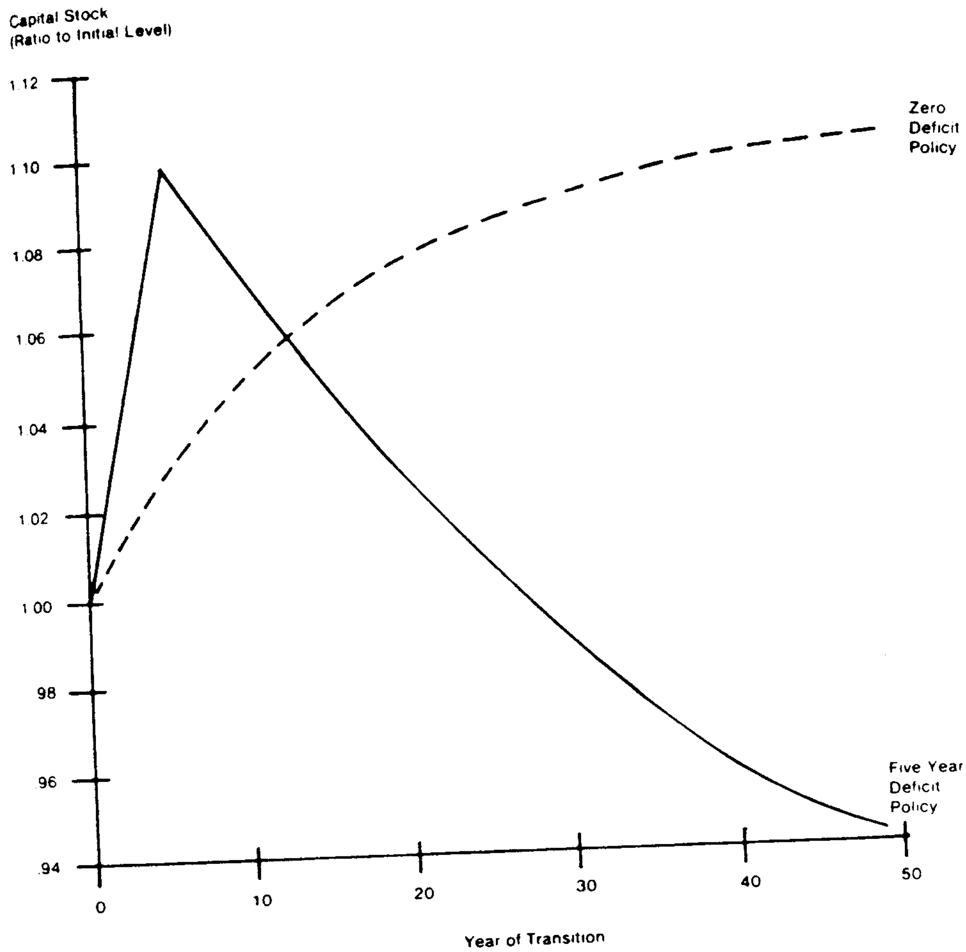

Figure 4-1 Capital Paths (Per Capita), Capital Income Tax Removal

The initial steady state is characterized by a capital output ratio of 3.04 and a gross interest rate of 8.22 percent. The specified policy leads to a 7.35 percent reduction in capital per capita, and a greater reduction in labor supply, with the resulting drop of 8.90 percent in output per capita. The wage tax rises to 47.8 percent in the long run. The path of per capita capital stocks over the transition period is shown by the solid line in figure 4-1.

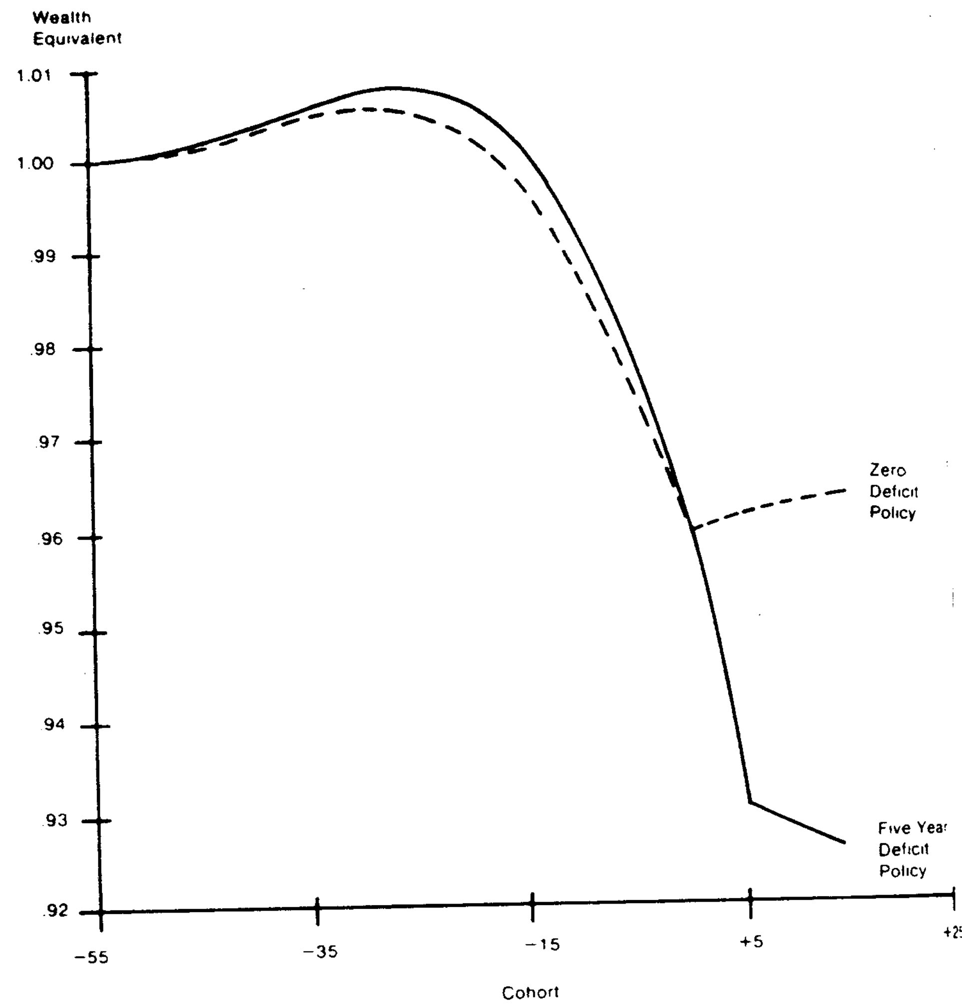

Figure 4-2 Wealth Equivalents, Capital Income Tax Removal

The solid line in figure 4–2 shows the welfare effects on transition cohorts of this deficit financed elimination of capital income taxation; the horizontal axis indexes the cohort's year of birth (relative to the first transition year, 1), and the vertical axis measures the amount by which the cohort's labor endowment vector would need to be increased (or decreased) under the old regime to allow the achievement of the same utility level as that attained under the new regime. The long-run welfare loss is 8.7 percent, but, in the short run, older generations gain relative to their *ex ante* prospects. This pattern of gains and losses is similar to that occurring under a policy (examined in Auerbach *et al.*, 1983) of switching immediately to wage taxation without running deficits, represented by the dotted line in figure 4–2. However, both the short-run gains and the long-run losses are larger when debt policy is used, because of the further shifting of tax liabilities onto future generations. The impact on capital formation is another difference associated with the use of deficits to finance savings incentives; the dotted line in Figure 4–1 shows the path of capital per capita arising from a balanced budget switch from income to wage taxation. Rather than falling, the capital stock rises in the long run.

The next policy we consider is a move to immediate expensing of all investment, with the income tax held at thirty percent for five years and deficits used to finance the loss in revenue. After five years, income taxes rise to maintain a constant level of debt per capita. The capital stock and welfare transitions are shown by the solid lines in figures 4–3 and 4–4, with corresponding paths under immediate balanced budget expensing (as discussed in Auerbach *et al.*, 1983), shown by the dotted lines. The effects of the implicit wealth tax on the original owners of capital is evident in both diagrams. The utility of older transition cohorts is decreased, and capital accumulation enhanced by the reduction in their consumption.

The five year delay in allowing tax rates to rise again leads to a lower long run capital stock, but to a much smaller degree. The reason for this is that the deficits created by the policy during its first five years are much smaller. The long-run level of debt to capital is just 2.13 percent, compared to 13.8 percent in the case of the first simulation. In fact, the long-run rate of income taxation is 28.9 percent—lower than the value that obtained before the creation of the debt.

Thus far in our simulations, we have ignored the possibility that the short-run supply curve for capital goods may slope upward. That is, attempts to increase quickly the amount of capital in response to an increased investment or savings incentive may result in a higher price of capital goods relative to consumption goods. If this is true, then our results may overstate the capital loss borne by holders of existing capital arising from an investment incentive such as expensing.

Setting the adjustment parameter b (see equation 4.16) equal to the empirically plausible value of five for the simulation of a transition to expensing with a five year deficit policy yields the following results. First, the drop in capital stock values by the full value of expensing is not immediate, because of the offsetting effect of the increasing supply price of new capital

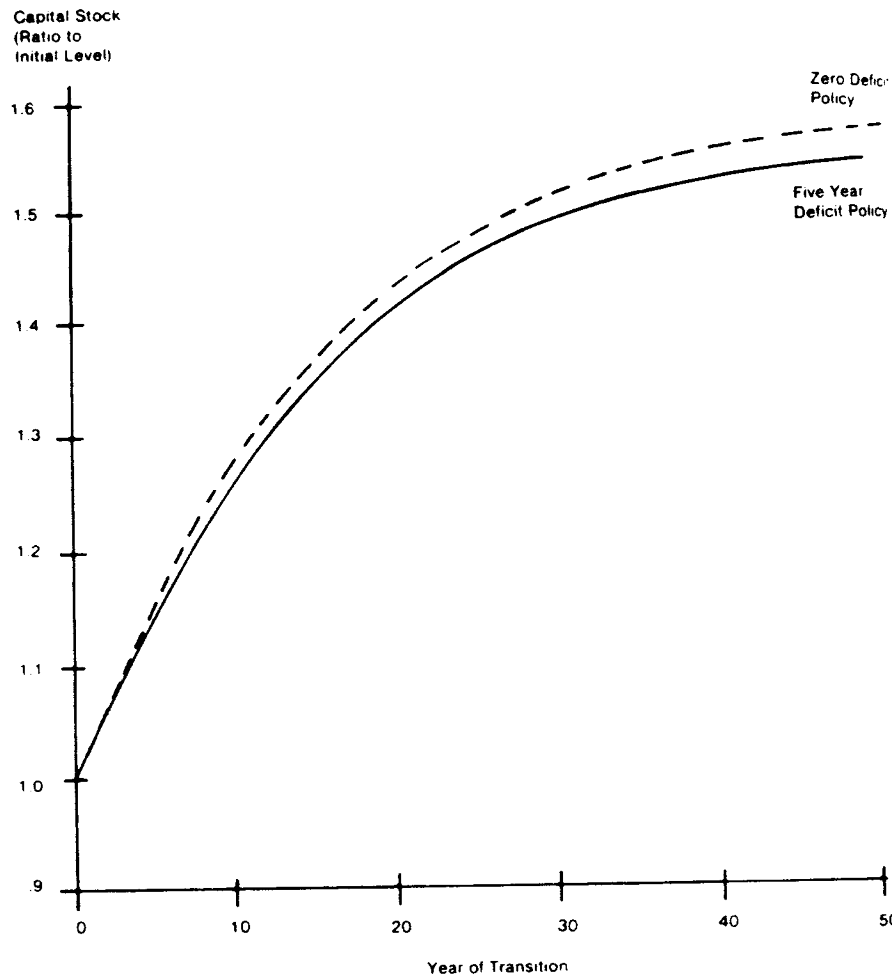

Figure 4–3 Capital Paths (Per Capita), Full Investment Expensing

goods. The price drops by 22.5 percent in the first year of the transition rather than thirty percent. Second, the welfare loss of older transition cohorts is smaller and the long-run gain also smaller (5.92 percent) than in the simulation without adjustment costs (6.29 percent). The welfare paths are compared in figure 4–5. Finally, the capital stock grows by a smaller amount, because not all of the demand induced by the investment incentives translates into increased output of capital.

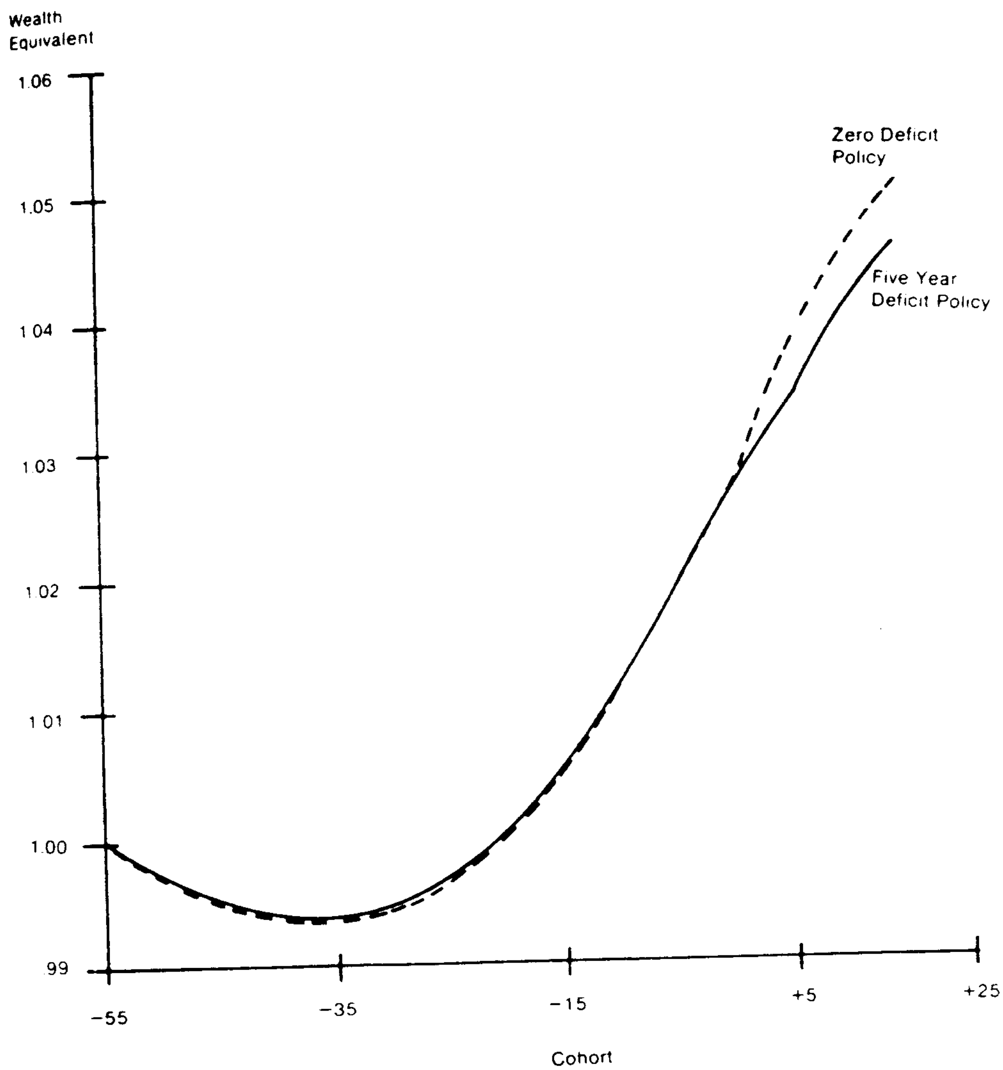

Figure 4-4 Wealth Equivalents, Full Investment Expensing

Dealing with Deficits

Various strategies have been offered to reduce short-run deficits associated with tax cut policies. In this section, we present three simulations that bear

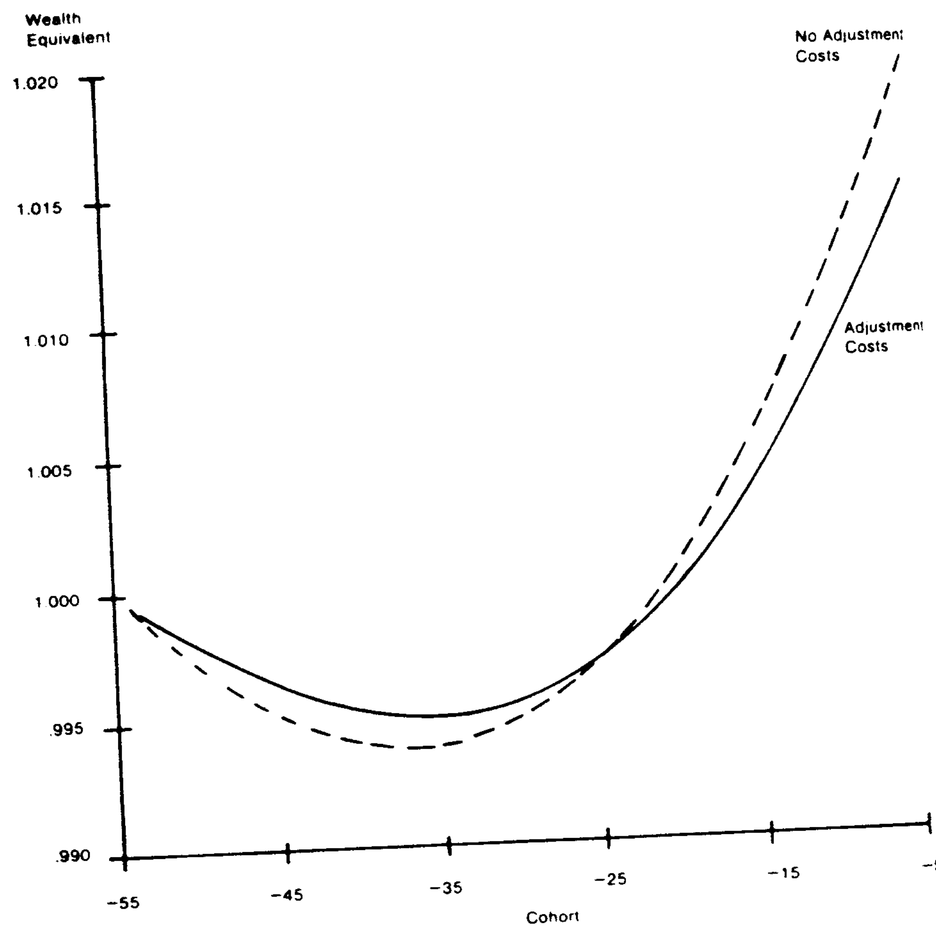

Figure 4–5 Wealth Equivalents. The Impact of Adjustment Costs (Switch to Expensing under Five Year Deficit Policy)

on the feasibility and advisability of avoiding short-run deficits while increasing the incentive to invest.

A typical solution to short-run revenue losses is a phase-in of investment incentives. This characterized the Economic Recovery Tax Act of 1981, which called for the acceleration of depreciation allowances to increase in 1981 and again in 1985 and 1986.[6] The problem with policies of this kind is that they induce capital losses gradually over the phase-in period. The awareness of potential investors of such future losses discourages investment in the short run, defeating the entire purpose of the legislation. This can be seen in the next simulation, which measures the effects of a five year phase-in of expensing without deficits, with the expensing fraction rising linearly from .2 in the first transition year to 1 in the fifth. Deficits are avoided by the adjustment of the income tax.

Though investment eventually expands under this policy, the short-run impact is to discourage investment. Figure 4–6 compares per capita capital stocks for the first twenty years of this policy with those arising from an immediate balanced budget switch to full expensing. The short-run disincentive to invest is also reflected by the drop in interest rates. The initial steady state interest rate is 8.22 percent. Under the investment phase-in policy, the gross interest rate (the yield that bonds would have to offer to provide the same after tax return as capital, inclusive of capital gains and losses) is negative until the phase-in is completed, and then jumps to over twelve percent. Thus, such a policy would sharply increase the slope of the yield curve.

A more successful way of avoiding deficits recognizes that investment incentives can often be achieved by raising rather than lowering capital income taxes. Recall that under a policy of full expensing that is effectively restricted to new capital the effective tax rate on capital income is zero. While the return on savings is not taxed at the margin, the increase in the statutory capital income tax rate increases the implicit wealth tax on existing capital. This reduces the consumption of wealth holders, permitting an expansion of national saving and investment. In addition, the extra revenue from the capital income tax allows the government to lower other taxes. Starting from an initial steady state with full expensing and a thirty percent income tax, raising the capital income tax rate to fifty percent allows an immediate drop in the wage tax rate to 26.5 percent (falling eventually to 21.6 percent) and an eventual increase in capital per person of 34.6 percent.

Finally, investment incentives may be self-financing in the long run, requiring no current or future increase in statutory tax rates to achieve a more capital intensive long-run steady state with no debt. As an example, from an initial steady state with no expensing consider a policy of moving directly to fifty percent fractional expensing, with the income tax held constant at thirty percent for twenty years; while there are short-run deficits, the expansion of the income tax base over time raises revenue sufficient to retire this debt. Indeed, in the twentieth year the debt-capital ratio is −.36 percent. This surplus permits a slight decrease in the income tax thereafter (to avoid an expanding surplus), to 29.2 percent in the twenty first year and 29.0

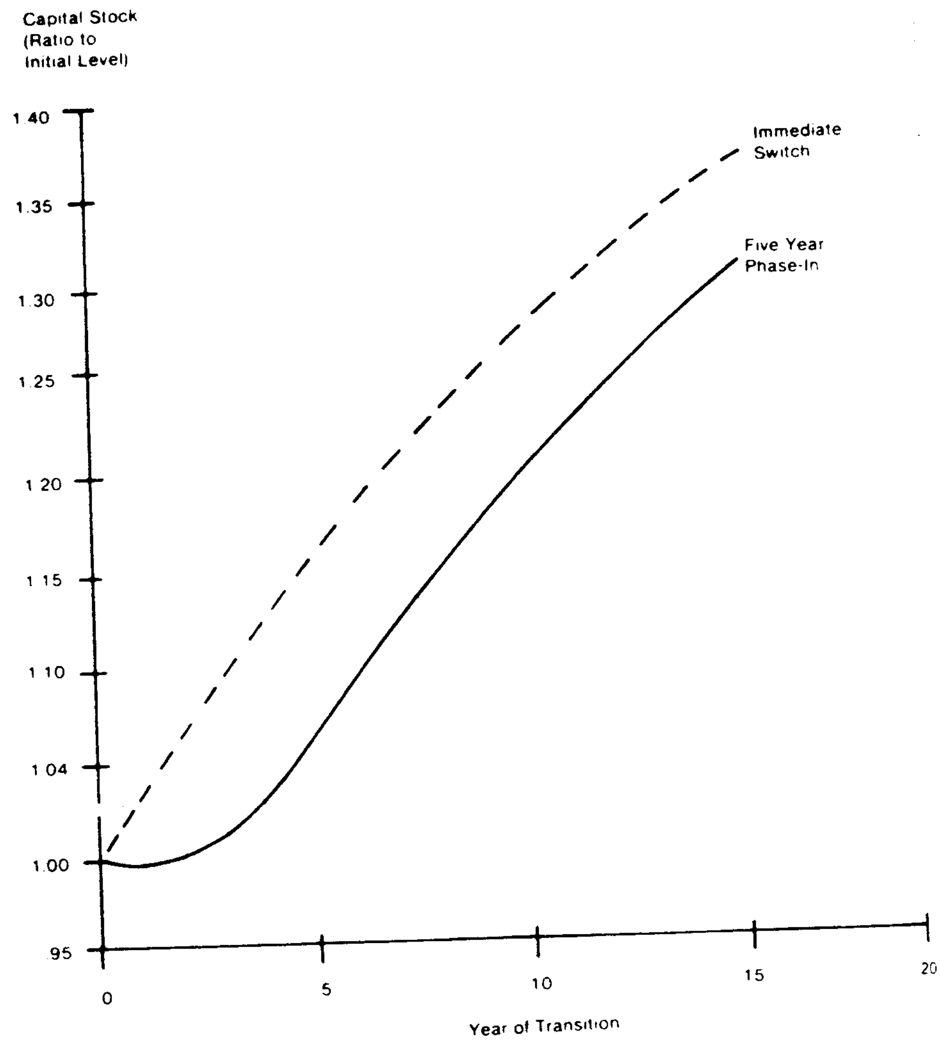

Figure 4–6 Capital Paths, Expensing Without Deficits

percent in the long run. The per capita capital stock increases by 25.9 percent in the long run.

Part of the explanation of this result is that, while taxes on capital income and, eventually, labor income decline, existing capital owners face increased implicit wealth taxation under this same policy. Their welfare declines, thus distinguishing this policy from those offered by the "free lunch" theorists. A second aspect of this policy is that the economy has shifted to a more efficient tax structure, substituting lump sum taxes on initial wealth holders for distortionary income taxes on current and future generations. These efficiency gains also provide economic resources to "cut taxes and raise revenues."

While this policy of fractional expensing eventually leads to surpluses and tax rate reductions, a policy of full expensing (discussed at the beginning of the previous section) does not have this feature, indicating the presence of nonlinearities in the functions determining the economy's behavior. One such nonlinearity is associated with the well known result that the excess burden of a tax rises at a rate proportional to the square of the tax rate itself. Thus, the initial reduction in the effective tax rate on saving induced by a policy of fifty percent expensing does proportionally more to reduce the distortion of savings behavior than does a policy of moving from fifty percent to full expensing.

Summary

The key difference between savings and investment incentives in closed economies is the applicability of these incentives to old as well as new capital. Investment incentives discriminate against old capital; savings incentives do not. This discrimination reduces the market value of old capital and, therefore, the economic resources of owners of the existing capital stock. The reductions in the resources and welfare of initial wealth holders under investment policies are essentially identical to those arising from a one time wealth tax.

In life cycle economies, the remaining resources of the elderly are held primarily in form of nonhuman as opposed to human wealth. The effective wealth tax generated by investment incentives falls, therefore, most heavily on the elderly. For a given time path of government consumption and given characteristics of tastes and technology, extra taxes on the currently elderly imply offsetting receipts of resources of young and future generations. In life cycle economies, the elderly have a greater marginal propensity to consume than the young because of their shorter life expectancies; future generations obviously have zero current marginal propensities to consume. Hence, the intergenerational redistribution of resources away from the elderly, arising from investment incentives, leads to a major reduction in the economy's current consumption. The reduction in the consumption of the elderly effectively finances the crowding in of investment.

For certain ranges of investment policy instruments, the long-term tax revenues arising from the increase in capital intensity are sufficient to finance the short-run loss in revenue from these incentives. Hence, there is a range of investment incentives that are self-financing. In general, deficits associated with investment incentives are less injurious to capital formation than those associated with savings incentives.

In contrast to investment incentives, savings incentives such as permanent reductions in the taxation of profits at the corporate level typically redistribute towards rather than away from the elderly. The impetus to current consumption arising from this redistribution—the income effect—is offset to some extent by the greater marginal incentive to save—the substitution effect of a higher after tax rate of return. The net impact of savings incentives on capital formation depends on the use of deficits to finance these incentives. As demonstrated here, deficit-financed reductions in capital income tax rates can sharply lower national capital formation.

The policy most conducive to capital accumulation involves simultaneously increasing investment incentives and capital income tax rates. Such a policy could eliminate deficits, raise the after tax return to marginal saving, and produce income and substitution effects that both operate in the direction of stimulating capital formation.

Notes

1. For the government to maintain long-term budget balance, it needs to choose a path of government consumption that equals $K_{t-1}(1 + F_{K_{t-1}})\tau_r$ in present value.
2. After the effective date of the 1982 Act, this result would be altered by the application of a fifty percent basis adjustment for new credits taken.
3. US Department of Commerce, Bureau of Economic Analysis, "Fixed Non-Residential Business and Residential Capital in the US, 1925–1975," PB 253 725, 1976.
4. *Flow of Funds*, "Balance Sheets for the U.S. Economy, 1945–1980," Board of Governors of the Federal Reserve System, Washington, D.C., 1981.
5. Auerbach, Kotlikoff and Skinner (1983) survey this literature.
6. The 1985 and 1986 changes have been repealed by the Tax Equity and Fiscal Responsibility Act of 1982.

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DISCUSSION

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It is a pleasure to comment on the Auerbach and Kotlikoff (AK) paper. I have found it fascinating, full of surprises and rich in paradoxes, though, admittedly, my enthusiasm may not be wholly unbiased. It turns out that their most unexpected and paradoxical results rely heavily on an unadulterated life cycle model, a model to which I am, understandably, attached and partial. In fact, their use of this model is even more extreme than some of my own applications in that they have "posited zero intergenerational altruism," or, in other words, they totally disregard the possibility and implications of an estate motive. I will come back to this issue. I am sure that the reader will hardly ever find a dull moment in their paper, although the presentation is frequently difficult and a bit too compact. I suspect that they have lived and become accustomed to those unusual results and paradoxes and thus overestimate the ability of the average reader to catch on.

I am happy to find that their paper largely confirms my long held conviction that common garden variety investment incentives, such as reductions in the taxation of profits and other property income, if financed by deficit, can be expected on balance to reduce rather than lift capital formation and the long-run stock of capital through its negative effect on net national saving. Their novel contribution consists in showing that different types of incentives can produce widely different results and that there is in particular a class of incentives that may succeed in increasing saving and investment without requiring any significant increase in some taxes in order to finance them. These incentives belong to a type that they label investment incentives. They are characterized by the feature that, like the investment tax credit, they apply only to newly produced capital goods. What makes these incentives work differently is the simple fact that they can be expected to reduce the market value of all preexisting capital. This can be seen quite clearly in the most elementary case where the government offers, for example, a fifty percent subsidy on new investment. Since the impact effect of this is to double the rate of return on new investments, the rate at which returns from capital are capitalized must double, halving the value of any infinite lived assets and reducing the value of all other, depending on their remaining life.

Now suppose that, for some reason, the community wishes, in long-run equilibrium, to maintain a stable ratio of wealth at market value to income. Then, in response to the initial decline in the market value of its wealth, the community will increase its saving rate, and accumulate capital, until the market value of wealth goes back to the initial level. But this same market value will now represent a larger physical quantity. (More generally, the value of capital will rise back to the initial multiple of incomes which, presumably, will also have risen because of the additional real capital).

The additional accumulation of capital and consequent increase in productivity is clearly a desirable outcome. But it should be noted that it is achieved at the expense of those who owned the capital that lost value; they are made poorer and need to save to reconstruct the capital lost. In other words, as the authors point out, the investment incentive acts like a capital levy. The authors rightly refer to this rise in the capital stock as a crowding in effect since it is the mirror image of the crowding out effect that occurs when the government finances a deficit on current account by tapping the current flow of saving and reducing thereby capital formation and the future stock of capital. But just like crowding out is basically beneficial to the current generation at the expense of future generations that will have less capital, so, investment incentives and the resulting crowding in benefit future generations at the expense of the current one. As the authors well put it, this distinguishes "this policy from those offered by 'free lunch' theorists."

The effects of investment incentives just described should hold, in particular, under life cycle saving, since such a model has precisely the property that the wealth income ratio tends to a constant (which depends on the rate of growth of income). In addition, by relying on a life cycle model, one can make inferences as to who is likely to lose and how the additional savings comes about. As to the first question, the loss should fall prevailingly on the old, and notably on the retired, who finance their consumption from the past accumulation of capital; and the additional aggregate saving basically comes about because the old can command less consumption goods as they sell their unexpectedly less valuable assets to the young. On the other hand, the young have no reason to consume more. If anything, they might be more likely to consume less, if the higher return on capital produces a substitution effect larger than the income effect. The reduction of consumption or rise in saving which occurs while the older generation leaves the scene, produces a one time increase in the stock of real capital.

Given these characteristics, I am not sure I am prepared to share the authors' enthusiasm for their newly discovered gadget. At any rate, as a representative of those oldsters who presumably stand to lose most from investment incentives, I would like to suggest that one can make a strong case that a redistribution of wealth from the old to the young is the most cruel type of redistribution. The old, in contrast to the young, have no opportunity to recoup. Indeed, it is precisely on this ground that in a number of my writings I have suggested that unexpected inflation is particularly bad because, like investment incentives, it redistributes wealth to future generations at the expense of the old. And, there are, of course, other devices that would work in the same general way: e.g., a Henry George type of tax on pure rent.

In the light of these equity considerations, I would suggest that, if there is a clear case for a higher capital intensity—which the authors implicitly assume by considering a stationary economy with a positive rate of return—then it should be achieved at the expense of the young who will benefit from it, rather than at the expense of the old. Thus, I would favor a policy of reducing capital income tax financed by higher wage taxes, which is illustrated in figures 4–1 and 4–2 by the dotted lines. I hope I am not unfairly swayed by that rising section of the curve in figure 4–2 between ages −55 and −30.

Another valuable aspect of the paper consists in pointing out that the incentives can take many forms—an outright subsidy or capital contribution is only one, but there are others, like investment credit and expensing: it is the latter device that the authors consider explicitly. This specific incentive has, among other things, the nice feature of giving rise to what is clearly the prized paradox in their analysis: namely, under appropriate conditions, investment and the capital stock can be increased by raising rather than lowering the tax on capital income. The condition is the existence or introduction of a full or high rate of expensing, since the reduction in the value of existing capital is larger the larger the benefit of expensing, and that benefit in turn clearly rises with the tax rate.

In closing I would like to speculate briefly on the extent to which their results would be affected by allowing for a bequest motive. Clearly the answer must depend on the determinant of bequests. Presumably in a pure Barro-type world, the investment incentive would leave the consumption path entirely unchanged, and just permanently reduce the market value of wealth carried by the community (on the assumption of course that the old have enough wealth to enable them to maintain their consumption at the expense of bequests, or can count on the help of their living children—the potential gainers). I personally assign zero belief to Barro's hypothesis as a model of prevailing behavior, in part because I have shown that, at least for the US, the evidence is strikingly inconsistent with the prediction of that model (see Modigliani, "The Life Cycle Hypothesis of Saving, the Demand for Wealth and the Supply of Capital," *Social Research*, Vol. 33, 1966, 160–217, and some forthcoming updating). I assign, instead, high credence to a model in which the share of life wealth bequeathed by a given household is a rising function of its position in the distribution of life wealth. With some further assumptions about the stability in time of the distribution of life wealth, that model again implies a constant ratio of income to the market value of wealth. But this means that, by and large, AK's conclusions should continue to hold in the long run, though a difference could still arise from the fact that it would take longer to reach long-run equilibrium.