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LONG RUN EFFECTS OF THE ACCELERATED COST RECOVERY SYSTEM

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This paper represents part of a larger ongoing project to build and use a numerical general equilibrium model of the U.S. tax system. Charles Ballard, Charles Becker, Larry Dildine, Hudson Milner, John Shoven, and John Whalley have not only participated in the construction of this model, but have also made substantial contributions to this paper. We are also grateful for helpful suggestions and data from Barbara Fraumeni, Jane Gravelle, Charles Hulten, Dale Jorgenson, and Martin Sullivan. We are grateful to Thomas Kronmiller for research assistance, to the Treasury Department's Office of Tax Analysis for financial assistance, and to the National Science Foundation for financial assistance under Grant No. SES8025404. Any opinions, findings, and conclusions expressed in this publication are those of the authors and do not necessarily reflect the views of the Office of Tax Analysis, the NBER, or the National Science Foundation. The research reported here is part of the NBER's research program in Taxation and project in Capital Formation.

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ABSTRACT

Much of the debate surrounding the enactment of President Reagan's tax plan was concerned with the short run effects of macroeconomic stimulation. Now that the Economic Recovery Tax Act of 1981 has become law, it is appropriate to look again at the long run effect of these tax cuts. This paper measures, for 37 different assets and for 18 different industries, the reduction in effective corporate tax rates that result from the acceleration of depreciation allowances and the expansion of the investment tax credit. It also uses a detailed dynamic general equilibrium model of the U.S. economy to simulate the effects of the new Accelerated Cost Recovery System (ACRS) on revenues, investment, long run growth, and capital allocation among industries. We find significant welfare gains from ACRS, but we find larger welfare gains from alternative plans that were not adopted.

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I. Introduction

Much of the debate surrounding the enactment of President Reagan's tax plan was concerned with the short run effects of macroeconomic stimulation. With existing combinations of high inflation and high unemployment, most of us were concerned with using tax cuts to encourage business investment and employment without causing unacceptable budget deficits. Now that the Economic Recovery Tax Act of 1981 has become law, it is appropriate to look again at the long run effect of these tax cuts. This paper estimates the likely effects of the new Accelerated Cost Recovery System (ACRS) on revenues, investment, long run growth, and capital allocation among industries. We will investigate whether attempts to stimulate total investment have had adverse effects on the use of that investment. We find significant welfare gains from ACRS, but we find larger welfare gains from alternative plans that were not adopted.

The general approach of this paper is really a combination of two approaches. The first uses a Hall-Jorgenson (1967) cost-of-capital formula to look at the incentive effects of alternative tax rules. The second approach uses a general equilibrium model in the tradition of Harberger (1962) to calculate tax incidence and welfare effects of discriminatory taxes on capital. Both of these approaches have advanced over the years, however, and we will combine more recent formulations of these two models in this paper. In doing so, we will abstract entirely from short run issues of macroeconomic stabilization. In particular, we assume a constant and correctly anticipated inflation rate. We also assume full employment of productive factors. There is no involuntary unemployment in our model, but there is a labor-leisure choice on the part of individuals. This "voluntary unemployment" depends on expected after-tax earnings. Similarly, there is no underutilization of industrial capital, but there is a savings-consumption decision on the part of individuals. The growth of the capital stock thus depends on the expected after-tax return to capital.

The Economic Recovery Tax Act of 1981 (also referred to here as the Reagan tax plan) changes two key provisions for capital cost recovery, depreciation allowances and the investment tax credit. Under the new Accelerated Cost Recovery System (ACRS), any depreciable asset falls into one of four classes and is given a tax life of 3, 5, 10, or 15 years. Autos, light-duty trucks, and R & D equipment will be depreciated over 3 years, and most other equipment will be depreciated over 5 years. A 10-year life for depreciation purposes will be granted to relatively short-lived public utility property, and a 15-year life will be granted to other public utility property and most structures. These recovery periods replace the previous system of basing tax lives on expected useful lives. For most assets, the new tax lives are considerably shorter than their economic lives.

Although these shorter lives are effective immediately, the depreciation schedule is less accelerated during a five year phase-in period. After 1985, equipment can again be depreciated by double declining balance with a switch to sum-of-the-years-digits. All structures immediately receive a 175 percent declining balance rate, replacing both the 150 percent rate for nonresidential property and the 200 percent rate for new residential property. Structures can still switch to straight line.

The Reagan plan has also increased the investment tax credit. Equipment with a recovery period of three years is now eligible for a six percent credit, and all longer-lived equipment receives a ten percent credit.

These depreciation and investment tax credit provisions have implications for the effective tax rate on a marginal investment in each type of equipment or structure. In this paper we will calculate and compare effective tax rates under the old law and under the new law, along the lines suggested in papers by Jorgenson and Sullivan (1982) and by Hulten and Wykoff (1981). These papers were written before the law was enacted, however, and they evaluated cost recovery proposals that were somewhat different from the 15-10-5-3 plan with tax credit changes that was actually adopted. Our method also differs from theirs by comparing tax rates under the assumption of tax-minimizing depreciation choices by firms. We take this approach because we are unable to consistently compare actual depreciation practices under the old law and under the new law: actual practices are not yet available for the new law. Finally, since we want long-run effects of these changes, we evaluate only the post-1985 depreciation rules for new investments.

Both the Hulten-Wykoff (HW) study and the Jorgenson-Sullivan (JS) study conclude that the adoption of a 10-5-3 approach drastically reduces effective tax rates. Because depreciation is accelerated rather than indexed, a reduction of inflation would send effective tax rates negative. They differ, however, in their conclusions about interindustry distortions. JS find that the new capital recovery system would widen the gaps among tax rates in different industries, implying less efficient allocation of capital than under the previous law. HW find that that the 10-5-3 proposal would make interindustry tax distortions lower among non-residential sectors.

The major difference between our study and the other two is that we go on to measure the size of efficiency changes associated with the new depreciation law. We capture not only intersectoral misallocations associated with tax rate differences, but also the intertemporal misallocation of resources associated with the overall level of capital taxation.

Efficiency effects are measured with the use of a computational general equilibrium model of the U.S. economy and tax system. This model is capable of second-best evaluation with simultaneous distortions due to corporate taxes, personal taxes, and property taxes. It encompasses tax advantages on owner-occupied housing, observed differences in the extent to which firms of each industry are incorporated, and observed differences in the financial policies of the firms in each industry. These existing distortions are important for measuring the interindustry effects of the Reagan capital cost recovery plan, because nonneutralities of the new tax code may reinforce or offset existing nonneutralities.

Finally, our study includes evaluation of other investment incentive plans that were not adopted. The Auerbach-Jorgenson (1980) first year capital recovery plan gives firms a depreciation deduction at the outset equal to the expected present value of economic depreciation. This proposal effectively indexes depreciation allowances to inflation, as discussed by Jorgenson and Sullivan (1982) and by Hulten and Wykoff (1981). We also look at the effects of indexing capital gains taxes.

Following this introduction, Section II derives the formulas for effective marginal tax rates. The Reagan plan is described in more detail, as is necessary to demonstrate the calculation of present values for depreciation allowances in each asset category. Our 37 assets include twenty types of equipment, fourteen types of structures, residential housing, land, and inventories. Section III proceeds to do those calculations, presenting tax lives, investment tax credit rates, and overall effective marginal tax rates for each tax scheme we consider.

Section IV presents the major features of the Fullerton-Shoven-Whalley (FSW) general equilibrium model used to simulate the above tax changes.

the asset to (1-k)q. Second, the firm receives a reduction in taxes due to depreciation allowances. The present value of this deduction per dollar of investment will be denoted by z, so the total tax reduction is uzq. The particular value for z will reflect the tax lifetime for the asset, the depreciation formula, and the basis (historical or replacement cost) on which the depreciation allowances are taken. It will also reflect the discount rate.

With the inclusion of all these features of the tax code, the equilibrium condition is expressed as:

$$(1-k)q = \int_0^\infty (1-u)ce^{(\pi-\delta)\tau} e^{-i(1-u)\tau} d\tau + uzq. \qquad (1)$$

The gross of depreciation rental rate, c/q, is then a function of the tax parameters as well as i, δ, and π :

$$c/q = \frac{i(1-u) - \pi + \delta}{1-u} (1 - k - uz) . \qquad (2)$$

We will denote by ρ the real rate of return net of depreciation:

$$\rho = c/q - \delta. \qquad (3)$$

The concept of the effective corporate tax rate refers to a measure of the difference between ρ, the real rate of return net of depreciation, and s, the opportunity cost to the corporation. To measure s, we note that the corporation arbitrages between real capital and bonds yielding $i(1-u) - \pi$. It is therefore a borrower or lender at the real after-tax interest rate. We thus take $s = i(1-u) - \pi$ as the corporation's net of tax return to saving.

Since this model specifies 18 private industry categories, we convert the vectors of 37 asset tax rates to vectors of 18 industry tax rates by using unpublished data from Dale Jorgenson on the stock of each asset used in each industry. However, these marginal tax rates by industry are not directly applicable to the FSW model which requires tax rates based on the ratio of taxes paid to capital income. Section V describes our procedure to convert the marginal tax rates into rates appropriate for that model.

The resulting simulations of each tax plan are described in Section VI, and Section VII is a brief conclusion.

II. Effective Tax Rates on Capital

To calculate effective tax rates for different assets, we start with the cost of capital formula developed by Hall and Jorgenson (1967). The underlying premise behind this formula is that the profit maximizing firm will undertake a marginal investment project if it earns a return net of tax such that the present value of cash flows is at least equal to the initial outlay. Under competitive equilibrium conditions the two will be exactly equal. Denote the acquisition cost of the asset by q. Assume that the rental rate is initially equal to c, but that it grows at the rate of inflation, π. Further assume that the quantity of capital embodied in the investment declines at the economic depreciation rate δ. If the statutory marginal corporate income tax rate is u, the net of tax rental receipts from the investment at time τ will equal $(1 - u)ce^{(\pi - \delta)\tau}$. To derive the present value of such a stream, these nominal cash flows would be discounted at the nominal after-tax interest rate, $i(1 - u)$.

Capital cost recovery provisions affect the rental rate in two ways. First, an investment tax credit at rate k lowers the acquisition cost of

It is common to express the difference between ρ and s as a proportion of ρ, the gross of tax return. Under this approach, the "gross" corporate tax rate is

$$t_c^g = (\rho - s)/\rho \quad . \tag{4}$$

For investments outside the corporate sector, the statutory income tax rate for the corporation, u, is replaced by the marginal income tax rate for the proprietor, m. It is then straightforward to rederive equations (1) through (4), identical except for the use of m in place of u.

We turn next to the measurement of z, the present value of depreciation allowances on a dollar of investment. The easiest case to consider is that of the Auerbach-Jorgenson proposal, where firms receive a first year deduction equal to the expected present value of economic depreciation, using replacement cost as a basis. Given a constant economic depreciation rate δ for either equipment or structures, the value of this allowance is:

$$z = \int_0^\infty \delta e^{-\delta\tau} e^{-(i(1-u) - \pi)\tau} d\tau \tag{5}$$

$$= \frac{\delta}{i(1-u) - \pi + \delta}$$

The Auerbach-Jorgenson proposal treats all assets symmetrically. It thus provides a high first year deduction for equipment with a high δ, a low deduction for structures with a low δ, and no deduction for land and inventories which do not depreciate. In contrast, both the old tax law and the Reagan plan have separate depreciation rules for equipment and for structures.[1/]

For equipment, both the old and the new tax laws allow double declining balance (DDB), with a switch to sum-of-the-years'-digits (SYD). This combination is used here as tax-minimizing practice because it can be shown to provide the earliest possible depreciation deductions.[2/] Define L as the asset's lifetime for tax purposes, an integer number of years. Define G as the time of the optimal switch, and B as the declining balance rate (equal to 2.0 for equipment). We can then define $b \equiv B/L$ as the exponential rate for the first part of the asset's life. Since DDB starts out with higher depreciation allowances, and since SYD on the remaining basis must eventually exceed DDB, the optimal switching point can be found by equating depreciation under the two methods:

$$\frac{L-G}{S(L-G)} = \frac{2}{L} \tag{6}$$

where the S function is defined by

$$S(x) = \sum_{j=0}^{x} (x - j) \tag{7}$$

if x is an integer. As seen below for cases where x is not an integer, the summation goes from zero to the integer part of x.

Normally the firm would use DDB in the first year, would be indifferent in the second year, and would switch to SYD by the third year of the asset's life. However, both the old and new tax laws make use of the half year convention, assuming that all assets were bought on July 1. The firm thus uses DDB for $G = 1\frac{1}{2}$ years, and SYD afterwards. Take, for example a one-dollar asset with L=5, B=2, and b=.40. Then the firm would deduct .2 (half of b) in the year of purchase and .32 (b times .8) in the first full taxable year. Switching to SYD for the .48 remaining basis over 3.5 years, the firm would use numerators of 3.5, 2.5, 1.5, and .5 respectively. The sum of those figures for the denominator is 8.0, as defined by S(L-G) in equation (7) where L-G is not an integer. These depreciation charges are discounted at the nominal after tax rate of return because allowances are on a historical cost basis. The general expression for the present value of depreciation deductions under the old law is: [3/]

$$z = b \int_0^{\frac{1}{2}} e^{-i(1-u)\tau}\, d\tau + b\left(1 - \frac{b}{2}\right) \int_{\frac{1}{2}}^{1\frac{1}{2}} e^{-i(1-u)\tau}\, d\tau \qquad (8)$$

$$+ \left(1 - \frac{b}{2}\right)(1-b). \quad \sum_{J=2}^{L} \frac{L - (J - \frac{1}{2})}{S(L - G)} \int_{J-\frac{1}{2}}^{J+\frac{1}{2}} e^{-i(1-u)\tau}\, d\tau \; .$$

The integration is not performed here to save space.

The new tax law is based on the same principles, but it incorporates two interesting differences. First, depreciation of the last half year is moved up. As a result, the 3 year class is depreciated in only $2\frac{1}{2}$ years, the five year class in $4\frac{1}{2}$ years, and the 10 year class in $9\frac{1}{2}$ years. For the five year asset example, depreciation deductions are .2 in the first half year and .32 in the first full year, but the remaining .48 basis is given SYD treatment over only 3 remaining years. Second, the taxpayer is not given the choice of when to switch. If the firm selects a 5 year life for equipment, the law actually provides a table requiring deductions of .2, .32, .24, .16, and .08, starting in the year of purchase. The general expression for z under the new law is thus:

$$z = b \int_0^{\frac{1}{2}} e^{-i(1-u)\tau}\, d\tau + b(1 - \frac{b}{2}) \int_{\frac{1}{2}}^{1\frac{1}{2}} e^{-i(1-u)\tau}\, d\tau \tag{9}$$

$$+ (1 - \frac{b}{2})(1-b) \sum_{J=2}^{L} \frac{L - J}{S(L - G - \frac{1}{2})} \int_{J-\frac{1}{2}}^{J+\frac{1}{2}} e^{-i(1-u)\tau}\, d\tau .$$

Finally, for structures, both laws specify a declining balance rate with a switch to straight line. The switch time G is again found where the two methods provide the same deductions. Since continued exponential deductions would allow B/L of remaining basis, and since straight line would allow 1/(L-G) of the same remaining basis, we can set these two expressions equal to each other and solve for G as:

$$G = (\frac{B - 1}{B})L . \tag{10}$$

With B = 1.5 for structures under the old law, firms would switch after 1/3 of the asset's life. With B = 1.75 under the new law, G is 3/7 of L. In either case, the firm must begin straight line at the start of a tax year. For a 15-year structure under the new law, for example, G would be 6.42 years. If we assume mid-year purchase dates on average, the firm actually switches after 6.5 years. The general expression for z under both laws is then:

$$z = b\int_0^{\frac{1}{2}} e^{-i(1-u)\tau}\, d\tau + b(1 - \frac{b}{2}) \sum_{J=0}^{G-1\frac{1}{2}} (1-b)^J \int_{J+\frac{1}{2}}^{J+1\frac{1}{2}} e^{-i(1-u)\tau}\, d\tau \tag{11}$$

$$+ (1 - \frac{b}{2})(1-b)^{(G - \frac{1}{2})} \cdot \frac{1}{L - G} \cdot \int_G^L e^{-i(1-u)\tau}\, d\tau$$

III. The Marginal Tax Rates Under Each Tax Regime

This section presents marginal tax rates for 37 assets under the provisions of the old tax code, the Economic Recovery Tax Act of 1981, and the Auerbach-Jorgenson first year capital recovery plan. These tax rates, for each version of the law, are then combined with information on the use of each asset by each of the 18 private industries to derive marginal effective corporate tax rates for each industry.

Equations (1) to (4) express the tax rate as a function of u, i, π, δ, k, and z. We will discuss u, i, and π first because those parameters do not vary by asset. The corporate tax rate u is taken as .46, the top statutory rate on corporations. The great bulk of corporate investment is undertaken by firms in this bracket.

To obtain the nominal interest rate i, we start with the assumption that the after tax rate of return would be .04 in the absence of inflation. The before tax interest rate with no inflation, i_o, would be .04/(1-u). The interest rate with inflation then depends on how π affects i. Empirical evidence in Feldstein and Summers (1978) and in Summers (1981) supports a "strict" version of Fisher's Law, where inflation adds point for point to nominal interest:

$$i = i_o + \pi \ . \tag{12}$$

In this formulation the real after tax interest rate s, which equals $i(1-u)-\pi$. would fall with π. Alternatively, evidence in Jorgenson and Fraumeni (1980) supports a "modified" version of Fisher's Law, where inflation adds more than point for point to nominal interest, enough to maintain the .04 real after tax return:[4/]

$$i = i_o + \frac{\pi}{1 - u} \tag{13}$$

We use both (12) and (13) to obtain alternative values of i.

For the expected inflation rate π, we use .07 in the standard case. This value reflects the gross private domestic product deflator between 1970 and 1980. For sensitivity, we also discuss some results with inflation rates of four and ten percent.

Other parameters vary across the 37 asset categories listed in column 1 of Table 1.[5/] Economic depreciation rates δ are taken from Hulten and Wykoff (1982), as shown in column 2 of Table 1. These rates range from a low of .015 for housing to a high of .333 for automobiles. Inventories and land are assumed not to depreciate.[6/]

The rate of investment tax credit k varies not only by asset but also according to the tax law being simulated. For the old law, in column 3 of Table 1, we use the statutory rates of .10 for public utility structures and equipment with at least a 7 year tax life, .067 for equipment with at least a 5 year life, and .033 for equipment with at least a 3 year life. Though other studies have shown lower effective ITC rates due to insufficient tax libability and incomplete carryover provision, our use of statutory rates is consistent with the assumptions of our steady state equilibrium model. In such a model, no firm would have abnormal profits, but all would have normal profits and tax liability.

Finally, the present value of depreciation allowances also varies by asset and tax law. Equations (8) to (11) express z as a function of the tax lifetime L and the declining balance rate B, as well as the nominal discount rate i(1-u). For the old law, guideline lifetimes for each asset

Table 1

Parameters and Effective Corporate Tax Rates for Each Asset under Modified Fisher's Law

	1. Asset	2. Hulten-Wykoff Depreciation Rate	Old Law: 3. ITC Rate	Old Law: 4. Lifetime	Old Law: 5. Gross Tax Rate	New Law: 6. ITC Rate	New Law: 7. Lifetime	New Law: 8. Gross Tax Rate
1	Furniture and Fixtures	0.110	0.100	8.00	0.084	0.100	5.00	-0.228
2	Fabricated Metal Products	0.092	0.100	10.00	0.173	0.100	5.00	-0.195
3	Engines and Turbines	0.079	0.100	12.48	0.240	0.100	5.00	-0.172
4	Tractors	0.163	0.067	5.00	0.086	0.100	5.00	-0.336
5	Agricultural Machinery	0.097	0.100	8.00	0.077	0.100	5.00	-0.204
6	Construction Machinery	0.172	0.100	7.92	0.107	0.100	5.00	-0.356
7	Mining and Oil Field Machinery	0.165	0.100	7.68	0.083	0.100	5.00	-0.340
8	Metalworking Machinery	0.123	0.100	10.16	0.212	0.100	5.00	-0.252
9	Special Industry Machinery	0.103	0.100	10.16	0.191	0.100	5.00	-0.215
10	General Industrial Equipment	0.123	0.100	9.84	0.197	0.100	5.00	-0.252
11	Office and Computing Machinery	0.273	0.100	8.00	0.160	0.100	5.00	-0.632
12	Service Industry Machinery	0.165	0.100	8.24	0.130	0.100	5.00	-0.340
13	Electrical Machinery	0.118	0.100	9.92	0.196	0.100	5.00	-0.243
14	Trucks, Buses, and Trailors	0.254	0.067	5.00	0.120	0.100	5.00	-0.571
15	Autos	0.333	0.033	3.00	0.198	0.060	3.00	-0.335
16	Aircraft	0.183	0.100	7.00	0.018	0.100	5.00	-0.382
17	Ships and Boats	0.075	0.100	14.40	0.281	0.100	5.00	-0.166
18	Railroad Equipment	0.066	0.100	12.00	0.207	0.100	5.00	-0.151
19	Instruments	0.150	0.100	8.48	0.139	0.100	5.00	-0.308
20	Other Equipment	0.150	0.100	8.16	0.116	0.100	5.00	-0.308
21	Industrial Buildings	0.036	0.0	28.80	0.513	0.0	15.00	0.409
22	Commercial Buildings	0.025	0.0	47.60	0.514	0.0	15.00	0.370
23	Religious Buildings	0.019	0.0	48.00	0.491	0.0	15.00	0.348
24	Educational Buildings	0.019	0.0	48.00	0.491	0.0	15.00	0.348
25	Hospital Buildings	0.023	0.0	48.00	0.509	0.0	15.00	0.365
26	Other Nonfarm Buildings	0.045	0.0	30.90	0.549	0.0	15.00	0.437
27	Railroads	0.018	0.100	24.00	0.266	0.100	15.00	0.167
28	Telephone and Telegraph	0.033	0.100	21.60	0.294	0.100	15.00	0.204
29	Electric Light and Power	0.030	0.100	21.60	0.285	0.100	15.00	0.196
30	Gas	0.030	0.100	19.20	0.260	0.100	10.00	0.090
31	Other Public Utilities	0.045	0.100	17.60	0.277	0.100	10.00	0.108
32	Farm	0.024	0.0	25.00	0.453	0.0	15.00	0.366
33	Mining, Shafts and Wells	0.056	0.0	6.80	0.263	0.0	5.00	0.273
34	Other Nonbuilding Facilities	0.029	0.0	28.20	0.486	0.0	15.00	0.385
35	Residential	0.015	0.0	40.00	0.443	0.0	15.00	0.333
36	Inventories	0.0	0.0	∞	0.460	0.0	∞	0.460
37	Land	0.0	0.0	∞	0.460	0.0	∞	0.460

provide the midpoints of the Asset Depreciation Range (ADR) system. We take these lifetimes from Jorgenson-Sullivan (1982) and ignore the possibility of shorter lives substantiated by facts and circumstances. Most structures are assigned these lives directly, but the ADR system allows 20 percent longer or shorter lives for equipment and public utility structures. Because of our optimizing tax practice assumption, these assets are assigned lives that are 80 percent of ADR midpoints, except where the use of a longer life would reduce effective taxes through eligibility for a higher investment tax credit. The resulting vector of lives, shown in column 4 of Table 1, is consistent with the ITC vector in that 3 and 5 year assets get a third and two-thirds of the full investment tax credit, respectively. [7/]

Equipment (assets 1-20) and public utility structures (assets 27-31) use double declining balance (B = 2.0) and sum-of-the-years'-digits in equation (8) to obtain z under the old law. Other structures use B = 1.5 with a switch to straight line in equation (11). Housing (asset 35) uses B = 2.0, switching to straight line, also in equation (11). When all of the resulting z values are combined with Modified Fisher's Law(MFL) and the parameters described above, we obtain the effective corporate tax rates t_c^g, shown in column 5 of Table 1.

This column demonstrates considerable variance of effective tax rates by asset. Aircraft, for example, had a 7 year life, accelerated depreciation, and full investment credit, resulting in an effective tax rate of less than two percent. Structures, without those tax reducing features, were often taxed at rates greater than 46 percent due to historical cost depreciation with inflation. Inventories and land are effectively taxed at exactly the statutory rate because they receive economic depreciation (at rate zero) and no investment credit.[8/]

Not shown in Table 1 are the tax rates resulting from alternative i and π combinations. With Strict Fisher's Law (SFL), the tax rates appear to have even more variance. In all cases, however, both ρ and s are reduced. As a result, the tax or subsidy as a proportion of ρ can appear large even when the wedge (ρ-s) is small. As shown in Bradford-Fullerton (1982), t_c^g can even have the wrong sign when an asset is so subsidized that the before tax return is negative in the denominator. Such anomalies occur for several assets under SFL, but we use only industry tax rates in the model. These are defined by $(\bar{\rho}-s)/\bar{\rho}$, where $\bar{\rho}$ is the asset-weighted average of ρ for each industry. 9/ Since $\bar{\rho}$ is always positive, and since s is positive, t_c^g by industry are always well defined.

Column 1 of Table 2 shows the eighteen industries of our model, while column 2 shows their effective corporate tax rates under MFL. Land intensive industries such as real estate and agriculture are weighted towards the .46 effective tax rate on that asset. The low rate on transportation, communications and utilities reflects the tax credits for public utility structures as well as the low rate for the aircraft example mentioned above. Next, effective tax rates of column 3 portray the same tax regime, but under the assumption of Strict Fisher's Law. Because of lower gross of tax returns $\bar{\rho}$, these tax rates are both higher and more variant than under MFL.

Turning now to effective tax rates under the Accelerated Cost Recovery System (ACRS), we begin with the statutory credits shown in column 6 of Table 1. Five-year equipment and public utility structures all get ten percent credits while three-year assets receive a six percent credit. Because of our equilibrium model with no carryover problems, both sets of tax rates reflect statutory credits and do not reflect any increase in

Table 2

Effective Corporate Tax Rates for Each Industry

	1. Industry	Old Law 2. MFL*	Old Law 3. SFL*	New Law 4. MFL*	New Law 5. SFL*
(1)	Agriculture, Forestry and Fisheries	0.443	0.440	0.432	0.404
(2)	Mining	0.410	0.552	0.262	0.147
(3)	Crude Petroleum and Gas	0.389	0.571	0.325	0.497
(4)	Construction	0.403	0.346	0.361	0.134
(5)	Food and Tobacco	0.434	0.521	0.366	0.331
(6)	Textile, Apparel and Leather	0.427	0.507	0.357	0.309
(7)	Paper and Printing	0.407	0.511	0.300	0.197
(8)	Petroleum Refining	0.457	0.594	0.381	0.437
(9)	Chemicals and Rubber	0.391	0.468	0.283	0.092
(10)	Lumber, Furniture, Stone, Clay and Glass	0.422	0.518	0.333	0.251
(11)	Metals and Machinery	0.430	0.506	0.363	0.307
(12)	Transportation Equipment	0.450	0.528	0.404	0.406
(13)	Motor Vehicles	0.403	0.461	0.305	0.080
(14)	Transportation, Communication and Utilities	0.284	0.332	0.131	-0.318
(15)	Trade	0.446	0.477	0.416	0.382
(16)	Finance and Insurance	0.483	0.626	0.403	0.486
(17)	Real Estate	0.447	0.569	0.371	0.453
(18)	Services	0.385	0.487	0.201	-0.283

* Modified Fisher's Law (MFL) and Strict Fisher's Law (SFL) are explained in the text.

availability of the credit through the new law's extended carryover and leasing provisions.

Column 7 displays lifetimes of each asset under the new law, assuming again that each asset is homogeneous. The law assigns a three year life to autos, light trucks, R & D equipment, certain racehorses, and personal property with an ADR midpoint of four years or less. Our level of aggregation shows autos with a three year life, but none of the other assets has an (average) ADR midpoint of four years or less. Thus, all other equipment gets a five year life. Similarly, for public utility structures, we assigned a ten year life to any asset category with an ADR midpoint between 18 and 25 years, as provided in the law. All other structures have a 15 year life, except mining, shafts, and wells which we reduced from 6.8 to a 5 year life.

The lives for equipment and public utility structures are combined with B = 2.0 in equation (9) to calculate z and effective tax rates. The lives for other structures are combined with B = 1.75 in equation (11).[10/] Resulting t_c^g are shown for Modified Fisher's Law in column 8 of Table 1. Effective tax rates are clearly and consistently negative for all types of equipment and positive for all types of structures. There is no a priori reason to believe that inter-asset distortions would be reduced by this tax change.

Notice also how sensitive tax rates are to lifetimes and credits. As the lifetime for computers (asset 11) changes from 8 to 5 years, the effective tax rate changes from plus 16 to minus 63 percent. As the credit for autos (asset 15) changes from .033 to .06, its effective tax rate changes from plus 20 to minus 33.5 percent.

The corresponding industry tax rates are shown in column 4 of Table 2. The fact that all these rates exceed zero reflects comparatively high weights on structures, inventories and land in all industries. Because tax rates are all lower than under the old law, intertemporal distortions might be reduced. But because they still exhibit considerable variance, there is no *a priori* reason to believe that intersectoral distortions will be reduced. Column 5 provides new effective tax rates under SFL, rates that are again lower than those of the old tax regime. Because the tax rates start out higher under SFL, however, we might expect Reagan's tax plan to produce greater intertemporal gains under SFL than under MFL.

For both MFL and SFL, we have translated the asset tax rates into industry tax rates through a fixed coefficient capital stock matrix. We therefore measure the costs of interindustry distortions, assuming a zero substitution elasticity among assets. As an alternative, Gravelle (1982) measures the costs of inter-asset distortions, assuming a unitary substitution elasticity among assets.

Finally, the Auerbach-Jorgenson (AJ) plan provides t_c^g that are all 46 percent when the ITC is zero and when Hulten-Wykoff depreciation rates are used to determine the first year recovery in equation (5).[11/] This neutrality with respect to interest rates and inflation is in fact the plan's innovation. The uniform rate implies intersectoral welfare gains but higher overall taxes on capital. In combination with E. Cary Brown (1982) investment tax credits, however, the uniform rate can be made as low as desired.[12/] The general equilibrium model of the next section can be used to estimate the size of net efficiency changes.

IV. The General Equilibrium Model

The Fullerton-Shoven-Whalley model has considerable disaggregation of industries and consumers, with a comprehensive treatment of the United States tax system. This section first describes the main features of the model and then provides detail on the treatment of capital taxation.13/

1. An Overview of the Model

The modeled economy is divided into eighteen profit maximizing producers, two government sectors, fifteen consumption commodities, and twelve consumers differentiated by income class. Each industry has a Cobb-Douglas or Constant Elasticity of Substitution (CES) production function, where the elasticity of substitution between capital and labor is chosen as a "best-guess" from evidence in the literature. Each output can be used as an intermediate input through a fixed coefficient input-output matrix. Outputs can be purchased by government, used for investment, or converted into consumer goods. There is also a simple foreign trade sector.

Each consumer has initial endowments of labor and capital services which can be sold for use in production. Because of perfect factor mobility and competition, the net-of-tax return to each factor is equal among industries. A consumer can also choose to buy some of his own labor endowment for leisure. The capital stock is fixed in any one period, but the dynamic version of the model allows the savings response to augment the stock in later periods. Demand functions are based on CES utility functions with double nesting. The elasticity of substitution between present and future consumption is based on an estimate of the uncompensated saving elasticity with respect to the net-of-tax rate of return. For this value we use 0.4 as found by Boskin (1978). The elasticity of substitution between consumption and leisure is based on an aggregate estimate of 0.15 for the uncompensated labor supply elasticity with respect to the net-of-tax wage.

The entire spectrum of Federal, state, and local taxes are typically modeled as ad valorem tax rates on purchases of appropriate products or factors. Corporate income taxes and property taxes are modeled as different effective rates of tax on use of capital by industry. Social security, workmen's compensation and unemployment insurance appear as taxes on each industry's use of labor. Personal income taxes operate as different linear schedules for each consumer group, with marginal tax rates increasing from an average of 1 percent for the lowest income group to an average marginal tax rate of 40 percent for the highest income group.

The model is parameterized for 1973 using data from the National Income and Product Accounts, the Bureau of Labor Statistics' Consumer Expenditure Survey, and the Treasury Department's merged tax file. These data are adjusted for known inaccuracies of government collection procedures and for general equilibrium consistency requirements. This "benchmark" data set is used to solve backwards for relevant preference parameters and tax rates, so that model solution can replicate the benchmark equilibrium. Tax rates can be altered to calculate a simulated equilibrium with different resource allocations for comparison with the benchmark. The model is solved using a variant of Scarf's (1973) algorithm for an equilibrium price vector where excess demands and profits are zero.

The model does not include involuntary unemployment, endogenous inflation, or other aspects of disequilibria. It measures real effects without a money equation, expressing all prices in relative terms. Voluntary unemployment is captured through the labor/leisure choice, however, and the effects of inflation are modeled by adjusting effective tax rates appropriately.

Finally, the model requires that government run a balanced budget. Therefore, when policy changes generate alterations in the tax equations and parameters, the implied revenue gain or loss cannot be recorded as a government surplus or deficit. It would be possible to balance the budget by changing expenditures, but any change in government spending on transfer programs or public goods would affect each consumer group's welfare in a manner that cannot be adequately captured in this model. Since we are not trying to evaluate Reagan's planned expenditure reductions, we will abstract from expenditure changes. Consequently, any loss of government purchasing power must be compensated in the model by an offsetting tax increase.

In previous uses of this model, we have offset revenue losses by scaling up personal income tax rates. In the context of Reagan's tax plan, however, this option does not seem appropriate. Instead, we will generally maintain an equal yield through additional taxes on consumer expenditure. This replacement can be considered an additional state or local sales tax, or a Federal consumption-type value added tax. Either may yet be used to replace lost revenues. As an alternative, we also consider a lump-sum tax (or rebate) in proportion to the twelve consumers' original after-tax incomes. Though not a viable policy option, this replacement serves to isolate the efficiency properties of each simulated change in effective corporate tax rates.

2. Taxation of Capital

As stated above, the modeled industries face different tax rates on their use of capital. Specifically, the total capital tax paid by each industry is the sum of its liabilities under the corporate income tax (CIT), the property tax (PT), the corporate franchise tax (CFT), and the personal income tax on income from capital of that industry. This personal tax component, which we call the "personal factor tax" (PFT), includes personal taxes paid on dividends, retained earnings, and all income from noncorporate business in the industry. Its value takes into account not only the marginal personal income tax rate averaged over owners of capital, but also such features as the partial exclusion of dividends and the value of capital gains tax deferrals. The calculation of the personal factor tax is also dependent on the expected inflation rate, in order to measure taxation of nominal rather than real capital gains. To obtain t^{cf}, the "cash flow" tax rate for each industry, capital tax payments are divided by total net capital income of the industry (KN):

$$t^{cf} = \frac{CIT + PT + CFT + PFT}{KN} \tag{14}$$

Each of these variables have industry subscripts which are suppressed for notational simplicity.

The Fullerton-Shoven-Whalley model obtains these tax rates for the benchmark calculations by using observed corporate income taxes and other taxes paid in 1973 in the numerator of this expression. These average tax rates are appropriate for simulating income effects and government tax receipts. In a steady state equilibrium model, they are also appropriate estimates of marginal tax rates since the two sets of rates will be equal. Alternative tax regimes are simulated with appropriate adjustments to (14). Integration, for example, is modeled by removing CIT and adjusting the personal factor tax to account fully for corporate source income. With the integration example, cash flow tax rates are still equal to tax rates for incentive purposes.

With changes in depreciation or investment tax credits, however, only new investments will be subject to the new marginal rates. Previous investments will continue to pay taxes based on old lives and schedules, affecting tax receipts as long as they generate capital income. Cash flow tax rates, t^{cf}, will gradually approach incentive tax rates, t^{in}, as a higher proportion of capital is covered by the new law. The Fullerton-Shoven-Whalley model now includes this capability. Each industry's factor demand functions depend on factor prices gross of incentive tax rates, as these will affect all capital allocation decisions at the margin. On the other hand, cash flow tax rates are used to determine tax receipts and the after-tax incomes of capital owners. In the benchmark sequence of equilibria, t^{cf} and t^{in} for each industry are equal, but in a tax change simulation the two sets of rates can be specified separately.

The next section describes our conversion of ACRS into model-equivalent form, that is, the derivation of t^{cf} and t^{in}. With a switch to shorter lives, cash flow rates will exceed incentive rates for a time, resulting in revenues that exceed the new steady state revenues as a proportion of income. This lump-sum tax effect will capture the efficiency properties of accelerated depreciation and investment tax credits. In particular, expensing of new investments is more efficient than corporate tax elimination, because more revenue can be obtained with the same marginal rates.

V. The Model-Equivalent Form of Each Tax Regime

The standard version of the FSW model, as just described, uses observed corporate taxes in the numerator of (14) to obtain cash flow and incentive tax rates for the benchmark calculations. On a steady state growth path with correctly anticipated inflation, no risk, no measurement problems, and no transitory profits or losses, the two sets of rates would be equivalent. However, when we compared different formulations of the marginal tax rates by industry under the old law with different formulations of the average tax rates by industry from Commerce Department data between 1973 and 1978, we never obtained a correlation coefficient higher than 0.3. This lack of resemblance between average and marginal tax rates poses an interesting research question, but one which lies outside the scope of this paper. For now we can appeal to the existence of unanticipated inflation, risk, measurement problems, and transitory profits or losses.[14]

If we accepted the FSW assumption that average tax rates are suitable for use as marginal tax rates in the benchmark, then the new rates appropriate for ACRS would not be immediately obvious. Instead, we assume that marginal tax rates from Table 2 are suitable as average tax rates in the benchmark. This procedure satisfies the steady state requirement that average and marginal tax rates be equal in the benchmark, and it provides appropriate new marginal rates for ACRS from Table 2. It has the further advantage of updating the 1973 general equilibrium model to 1980 tax law for comparison with the Economic Recovery Tax Act of 1981.

We thus changed the model by rejecting CIT data in favor of

$$CIT^* = t_c^g(BTP^* + INT) - u(INT), \qquad (15)$$

where INT are the corporate interest payments of each industry and BTP* are the before-tax profits that would have to be earned under marginal tax rates t_c^g to yield the observed after-tax profits ATP. Taking the latter as fixed data for the counterfactual, BTP* equals ATP plus CIT*, so algebraically

$$CIT^* = \frac{t_c^g}{1 - t_c^g} ATP - \frac{t_c^g - u}{1 - t_c^g} INT . \qquad (16)$$

Only u does not vary by industry. These expressions account for the fact that debt financed investments qualify for the same investment tax credits and depreciation deductions as equity financed investments. The gross of tax return on both forms of finance (BTP* + INT) corresponds to $\bar{p}$ and is taxable at t_c^g. Interest payments are deducted by corporations at the statutory rate u, but are then included by individuals later at the individual rate m.[15/]

A similar treatment of noncorporate business closes the model. Marginal tax rates are calculated for each asset and industry using a statutory personal rate m, equal to .278, the average personal marginal tax rate on capital income in the model. All rental income in each industry, noncorporate interest payments, and noncorporate profits are assumed to be taxable at these calculated effective rates, while noncorporate interest payments are both deducted by business and included by individuals at rate m.

Once the benchmark sequence has been calculated, we are ready to specify t^{cf} and t^{in} for simulations. First, t_c^g from the new law in Table 2 are used in equation (16) to get CIT*. Second, noncorporate effective rates under the new law are used to adjust personal factor taxes. Then, equation (14) provides t^{in} for all future periods.

The cash flow rates, however, will begin at exactly the old cash flow rates, since all capital income will initially be generated by assets put in place before the tax change. These older assets will depreciate at an average rate $\bar{\delta}$, while the total capital stock will increase at approximately the steady state growth rate n. The ratio of old capital to total capital after N years will be

$$R = \left(\frac{1 - \bar{\delta}}{1 + n}\right)^N \quad . \tag{17}$$

The cash flow tax rate for each period is calculated from (16) and (14) as before, but where t_c^g is based on a weighted average of $\bar{\rho}$ from the old law and $\bar{\rho}$ from the new law. The weights after N years are R and (1 - R) respectively. The FSW model can then still simulate its fifty years by calculating six equilibria that are ten years apart. Suitable terminal conditions account for years beyond fifty.

These procedures furnish model-equivalent tax rates that account for industry differences in the use of many assets, state and local taxes on capital, the degree of incorporation, and the financial decisions of firms. On the other hand, these behaviors are not allowed to change with the tax law. Each industry continues to use the same mix of assets, the same proportion of corporate activity, and the same proportions of capital income accruing to debt and equity. With no risk in the model, these procedures imply a fixed debt/equity ratio for each industry. We thus concentrate on capital intensity decisions in this paper.[16/]

VI. Simulation Results

The FSW model provides complete descriptions of each equilibrium in the base and revised sequences. In Table 3, we select key results for discussion in this paper. Column 1 contains a list of simulated tax regimes, categorized by alternative assumptions. In Part I of this table, effective corporate tax rates t_c^g are calculated using Modified Fisher's Law of equation (13). The corresponding industry tax rates for the old law and for ACRS are shown in columns 2 and 4 of Table 2 above. When the new lower tax rates are imposed, we abstract from expenditure changes or budget deficits by raising some other tax to replace the lost revenue. The revised equilibrium includes either (A.) a lump-sum tax on each group in proportion to their orginal after tax incomes, or (B.) a consumption-type value added tax (VAT), equivalent to a sales tax. In either case, the additional tax is at a rate just high enough so that government can make the same real purchases as in the corresponding period of the benchmark sequence.

The present value of welfare gains, in billions of 1980 dollars, is shown in column 2 of Table 3. These are the sums of consumers' compensating variations, and can be expressed as a percentage of $97 trillion, the present value of

Table 3

Welfare Gains, Revenue Changes, and Capital Growth for Each Tax Regime

1. Tax Regime	2. Present Value of Welfare Gains in Billions of 1980 Dollars	3. Eventual Simulation Capital as a Proportion of Base Capital	4. Eventual Required Replacement Tax as a Proportion of Revenue
I. **Modified Fisher's Law**			
A. Lump-Sum Replacement			
Reagan Plan (ACRS)	311.9	1.029	.0125
B. VAT Replacement			
1. Reagan Plan (ACRS)	264.1	1.031	.0185
2. Auerbach-Jorgenson(AJ)	-221.6	0.976	-.0105
3. AJ with Credit (.75AJ)	286.3	1.031	.0206
4. (.75AJ) with Indexing	642.4	1.078	.0530
5. Integration with Indexing	916.3	1.114	.0704
II. Strict Fisher's Law			
A. Lump-Sum Replacement			
Reagan Plan (ACRS)	1019.2	1.088	.0316
B. VAT Replacement			
1. Reagan Plan (ACRS)	894.2	1.091	.0460
2. Auerbach-Jorgenson (AJ)	458.0	1.015	.0061
3. AJ with Credit (.75AJ)	1066.0	1.075	.0371
4. (.75AJ) with Indexing	1485.7	1.126	.0698
5. Integration with Indexing	1759.9	1.173	.0904

consumers' incomes in the benchmark sequence.[17/] That is, the \$311.9 billion gain for ACRS with lump-sum tax replacement represents 0.32 percent of base income.

A substantial portion of the recent ACRS debate concerned growth effects and revenue effects of alternative policies. Tax cuts can provide incentives for additional investment, increasing total capital, and the future tax base. As an indicator of the eventual effects on capital, we show in column 3 the ratio of the capital stock after fifty years in the simulation to the capital stock after fifty years in the baseline. In the same ACRS example, the capital stock is 2.9 percent higher than in the baseline. Then, in column 4, we indicate whether this feedback effect was sufficient to offset the reduction in tax rates. This column shows, after fifty years, the proportion of revenue that must come from the replacement tax, as necessary for government to make the same real purchases. Since ACRS reduces revenue by 1.25 percent, feedback effects were not sufficient to increase revenues.

Since lump-sum taxes are not generally available, the VAT provides a more realistic replacement tax. It does not distort intertemporal decisions in this model, but does affect the labor/leisure choice. Welfare gains of ACRS are then smaller, at \$264.1 billion, as shown in column 2 of Table 3. Note that cash flow rates exceed incentive rates for a time, providing some non-distorting revenues on previous investments.

Next, we simulate three versions of the Auerbach-Jorgenson first year recovery plan. The basic plan provides a uniform .46 effective corporate tax rate, higher than all industries' former tax rates under the assumption of MFL as shown in Table 2. The increased intersectoral efficiency is overpowered by reduced intertemporal efficiency, for a net loss of \$221.6 billion. The simulated capital stock after fifty years is lower than in the baseline, but revenues are higher.

The next simulation combines the AJ first year recovery with an E. Cary Brown investment tax credit such that the uniform t_c^g is .345, three-fourths of the statutory .46 rate resulting from AJ alone. This particular combination (.75AJ) implies incentive tax rates for the FSW model that are at the same overall level as those for ACRS. It will thus imply the same intertemporal distortions and allow us to isolate intersectoral effects. Since the $286.3 billion welfare gains exceed the $264.1 billion of ACRS under the same assumptions, the difference can be attributed to intersectoral misallocations[18] associated with the differing t_c^g under ACRS.[19]

First year recovery schemes effectively index depreciation since inflation cannot affect the present value of deductions. The FSW model also allows indexing of capital gains by appropriate changes in the personal factor tax of equation (14). This construct includes taxation of all inflationary increases in the value of capital in each industry, but at reduced personal rates to account for deferral and the 60 percent exclusion. "Indexing" in Table 3 refers to eliminating any tax on purely nominal capital gains. In combination with (.75 AJ), indexing provides substantially larger welfare gains, at $642.4 billion.

Finally, for the baseline with Modified Fisher's Law, we resimulate the integration plus indexing plan which formed the major topic of earlier papers.[20] The CIT* is eliminated from the numerator of (14), but dividends and retained earnings become fully taxable at the personal level. Noncorporate capital income taxation is unchanged, but nominal capital gains cease to be taxed. In combination, these policies imply reduced intertemporal and intersectoral distortions. This plan does not have the advantage of lump-sum revenues on previous investments, since separate taxation of all corporate capital is eliminated. Integration reduces capital tax revenue, encourages savings, increases the capital stock by eleven percent, and provides a $916.3 billion welfare gain, equal to 0.94 percent of baseline income.

In the second part of Table 3, t_c^g are calculated using Strict Fisher's Law of equation (12). The old law and ACRS tax rates for this case were shown in columns 3 and 5 of Table 2. Since the old t_c^g were often greater than .46, all of these capital tax cuts imply greater intertemporal gains than under MFL. ACRS provides a full one percent of baseline income as a gain in consumer welfare. This time, however, the uniform AJ rate of .46 represents an effective tax reduction. It provides intersectoral gains together with some intertemporal gains.

Welfare gains in column 2 suggest substantial sensitivity to the assumptions about nominal and real interest rates that are embodied in MFL and SFL. However, the ordering of the tax regimes is robust. The intertemporal gains from the lower tax rates of ACRS still dominate the intersectoral gains from the uniform tax rates of Auerbach-Jorgenson. Both are still dominated by the combined intertemporal and intersectoral gains of AJ with credit, the uniform .345 effective corporate tax rate. Indexing capital gains still provides further welfare gains, while integration still provides the largest gain of all plans considered. A major force in these results is that any overall capital tax reduction increases welfare, because of the efficiency properties of a consumption tax in this model. The VAT replacement is superior on efficiency grounds, but has its own distributional implications that are not considered here.

Other simulations were performed to test the sensitivity of our results. A lower inflation rate implies lower t_c^g effective corporate tax rates for every industry in the benchmark. As a result, welfare gains from ACRS are lower than those in Table 3. A higher inflation rate implies higher initial

t_c^g and greater welfare gains from ACRS. When inflation erodes the real value of depreciation deductions, acceleration makes more of a difference. Indexing, however, is still more efficient than acceleration. Results are also sensitive to other parameters in the model. In particular, the capital stock responses and welfare gains in Table 3 depend on the 0.4 savings elasticity assumed earlier in the description of the model. The revenue impact also depends on this assumed elasticity. The present value of these welfare gains depends on the assumed elasticities of substitution between capital and labor in production. Fullerton, Henderson, and Shoven (1982) discuss more fully the sensitivity of results to these and other model specifications.

VII. Conclusion

This paper has provided a comprehensive study of the cost recovery provisions in the Economic Recovery Tax Act of 1981. We have measured, for 37 assets and 18 industries, the reduction in the cost of capital and effective tax rates resulting from acceleration of depreciation allowances and expansion of the investment tax credit. We then used these revised measures of capital cost incentives to simulate the long run effects on investment and growth.

Our principal finding is that, although the Accelerated Cost Recovery System (ACRS) moves the economy toward increased output in the long run by reducing tax biases against capital, economic efficiency might be further enhanced by other reforms that were not selected. ACRS lowers tax rates on capital, but it leaves large differences in tax rates among corporations in different industries. With these discrepancies, capital will tend to be allocated less efficiently among its alternative uses. It would be possible, as an alternative, to enact a reform that reduces overall effective tax rates by the same amount as under ACRS, but that tends to equalize tax rates across industries. Adoption of the Auerbach-Jorgenson first year recovery plan in combination with an investment tax credit would move in this direction by indexing allowances at economic rates of depreciation.

More importantly, however, both the ACRS and the first year recovery plan fall short of alleviating further distortions in U.S. tax policy toward capital. First, nominal capital gains are subject to tax, so inflation raises the effective tax rate on income from real capital gains. Second, businesses in the corporate sector are taxed differently from those in the noncorporate sector. Integration of the personal and corporate income tax systems could be used to eliminate this differential. Results in this paper indicate that the efficiency gains associated with integration in combination with indexation of capital gains would be far larger than the gains from ACRS or from the first year recovery plan. However, such a reform would create a larger revenue shortfall. We did not investigate distributional implications of any tax plan, nor did we investigate efficiency or distributional implications of any government expenditure reduction.

Footnotes

1/ Certain structures are treated as equipment for depreciation purposes, including public utility property and single purpose agricultural structures. Under the old law, residential structures receive double declining balance, but under the new law they are grouped with other structures at 175 percent of declining balance with a switch to straight line.

2/ See Shoven and Bulow (1975). If a firm expects a steady stream of positive taxable profits, it would always take depreciation allowances as early as possible. Under other circumstances, however, the firm may prefer later deductions. Under the old law, the firm could delay its depreciation deductions by delaying the switch or by using straight line. The new law is less flexible, however, because it mandates the switchover time that would be optimal for the firm wanting the earliest deductions. Both laws allow the flexibility to combine just straight line depreciation with longer tax lives, but this decision can be made only at the time of acquisition. Our analysis abstracts from these details by using an equilibrium model where all firms expect positive taxable profits (but no abnormal profits).

3/ Many studies simplify the first two terms in equations (8) to (11) by using b as an exponential rate over G years:

$$\int_0^G be^{-b\tau} e^{-i(1-u)\tau} d\tau .$$

This expression inaccurately assumes a continuously declining basis, and it inaccurately leaves e^{-bG} as the remaining basis. Instead, equations (8) to (11) follow the law by specifying yearly adjustments to basis. Furthermore, many studies simplify the third term of these z expressions by using discrete time:

$$(1 - \frac{b}{2})(1-b) \cdot \sum_{J=2}^{L} \frac{L - (J - \frac{1}{2})}{S(L-G)} \cdot \left[\frac{1}{1 + i(1-u)}\right]^J .$$

Instead, equations (8) to (11) discount depreciation deductions at the end of a year by more than those at the beginning of the year. This procedure explicitly recognizes that depreciation deductions are "coincident" with the associated earnings and tax liability of equation (1).

4/ Fisher's original argument ignored taxes to find that equation (12) would maintain real interest rates in the presence of inflation. With taxes, the same logic would suggest that (13) would maintain the real after tax return. However, taxes are not neutral to inflation, due to historical cost depreciation and the taxation of purely nominal capital gains. Bradford and Fullerton (1982) demonstrate the sensitivity of tax rates to the choice between (12) and (13), or more generally, to the choice of i and π.

5/ The corporation also earns income on intangible assets such as knowledge acquired through research, or goodwill acquired through advertising. Because we do not have adequate estimates for the stock of these assets in each industry, they are excluded from this study.

6/ For assets 27 through 31, the depreciation rates come from Jorgenson and Sullivan (1982). They use the Hulten-Wykoff methodology to obtain estimates for these additional assets. The rate for housing is an unpublished estimate of Hulten and Wykoff.

7/ Lifetimes for many of the 37 assets are actually averaged over more diverse asset categories. As a result, only some of the assets in one of our categories may need their lifetimes adjusted to receive higher credits. Since the aggregation to 37 assets provides considerable detail, however, it seems appropriate to treat each asset as individually homogeneous. One example of where this treatment may be less appropriate is in mining, shafts and wells. The 6.8 year life here reflects an average of intangible drilling with a zero life and other structures with a longer life.

8/ Inventories could be effectively taxed at more than 46 percent with FIFO accounting in times of inflation. Because of our optimizing assumption, however, all firms would use LIFO to minimize taxes.

9/ For weights, we use Dale Jorgenson's unpublished data on the 1977 stock of each asset used in each industry. See Jorgenson and Sullivan (1982) and Fraumeni and Jorgenson (1980) for more detail. Briefly, they use Commerce Department investment series, a capital flow table, and an RAS scaling routine to estimate an investment matrix for every year. Then they use Hulten-Wykoff depreciation rates and the perpetual inventory method to obtain the capital stock matrix for 1977.

10/ As mentioned above, the new law provides tables with depreciation amounts rather than specifying DDB with a switch to SYD. The derivations of (9) and (11) make clear the equivalence, however. Thus we are effectively putting the tables of the law directly into present value calculations.

11/ If actual depreciation rates differ from the Hulten-Wykoff rates used in the first year recovery provisions, then actual effective tax rates could differ from 46 percent. Thus the uniformity of AJ effective tax rates depends on the accuracy of depreciation rate estimates.

12/ Brown (1982) suggests an investment credit that is proportional to the difference between the acquisition cost of the asset and its first year allowance. This particular choice of asset-dependent credits and first year write-offs results in a uniform effective tax rate.

13/ More detailed descriptions of this model may be found in Fullerton, King, Shoven, and Whalley (1980, 1981). These papers used the model to simulate integration of the personal and corporate income tax systems.

14/ By considering the expected future tax on a hypothetical dollar of investment, the marginal tax rate depends on expected inflation. If inflation turns out to be higher than expected, the use of historical cost depreciation will increase tax payments and thus average tax rates. Indeed, Jorgenson and Sullivan (1982) argue that inflation rates have been higher than expected, acting as a lump-sum tax on investments already in place. Also, if some of the return to capital is treated as a risk premium, and if losses on marginal investments can be used to offset profits on other investments, then the corporate tax can be viewed as risk-sharing by the government. As such, at least part of the tax receipts would not reflect any marginal investment disincentives. Fullerton and Gordon (1982) have argued that marginal tax rates are considerably less than average or cash-flow tax rates for this reason as well. Finally, if capital income contains abnormal profits or is measured with error, then cash flow taxes could again exceed the expected future taxes on a competitive marginal investment. Indeed, actual tax practices are not the tax minimizing practices assumed in this paper, firms can affect tax receipts by taking charitable deductions, and the marginal tax rate calculations can err by excluding intangible assets, depletion deductions, and other detailed features of tax code.

15/ In a few cases, where (16) implied negative corporate tax payments, we set CIT* to zero. An asset can have a negative effective tax rate as in Table 1, but only when we assume that the firm has a taxable return on other assets. It would be difficult for a firm, or especially an entire industry, to have negative taxes in the long run setting of our model. Note, however, that the leasing provisions of the 1981 Tax Act may make negative taxes more likely.

16/ As mentioned above, Gravelle (1982) considers changes in the mix of assets. Slemrod (1982) includes debt/equity decisions, explained by clientele effects. Fullerton and Gordon (1982) include debt/equity decisions, explained by bankruptcy costs at the margin. They also include considerations of risk, with a powerful effect on marginal tax rates and welfare costs. Finally, Fullerton-Gordon suggest that local property taxes are not disincentives at the margin to the degree that mobility ensures compensating local public benefits. We abstract from these phenomena here.

17/ The discount rate is .04, the consumers' after tax rate of return in the model. Because the FSW model uses 1973 data, we multiply all values by 1.95, the ratio of 1980 to 1973 national income.

18/ Intersectoral misallocations of ACRS are probably understated because we assume that producers in each industry cannot substitute among assets. Table 1 tax rates by asset vary much more than Table 2 tax rates by industry, because the latter are all averages of the former with different sets of weights given by columns of the capital matrix.

19/ Even when t_c^g are all the same, corporate taxes as a proportion of profits can differ due to different financial policies. Equation (15) captures the fact that debt financed investments are taxed at t_c^g while interest is deductible at rate u. Equation (14) captures the subsequent tax on interest income of individuals in the "personal factor tax". It also captures the differing property taxes and corporate franchise taxes by industry.

20/ See Fullerton, King, Shoven and Whalley (1980, 1981). These papers used observed CIT in (14) for both average and marginal tax rates. When corrected for the difference between 1973 and 1980 prices, those integration results with VAT replacement fall directly between the MFL and SFL results reported here.

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