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Replacing the U.S. Income Tax with a Progressive Consumption Tax : A Sequenced General Equilibrium Approach

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REPLACING THE U.S. INCOME TAX WITH A PROGRESSIVE CONSUMPTION TAX

A sequenced general equilibrium approach

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This paper examines the welfare consequences of changing the current U.S. income tax system to a progressive consumption tax. We compute a sequence of single period equilibria in which savings decisions depend on the expected future return to capital. In the presence of existing income taxes, the U.S. economy is assumed to lie on a balanced growth path. With the change to a consumption tax, individuals save more and initially consume less. As the capital stock grows, consumption eventually overtakes that of the original path, and the economy approaches the new balanced growth path with higher consumption and a greater capital stock. Both the transition and the balanced growth paths enter our welfare evaluations. We find the discounted present value of the stream of net gains is approximately $650 billion in 1973 dollars, just over 1 percent of the discounted present value of national income. Larger gains occur if further reform of capital income taxation accompanies the change. We examine the sensitivity of the results, both to the design of the consumption tax and to the values of elasticity and other parameters. The paper also contains estimates of the time required to adjust from one growth path to the other.

1. Introduction

In this paper, a change from the current U.S. income tax to a progressive consumption tax is evaluated using a dynamic general equilibrium model of the U.S. economy and tax system. This model includes endogenous household savings behavior, where savings in any period depend on the

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expected future return to capital. The U.S. economy is assumed to be on a balanced growth path in the presence of existing income taxes as represented by 1973 data. The behavior of the economy under a progressive consumption tax is modelled in terms of a sequence of equilibria involving a transition to a new balanced growth path.

This sequenced general equilibrium model can be used to shed light on recent debates in the tax incidence literature. In static equilibrium models like that of Harberger (1962), plausible parameter values suggest that capital bears the full burden of capital income taxation. In steady state models, Feldstein (1974) and Grieson (1975) compare the growth path with a profits tax to one with a wage tax. They find that labor can be better off with the wage tax because the higher capital stock increases the gross wage by more than the tax rate. These opposing results are reconciled by Boadway (1979), who calculates that considerable time may be required to move from one path to the other. The switch from a profits tax to a wage or consumption tax can be expected to reduce net wages or consumption initially. Depending on the savings elasticity, the capital stock can eventually grow to the point where all can be made better off. In at least one of Boadway's examples, the net wage remained higher under the profits tax for 65 years. Depending on the discount rate, labor/consumers may or may not prefer elimination of capital taxation. Bernheim (1981) found considerable sensitivity to savings parameters and the discount rate, as do we in results below.

Our model contains 12 income groups, each endowed with some labor and capital. In order to measure the relative efficiency of different tax policies, we compute a dynamic analogue of compensating variations for each household group and sum these to give an aggregate measure. Since the model incorporates several tax systems and a labor/leisure choice, the move to a consumption tax is not equivalent to full restoration of Pareto optimality. In spite of second-best considerations, our results indicate significant gains from such a switch. On an annualized equivalent basis, these gains are in the region of 1 percent of national income. Larger potential annualized equivalent gains accrue from removing further distortions.

The next section reviews some of the arguments typically made for the switch to consumption taxation. Section 3 summarizes our general equilibrium model, while section 4 gives special attention to our treatment of endogenous factor supplies. Specific proposals are converted into model equivalent form in section 5, and simulation results are presented in section 6. A final section summarizes our conclusions.

2. The progressive consumption tax

The idea of taxing consumption rather than income has a long hstory. It is frequently credited to Mill, but more recent advocates include Fisher (1942), Kaldor (1957), Feldstein (1978), and Bradford (1980). The efficiency argument in favor of such a change is that it would remove intertemporal distortions associated with the income tax. Post-income-tax earnings can be saved or consumed, but the return to savings is further taxed before consumption can occur in future periods. This double taxation can be removed by switching to a proportional or progressive tax on labor income only or on all income with complete deductibility of savings.

This double taxation issue is usually explained in terms of a two-period consumption diagram. The income tax changes the slope of the no-tax budget constraint, favoring consumption today over consumption tomorrow. As recent literature has highlighted, however, the main problem created by the income tax is that intertemporal consumer prices for consumption today and tomorrow also do not equal intertemporal producer prices. This deviation from conditions for general efficiency typically causes the economy to be on a growth path where sub-optimal savings occur.

If we assume the economy is on a balanced growth path in the presence of an existing income tax, the initial impact of a switch to a progressive consumption tax would typically be to increase savings and reduce consumption. When balanced growth is again achieved, the higher savings result in a capital stock that is higher than under the income tax. The consumption profile following a switch to a consumption tax would at first be below that associated with the income tax, but would eventually exceed it. Initially, instantaneous welfare is reduced, but it grows as the economy approaches a new balanced growth path with higher consumption. In a model with no other distortions and with a complete set of contingent commodity markets (or equivalently, perfect foresight), such a change involves a move to a Pareto optimal allocation. The time profile for consumption is shown in fig. 1. Levhari and Sheshinski (1972) discuss similar consumption profiles and provide analytical intertemporal welfare measures similar to the type we compute.

Our objective is to evaluate the net gain or loss to the U.S. economy from making an income–consumption tax switch. The presumption for a net gain mentioned above does not automatically follow in this model for a number of reasons, although such a result remains likely. Our model incorporates other distortions from the tax system,[1] the sequenced equilibrium approach

[1]In fact, several elements interlink in creating a number of sources of intertemporal inefficiency in the U.S. tax system. The income tax embodies the double taxation feature mentioned above, but it is both amplified in some directions and offset in others. Since nominal rather than real returns to capital are taxed, inflation raises the effective tax rate on the real return to capital under the income tax. In addition, income from capital is subject to the corporate income tax and local property tax. On the other hand, a number of tax features reduce effective tax rates on capital income. Savings which are sheltered through pension funds yield tax-free capital income, as does owner-occupied housing. Both of these cases imply single rather than double taxation of income to capital. All of these features appear in our general equilibrium model.

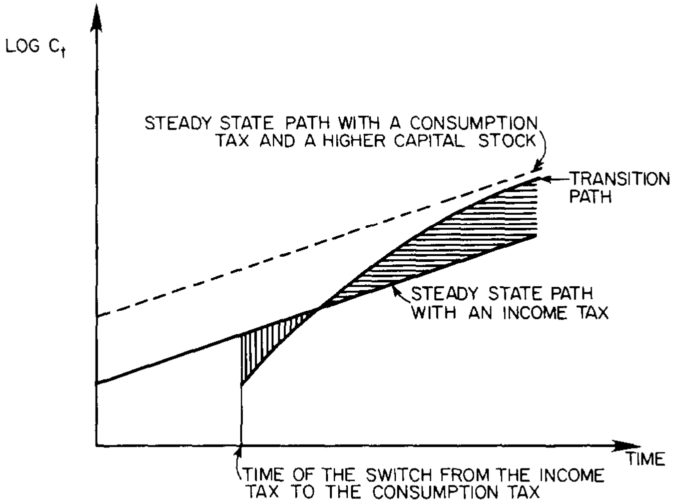

Fig. 1. Consumption profiles under a simple income tax and consumption tax. The vertically hatched area represents instantaneous welfare loss, and the horizontally hatched area represents instantaneous welfare gain.

involves myopic expectations rather than perfect foresight,[2] and, in the presence of a labor–leisure choice, both income and consumption taxes are distorting.[3] We also use a multi-consumer model which necessitates aggregating over the separate consumer gains or losses, an important departure from much of the theoretical work on this issue.

In addition to intertemporal efficiency, the consumption tax has been supported on ground of intersectoral efficiency. If all assets are given the same consumption tax treatment, welfare can be improved through the more efficient use of a given capital stock. This argument may favor the consumption tax over the current U.S. personal and corporate tax system, but not necessarily over a comprehensive income tax at a uniform rate. Thirdly, the consumption tax is often supported on the philosophical

[2]Investors use current prices and returns as expected future prices and returns. These expectations turn out to be correct on a balanced growth path, but not in the transition between growth paths. An interesting result is that tax distortions may compensate for the myopia in expectations. If capital deepening occurs so that the future return to capital falls, a consumption tax can result in 'too much' savings under myopic expectations. It is possible in this case that an income tax can partially or fully offset the myopia in expectations through double taxation of savings. In the results which follow, we do not believe this effect to be quantitatively significant.

[3]Due to the nontaxation of leisure, an income tax can be more efficient than a consumption tax if leisure and future consumption are complements. Atkinson and Stiglitz (1976) note that if preferences are separable into consumption and leisure, optimal taxation suggests a consumption tax rather than an income tax. A feature of the present model which complicates this result is the redistribution among households which accompanies the tax change. The presumption that a consumption tax will be preferrred to an income tax even in the presence of a labor-leisure distortion nonetheless carries over to the present model since the underlying structure is so similar to that used by Atkinson and Stiglitz.

grounds that it is more equitable to tax withdrawals from the economy in the form of consumption than it is to tax contributions to the economy in the form of factor supplies.

Finally, the consumption tax has been supported on administrative grounds. Because of the difficulty of taxing expenditures of individuals as they occur, most proposals have opted for a consumption tax operated as an income tax with a savings deduction. The U.S. Treasury's *Blueprints for Basic Tax Reform* (1977) introduces the concept of a 'qualified account', with the requirement that all financial savings which qualify for a tax deduction must feed through such an account. With a redistributive tax on all expenditures, the need no longer arises for separate corporate, capital gains, and wealth transfer taxes. Interest, dividends, and sales of corporate stock may remain in the account, untaxed until withdrawn and spent. The tax base is easily measured since it only includes labor and rental income and withdrawals from the qualified account.[4] This device has a comparative advantage in an inflationary economy since it completely avoids the need to define real income or measure economic depreciation: whatever the income to an account, the tax is based on nominal withdrawals in the same year. Similarly, the need to tax inheritances under the Haig–Simons concept disappears,[5] although there remains the issue of whether transfers at death are to be taxed as consumption.

While financial assets receive a consumption tax treatment through the 'qualified account', other assets receive equivalent treatment through the 'prepayment' approach. Outlays for durables and housing would not qualify for a tax deduction, but the imputed service stream from these assets would not appear as taxable expenditure. If the durable's purchase price equals the present value of imputed net rents, then a tax on the acquisition price has the same present value as a tax on rents as they accrue. The model incorporates both types of vehicles, for the existing tax system as well as for the expanded savings deductions under a progressive consumption tax.[6]

[4]The qualified account is similar to a Keogh or Individual Retirement Account, but with no ceilings and no constraints other than the taxation of withdrawals. The *Blueprints* proposal would also eliminate medical, charitable, and state and local tax distortions. It would include Social Security benefits as income and it would eliminate the standard deduction. The rate structure would include only three brackets with a top marginal rate of 40 percent, designed to preserve revenue in 1976. It is estimated that the tax base would be 23 percent more than under the current income tax, but 7 percent less than under a comprehensive income tax (without the savings deduction). While we have not captured base-broadening features of the *Blueprints* proposal, we have used the concept of an income tax with deduction for savings.

[5]There is in fact some disagreement on this point. A strict Haig–Simons definition of income as consumption plus change in net worth would tax inheritances and gifts received while giving a deduction to the donor (or his estate in the settlement of final year taxes). The Carter Commission (1966), however, advocated taxing inheritances with no deduction.

[6]Though the consumption tax itself may be easy to administer, the transistion to a consumption tax may be difficult. When first enacted, for example, the qualified account might be used not just for new savings but for the transfer of existing savings. In any case, our model does not include any of these administrative costs.

3. A general equilibrium model of the U.S. economy: Structure and data

In order to investigate the possible impacts of the adoption of a progressive consumption tax, we have used a dynamic numerical general equilibrium model of the U.S. economy and tax system. In any period of the equilibrium sequence, savings are endogenously dependent on the expected future return to capital. Expectations are myopic in the sense that investors expect current prices to prevail in future periods. Savings result in increments to the economy-wide capital stock in the next period, and different sequences of equilibrium prices and quantities are traced out for alternative policy regimes. Policy appraisal proceeds by comparing the resulting consumption profiles.

The general equilibrium model stresses the interactive nature of the price mechanism in jointly determining the behavior of all producers and consumers in each market of the economy. Such a model is needed to appraise tax policy changes which are of sufficient magnitude to cause interactive effects throughout the economy. Since it is not based on differential calculus, the model can handle a number of large distortions and measure discrete changes in any number of them without linearity assumptions and without ignoring income effects. There can be any number of sectors and agents, and any specification of demand so long as it satisfies Walras' Law.

To keep the focus of the paper on results and policy implications, only a brief overview of model structure is given here.[7] In any single period, there are 19 producer good industries that use capital and labor in constant elasticity of substitution (CES) value-added production functions. They also use the outputs of other industries through an input/output matrix with fixed coefficients. Tax rates on labor for each industry are derived by taking payroll taxes as a proportion of labor income, while tax rates on capital for each industry are derived by taking corporate income and property taxes as a proportion of capital income. Each of these 19 producer goods are used directly by government, for export, and for investment goods, but indirectly for consumption through a fixed-coefficient Z-matrix of transition into 15 consumer goods with suitable definitions for consumer demands. This transition is necessary because the goods classification of consumer expenditure data is different from the output of the 19 production sectors. There are 12 consumer groups, differentiated by income class, each with an initial endowment of capital and labor. As discussed below, consumers maximize utility defined over the 15 current consumer goods, current leisure, and anticipated future consumption. The price of future consumption

[7]A more detailed presentation of an earlier single period version of this model appears in Fullerton, Shoven and Whalley (1978), and further discussion of the dynamic version used in the present paper appears in Fullerton, King, Shoven and Whalley (1981).

depends inversly on the expected rate of return (which equals the current rate of return). The resulting demand for future consumption is translated into current desired savings. The latter is, in turn, translated into a vector of investment demands for the 19 industry outputs.

Government collects taxes from both the production and demand sides of the economy and uses the revenue in a balanced budget to purchase producer goods via Cobb–Douglas demand functions, to make direct transfer payments to consumers, and to subsidize government enterprises. A simple trade sector closes the model.

The 1973 data for this model are derived from five major sources including the July 1976 *Survey of Current Business*, the Bureau of Economic Analysis Input–Output matrix, unpublished worksheets of the U.S. Commerce Department's National Income Division, the U.S. Labor Department's 1973 Consumer Expenditure Survey, and the U.S. Treasury Department's Merged Tax File. Because the data set for this model is so comprehensive, the sources are necessarily divergent. In order to use all of these data together, adjustments are made to ensure that each part is consistent with the rest. All data on industry and government uses of factors are taken to be fixed, while data on consumers' factor incomes and expenditures are correspondingly adjusted. Tax receipts, transfers, and government endowments are fixed, and government expenditures are scaled to balance their budget. Similar adjustments ensure that supply equals demand for all goods and factors.

The fully consistent data set defines a single period benchmark equilibrium in transactions terms. Value observations are separated into prices and quantities by assuming that a physical unit of a good or factor is the amount that sells for one dollar. All benchmark equilibrium prices are $1, and observed values are benchmark quantities.

The equilibrium conditions of the model are then used to determine behavioral equation parameters consistent with the benchmark data set. This procedure calibrates the model to the benchmark data in the sense that benchmark data can be reproduced as an equilibrium solution to the model before any policy changes are considered. In order to implement this we specify exogenous elasticities of substitution between capital and labor in each industry. We also specify labor supply and savings elasticities to which substitution elasticities in preferences are calibrated. Factor employments by industry are used to derive production function weights, and expenditure data are used to derive utility function weights. This calibration procedure allows for a test of the solution and ensures that the various agents' behaviors are mutually consistent in our benchmark data before we evaluate policy changes.

Through their interaction, utility-maximizing consumers and profit--maximizing producers are assumed to reach a single period competitive equilibrium where all profits are zero and supply equals demand for each good and factor. Starting with data on endowments, tax rates, preferences, and production parameters, we use Merrill's (1972) algorithm, a revised version of Scarf's (1973) algorithm, to calculate prices that satisfy these conditions at each point in time. Single period equilibria are sequenced through endogenous savings decisions which augment the capital stock of the economy. An exogenous labor force growth rate is assumed.

For the benchmark sequence, we calculate a balanced growth path that begins with our replicated data, has constant prices, and implies quantities that all grow at the labor force growth rate. We then alter tax parameters and calculate a revised sequence of equilibria. A higher net return to capital implies more savings, capital growth, and a transition with an asymptotic approach to a new balanced growth path. The model assumes no involuntary unemployment of factors. Markets are perfectly competitive with no externalities, quantity constraints, or barriers to factor mobility. Since we compute a complete set of prices and quantities under alternative tax policies, we can estimate the change in national income, utility or income changes for each group, and all new factor allocations among industries.

4. The treatment of endogenous factor supplies

An aspect of the model which is especially important for the analysis of the consumption tax is the incorporation of endogenous factor supplies. Consumer decisions regarding factor supplies are made jointly with their consumption decisions. Each household at any point in time has a nested CES utility function of the form

$$U = U\left[H\left(\prod_{i=1}^{15} X_i^{\lambda_i}, l \right), C_f \right], \tag{1}$$

where H is the instantaneous utility function defined over current consumption commodities X_i and leisure l, the function U determines the allocation between consumption-cum-leisure and expected future consumption, C_f. Current consumption commodities X_i are aggregated using a Cobb–Douglas function, whereas both U and H are constant elasticity of substitution (CES) functions. Because of our myopic expectations assumption, the current rate of return and other current prices are all that are required to formulate a budget in terms of prices for present and future consumption. Budget-constrained maximization of U then results in a desired C_f which can be used to imply current desired savings.

In calibrating the model, the parameters of the functions U and H are determined so as to be consistent with the benchmark data set and to be consistent with labor supply and savings elasticity estimates from the literature. Because observed 1973 expenditures and savings differ among the

12 income classes in the model, weighting parameters in the Cobb–Douglas and CES functions will also differ.

There is considerable controversy regarding the magnitude of the uncompensated elasticity of saving with respect to the real after-tax rate of return. For a long time the consensus appeared to favor a zero value for this elasticity, a proposition that was termed Denison's Law due to Denison (1958). In more recent work, Boskin (1978) has estimated this elasticity to be approximately 0.4, although Howrey and Hymans (1980) have re-examined Boskin's estimates and suggest that a value closer to zero would be more realistic. On the other hand, Summers (1981) derives savings elasticities between 1.5 and 3.0 by attaching plausible magnitudes to the parameters of a life cycle model. We use the 0.4 estimate in our central case, but we test the sensitivity of our results to a wide range of elasticity estimates.

There also exist a number of different estimates for the uncompensated elasticity of labor supply with respect to the real net-of-tax wage. A consensus finding from Lewis (1975) is that the uncompensated elasticity for working age males lies in the range -0.1 to -0.2, with a midpoint estimate of -0.15.[8] The estimates for labor supply elasticities of females and older males contrast with these, are on average significantly positive, and in some cases are larger than one. We assume an identical value for all income groups in the model, and $+0.15$ is chosen as an appropriate weighted average over the econometric estimates for males and females.[9] We also assume a labor endowment equal to 7/4 of the labor supply in the benchmark equilibrium, reflecting an assumption that 40 hours are typically worked out of a possible 70-hour week.

To derive the steady state growth rate for the benchmark equilibrium sequence, we compare the amount of observed 1973 savings to the capital stock in the benchmark data set. We then assume that the effective units of labor grow at the same rate. Though labor endowments grow at this fixed 2.89 percent annual rate in both the benchmark sequence and the simulated sequence, endogenous demand for leisure implies that actual labor supply will differ. Though the capital stock grows at the same 2.89 percent rate in the benchmark sequence, endogenous saving implies that capital in the simulation will grow at a different rate.

The 2.89 percent labor growth rate is also assumed equally divided between Harrod-neutral technical change and population growth. Our welfare measures of tax changes are adjusted to account only for the initial population size. If total population were included in welfare calculations, the importance of future periods would be sensitive to population growth.

[8]A similar conclusion is also suggested by Stern (1976).

[9]We recognize the biases introduced by using a single aggregate elasticity, but the current model cannot accept parameter differences based on age or sex. It could accept different elasticity parameters for each of our income groups, but these are not readily available.

A final important parameter is the real net-of-tax rate of return to capital in the benchmark data. Since this value is used to calibrate preference parameters under the assumption of utility maximization, it also determines the rate of time preference in the benchmark sequence of equilibria. Following recent literature we use 4 percent for the average value of this parameter, but each income class receives a net-of-tax return that depends on its own marginal tax rate. We test other values for sensitivity.

5. Representing consumption tax plans in model equivalent form

We consider a number of alternative plans for adopting a progressive consumption tax as the major broadly based U.S. tax source. In order to evaluate each plan in the model, it must first be represented in model equivalent form. Each plan is treated as a variation on the existing income tax, represented as a set of linear tax functions.

For each of the 12 consumer classes, we have data on the taxes collected in 1973, the income for that year, and the effective marginal tax rate. With this information, the tax schedule for each group is modelled as a linear income tax reflecting both the average and the marginal rate faced by the group in 1973. This treatment captures the facts that average and marginal tax rates differ by group, that both are increasing, and that it is the marginal tax rate which causes the distortionary substitution effects of the income tax system. One shortcoming of our treatment is that consumers do not move into higher marginal tax brackets if they experience a large increase in real income. For each consumer class the income tax function is

$$T_j = B_j + \tau_j(TI_j), \tag{2}$$

where τ_j is the marginal tax rate and TI_j is the taxable income of the jth group. The B_j intercept is derived such that observed income and observed marginal tax rates yield observed 1973 taxes paid for each group.

Taxable income TI_j in the benchmark is less than Haig–Simons income for two major reasons. First, a significant amount of savings flow through private, state, local, or federal government pension plans, through Keogh and Individual Retirement (IRA) Accounts, or through cash value life insurance policies. These are either taxed on a deferral basis (where both the initial contribution and the return are sheltered but the payouts are fully taxed) or on a prepayment basis (where the initial contribution is taxed but the return and payout are tax-free). It is simple to show that the two methods are identical except that the tax rate at the time of withdrawal may be different from the rate at the time of contribution.

Flow of Funds (1976) data indicate that in recent years approximately 30 percent of savings flow through these vehicles and are thus taxed on a consumption basis. Our model captures the tax-sheltered nature of these forms of saving by allowing households to deduct 30 percent of savings in our calculations for the current tax policy.[10]

Second, for the existing income tax, different fractions of different types of capital income are taxable. Due to the \$100 dividend exclusion, for example, only 96 percent of dividends are taxed by the personal income tax. The 50 percent exclusion of nominal realized capital gains in 1973 implied that 73 percent of real accrued capital gains were effectively fully taxed. For owner-occupied housing, none of the imputed net return is subject to tax. These proportions are further explained in Fullerton, King, Shoven and Whalley (1981).

According to the *Flow of Funds* accounts, roughly 20 percent of net savings are made in the form of net accumulation of owner-occupied housing. This form of saving receives a consumption tax treatment through the 'prepayment' approach discussed above. With 20 percent of savings in owner-occupied housing and an additional 30 percent in tax-deductible savings vehicles, already the current U.S. tax system is roughly halfway between an income tax and a consumption tax. Our model captures this complexity in current U.S. tax law as well as the allocation effects of allowing consumption tax treatments for only some investments.

Because each industry has different proportions of capital income in the form of dividends, interest, and capital gains, each has a different proportion of capital income that is taxable by the personal income tax. For this reason, the personal income tax on the taxable fraction of capital income is collected at the industrial level at rate τ, the weighted average household marginal income tax rate. The weights for τ are proportional to capital ownership. These taxes, which we term 'personal factor taxes', act as a withholding system and capture the industrial discrimination and resulting reallocation of resources inherent in the present tax system. On the consumer side of the model, a tax is paid at rate $(\tau_j - \tau)$ on that amount of capital income which is fully taxable. That is, the consumer pays additional taxes or gets a refund depending on whether his marginal tax rate exceeds or is less than τ. Thus, actual taxes paid on capital income vary according to the marginal tax rates of the various groups.

In order to incorporate a consumption tax into the model, we begin with existing values of B_j and τ_j and allow an increased deduction for savings. The maintenance of the existing B_j and τ_j, however, would imply a reduction in tax revenues in 1973 under a consumption tax. Given that government

[10]Because each vehicle has a different ceiling on the contributions which can be deducted each year, and because of nonconstant savings propensities, the proportion of marginal savings which are deductible may not be the same as the average proportion of savings deducted. Later simulations of tax plans with different deductible proportions provide results which are similar in nature to those that would be obtained with different proportions deductible in the benchmark.

purchases and transfer payments play such a major role both in the actual U.S. economy and in our model, tax effects can only be separated from the expenditure impacts if real government revenues are maintained. The form of yield equality we impose is that the time path of government receipts must be the same for all tax alternatives. We examine three separate approaches: (1) imposing lump-sum taxes or transfers on consumers, proportional to initial incomes and effected by changing the zero income intercept in the linear income tax function for each consumer; (2) raising all marginal tax rates by adding the same number of percentage points to each; (3) multiplying all marginal tax rates by an endogenously determined constant. In each case, the scalar is determined so as to generate sufficient funds for government expenditures.

The lump-sum case abstracts from the efficiency effects of the replacement tax, and it isolates the effects of the consumption tax change alone. This may not be realistic, however, since potential replacement taxes are generally distorting. Additive and multiplicative scaling are more realistic, but have different effects on the income distribution. Since high income individuals save more, the consumption tax may have regressive effects unless the tax rates of high income groups are scaled more.

In our evaluation of consumption tax alternatives, we have examined eight different tax modification packages. The features of each of these are shown in table 1. Since we model the sheltering of imputed net returns to housing at the industry level, and since saving in housing amounts to 20 percent of total net saving, a complete move to an expenditure tax would mean that the remaining 80 percent of net saving should be deductible from the personal income tax base. Plan 1, labelled consumption tax, raises the fraction of sheltered savings in the federal personal tax from 30 percent to 80 percent. This policy could be accomplished by greatly liberalizing existing Keogh and IRA savings vehicles.

The second plan involves the integration of corporate and personal income taxes via the partnership method.[11] With this plan, the present system of taxing a fraction of realized nominal capital gains is also modified so that real gains are fully taxed as they accrue. The third plan is the consumption tax (80 percent of savings deductible) combined with corporate tax integration. The fourth plan corresponds most closely to the theoretical consumption tax in that all income is taxed (including the imputed income from housing), while all savings are deductible. The separate corporate income tax is eliminated with this plan. Plan 5 represents a partial movement towards a consumption tax, where the 55 percent savings deduction represents a point halfway between the current deduction of 30 percent and the plan 1 deduction of 80 percent. In plan 6, all savings are deductible, but

[11] See Fullerton, King, Shoven and Whalley (1981) for details of this plan.

Table 1

Tax modification alternatives considered in the model.

Description	Fraction of savings deductible from personal taxation	Preferential treatment of income from housing capital at industry level	Fraction of dividends taxable	Fraction of real retained earnings taxable at personal level	Separate corporate income tax
0. Current U.S. system	0.3	yes	0.96	0.73	yes
1. Consumption tax	0.8	yes	0.96	0.73	yes
2. Corporate tax integration with indexation of capital gains	0.3	yes	1.0	1.0	no
3. Consumption tax with integration	0.8	yes	1.0	1.0	no
4. Pure consumption tax with integration	1.0	no	1.0	1.0	no
5. Partial consumption tax	0.55	yes	0.96	0.73	yes
6. Full savings deduction with housing preference	1.0	yes	0.96	0.73	yes
7. Pure income tax without integration	0.0	no	1.0	1.0	yes
8. Pure income tax with integration	0.0	no	1.0	1.0	no

the existing preference on income from housing and the corporate income tax are retained. Plans 7 and 8 investigate whether the present U.S. system, a hybrid of an income tax and a consumption tax, is better or worse than a pure income tax. A pure income tax would remove the special treatment of capital gains, tax the imputed income to owner-occupants, and eliminate shelters offered by pension funds and other retirement savings vehicles. While savings would be taxed more heavily, much of the inter-industry distortion of the present tax system would be eliminated. In Plan 7, a pure income tax replaces the existing income tax. Plan 8 goes further and also removes the corporate income tax.

6. Results

For each of the tax alternatives the new sequence of equilibria has been computed. For each of the 12 consumer classes we have calculated the present values of their compensating variations over time using individual discount rates which are based on the model's 4 percent average after-tax rate of return to capital in 1973. These welfare estimates are to be interpreted as the income change in 1973 dollars which would permit that group to obtain the same pattern of instantaneous utility over time under the new tax regime as under the old.[12] Strictly speaking, a welfare improving change produces a negative compensating variation. However, we adopt the sign convention that a positive entry indicates a welfare improving change and a negative entry a welfare reducing change. The instantaneous utility derives from current consumption and leisure, excludes expected future consumption from savings of that period, and corresponds to H of eq. (1). This procedure avoids double counting when the next period's current consumption is added. The individual results are summed over the 12 groups and are presented in table 2.

The consumption tax (plan 1) involves an efficiency gain of \$686 billion if the revenue shortfall caused by the additional saving deductions is made up using the lump-sum income tax intercepts. The gain is reduced to \$621 billion if marginal tax rates are increased in a multiplicative manner and to \$636 billion if an additive surtax is applied to the marginal rates. Some of the potential efficiency gain is lost because of the distorting effects of the higher marginal rates with multiplicative and additive scaling.[13] The figures

[12]If we had a complete life cycle utility function of the form $U=U(H_0 \ldots H_T)$ with the possibility of substitution among H in different periods, then compensation sufficient to reach the old U could be less than compensation required to reach the old pattern of H. Our eq. (1) for U is not of this form, but allows simple calculation of savings and instantaneous utility H from current prices in each period of the sequence. Our welfare measure may be biased for this reason.

[13]The distorting effect on intertemporal choices is affected to varying degrees by these tax replacements but is entirely eliminated in the pure consumption tax example. Distorting effects on labor–leisure choices remain and are further affected by raising marginal rates.

Table 2
Dynamic welfare effects in present value of compensating variations over time (in billions of 1973 dollars).[a]

Tax replacement	Types of scaling to preserve tax yield: Lump-sum	Multiplicative	Additive
1. Consumption tax (80% savings deduction)	686.167 (1.376)	620.652 (1.245)	636.002 (1.275)
2. Corporate tax integration with indexation of capital gains	731.550 (1.467)	338.858 (0.680)	448.541 (0.889)
3. Consumption tax with integration	1429.503 (2.867)	999.813 (2.005)	1135.083 (2.276)
4. Pure consumption tax with integration	1500.881 (3.010)	1344.423 (2.696)	1388.410 (2.784)
5. Partial consumption tax (55% savings deduction)	328.268 (0.658)	289.999 (0.582)	298.180 (0.598)
6. Full savings deduction with housing preference	991.704 (1.989)	962.633 (1.931)	964.370 (1.934)
7. Pure income tax without integration	−579.177 (−1.162)	−471.653 (−0.946)	−496.861 (−0.996)
8. Pure income tax with integration	128.298 (0.257)	−22.596 (−0.045)	21.422 (0.043)

[a]The numbers in parentheses represent the gain as a percentage of the present discounted value of consumption plus leisure in the base sequence. This number is \$49.863 trillion for all comparisons, and accounts for only the initial population.

in parentheses in table 2 give the efficiency gain of each of our plans as a fraction of the present value of future expanded national income (estimated at \$50 trillion). This includes current consumption and leisure valued at the net of tax wage, and it corresponds to the dollars needed for instantaneous utility H. The gain under plan 1 with the lump-sum adjustments for revenue replacement is 1.4 percent of the present discounted value of the future national income (including the value of leisure). Since high income groups have the largest savings deductions, multiplicative scaling might be preferred on equity grounds. However, efficiency gains for multiplicative scaling are typically smaller than those for additive scaling. The welfare costs of labor/leisure distortions depend on the square of the marginal tax rate, and multiplicative scaling adds more to the already high rates of high income consumers.

Results regarding corporate income tax integration are presented for plan 2 in table 2. With a lump-sum replacement the windfall gain for the economy is larger than that of the move to a consumption tax, but with the alternative replacements the gain is smaller. Our estimates indicate that the present value of the gain is \$732 billion with lump-sum replacement taxes and \$399 billion with multiplicative increases in marginal rates. The third plan combines the features of 1 and 2, and our estimates suggest that the efficiency improvement is approximately additive. The combined tax changes were advocated in *Blueprints* and offer a present value efficiency gain of $1 trillion or more.

Since 80 percent of total savings are deductible and 20 percent of total savings flow into tax favored housing, these plans capture the intertemporal effects of a full consumption tax. However, since any savings can be used for housing, these plans leave an intersectoral distortion in favor of owner-occupancy. To capture the equivalence of the prepayment and postpayment approaches, plan four allows full deductibility of savings and eliminates the preference for housing. Gains are larger, as expected. The efficiency gain of plan 4 relative to the current tax system is roughly $1.5 trillion with lump-sum revenue replacement, $1350 billion with multiplicative marginal rate surcharges, and $1390 billion with additive marginal rate surcharges.

Plan 5, a move halfway from the current deduction of 30 percent to the plan 1 deduction of 80 percent, would result in efficiency gains roughly half those of plan 1. Plan 6 exempts all saving from taxation, leaves the housing preference unchanged, and results in a personal income tax subsidy to saving. However, since this subsidy offsets the corporate income tax which is left in place, total efficiency is enhanced relative to plan 1.

The results from plans 7 and 8 indicate that the U.S. could move to a pure income tax and integrate the corporate tax with no loss in efficiency, but that a pure income tax alone would lose efficiency. For plan 7, the tax base is increased since imputed income from housing is included and existing savings deductions are eliminated. Thus, the rate structure can be lowered rather than raised in order to maintain government revenues. Results for Plan 7 show that moving to a pure income tax alone involves an efficiency loss of $579 billion if marginal tax rates are not lowered. This is primarily because the intertemporal distortions of the current system are made worse. However, if the marginal rates are reduced, the efficiency loss to the economy is lowered to roughly $470 billion. The improvement in the inter-industry allocation of capital (resulting primarily from the taxation of the return to owner-occupied housing) tends to offset the deterioration in the intertemporal efficiency (now reduced by the marginal rate adjustments). Plan 8 is a comprehensive single level income tax plan involving corporate tax integration as well. Such a tax system lowers revenues and thus necessitates a rate hike to maintain the yield. When the rates are adjusted either multiplicatively or additively, the net efficiency impact of the package is negligible.

Our model identifies 12 household groups and includes the capability of analyzing welfare impacts by household. In table 3 we present welfare impacts by household for plan 1 (80 percent savings deduction). These results need careful interpretation since we do not explicitly model life cycle

Table 3
Distributional impact of an 80 percent saving deduction (present value of welfare gains as a percentage of base sequence income for each group).

Households classified by $thousand of 1973 gross income	Types of scaling to preserve tax yield		
	Lump-sum	Multiplicative	Additive
$ 0–3	1.059	2.147	1.412
$ 3–4	1.251	2.057	1.470
$ 4–5	1.368	1.937	1.464
$ 5–6	1.440	1.891	1.477
$ 6–7	1.455	1.827	1.451
$ 7–8	1.480	1.723	1.422
$ 8–10	1.473	1.588	1.377
$10–12	1.446	1.446	1.328
$12–15	1.385	1.307	1.242
$15–20	1.302	1.061	1.137
$20–25	1.256	0.916	1.088
$25+	1.444	0.746	1.325
All households	1.376	1.245	1.275

behavior. One can think of each household as an income group which at each point in time contains several individuals at differing stages of their life cycle. Any one individual could move among income ranges over his or her lifetime.[14]

Results by income range indicate that welfare impacts depend again on the tax replacement. All estimates are expressed in terms of percentage gains from the base sequence income of the group. The most regressive pattern is given by the replacement with lump-sum taxes proportional to base sequence incomes. Multiplicative and additive replacements yield larger gains to low income groups since the replacement taxes impact more heavily on those with high incomes. An interesting feature of these results is that all three cases involve a Pareto improvement in the sense that all household groups gain.

To test the robustness of our results for plan 1, we have performed some sensitivity analysis with respect to two key parameters. These results are reported in table 4. The efficiency gain numbers for plan 1 (consumption tax)

[14]A further problem is that the highest income group saves a high proportion of income in the 1973 data, while the lowest income group actually dissaves. If we allowed each group to retain its own savings, then the rich would get richer and the poor would get poorer. In fact, of course, high income individuals often retire to a lower bracket and take their wealth with them. To approximate this movement of wealth and to insure balanced growth in the benchmark sequence, the model takes total savings at the end of any period and reallocates it in proportion to the capital holdings of each group. This reallocation of wealth detracts from the confidence we place in the model's distributional results.

Table 4

Sensitivity of welfare effects for an 80 percent saving deduction (present value of compensating variations over time in billions of 1973 dollars).[a]

	Types of scaling to preserve tax yield		
	Lump-sum	Multiplicative	Additive
A. Savings elasticity			
0.0	511.554	410.854	437.999
	(1.026)	(0.824)	(0.878)
0.4[b]	686.167	620.652	636.002
	(1.376)	(1.245)	(1.275)
2.0	1248.607	1278.714	1278.721
	(2.504)	(2.564)	(2.564)
B. Base sequence net of tax rate of return[c]			
0.03	1637.543	1556.911	1588.483
	(2.025)	(1.926)	(1.965)
0.04[b]	686.167	620.652	636.002
	(1.376)	(1.245)	(1.275)
0.05[c]	334.839	275.321	285.559
	(0.918)	(0.755)	(0.783)

[a]The numbers in parentheses represent the gain as a percentage of the present discounted value of welfare (consumption plus leisure) in the base sequence. This accounts only for the initial population.

[b]This row is also presented in table 2.

[c]The present value of income along the base sequence is sensitive to the choice of the net of tax real rate of return to capital. For 0.03 the value is \$80.9 trillion, for 0.04 the value is \$49.9 trillion, and for 0.05 the value is \$36.5 trillion.

are shown for three different savings elasticity values and for three different assumptions on the exogenous real return to capital in our benchmark data. The latter implies a different value for the rate of time preference of each group.

In addition to the +0.4 savings elasticity used above, we have run our simulations with savings elasticities of 0.0 and 2.0. The former is consistent with 'Denison's Law' (1958) and with the Howrey and Hymans (1980) recalculation of Boskin's estimate, while the latter is roughly comparable to numbers suggested by Summers (1981) as possible short-run impact savings elasticities. The results of table 4 indicate that the efficiency gain increases with the savings elasticity. The results for the high elasticity are consistent with the high range of Summers' results on welfare impacts of intertemporal tax distortions. With an additive marginal tax surcharge, we find that the welfare gain is \$438 billion with a savings elasticity of 0.0, while it is \$636 billion or \$1279 billion if that parameter is 0.4 or 2.0, respectively. An interesting aspect of the results of table 4 is that the efficiency gain is not sensitive to the replacement tax for the case with the saving elasticity set at

2.0. The reason is that while the movement to a consumption tax initially necessitates rate increases, the high saving elasticity implies that the economy grows sufficiently more rapidly with a consumption tax to actually permit a lower rate structure in future years.

Table 4 indicates greater sensitivity of results with respect to variations in the exogenously specified real net of tax rate of return to capital in the base sequence. As previously mentioned, we specify this value as 0.04. In the calibration of utility function parameters to the benchmark data set, this value becomes the rate of time preference in the base sequence. Since initial consumption losses are followed by consumption gains, it should not be surprising that the rate of time preference is a key parameter. The same finding appears in Summers (1981), whose large welfare impacts are in part due to his choice of a low discount rate. Varying the implicit discount rate between 3 and 5 percent changes the size of the percentage welfare gain by a factor of approximately two. The size of base sequence income also changes between these cases, complicating a comparison of absolute magnitudes.

Table 5 provides information on how long the economy takes to resettle into a steady state growth path after a tax change occurs. Once the economy has completely adjusted to the new policy regime, all relative prices will again remain constant. In the case of consumption tax proposals, the new steady state is characterized by a higher capital intensity and a lower relative return to capital. The results of table 5 indicate that, for the cases with a 0.4 savings elasticity, roughly 40 percent of the adjustment is completed after 10 years, and 80 percent is completed after 30 years. The economy then asymptotically approaches the new steady state growth path as in fig. 1 above. The transition is accomplished much more rapidly with a savings elasticity of 2.0, despite the fact that the total adjustment is larger. Adjustments in capital/labor ratios proceed in patterns similar to the adjustments in table 5 price ratios.

Table 5
Time path for the ratio of the rental price of capital to the wage rate.

				Factor price ratios					
				Time period (years)					
Plan number	Savings elasticity	Revenue replacement	Pre-change	0	10	20	30	40	50
1	0.4	lump-sum	1.00	1.00	0.93	0.89	0.86	0.84	0.83
1	0.4	additive	1.00	0.99	0.92	0.88	0.85	0.84	0.83
3	0.4	additive	1.00	1.19	1.04	0.96	0.92	0.89	0.88
1	0.0	additive	1.00	0.99	0.94	0.91	0.89	0.87	0.86
1	2.0	additive	1.00	0.99	0.80	0.79	0.79	0.79	0.79
7	0.4	additive	1.00	0.97	1.00	1.02	1.04	1.06	1.07

There is a high variance of previous literature estimates on the length of the long run. Sato (1963) and Atkinson (1969) find the adjustment to be extremely long (greater than 100 years), while Summers (1981) and Hall (1968) find it to be surprisingly short (around 5 years). It is difficult to completely reconcile these various findings, but it is clear that a prime determinant is the strength of substitution effects in the model used for the analysis.

7. Conclusion

In this paper we have reported results from an analysis of a possible switch from the existing U.S. income tax to a progressive consumption tax. We used a dynamic general equilibrium model of the U.S. economy and tax system. Results indicate that sheltering more savings from the current U.S. income tax could improve economic efficiency even if the necessary marginal tax rate adjustments are made in order to maintain government revenue. Using our central specification, the present value of welfare gains for a complete savings deduction from the personal income tax is around $650 billion in 1973 dollars. We find that a combined policy of tax integration and savings deduction offers the largest welfare improvement with the present value figure lying between $1 and $1.5 trillion, even when other tax rates are adjusted to maintain government revenue. On an annualized equivalent basis, the latter figures are in the region of 2–3 percent of national income.

Results emphasize that while only half of net savings are currently taxed in the U.S., this system leaves room for significant improvements. The reason is that only certain savings vehicles are tax sheltered, particularly owner-occupied housing. The intertemporal efficiency gain is offset by the distortions created in the inter-industry allocation of capital.

Additional analyses with the model indicate considerable sensitivity to the elasticity of savings with respect to the real after-tax rate of return. Further efforts to narrow the profession's consensus on the value of this elasticity would clearly aid policy evaluation. We also find sensitivity with respect to the implicit rate of time preference in the model.

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