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Taxation and Savings: A Neoclassical Perspective

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I. *Introduction*

THE ABILITY of governments to alter an economy's rate of wealth accumulation is a question that has intrigued economists since the inception of the discipline. Recently the issue has received considerable attention from researchers puzzled by historically low U.S. saving rates and dramatic differences in saving rates across industrialized countries. While no consensus on the appropriate model of saving behavior has been reached, investigation of tax policy within a variety of neoclassical models suggests that governments can significantly influence the accumulation of national wealth. This assessment of the current state of knowledge about neoclassical models of savings behavior and government policy differs markedly from a view, still accepted in many circles, that tax policy within the standard economic paradigm has highly ambiguous impacts on wealth accumulation. The ambiguity is associated with allegedly opposing income and substitution effects arising from changes in tax rates, in particular, capital income tax rates. While this allegation is true for a subset of tax changes, neoclassical models admit a host of policies with clear and potentially powerful affects on national savings.

"Structural" tax changes provide an important example of such effective policies. They are defined here as changes in either the tax base or the progressivity of the rate structure holding constant both the time path of receipts and the time path of government consumption. Holding constant the time path of receipts provides a prescription for setting tax rates through time. A key feature of these policies is that they "compensate" the private sector for imposing a new tax by removing an old one. Since these policies involve no changes in the timing and level of the government's direct absorption of resources, they leave unchanged, in the ag-

gregate, the private sector's intertemporal consumption and leisure possibility frontier.[1] If it so chooses, the private sector can consume as much and work as little in the new tax regime as it does in the old. Such a response clearly leaves the private sector in the aggregate with the same collective resources to finance its own as well as the government's unaltered time path of consumption. The private sector will, however, generally respond to new tax regimes by choosing a different point on its budget frontier. The movement along this intertemporal frontier and its associated changes through time in savings and labor supply are determined by unambiguous substitution effects and, potentially, income effects. Although there is no aggregate change in income for the private sector, since its possibility frontier has not changed, structural tax changes typically redistribute resources across and within generations. However, for many structural tax policies the net income effects of this redistribution reinforce the substitution effects in raising or lowering savings.

The distinction between compensated and uncompensated policy changes is clarified by considering the government's intertemporal budget constraint. Excluding the possibility that government debt can grow indefinitely at a faster rate than that of the economy, this constraint requires governments to equate the present value of receipts, inclusive of base money creation, to the present value of expenditures, inclusive of interest and principal payments on net government debt. While restricting the set of policies, including structural tax policies, that can be used over time to alter wealth formation, the government's long-term budget is consistent with a wide range of short- and medium-term policies. In particular, the government can permit debt to grow for a long time at a faster rate than the economy, although indefinite use of this policy is not feasible.[2]

In addition to Structural Tax Policy, the government's intertemporal budget constraint suggests three other classes of policies for organizing a discussion of taxation and saving. These are:

Tax-financed Changes in Government Consumption—changes in the time path of government consumption that are contemporaneously financed by adjustments in tax rates of a particular tax base.

Intergenerational Tax Policy—reduced taxation of particular cohorts financed by increased taxation of other cohorts, holding constant the tax base and the time path of government consumption. In contrast to structural tax policy, this rule for setting tax rates involves changes in the time path of total annual tax receipts while holding constant the time path of government consumption.

Intragenerational Tax Policy—reduced taxation of particular members of a cohort contemporaneously financed by increased taxation of other members of that cohort. In contrast to broad structural changes in either the tax base or tax progressivity which are not cohort-specific and, consequently, redistribute intergenerationally, these cohort-specific policies involve only intragenerational redistribution.

Analysis of these four classes of policies provides insight into the economic impacts of the essentially unlimited broader combination of these and other policies.

This survey is limited to the savings ef-

[1] This is strictly true only in partial equilibrium, i.e., holding pretax factor returns and producer prices constant.

[2] Bennett MaCallum (1984) demonstrates that the government's budget constraint holds under a weaker condition than that assumed here. In particular the constraint holds even if debt indefinitely grows at a faster rate than the economy provided that rate is less than the long-run real return to capital.

fects of fiscal policy in "full employment" neoclassical models, assuming, in most of the discussion, well functioning capital markets. The emphasis on "full-employment" neoclassical models may be justified by the secular, rather than cyclical nature of the subject. In addition, the very significant new body of literature based on such models provides more than enough material for a single survey. Finally, much of the popular discussion concerning the behavior of savings and related variables over the cycle invokes these models, although not always correctly.

Section II provides background information for the subsequent discussion; it describes long-term trends in U.S. saving rates and domestic investment rates. Striking differences in postwar saving behavior among industrialized nations are also documented. This historical and international evidence provides a healthy perspective on the issue of taxation and saving. Few would argue that long-term trends in U.S. saving rates and the current low rate of U.S. saving relative to those of our principal trading partners are due solely, or even primarily, to differences in fiscal environments. Government policy is a significant determinant of national savings, but it is only one of several important forces at play. Other critical factors that jointly influence savings are intertemporal preferences, demographics, existing technology and the rate of technical change, patterns of human capital formation, the extent of market and intrafamily lending, and the degree of market and intrafamily risk-pooling.

Each of the four stylized policies is considered sequentially in Sections IV–VII. An examination of them raises a number of traditional topics including: the impact of government debt on national savings, the extent to which government consumption substitutes for private consumption, the distinction between investment and savings incentives, the savings impact of progressive taxation, the relationship between human and physical capital accumulation, the degree to which borrowing constraints alter the analysis, and the welfare implications of alternative tax structures. The discussion in these sections, which takes up a large portion of this article, ignores issues of uncertainty. Many important and interesting insights can be obtained by working with models of certainty. The introduction of uncertainty, in some cases, obscures these insights. In addition, many of the results from certainty models carry over to models with uncertainty. In general, certainty models provide a benchmark against which to examine current policies in more realistic settings in which tastes, technologies, and indeed future government behavior are uncertain.

Analysis of the four classes of policies as constrained by the government's long-term budget makes it clear that the fundamentals of fiscal policy are not aggregate "taxes," "spending," and "deficits," but rather changes in marginal incentives, intramarginal redistribution across and within generations, and direct government consumption. Section III examines government and private intertemporal budget constraints for purposes of precisely defining the policies considered in Sections IV–VII. The main objective of Section III is, however, to identify the government's underlying policy instruments and to caution the reader that official accounting definitions of taxes, expenditures, and debt provide little guide to the underlying fiscal structure. On the contrary, our proclivity to discuss such issues as savings and government policy in terms of this conventional nomenclature is symptomatic of widespread fiscal illusion. To drive home this point, Section III demonstrates how identical fiscal policies can be conducted with the government reporting essentially any level of taxes,

spending, and deficits it desires. Describing fiscal policy in terms of its effects on marginal incentives, intramarginal transfers, and direct absorption of resources requires changes in vocabulary and accounting, but a new fiscal language is necessary to discuss consistently the savings impact of our plethora of fiscal policies, all of which ultimately involve these basic elements. A key feature of the new fiscal language should be descriptions of the lifetime budget constraints of a small set of representative households as well as descriptions of the fundamental fiscal instruments that affect these constraints. Household budget constraints depend only on net marginal prices and net intramarginal endowments. Since the calculation of these prices and endowments are free of accounting conventions, a set of representative budget constraints would provide a coherent basis for analyzing the changes in and the consequences of a large variety of fiscal policies.

Section VIII addresses the impact of taxation on savings in uncertain environments. A series of contributions (Evsey Domar and Richard Musgrave 1944, James Tobin 1966, Jan Mossin 1968, Peter Diamond 1977, James Mirrlees 1974, Diamond and Mirrlees 1978, Martin Baily 1978, Steven Shavell and Laurence Weiss 1979, Hal Varian 1980, Roger Gordon 1981, Alan Auerbach 1981, Jeremy Bulow and Lawrence Summers 1982, Jonathan Eaton and Harvey Rosen 1980, Robert Merton 1983) expressly or by implication suggest that a variety of tax/transfer schemes constitute implicit insurance markets. To the extent that private provision of insurance is both available at the margin and is as efficient as government insurance, the government's pooling of risks through the tax/expenditure system will have few or no implications either for risk-pooling or for national saving. At the opposite extreme one could imagine that, in the absence of government insurance, particular risks would be pooled neither in formal private markets nor in informal family settings. In this case the effect of government taxation on savings is analyzed by simply considering the impact of the availability of each particular type of insurance on national savings.

Section VIII describes the potential insurance properties of a number of fiscal policies including capital and labor income taxation, and Social Security's unfunded tax/benefit provisions. Unfortunately, there are few studies that directly compare wealth accumulation with and without particular forms of insurance. Section VIII, as a consequence, draws inferences about taxation, insurance, and savings that are rather speculative in nature. These types of comparisons certainly represent a promising area for future research.

The government as a cause of uncertainty, rather than a source of insurance, is an alternative possibility explored briefly in Section VIII. In principle the private sector could self-insure against random government redistribution among current generations. Capricious redistribution between current and future generations is also potentially insurable assuming intergenerational altruism as in Robert Barro (1974). Without such private insurance, the impact on savings of government-imposed uncertainty is again determined by comparing economies with and without the particular risks generated by the government.

The final section plays devil's advocate to Sections IV–VII, by presenting a set of conditions under which government policy, regardless of type, has no effect whatsoever on national saving. The conditions required are extreme and reveal the improbability of such behavior. But the example also illustrates the fact that the underlying effective tax schedules influencing saving may have little or nothing to do with the legislated tax system.

The distinction between effective and legislated tax schedules dates at least from Charles Tiebout (1956) and underlies the emerging literature on the "dynamic inconsistency" of government policy (Finn Kydland and Edward Prescott 1977, Guillermo Calvo 1978, Stanley Fischer 1979, Stephen Turnovsky and William Brock 1980). Dynamic inconsistency refers to the proposition that, as ongoing institutions, governments are likely continually to reoptimize their fiscal choices taking current, but not past circumstances into account. As a result, policies slated today to go into effect in the future will likely be altered by the government in power in the future. In this sense, the government's actual actions may be inconsistent with its previously expressed intention.

Research in this area cautions that rational households look at what governments do, not what governments say. If households understand the government's objective function, they can potentially deduce the course of future tax policy independent of the government's current declarations. The difficulty of ascertaining private beliefs about future government actions presents special problems for studying the savings impact of current tax policy. Such analyses are clearly sensitive to assumptions concerning private beliefs about actual future tax policy.

II. *U.S. Savings Behavior—Some Stylized Facts*

The net national saving rate is one of several important indicators of a nation's savings behavior. It records the fraction of annual net output that will be available to support future consumption, and is defined as NNP less private and government consumption, C and G, respectively, divided by NNP. The first column of Table 1 presents averages of the annual U.S. net national saving rate over the five decades prior to 1980 and the period 1980 through 1982. Values for NNP, C, and G differ somewhat from those reported in the National Income and Product Accounts (NIPA). The major difference is that private spending on consumer durables and government spending on highways, structures, equipment, other durables, and military hardware are treated as saving in the present figures. Private consumption excludes expenditures on durables, but includes imputed rent on the stock of durables. Government consumption excludes purchases of structures and other durables, but includes imputed rent on these tangible assets, including military assets. NNP includes imputed rent on consumer durables and government assets less depreciation of these assets.[3] The figures in column one are little affected by the treatment of military durable purchases as investment. For reference column 2 presents the net national saving rate based on NIPA definitions of the relevant variables.

Both sets of figures reveal major variations in the saving rate over the 53 year period. The corrected numbers in column one show a 28 percent reduction in the average saving rate since 1970 compared with the average rate in the preceding two decades. The comparable reduction is 19 percent based on the NIPA definitions of the relevant variables.

Columns 3 and 4 display rates of household and government consumption out of NNP. At first glance the 7 percentage point increase in the government consumption rate between the 1950s and early 1980s appears responsible for the recent dramatic decline in the rate of U.S. saving; household consumption as a share of NNP increased by only 1 percentage

[3] John Musgrave provided the BEA data used in these calculations. Imputed rent is defined here as depreciation (estimated by the BEA) plus beginning of year assets, measured in current dollars, times the average annualized three month Treasury bill rate less the annual percentage change in the Consumer Price Index.

TABLE 1
INDICES OF U.S. SAVING BEHAVIOR: 1930–1982
(Average Annual Rate Over Specified Period)
(Percent)

Sample Period	Net[a] National Saving Rate	Net National Saving Rate (NIPA Basis)	Household[a] Consumption Rate (C/NNP)	Government[a] Consumption Rate (G/NNP)	Rate of[a] Household Consumption Out of Disposable NNP (C/NNP-G)
1930–1939	−1.17	−2.86	87.66	13.51	101.49
1940–1949	10.23	5.32	68.35	21.42	87.29
1950–1959	15.60	8.79	67.64	17.02	81.60
1960–1969	14.25	8.71	65.35	20.40	82.09
1970–1979	11.90	7.70	67.10	21.00	84.92
1980–1982	7.04	5.07	68.62	24.35	90.71

[a] Household consumption, C, equals NIPA personal nondurables consumption expenditures plus imputed rent on household durables. Government consumption, G, equals NIPA government nondurables consumption expenditures plus imputed rent on government tangible assets, including military hardware. NNP equals NIPA NNP plus imputed rent on household durables and government tangible assets less depreciation of these assets.

point across these two time intervals. Had this share remained constant, the nation's saving rate would still have fallen by 21 percent.

A neoclassical perspective suggests, however, that private behavior determines most if not all of these historical changes in the nation's saving rate. Consider the following two alternative hypotheses: The first assumes that government consumption substitutes perfectly for household consumption. In this case, since household consumption is a marginal choice, the sum of the figures in columns 3 and 4 indicate that households, on average, collectively chose to consume 85 percent of NNP in the 1950s and 1960s and 89 percent of NNP in the 1970s and early 1980s. NNP, in this case, properly measures annual household disposable income, since the government is simply engaging in consumption the household sector would otherwise do on its own.

The second extreme hypothesis is that government consumption provides no welfare whatsoever to the private sector. As Section III points out, under reasonable assumptions concerning limitations on deficit finance, the private sector must eventually pay for current government consumption. Hence the amount of net national product remaining after government consumption, NNP-G, provides a measure of the private sector's effective annual disposable income; this is true despite the fact that net tax payments may differ from government consumption in particular years. Column 5 examines the rate of consumption out of this definition of annual household disposable net national product. Note that this consumption rate rose from 82 percent in the 1950s to 91 percent in the early 1980s. Had the post-1969 rate of household consumption out of NNP-G remained at its 1950–1969 average value, the net national savings rate would have fallen by 5 percent rather than 28 percent. This second assumption concerning the substitutability of private and government consumption attributes

none of the increased government consumption to private sector decisions. Hence, from this perspective, increased government consumption is directly responsible for at most one fifth of the post-1969 drop in the net national saving rate.

The figures in Table 1 showing considerable variations in national and household saving propensities may appear surprising in light of what has been dubbed "Denison's Law." Edward Denison (1958), Bert Hickman (1966), and Paul David and John Scadding (1974) document that the U.S. ratio of gross private saving to gross national product has been remarkably stable through time. Without questioning the validity of this proposition, it is well to point out that gross private saving is the difference between gross national saving and the NIPA definition of government deficits. As Section III emphasizes, the NIPA definition of deficits is an entirely arbitrary accounting choice. If one assumes that economic behavior depends on real variables rather than accounting conventions, then the U.S. gross private saving rate is similarly an entirely arbitrary accounting construct. Had government accountants chosen a quite different definition of deficits, the gross private saving rate would have exhibited substantial variation through time.[4] Unlike measures of "private" saving rates, measurement of the net national saving rate is independent of accounting conventions that arbitrarily label particular variables as "private" or "government"; in addition, assuming no fiscal illusion on the part of economic agents, the actual rate of net national saving responds only to economic variables and not to accounting labels.

Much of the variation in saving rates described in Table 1 may simply reflect intertemporal consumption smoothing during periods of fluctuating net national product. Figure 1 displays deviations from trend in corrected measures of private consumption and net national product. Detrended consumption is clearly a much smoother series than detrended NNP. This well-known fact provides some empirical support for examining neoclassical models that assume reasonably well-functioning capital markets and predict intertemporal consumption smoothing.

International Comparisons of Saving Rates and International Capital Mobility

For the period 1930 to 1982 the correlation coefficient between the U.S. net national saving rate and the net domestic investment rate, defined as the ratio of the net domestic investment to NNP is .99. The absolute discrepancy between these two rates exceeds 1.5 percentage points in only 4 of the last 53 years. Studies by Martin Feldstein and Charles Horioka (1980) and Feldstein (1982) of time series and cross-country correlations between saving and investment rates suggest that policies generating an additional dollar in national saving increase domestic investment by roughly 85 cents. Arnold Harberger (1980) and Jeffrey Sachs (1981a, 1981b) reject this view, and present evidence that numerous countries are financing major portions of their domestic investment through foreign sources.

While the debate on the degree of international capital mobility has been joined, the issue has not been resolved. Eaton and Mark Gersowitz (1981), and Michael Doo-

[4] David and Scadding (1974) suggest that the private sector may use "taxes," as defined and reported by the National Income and Product Account, to measure current government consumption. In this case the gross private saving rate equals the perceived gross national saving rate, and its constancy, assuming a roughly stable economic environment as well as stable preferences, suggests that perceived government consumption substitutes perfectly and intramarginally for private consumption. As Michael Boskin (1978) points out, however, "ultrarational" households presumably take account of the depreciation of the economy's physical capital in making economic choices. Table 1 indicates that the net national saving rate, which accounts for depreciation, has been anything but constant since 1950.

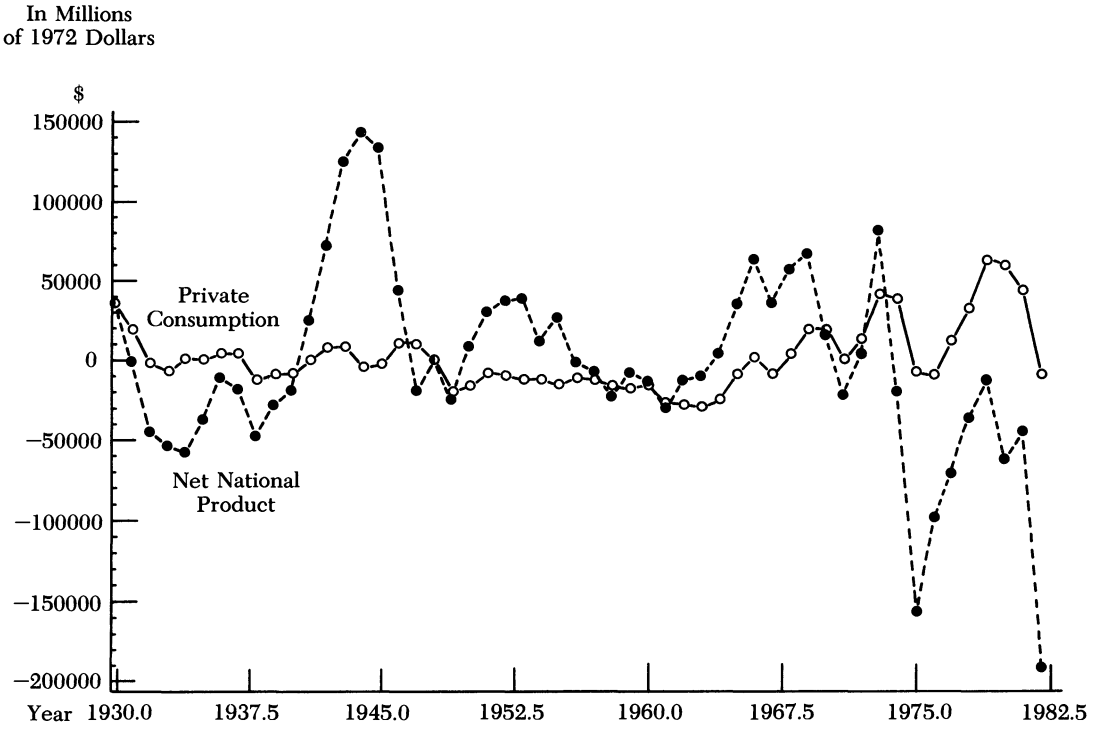

Figure 1. Volatility of National Aggregates—Deviations from Trend

ley and Peter Isard (1980) provide a theoretical foundation for the Feldstein-Horioka findings based on a perception of potential foreign expropriation; their models suggest possibly large gross international capital flows, but quite small net flows. The limited size of net international flows is ascribed to the increasing probability that a country will expropriate foreign equity investments or default on its foreign borrowing as the amount of net foreign claims on its assets increases. An alternative explanation of the Feldstein/Horioka findings, that is consistent with full international capital mobility at the margin, is that factor price equilization eliminates the incentives for international capital flows.[5] Given the unresolved nature of this debate, prudence suggests analyzing the savings impact of domestic fiscal policies in both closed and open economics; In open economies—as originally pointed out by Peggy Musgrave (1969) and recently examined by Lawrence Goulder, John Shoven and John Whalley (1983) and Harberger (1983)—policies that stimulate domestic investment can be quite different from policies that stimulate national saving. The concluding subsection in IV briefly points out the nature of these differences.

Whether or not capital is perfectly mobile internationally, cross-country comparisons of saving rates are obvious guides to changes over time in the international distribution of wealth and in relative standards of living. Table 2 compares the net national saving rates of U.S. and other OECD countries based on newly available OECD data. The OECD concepts of NNP, C, and G are roughly those used in the

[5] This requires that each trading country have positive net wealth. David Bradford made this observation in a conversation with the author.

TABLE 2
SAVING AND CONSUMPTION RATES: INTERNATIONAL COMPARISONS
(Average Annual Rates Over Specified Period)
(Percent)

Period	Net National Saving Rate			Government Consumption Rate: G/NNP			Household Consumption Rate: C/(NNP-G) Out of Disposable NNP		
	U.S.	OECD Europe	Japan	U.S.	OECD Europe	Japan	U.S.	OECD Europe	Japan
1955–1959	9.8	NA	21.5	19.1	NA	10.6	87.9	NA	76.0
1960–1969	10.5	17.3	17.0	20.1	15.7	9.4	86.9	79.8	70.2
1970–1979	8.0	15.1	25.5	20.1	18.5	10.4	89.9	81.5	70.5
1980–1981	5.0	11.0	21.3	20.9	19.9	11.7	93.6	86.3	75.9
1960–1981	8.7	15.7	25.8	20.2	17.3	10.1	88.9	81.0	71.3

Source: OECD (1983); variables are defined according to U.N. System of National Accounts.
NA = Not available.

U.S. National Income and Product Accounts except that government consumption, G, excludes expenditures on nonmilitary durables and structures.

Table 2 provides evidence of persistent and sizeable international differences in rates of net national saving and rates of household consumption out of NNP-G. Since 1960, the U.S. net national saving rate has averaged 55 percent of the corresponding rate for the European OECD countries, and 34 percent of the Japanese rate. For this period the average U.S. household consumption rate, C/(NNP-G), exceeds the corresponding European OECD rate by 8 percentage points and the Japanese rate by 18 percentage points.

International differences in rates of domestic capital formation and increases in capital-labor ratios are equally striking. OECD data indicates that the U.S. net domestic capital stock grew at an average annual rate of 3.6 percent between 1960 and 1982; the comparable figures for France and Germany are 12.3 percent and 10.4 percent, respectively. Over this period U.S. capital per worker grew on average by 1.5 percent per year compared with 11.6 percent in France and 10.4 percent in Germany.

III. *Government and Private Budget Constraints: A Description of Fundamental Policy Instruments*

The government, as an institution with potentially unlimited life, is in a position to borrow from succeeding new generations to meet its liabilities to existing generations. If the real interest rate paid on such borrowing exceeds the economy's rate of population plus productivity growth, a policy of continually borrowing to meet all interest and principal payments means that government debt continually grows relative to the size of the economy. Such a policy is clearly infeasible; if government creditors demand real resources upon settlement with the government, all current output plus claims to existing assets will eventually be insufficient to meet these demands. In an economy in which the pretax real return paid on government borrowing exceeds the underlying rate of economic growth, deficit-financed spending ultimately requires

the government to raise real resources either by explicit taxation or by expropriation through inflation or otherwise of its creditors' nominal assets. In the long run, these revenues must meet government spending plus the excess of interest payments on past borrowing over the expansion of debt that could perpetually be financed by the growth in the economy. The limitation on debt finance implies the following relationship between the course of taxation, base money creation, spending on government consumption plus transfer payments, and the market value of the government's initial net liabilities, D_0:

$$\sum_{t=0}^{\infty} \frac{T_t + \Delta M_t}{1 + r_t} = \sum_{t=0}^{\infty} \frac{E_t}{1 + r_t} + D_0. \qquad (1)$$

Equation (1) expresses the government's intertemporal budget constraint in terms of conventional fiscal taxonomy. T_t, ΔM_t, and E_t are, respectively, nominal taxes, base money creation, and nominal expenditures on consumption and transfer payments in year t. These flows are discounted at nominal interest rates, r_t, that are realized between time zero and t. In a world of certainty, the $r_t s$ are given by the term structure of interest rates prevailing at time zero. D_0, the market value of net government liabilities at time zero, can also be written as the discounted value of interest plus principal repayments.

The budget constraint indicates that "printing" of high-powered money is a source of government revenue; in the U.S. and in many other countries government acquisition of real resources by simply "printing" money is effected by the treasury or finance ministry selling bonds to the private sector which the central bank then purchases with newly created money. Equation (1) consolidates the fiscal behavior of these institutions.

The long-run connection between this constraint and the economy's growth and interest rates is evident in equation (2) which expresses the constraint when the economy is in a stationary state in which all real variables are growing at the rate n and the inflation rate is Π:

$$t + \Delta m = e + (r - \Pi - n(1 + \Pi))d. \quad (2)$$

Each of the variables in (2) is measured per effective worker. This expression verifies the proposition that long-run real revenues including base money creation $(t + \Delta m)$ less spending (e) must cover real interest payments on debt $(r - \Pi)d$ less the additions to the stock of debt that can be financed by economic growth alone $n(1 + \Pi)d$.

A. *The Fragility of Government Bookkeeping and the Potential for Fiscal Illusion*

Macroeconomists typically discuss fiscal policy in terms of officially reported values of "taxes," "spending," and "deficits." "Taxes" in excess of "spending" is commonly referred to as "tight" fiscal policy, while the converse is described as "loose" fiscal policy. Unfortunately, the accounting definitions of "taxes," "spending," and "deficits" are arbitrary, having no counterparts in economic theory; in full employment equilibrium models with operative capital markets, household budget constraints depend on marginal prices and endowments and are independent of accounting conventions with respect to government policy. From the perspective of these microbudget constraints, fiscal policies that are tight are often mislabeled loose and vice versa. The failure to discuss fiscal policy in terms of household budget constraints raises the potential for fiscal illusion.

The "pay-as-you-go" financing of the U.S. Social Security System provides an excellent example of our propensity to engage in fiscal illusion. The Social Security System represents the Federal government's largest program of intergenera-

tional transfers, yet none of what effectively constitutes enormous borrowing from current and future generations was officially recorded as "deficits." Recent estimates by Social Security actuaries suggest an unfunded Social Security liability of 4 to 6 trillion dollars owed to the current adult population. These liabilities, while they are not legally enforceable obligations and have different risk properties than official debt, swamp estimates of the government's current official net liabilities. Indeed, official U.S. net liabilities (D_0 above) measured at market value appear to be slightly negative (the government's official net worth is positive), reflecting considerable federal holdings of financial and tangible assets and sizeable capital gains on nominal government liabilities accrued during the 1970s (Robert Eisner and Paul Pieper 1983; *1982 Economic Report of the President,* Chs. 4 and 5).

Historically, the government could have made its hidden annual Social Security "deficits" explicit by simply handing each Social Security taxpayer a piece of paper indicating his or her projected claim to additional future benefits "purchased" with his or her annual payment of Social Security "taxes." Had the government recorded Social Security "taxes" as payments for Social Security bonds, the government would have reported deficits, inclusive of these bond issues, in excess of $300 billion dollars in several of the last 20 years, and deficits in excess of $100 billion dollars in most of the last 20 years. One imagines that this alternative tally of government indebtedness would have engendered very different estimates of concepts such as *"the* full employment deficit" and would have led to an array of quite different econometric findings. Economists, insensitive to the problem of fiscal illusion, may well have reached very different conclusions about the degree of fiscal stimulus.

Presumably, such a redefinition of official government liabilities would raise the question of classifying other implicit commitments to future expenditures as government debt.[6] If one is willing to label implicit promises to pay future retirement benefits official liabilities, why not include implicit expenditure commitments to maintain the national parks, to defend the country, or to provide minimum sustenance to the poor?

A heated debate about the appropriate definition of government debt would likely lead some exasperated officials to suggest eliminating deficit financing entirely and simply relying on taxation. These officials might also argue that one could switch from "deficit" to "tax" finance with no effect whatsoever on the economy. Under the assumption of perfect capital markets, they would be quite correct. Rather than raise additional funds by issuing treasury securities, the government could simply levy a head "tax" per adult promising to provide each adult in the following year a tax credit equal to the tax plus interest on the tax. If the adult died during the year, the payment would be made to his or her estate. Those too poor to pay the head tax could borrow against next year's tax credit to obtain the required funds. The equality, in present value, between each household's head tax and its head tax credit, leaves household budgets and, therefore, private behavior unaltered. However, since future tax cred-

[6] The decision to label prospective expenditures "official liabilities" has real effects to the extent that it alters the probability that such expenditures will be made. While the default risk may be smaller for official than for unofficial, implicit liabilities, the real return to official liabilities may still be highly risky. In the U.S., for example, official commitments to future nominal expenditures do not correspond to commitments to future real expenditures. During the 1970s the U.S. federal government accrued 365.5 billion dollars, measured in 1980 dollars, in real capital gains on its official liabilities while never missing a nominal principle or interest payment. This default on the real value of official liabilities through inflation is documented in the *1982 Economic Report of the President,* Ch. 5.

its, like future Social Security benefit payments, are not recorded in the current budget, this policy permits the government to report a smaller deficit.

An analysis of (1) indicates more precisely how shrewd accounting can eliminate the reporting of deficits without changing any real policy. Define a sequence of head taxes, $\bar{T}_t$, that may be negative or positive, but that sum in present value for each household and, therefore, for the aggregate economy to zero, by:

$$\bar{T}_0 = D_0(1 + r_0) + E_0 - (T_0 + \Delta M_0), \text{ and}$$
$$\bar{T}_t = E_t - (T_t + \Delta M_t) \text{ for } t > 0. \tag{3}$$

Condition (4) follows immediately from (1) and (3).

$$\sum_{t=0}^{\infty} \frac{\bar{T}_t}{1 + r_t} = 0. \tag{4}$$

Adding zero as defined by (4) to the left-hand side of (1) and letting $T_t^{**} \equiv T_t + \bar{T}_t$ produces:

$$\sum_{t=0}^{\infty} \frac{T_t^{**} + \Delta M_t}{1 + r_t} = \sum_{t=0}^{\infty} \frac{E_t}{1 + r_t}, \tag{5}$$

and for all $t > 0$,

$$T_t^{**} + \Delta M_t = E_t. \tag{6}$$

According to (6) the government can now report zero debt and zero deficit in every year in the future, while running exactly the same policy. The trick in going from (1) to (6) is simply to have the government label private sector loans to the government positive "taxes" and to classify government loan repayments as negative "taxes."

Starting from (6) the government could further modify its accounting practices and start reporting enormous "surpluses," although it again engages in no real policy change. The game here involves the government imposing additional positive head taxes, $\bar{\bar{T}}_t$, and positive head transfer payments, $\bar{\bar{E}}_{t+1}$, related by:

$$\bar{\bar{T}}_t = \bar{\bar{E}}_{t+1} \frac{(1 + r_t)}{(1 + r_{t+1})}. \tag{7}$$

Provided the "tax" payers at t are the "transfer" recipients at $t + 1$, this policy has no effect on household budget constraints. The official "surplus" (a stock) at time t, S_t, for $t > 0$ is now reported as:

$$S_t = S_{t-1} \frac{(1 + r_t)}{(1 + r_{t-1})} + \bar{\bar{T}}_t + T_t^{**} + \Delta M_t - E_t - \bar{\bar{E}}_t = \bar{\bar{T}}_t, \tag{8}$$

since $\bar{\bar{E}}_t = S_{t-1}\,[(1 + r_t)/(1 + r_{t-1})]$ by construction, and $T_t^{**} + \Delta M_t - E_t$ equals zero from (6). The government can potentially make $\bar{\bar{T}}_t$ and, therefore, its reported surplus at time t as large as the economy's stock of wealth at time t.[7]

The fact that economic theory does not distinguish positive "taxes" or negative "spending" from government "borrowing" and positive "spending" or negative "taxes" from government "debt service" potentially permits the government to report essentially any level of debt and deficits it wants without affecting the economy. In addition to this freedom to manipulate the reporting of "deficits," the government has essentially unlimited flexibility in altering the size of reported

[7] The government, in this case, "owns" all wealth and invests its wealth in the private sector each period either directly through government firms or indirectly through government loans to private firms and individuals. For neutrality, the allocation of government direct and indirect investment must correspond to what would otherwise have arisen in the absence of the "surplus." In this example the government effectively acts like the private sector's bank, since private sector wealth is simply funneled through the government's hands and invested back in the economy. The "taxes," $\bar{\bar{T}}_t$ are, in effect, loans to the government, and the "spending," E_t, represents repayment of principal plus interest. Just as positive "taxes" may constitute private loans to the government, negative "taxes" may be equivalent to government loans to the private sector. For example, accelerated depreciation allowances and other investment incentives at the early stages of an investment prospect, coupled with positive taxation of investment returns at later stages, can, apart from their impact on marginal incentives, be viewed as government loans to the private sector. The repayment of these "loans" is paid in the form of "capital income taxes."

"taxes" and "spending" given the level of "deficits" it chooses to report. The government could, for example, declare a new set of taxes and transfers of equal value. Assuming that households paying these additional "taxes" receive an identical amount back in the form of additional "spending" and that any changes in marginal incentives (prices) associated with the new "taxes" are exactly offset by changes in marginal incentives (prices) associated with the new "spending," economic activity will remain unchanged. Reducing the "size" of government taxes and spending with no real consequences is also in the power of government bookkeepers.

Between 1960 and 1983, U.S. Federal spending on transfer payments, including grants-in-aid to state and local governments, rose from 6 percent to 14 percent of GNP, leading many to praise, many to decry, and others to study the "growth" in government. The bulk of Federal transfer payments, 75 percent, are direct payments to individuals; most Federal transfers to state and local governments are ultimately paid to individuals in the form of medical, housing and general welfare support.

In principle, the Federal government could have incorporated all postwar transfer payments within the tax code in the form of special tax credits and deductions. Had the government imbedded this "growth" in spending in the tax code as additional "tax expenditures," a term coined by Stanley Surrey (1973), and adopted in the Congressional Budget Act of 1974, reported Federal spending would simply have consisted of consumption. Federal consumption, excluding purchases of durable goods, but including imputed rent on government assets, fell as a fraction of NNP in the postwar period from 10 percent in the 1950s to 8 percent in the 1982. One presumes that this manner of displaying economic reality would have led many of those who now praise, decry, and study the growth in government, to decry, praise, and study its decline.

The point here is certainly *not* to claim that there were no economic effects from the postwar rise in reported transfer payments. These policies were associated with significant changes in the intertemporal budget constraints of virtually all American households. The point is that the size and character of the effects of fiscal policy cannot be judged from the size of "taxes," "deficits," etc, because these accounting entries can vary widely without having any affect whatsoever on economic activity. Discussing fiscal policy and savings without engaging in fiscal illusion requires identifying the government's fundamental policy instruments including those that have a direct impact on the economy and those that indirectly affect the economy by altering household budget constraints.

B. *Real Versus Illusory Fiscal Policy*

Equation (9) represents a final rewriting of equation (1) that conveniently illuminates the government's fundamental policy instruments. This description of the government's budget uses the fact that D_0, the government's initial net liabilities, may be expressed as the present value of net interest plus principal payments on D_0. In (9) all government outlays including interest and principal payments on D_0, but excluding consumption outlays, G_t, are incorporated in a "tax expenditure" tax code denoted by ^. The ^ tax code treats all such outlays as either refundable tax credits or deductions, specifying, where necessary, the names of particular households in society receiving these payments. All households that are alive or will be alive are referenced by the index j. Obviously, the $\hat{T}_{jt}s$ are zero for years prior to and after the households are in economic existence.

$$\sum_{t=0}^{\infty} \frac{\hat{T}_t + \Delta M_t}{1 + r_t} = \sum_{t=0}^{\infty} \sum_{j=1}^{\infty} \frac{\hat{T}_{jt} + \Delta M_t}{1 + r_t} = \sum_{t=0}^{\infty} \frac{G_t}{1 + r_t} \tag{9}$$

Transforming all nonconsumption outlays into equivalent "tax expenditures" permits one to focus directly on net lump sum and net marginal taxation of households; i.e., each $\hat{T}_t$ terms equals a net (positive or negative) lump sum tax imposed in year t on households j, plus year t, household j tax schedules applied to corresponding year t, household j tax bases.[8]

In the U.S., earnings- and incomes-tested welfare and social insurance programs significantly alter marginal incentives to work and save. By adding this implicit net tax schedule to other explicit federal, state and local tax schedules, the ^ code identifies the ultimate effective tax structure facing each household. Piercing the "welfare veil" of taxation under the tax code reveals that "negative income taxation" is already a reality in the U.S., although the negative income tax schedules confronting U.S. households differ greatly from those that have been proposed (Milton Friedman 1962); current U.S. negative income tax schedules are categorical, depending on the household's demographic composition, and often exhibit extraordinarily high marginal tax rates on labor supply at low earnings levels. The ^ tax code should also be understood as piercing the "corporate veil," taking account of both corporate and personal taxation and subsidization, (e.g., investment incentives) of the return to capital in describing the government's net influence on the tradeoff between current and future consumption and leisure.[9]

The government's fundamental policy instruments are thus its choices of ΔM_t, G_t, its effective net marginal tax schedules, and its net intramarginal taxation. Household preferences and budget constraints are, by assumption, the sole determinants of household consumption and labor supply decisions. Hence, government policy involving feasible (satisfying Eqn. 9) choices of the terms $\hat{T}_{jt}$, ΔM_t, G_t and the net marginal tax rates and the net intramarginal taxes influencing its T_{jt} revenue alters private behavior only by changing the after-tax prices and after-tax endowments appearing in household intertemporal budgets.

C. *Marginal Taxation and Human Capital Formation*

The government's effective marginal tax schedules affect household budgets in

[8] For example, a household's welfare and Social Security benefit payments, before any reduction for earnings, are treated as lump sum tax credits; and the schedule of potential losses of these benefits because of labor earnings is added to other marginal labor tax and subsidy schedules facing the household (more precisely specific household members) in year t to produce a total net labor earnings tax schedule. This schedule is applied to household j's actual earnings to calculate total taxes on labor earnings in year t by household j. Similarly, the government's year t payments of interest and principal on net official debt held by household j are subtracted from other net intramarginal taxes to determine household j's total net lump sum tax in year t. Effective (net) capital income tax rate schedules confronting each household in each future year are determined by comparing before-tax returns earned on a household's marginal investment with the after-tax (including corporate and personal tax) return received by that household (Auerbach and Dale Jorgenson 1980).

[9] For most fiscal programs the relationship between their provisions and these fundamental policy instruments is easily discerned. For other policies the connection is extremely subtle. Section VI, for example, describes how government investment incentives redistribute resources from older to younger cohorts not through the explicit collection and transfer of resources, but by lowering stock market values. Another example, pointed out by Boskin (1982), are government regulations governing the characteristics of particular commodities; a rule that mandates automobile seat belts in new cars can effectively be equivalent to the government's levying a tax on the purchase of each automobile, and spending (consuming) these revenues on safety belts for each new automobile.

three ways. First, they change after-tax prices between current and future values of consumption and leisure. Second, they change the present value of households' resource endowments, including their human and nonhuman wealth. Third, they change incentives to accumulate human capital, which, in turn, alters the household's time path of pretax wage rates. Research on fiscal policy and savings has focused most closely on the first two channels by which government marginal taxation affects household behavior. Michael Boskin's (1975) article on taxation and human capital formation is a notable exception. Under the assumption that time spent in training and related activities is the only input into human capital formation, Boskin showed that a proportional labor tax has no distorting affect on the human capital investment decision; the proportional labor tax reduces the opportunity cost of human capital accumulation (i.e., it reduces the size of net foregone earnings) while also reducing the return from the investment paid in the form of future after-tax wages. The additional incentive to invest in human capital is exactly offset (in present value) by the additional disincentive in the case of proportional labor taxation.

Boskin further clarified the net disincentive to human capital formation under progressive taxation of labor income or under proportional taxation, assuming that additional inputs are required for this investment and that expensing of these inputs is not permitted. Subsequent articles by James Heckman (1976) and Kotlikoff and Summers (1979) stressed the incentive to human capital formation arising from capital income taxation; higher capital income tax rates mean lower after-tax rates of return and larger discounted values of the future returns from human capital investment.

In neoclassical models with no uncertainty and no borrowing constraints the timing of household consumption decisions is not contingent on the timing of the receipt of labor earnings. Hence, more human capital investment means less current labor supply, less current output, as conventionally measured, and, with household consumption not directly reduced, less conventional saving. In addition, if consumption goods, such as educational services, are used in human capital investment, the expansion of such investment directly increases consumption of this type, further lowering current saving. A corollary to this point is that tax incentives that promote human capital formation typically do so at the cost of less nonhuman capital formation. In the case of capital income taxation, incentives for greater current human capital formation (smaller current labor earnings) reinforce incentives to substitute current for future consumption in discouraging nonhuman wealth accumulation (Kotlikoff and Summers 1979).

While additional investigation of the tradeoffs between human and nonhuman capital formation is needed, it appears unlikely that realistic modeling of these interactions would greatly affect many of the findings about taxation and nonhuman capital formation described below.

D. *Structural Tax Policy*

Household budget constraints, like those of the government, can be rewritten in multiple ways. In particular, quantities can be multiplied by either before-tax or after-tax prices, with additional terms appearing in the expression that uses before-tax prices. The conventional formulation multiplies quantities by after-tax prices, since households are presumed to consider after-tax prices in making economic choices. In the standard expression the present after-tax prices of current and future consumption incorporate consumption and capital income tax rates, while the present after-tax prices of current and

future leisure incorporate labor and capital income tax rates. Structural tax policy involves changes in tax rates and, therefore, changes in relative prices of current and future consumption and leisure. The requirement that the new tax code generate the same time path of receipts as the code it replaces provides a rule for setting net tax rates through time. Such changes in tax bases or the rate structure under a given tax base leave unchanged the private economy's intertemporal possibilities frontier, although they typically induce different choices of points on that frontier.[10]

While each household, acting independently, perceives that its budget has been changed by structural policy, the private sector as a whole ultimately operates with the same budget; i.e., it experiences no aggregate change in income. To see this consider equation (10) that presents the aggregate (private plus government) economy's intertemporal budget constraint. In (10) Z_{jt} equals expenditures in year t by household j on leisure and consumption goods, including imputed rent on consumer durables and money holdings. H_0 and A_0 are, respectively, human wealth (the present value of labor earnings) and the market value of nonhuman wealth of the economy at time zero. All terms in (10) are measured in pretax nominal units of account discounted at pretax nominal interest rates:

$$\sum_{t=0}^{\infty}\sum_{j=1}^{\infty}\frac{Z_{jt}}{1+r_t}+\sum_{t=0}^{\infty}\frac{G_t}{1+r_t}=H_0+A_0. \quad (10)$$

The right-hand side of (10) indicates the total present value of the economy's current and future resources available to finance the present value of government consumption and private purchases of consumption goods and leisure, the first term on the left side of (10).

For a given time path of G_t, (10) corresponds to the private economy's intertemporal budget, i.e., the resources available for private consumption and leisure are the economy's total resource endowment, $H_0 + A_0$, less the government's claim on that endowment, $\sum_{t=0}^{\infty}[G_t/(1+r_t)]$.[11] Hence, one feasible response to the government's switching tax bases or altering the rate structures of prevailing tax bases is that private behavior as well as all before-tax prices (including the r_t's) remain unaltered. Changes in the tax structure in the presence of unchanged private behavior and before-tax prices imply, of course, changes in some if not all the $\hat{T}_{ij}$'s, but, according to (9) these new taxes plus base money creation must still equal, in present value, the present value of government consumption. From (10), then, the economy's resources remaining for private expenditures on consumption and leisure are unaltered. Stated differently, if real private sector behavior and the G_t's remain unchanged, the government will be forced to choose tax rates under the new tax structure that are consistent with (9) for unchanged values of both the r_t's, the ΔM_t's and the G_t's.

If the private sector consisted of a single, infinitely-lived household, one would expect that household to understand the aggregate economy's budget constraint (10). Such a rational household would know it had to pay for the government's time path of consumption regardless of what tax system was being used to collect the resources; more precisely, it would know that changes in its behavior would automatically lead to changes in tax rates. A single household would, therefore, in-

[10] This statement and the subsequent discussion ignore differential rates of taxation of the same factor across industries and assume constant pretax factor returns and producer prices.

[11] Substituting for $\sum_{t=0}^{\infty}[G_t/(1+r_t)]$ from (9) into (10) gives the private sector's budget constraint with quantities multiplied by before-tax prices.

ternalize the government's budget constraint and treat taxes, no matter how they were imposed, as lump sum levies. In such a setting structural tax changes would have no effect whatsoever. However, in the case of a large number of households, none of whom pay more than a trivial fraction of total taxes, the assumption that no single household considers the feedback of its behavior on government tax rates is more appealing. Under this Cournot-Nash assumption each household attempts to "free ride" on the tax payments of other households by altering its behavior in response to changes in tax incentives. In partial equilibrium, i.e., holding constant before tax prices, including the r_t's, (9) and (10) indicate that the new values of private consumption and leisure (summarized by Z_{jt}), after the private sector responds to the new tax structure, lie on the private economy's original budget frontier. Thus, structural tax changes, in partial equilibrium, produce compensated changes in behavior of the type described by Harberger (1964) and Diamond (1970). These compensated changes along the initial budget frontier, like John Hicks' (1942) compensation around an initial indifference surface, are unambiguous in sign.

Figure 2 illustrates this type of partial equilibrium compensated change for a consumer who chooses consumption over two periods, C_1 and C_2, based on an exogenous initial endowment, E_1. The government taxes the consumer to finance its consumption which has a present value of G_1. The slopes of lines 1 and 2 equal $1 + r$ where r is the before-tax interest rate. The slope of line 4 is $1 + r(1 - \tau_r)$, where τ_r is the capital income tax rate. Point A is the equilibrium under lump sum taxation, while point B corresponds to the equilibrium under a capital income tax structure. The government collects the same present value, G_1, in taxes under both tax structures, and private consumption occurs along the same budget frontier, line 2;[12] the increase in capital income taxation is compensated by a decline in lump sum taxation permitting the consumer to end up consuming on his initial budget frontier. Assuming smooth convex indifference curves, private consumption in period 1 unambiguously rises from C_1^* to C_1^{**}. Note that if the private sector had maintained its initial consumption bundle, the government's capital income tax rate would have been lower by the difference in the slopes of lines 3 and 4 divided by r.

Figure 2 can be used to describe the impact on national savings of a structural shift from lump sum to capital income taxation. Since structural tax policy, as here defined, leaves unaltered the time path of government revenues, the lump sum tax, like the capital income tax, is assumed to be levied in period two. The post-tax endowment point in Figure 2 is thus E_1' under the lump sum tax and E_1 under the capital income tax.

In a simple two-period overlapping generations life cycle model (Franco Modigliani and Richard Brumberg 1954, Albert Ando and Modigliani 1963), each generation lives for exactly two periods. The young generation in this model has no initial wealth and all private wealth is held by the old generation. The wealth of the old generation, in turn, corresponds to the savings accumulated by the old generation when it was young. Letting W_{P1} stand for the private wealth of the old generation accumulated during its first period and letting W_g denote government

[12] Note that in the case of a capital income tax, τ_r, the present value of revenues is $\tau_r r(E_1 - C_1)/(1 + r)$, where $E_1 - C_1$ is first period saving, and $r(E_1 - C_1)$ is capital income in period 2. The household budget constraint, $C_2^{**} = (E_1 - C_1^{**})(1 + r(1 - \tau_r))$, can be written as, $E_1 - \tau_r\, r(E_1 - C_1^{**})/(1 + r) - C_1^{**} = C_2^{**}/1 + r$. In Figure 2 C_2^{**} equals the verticle distance BC_1^{**}, and the slope of line 2, $1 + r$, divided into the length BC_1^{**} equals the horizontal distance $E_1 - G_1 - C_1^{**}$, i.e., $E_1 - G_1 - C_1^{**} = C_2^{**}/1 + r$. Hence the distance G_1, in the diagram measures the present value of tax receipts under either lump sum or capital income taxation.

wealth, then National Wealth W is given by: $W = W_g + W_{P1}$.[13] In terms of Figure 2, W_{P1} under lump sum taxation equals $E_1 - C_1^*$, since E_1 is first period income, and C_1^* is first period consumption. The period-to-period change in national wealth, national saving, equals output less government and total private consumption. By assumption government consumption is fixed; hence, current changes in national saving depend only on changes in private consumption.

Consider an announcement at time t that the government will permanently switch to capital income taxation starting at time $t + 1$. Such a policy has no impact on the consumption of the elderly at time t, since they still face the lump sum tax in period t and do not survive to period $t + 1$. The young at time t, however, increase their consumption according to Figure 2 by $C_1^{**} - C_1^*$, which corresponds precisely to the partial equilibrium reduction in national wealth. This savings reduction is permanent because all successive, young generations face the same budget constraint, line 4 in the diagram, and save $E_1 - C_1^{**}$ rather than $E_1 - C_1^*$. In this example, the change in national savings is unambiguous in sign. This compensated tax change involves only substitution effects; the change in income for the private sector in toto and for each age cohort is zero.[14]

An example of a structural tax policy in which income effects also arise is an immediate switch from proportional capital income to consumption taxation. While the government collects the same total revenue each period under the new tax structure, as Summers (1981a) recently emphasized, such a policy typically alters the taxes collected from each cohort. In particular, the tax extracted from the elderly at the time the change is introduced is likely to be substantially in excess of their tax liability under the capital income tax. Since, as implied by (9), the present value of all future taxes remains unchanged, the greater tax burden on the initial elderly implies a smaller lifetime tax burden on young and/or future generations. This redistribution away from the elderly reinforces the substitution effects of the tax policy in lowering current consumption and stimulating current saving; while the larger tax burden imposed on the initial elderly means a smaller burden on the initial young, the elderly, in life cycle models, have larger marginal propensities to consume than the young. In addition the associated reduction in tax burdens for future generations obviously has no affect on current consumption. The larger consumption propensities of the elderly than the young in a strict life cycle model simply reflect their shorter life expectancies and their absence of a bequest motive.

To summarize, structural tax policies leave the private sector's aggregate income unchanged, but they produce unambiguous substitution effects and, potentially, income effects for specific groups that may, on net, reinforce the substitution effects.

E. *Tax-Financed Changes in Government Consumption*

In contrast to structural tax policy, contemporaneous tax-financed changes in government consumption can produce aggregate changes in income for the private sector. Assume government con-

[13] This equation for national wealth is unaffected by manipulations in government accounting; for example, if the government chooses "to run a larger surplus" by levying a lump sum tax of L_1, in period 1, which is returned with interest as a lump sum rebate, L_2, in period 2, then W_g and W_{P1}, will respectively increase and decrease by L_1, leaving national wealth, W, unchanged.

[14] The assumption that the policy is enacted at time $t + 1$ rather than t is made to simplify the discussion. If the policy change is enacted at time t, the outcome is the same except the government must raise its capital income tax rate after t to reflect the reduced accumulation of the period t young.

sumption does not enter private utility functions; then permanent increases or reductions in government consumption require permanent increases or reductions in taxes to finance such changes in government consumption.[15] If the government is using distortionary taxation, the required changes in tax rates produce a rotation of the private intertemporal budget reflecting government-induced changes in private after-tax relative prices. As an example, consider how private consumption is altered when both government consumption and the capital income taxation used to finance that consumption are eliminated. For the initial elderly generation alive in the period the new policy is first implemented, the change provides a windfall gain equal to the capital income taxes it would otherwise have paid. Since the old are in the last period of their life and have no bequest motive, they immediately consume the entire amount of the windfall. But since government consumption, by assumption, had exactly equaled capital income tax revenues, the reduction in government consumption in the first period of the policy is exactly offset by an equal increase in the consumption of the initial elderly. Hence, the policy's initial period effect on total national consumption and, therefore, initial period total national saving, depends on the consumption of the young in the initial period. The impact on the consumption of the young at the time the policy is implemented is ambiguous. For the young, the elimination of capital income taxation serves to rotate their lifetime budget from line 4 to line 1 in Figure 2. The initial period change in national consumption (which equals the change in national saving) has, in this case, the opposite sign as the uncompensated elasticity of first period consumption (consumption of the current period young) with respect to the interest rate. Thus, this is a question about tax policy and saving to which a particular "interest elasticity" by itself provides useful information, but this is a very special type of policy experiment imbedded in one very simple neoclassical model.

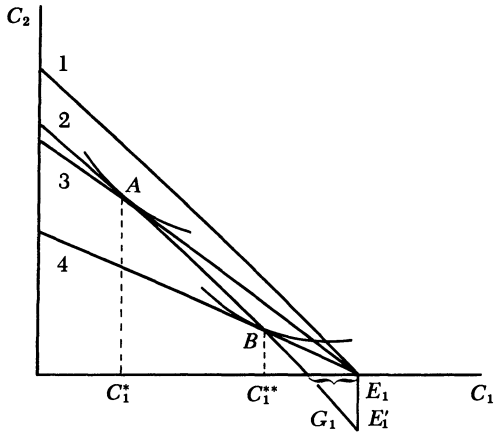

Figure 2.

Unfortunately, much research effort (Harberger 1964, Feldstein 1978, Colin Wright 1969, Warren Weber 1970, 1975; Alan Blinder 1975, Boskin 1978, Philip Howrey and Saul Hymans 1978, Summers 1981a, 1982; Owen Evans 1983, David Starrett 1983) has focused on defining and measuring *"the* interest elasticity of saving" suggesting that a single number could provide a summary statistic for the effects of a wide range of government policies. Such is not the case.

According to the government's budget constraint, exogenous changes in the return to saving arising from changes in capital income tax rates necessarily require some offsetting adjustment in current and/or future fiscal instruments. Changes in the course of government consumption is only one of many possible adjustments to changes in capital income taxation that

[15] According to (11), in partial equilibrium (i.e., holding the r_t's constant the government can finance a temporary increase (decrease) in its consumption by a future decrease (increase) in its consumption with no necessary change in private consumption or leisure.

would restore balance to the government's intertemporal budget. Suppose, for example, that the cut in capital income tax rates is temporary; in this case the fiscal adjustment might take the form of higher future capital income tax rates. Exactly which policy instrument or set of instruments is used to satisfy (9) and the timing of their use is critically important for determining the response of current national saving to a current reduction in capital income taxation. Thus "the interest elasticity" of current saving will be one number if the tax cut is expected to last one year, it will be a different number if the tax cut is expected to last 10 years, and it will be a still different number if the tax cut is expected to last 20 years. Furthermore, the percentage response of national saving to a tax cut depends on whether the tax cut is financed by reduced government consumption, concomitant increases in other tax rates, or future increases in other tax rates. Neither the sign nor the absolute magnitude of the change in saving can be determined without specifying precisely what policies will accommodate a current reduction in capital income tax rates.

The time series regression analyses of private consumption decisions referenced above do not include variables capturing the future time path of accommodating fiscal policy. In particular they do not distinguish current from future capital income tax rates, nor do they include estimates of the future values of wage or consumption tax rates. As a consequence the estimated coefficients are of dubious value in describing the potential saving impact of changes in fiscal policy. Other studies (Summers 1981a, 1982; Evans 1983, Starrett 1983) purport to simulate *the* interest elasticity of savings by examining the impact on wealth accumulation of a permanent cut in capital income taxation. Since they alter no other tax rates in this analysis of interest elasticities, they are implicitly assuming, according to (9), that government consumption will be permanently reduced. These elasticities have, therefore, as much to do with the savings response to reduced government consumption as they do with private responses to capital income taxation. Indeed, since the bulk of government consumption is financed by wage taxes it is surprising that attention has focused on "the interest elasticity of saving" as opposed to "the wage elasticity of saving."

Other research has been more sensitive to the multiplicity of future after-tax prices determining current consumption and saving. Boskin and Lawrence Lau (1977) estimate aggregate demands for consumption and leisure taking account of several current and future cross price effects. Unfortunately, while they report sizeable elasticities of current consumption both with respect to the current wage and the price of future consumption, they do not trace out the implications of these findings for feasible, concomitant changes in the time paths of fiscal instruments. A different approach to determining potential household responses to government policies is direct estimation of household intertemporal preferences. Robert Hall (1978) is the first of a series of articles (Sanford Grossman and Robert Shiller 1981, Lars Hansen and Kenneth Singleton 1983, Hall 1981, and Greg Mankiw, Julio Rothenberg and Summers 1982) to directly test some of the implications of intertemporal optimization under uncertainty. These tests, the results of which are rather mixed, require specifying explicit functional forms for household utility. A byproduct of these tests is estimates of key preference parameters, knowledge of which is sufficient to determine household responses to virtually all hypothetical policy changes. Several of the utility functions estimated in the empirical literature have been used in simulation studies discussed below.

The effects on national saving of contemporaneous tax-financed changes in government consumption depend not only on concomitant adjustments in particular tax instruments, but also on private valuation of government consumption. If government consumption is a perfect substitute for private consumption and is always intramarginal with respect to private consumption decisions (i.e., the private sector always consumes more of each good than the government directly provides) then (10) may be re-expressed as:

$$\sum_{t=0}^{\infty}\sum_{j=1}^{\infty}\frac{\hat{Z}_{jt}}{1+r_t}=H_0+A_0, \qquad (10')$$

where $\hat{Z}_{jt}$ equals consumption by household j inclusive of its imputed consumption of government purchases of consumption goods and services in year t.

Intramarginal changes in the level and and/or timing of government consumption as well as concurrent changes in its finance through the tax system need not, according to (10′), necessitate any changes in the $\hat{Z}_{jt}$'s. As in the case of structural tax changes, such alterations in government policy leave the private sector with sufficient resources to maintain its prior behavior. Here again there is no change in aggregate income for the private economy; from a partial equilibrium perspective, i.e., holding before-tax factor returns constant, tax-financed increases in government consumption simply alter after-tax relative prices and produce compensated movements along the private sector's pretax budget frontier. Assuming changes in particular households' imputed government consumption are not exactly matched by intramarginal changes in their net tax burden, there will be offsetting income effects across households. In this case one must account not only for the impact of tax changes on the after-tax relative prices confronting particular households, but also for the net income effects on those households arising from the government's revised pattern of consumption.

F. *Intergenerational Tax Policy*

Intergenerational tax policy, as defined here, involves reduced taxation of particular cohorts paid for (in present value) by increased taxation of other cohorts. The time path of government consumption is held constant under this policy. As in the case of structural tax policy, in partial equilibrium this intergenerational redistribution leaves unaltered the intertemporal consumption and leisure frontier of the private sector. To simplify the analysis, assume for the moment that all taxes are lump sum. If the private economy consists of a single household that, because of concern for its progeny, is effectively "infinitely lived" (Barro 1974), its budget constraint, from (10), is:

$$\sum_{t=0}^{\infty}\frac{Z_t}{1+r_t}=H_0+A_0-\sum_{t=0}^{\infty}\frac{G_t}{1+r_t}. \qquad (11)$$

Since intergenerational tax policy, by definition, generates zero revenue in present value and, under the assumption of nondistortionary (lump sum) taxation, also alters no marginal prices, the private sector's budget constraint (11) is completely unaffected by such a policy. Consequently, intergenerational redistribution will have no impact whatsoever on the economy. This argument, originating with David Ricardo (1951) and rigorously demonstrated by Barro (1974), can obviously be extended to the case of multiple infinitely-lived households each of which experiences intergenerational net lump sum taxation that sums to zero in present value.

In contrast to "infinitely lived" households, for "finite lived" life cycle households who, at least after their children are adults, are concerned only with their own welfare, government intergenerational, nondistortionary transfers alter private

sector behavior. According to the strict, nonaltruistic life cycle paradigm, household heads and their spouses selfishly spend their resources over the remainder of their own lives. The age of the household is, thus, a critical variable in determining its marginal propensity to consume; elderly households with only a few remaining years exhaust additional resources at a much faster rate than younger households, who spread incremental resources over more periods. These age-related differences in marginal propensities to consume goods and leisure explain why intergenerational transfers to older generations lead to increased aggregate consumption and reduced aggregate labor supply.

To procure the resources to redistribute towards early generations, the government either draws down its own stock of assets, "borrows" from the private sector, or "taxes" the private sector. As indicated above, whether the government acquires current resources under the heading "borrowing" as opposed to "taxes" may be of little or no economic consequence. Increased taxation (resource payments to the government) of younger (including future) generations which is not offset in present value by increased transfers (resource receipts from the government) to such generations is necessary either to restore the government's own net asset position, or, at a minimum, to offset the reduction in the government's net capital income. Such higher net lifetime taxes are likely to fall most heavily on young or yet unborn generations. Thus the economic as opposed to accounting definition of "deficit finance" is any policy resulting in an intergenerational redistribution of resources (Anthony Atkinson and Joseph Stiglitz 1980).

Assuming those households experiencing positive increases in net lifetime resources predate those experiencing the losses, the policy will increase the consumption and leisure of early generations and decrease the consumption and leisure of later generations assuming consumption and leisure are both normal goods and that net taxation is lump sum. In real terms the additional consumption accorded early generations is financed not by additional current output, since early generations presumably work less not more, but by reductions in the economy's stock of wealth. This "crowding out" of the economy's real assets leaves future generations with less capital to combine with their labor in production and implies, except for small open economies, general equilibrium changes in factor returns. Each future generation may associate their reduced standard of living resulting from economic deficits with higher net lifetime taxation; but equation (11), which holds from each point in time forward, indicates that, under lump sum taxation, it is ultimately a lower value of A_0, relative to what would otherwise have occurred that limits the private sector's future consumption and leisure possibilities. A necessary and sufficient condition for intergenerational redistribution under lump sum taxation is a change in the time path of the economy's holding of real wealth (i.e., values of A_0 in successive years).

While income effects are the primary focus of intergenerational tax policy, redistribution across generations is typically conducted by changing the timing and level of distortionary taxes. Hence, substitution as well as income effects play a role in determining the full economic consequences of many intergenerational tax policies.

G. *Intragenerational Tax Policy*

This policy is defined as contemporaneous redistribution among members of a given cohort. Assuming these members belong to different households such a policy will produce offsetting income effects,

with the net impact on aggregate private consumption and saving depending on household differences in marginal propensities to consume and to work. Intragenerational tax policy encompasses redistribution potentially cross-classified by a very large set of socio-economic characteristics including sex, race, education, marital status, number of children, earnings, and accumulated wealth. Unfortunately, empirical evidence on differences in marginal propensities to consume and work by such characteristics is exceedingly scarce.

The commonplace notion that "redistribution from the rich to the poor reduces saving" is probably the central concern surrounding intragenerational tax policy. This concern seems based, to a large extent, not on a detailed comparison of differences in consumption propensities, but rather on the simple observation that the rich have wealth and the poor do not. There are at least four immediate reasons why the level of current assets could be unrelated to underlying differences in preferences, and, therefore, differences in consumption propensities. First, current wealth may reflect receipt of intergenerational transfers from wealthy parents and ancestors (Simon Kuznets 1961). Second, current wealth may reflect random high returns to past investments (Friedman 1957). Third, current wealth may simply reflect differences in the timing of receipt of labor earnings for a given present value (Modigliani and Brumberg 1945, Ando and Modigliani 1963). Fourth, household differences in earnings abilities will produce differences in levels of accumulated wealth when household intertemporal preferences and marginal consumption propensities are identical.

Of course, the current rich at a given age may be rich because of differences in intertemporal preferences. Alternatively, the rich may differ from the poor with respect to marginal consumption propensities because the poor are liquidity constrained at the margin. Section VII briefly examines the available evidence concerning intragenerational transfers in the presence of differences in intertemporal preferences and liquidity constraints.

IV. *Savings and the Quantitative Impact of Structural Tax Policy*

Neoclassical models of economic growth posit utility maximizing consumption and leisure decisions over either a finite or infinite horizon. Modigliani and Brumberg (1954) and Ando and Modigliani (1963) invoke the former assumption in their seminal development of the life cycle model, while the later assumption is an implication of Barro's (1974) equally seminal article on intergenerational altruism. Structural tax policies as well as the three other fiscal policies defined above can have markedly different transitional and long-term effects depending on which of these two sets of preferences is considered.

The extent to which altruistic as opposed to selfish behavior best characterizes actual intertemporal preferences is a matter of considerable controversy. Articles by Ando and Modigliani (1963), Tobin (1967), James Davies (1981), Mervyn King and Louis Dicks-Mireaux (1982), and Modigliani (1983) provide evidence in support of the strict, nonaltruistic life cycle model. In contrast, Betsy White (1978), Thad W. Mirer (1979), Michael Darby (1979), Kotlikoff and Summers (1981), Sheldon Danziger, Jacques van der Gaag, Eugene Smolensky and Michael Taussig (1982), Douglas Bernheim (1982), Kurz (1984b), and Boskin and Lau (1984) report results contrary to the life cycle model, suggesting an important, if not predominant, role for private intergenerational transfers in explaining the current stock of U.S. wealth. Kotlikoff and Summers stress that the shapes of age-earnings and age-consumption profiles are far from

those required under the strict life cycle model to produce significant hump saving. This finding does not, however, preclude the possibility that the majority of households conform to the selfish life cycle model. The majority of households could have such preferences, but simply have very little "hump" savings. As stressed by Kurz (1984a) and suggested by Boskin and Lau's (1984) findings, we may well live in a mixed society consisting of a minority of quite wealthy, altruistic households, and a majority of rather poor, life cycle households. While life cycle households may hold little, if any, of the current stock of wealth, their response to new structural as well as intergenerational tax policies could well dictate the economy's saving behavior over several decades, even if not the indefinite future.

Another explanation of the evidence for significant intergenerational transfers that is consistent with life cycle behavior involves imperfections in the market for annuity insurance. In the absence of a well-functioning annuity market, elderly households may share the risk of their uncertain longevity with their children in a manner that involves intergenerational transfers (Kotlikoff and Avia Spivak 1981). Alternatively, in the face of uncertainty about their own life spans and needs, or if wealth exceeds the satiation level of consumption, the elderly may simply involuntarily bequeath wealth to their children extracting either nothing or nonmonetary services in exchange (Kuznets 1961, Davies 1981; Bernheim, Andrei Shleifer and Summers 1983).

Section VI describes the failure of econometric research based on the limited available data to clarify the degree of marginal altruism in the U.S. economy. Given our state of ignorance concerning the distribution of intertemporal preferences, exploring the implications of tax policy within each of the two alternative models is important; indeed, analysis of models with heterogeneous preferences is an obvious area for additional research.

A. *Structural Tax Policy in a Life Cycle Model*

In the life cycle model each household makes independent choices, but the combined behavior of more than 60 contemporaneously living adult age cohorts enters into the determination of the general equilibrium transition path of a life cycle economy. The economy's transition path also depends on the future decisions of generations not yet in existence; today's generations base current economic choices partly on information about future wages and interest rates. These future prices are determined not only by the saving and labor supply decisions of those currently alive, but also by the saving and labor supply behavior of succeeding generations; the expectations about wage rates for today's twenty-year olds, when they reach thirty, are partly influenced by their expectations of the labor supply of twenty-year olds, ten years from now, whose labor supply, in turn, depends on expectations of the labor supply of twenty-year olds, twenty years from now, and on and on.

The complexity of the multi-cohort life cycle model as well as its extensive, if not unlimited data requirements, has led many economists to simulate rather than empirically estimate the effects of government policy in nonaltruistic neoclassical environments. Simulation analysis of steady (or stationary) state predictions of life cycle economies dates from Ando and Modigliani (1963), Tobin (1967), and Atkinson (1971). Papers by Tobin and Walter Dolde (1971, 1981), Eytan Sheshinski (1978), and Kotlikoff (1979a) simulate the impact of social security on steady state labor supply and savings. Summers (1981a) presents a steady state simulation analysis of other government fiscal policies, in particular, structural tax policy.

Merton Miller and Charles Upton (1974) and Summers (1981a) simulate effects of selected government policies on the growth path of life cycle economies under the assumption of myopic expectations.

Summers' 1981 article represents a very important contribution to the analysis of taxation and savings. His comparison of equal (annual) revenue wage and consumption tax regimes illustrates the intergenerational redistribution underlying many structural tax policies; the paper stresses that lowering capital income tax rates reduces current private consumption not only through substitution effects associated with the higher price of current relative to future consumption, but also through income affects associated with the reduced present value of a household's human capital endowment.

In a series of articles Auerbach and Kotlikoff (1983a, 1983b, 1983c, 1983d) and Auerbach, Kotlikoff and Jonathan Skinner (1983) extended this research by developing a perfect foresight general equilibrium life cycle simulation model. "Perfect foresight" in this context means that households make economic choices based on common projections of future wages, interest rates, and tax rates, and these decisions, in the aggregate, produce equilibrium time paths of these variables equal to those projected. In the life cycle version of the model considered here agents live for 55 periods, corresponding to adult ages of 21 to 75, and are concerned only with their own welfare, i.e., they have no bequest motive. The model incorporates variable labor supply, including endogenous retirement, and a wide range of fiscal instruments, including investment incentives, progressive taxes, and social security. Its chief contribution is determining the equilibrium transition path generated by fiscal policies. "Equilibrium transition path" corresponds to the course of the economy as it moves from one stationary equilibrium to another. During this transition there is market clearing for all goods, factors, and assets. While the model solves for the course of all economic variables over a 150-year period, convergence to the new stationary state in the simulations described here typically occurs within 70 years.

The extended focus on this particular model's results in the succeeding discussion may appear excessive, but the intention is to illustrate potential differences in the quantitative affects of the four policies considered; obviously, isolating these differences requires holding the model constant while changing the experiment. The computer simulation model used here incorporates CES utility and production functions, which are frequently posited in empirical studies. In addition, the parameterization of these functions is based on empirical findings. We are able to display the (usually limited) sensitivity of the results to variation in the values of key parameters. Other models incorporating utility or production functions of other types would doubtless yield different results. The apparent impacts of changes in tax policy would certainly be quantitatively different—in some instances, perhaps qualitatively different than those that emerge in the simulations reported below. Those we do report, however, have the virtue of illustrating the operation of alternative tax policies in a model that incorporates commonly employed and widely studied functional forms. Moreover, this analysis permits one to obtain an understanding of the factors which control the impact of a change in tax policy on saving.

In addition to their pedagogic value, simulation studies can be viewed as a second stage of empirical analysis, i.e., as ways to display the implications of parameter estimates and assumptions about particular function forms. From this perspective they are also useful tools for designing empirical studies. Empirical work pro-

ceeds by assuming functional relations and testing their validity; simulating the affects of these functional relations for different parameter values in advance of empirical testing permits the researcher to trace out the full implications of his/her assumptions and to distinguish critically important from less important parameter values. Such knowledge will likely lead the econometrician to "spend" more of his/her limited data on estimating parameters to which the simulation results are most sensitive.

One may also question the emphasis on simulation results rather than empirical findings. Simulation analysis is certainly no substitute for empirical research; rather it provides a methodology for exploring the full implications of empirical findings. Unfortunately there is no large scale neoclassical econometric model that can be simulated to estimate the general equilibrium savings impact of policy. While one may be dubious about the absolute magnitude of changes in economic variables arising in simulation models, the models are likely to permit more reliable inferences concerning the relative effects of alternative policies. Thus one may find through simulation analysis that one tax structure is virtually always more conducive to saving than another within a large class of economic models. For certain policy choices a qualitative ranking of alternatives may be all that is needed.

Equation (12) presents the CES utility function of consumption, C, and leisure, ℓ, underlying the life cycle policy simulations described below:

$$U = \sum_{a=1}^{55} \left(\frac{1}{1+\delta}\right)^{a-1} \left[\mu C_a^{(1-1/\rho)} + (1-\mu)\ell_a^{(1-1/\rho)}\right]^{\frac{1-\gamma}{1-1/\rho}} \tag{12}$$

In (12) δ in the time preference rate, ρ is the "static" elasticity of substitution between consumption and leisure at each age a, and γ is the intertemporal elasticity of substitution between consumption and leisure at different ages. The reciprocal of γ equals the coefficient of relative risk aversion.

Baseline parameter values for δ, γ, ρ and σ, the elasticity of substitution of capital for labor in the production function, are .015, .25, .8 and 1. These figures are mid-range estimates based on a variety of empirical studies many of which are cited in Auerbach, Kotlikoff and Skinner (1983).

Table 3 contains simulation results for three structural tax policies involving changes in the tax base from proportional income taxation to either proportional consumption, wage, or capital income taxation with each designed to yield equal revenues. The simulated economy has an initial steady state capital-output ratio of 3.7, a capital-labor ratio of 5, a pretax wage normalized to 1, a 6.7 percent pretax real interest rate, a 3.7 percent net national saving rate, and a 15 percent proportional tax on all income. Since there are no transfer programs conducted either through "official" or "unofficial" mechanisms, receipts from the 15 percent income tax are solely used to finance government consumption. In each of Table 3's simulations government consumption per capita is held fixed, and the tax rate of the specified tax base is adjusted to produce revenues equal, on an annual basis, to the exogenous path of government consumption.

Table 3 displays the primarily large impact structural tax policies can have on an economy's saving rate and related variables. Relative to the initial income tax regime, long-run saving rates are 19 percent larger under a consumption tax, 8 percent larger under a wage tax, and 32 percent smaller under a capital income tax. Changes in the economy's saving rate during the transition period are even more dramatic; in the first year after the switch to consumption taxation, the saving rate rises to 9.3 percent from an initial

TABLE 3: STRUCTURAL
(Switch from 15% Proportional Income

Initial Steady State	Capital-Labor Ratio			Wage Rate (Pretax)		
	Tax Base			Tax Base		
Year of Transition	Consumption	Wage	Capital Income	Consumption	Wage	Capital Income
	5.0	5.0	5.0	1.00	1.00	1.00
1	4.8	5.1	4.8	.99	1.00	.99
5	5.1	5.1	4.4	1.01	1.01	.97
10	5.4	5.2	4.1	1.02	1.01	.95
50	6.2	5.4	3.0	1.05	1.02	.88
150	6.2	5.4	2.9	1.06	1.02	.87

[a] Simulations assume a population growth rate of 1.5 percent, a time preference rate of 1.5 and .25, respectively, and a Cobb-Douglas production function.

value of 3.7. In the case of the capital income tax, there is a negative 2.9 percent saving rate in the first year of the transition, and saving rates remain negative for over a decade. As Table 1 indicates such swings in saving rates are within the range of U.S. historical experience, although U.S. saving experience is certainly neither solely nor primarily a reflection of historical changes in fiscal policy. The figures in Table 3 would, of course, all be magnified in absolute value if one started with a larger initial steady state income tax. For example, a structural shift to consumption taxation starting from a 30 percent income tax ultimately increases the capital-labor ratio by 63 percent, rather than the 24 percent increase of Table 3.

The capital deepening associated with switching from the 15 percent income tax to consumption and wage taxation generates long-run pretax wage rates that are respectively 6 percent and 2 percent larger than their initial values. In the case of capital income taxation, the long-run wage rate is 13 percent smaller than in the initial equilibrium. The long-run pretax real interest rate declines by one percent or less under consumption or wage taxation, while it rises 3.4 percentage points under capital income taxation. Long-run tax rates are 17.6 percent under a consumption tax, 20.1 percent under a wage tax, and 62.7 percent under a capital income tax. The much larger rate required under capital income taxation obviously reflects the fact that capital income is a much smaller tax base than total income, labor income, or consumption.

These changes in after-tax prices of factors and goods obviously alter the utility levels of each cohort alive at the time of the tax change or born thereafter. One measure of these utility differences is the equivalent percentage increase in full lifetime resources needed in the original income tax regime to produce each cohort's realized level of utility under the specified alternative tax regimes. For cohorts living in the new long-run equilibrium under consumption, wage, and capital income tax regimes the equivalent variations are 2.32 percent, −.89 percent, and −1.14 percent. These figures are smaller than the long-run changes in wage rates indicated in Table 3, because they encompass the additional amount of both lifetime leisure and consumption that could hypo-

TAX CHANGE[a]
Tax to Specified Proportional Tax Regimes)

Real Interest Rate (Pretax)			Net National Saving Rate		
Tax Base			Tax Base		
Consumption	Wage	Capital Income	Consumption	Wage	Capital Income
6.7%	6.7%	6.7%	3.7%	3.7%	3.7%
6.9%	6.6%	6.8%	9.3%	5.3%	−2.9%
6.5%	6.5%	7.3%	8.2%	5.0%	−1.9%
6.3%	6.4%	7.7%	7.2%	4.7%	−1.0%
5.7%	6.3%	9.7%	4.5%	4.0%	2.0%
5.7%	6.3%	10.1%	4.4%	4.0%	2.5%

percent, "static" and intertemporal elasticities of substitution in consumption and leisure of .8

thetically be afforded in the old steady state. Stated differently since 65 percent of lifetime resources are spent on leisure in the initial steady state, a 2.32 percent increase in full-time resources would permit a 6.63 (2.32/.35) percent increase in lifetime consumption, holding leisure constant.

One perhaps surprising feature of these numbers is that steady state utility is lower under wage taxation than under income taxation despite an 8 percent increase in capital intensity. While the before-tax wage rises to 1.02 from an initial value of 1, the after-tax wage is .80 in the wage tax steady state compared with .85 under the income tax. In addition, the long-run after-tax interest rate, which determines prices of future consumption and leisure is only .61 percentage points greater in the wage taxation steady state. These numbers are indicative of, rather than the reason for, the lower level of steady state welfare under wage versus income taxation. Despite the 21 percent greater capital stock in the wage tax steady state, aggregate steady state consumption is lower reflecting the smaller aggregate supply of labor induced by the increased wage tax. While the new steady state has sufficient resources to sustain a higher level of welfare, the choice between consumption and leisure is suboptimally skewed towards leisure by the new post-tax intertemporal price structure imposed by a wage tax. Auerbach, Kotlikoff, and Skinner (1983d) demonstrate that for the CES utility function given in (12) wage taxation is Pareto inefficient relative to income taxation over a wide range of parameter values partly because it places all the tax distortion on the static choice between consumption and leisure, while leaving intertemporal decisions free of marginal distortions; i.e., it does not directly alter the after-tax rate of return, a key determinant of relative prices of goods and leisure at different dates. The income tax, in contrast, spreads the tax distortions over both margins of choice and the larger tax base permits lower tax rates.[16] The situation here is similar to that pictured in Figure 2, where utility at B is less than at A, al-

[16] The capital income tax component of the income tax also involves an element of lump sum taxation since it taxes, in part, the immediate return on existing wealth, which is obviously predetermined (Chamley 1981).

though the resource endowment (line 2) is unchanged.

The consumption tax affords a higher steady state level of welfare than the income, wage, or capital income taxes, because it derives a part of its portion revenue from an implicit lump sum levy, which implies less dead weight loss from distortionary taxation. Intuitively, consumption taxation is, in part, effectively equivalent to a capital levy, because household wealth is indirectly taxed when it is ultimately surrendered in exchange for consumption goods. The capital levy represents a lump sum tax, since at the time the consumption tax is imposed, current wealth is given (i.e., is in perfectly inelastic supply). Christophe Chamley (1981) and Fisher Black (1981) emphasize the equivalence, for time invariant tax rates, of consumption taxation to wage taxation plus a one-time capital levy. In the case of time varying tax rates a consumption tax is structurally equivalent to a capital levy, plus taxation of wage and capital income at different rates over time.

The second reason for the long-run utility gain under consumption taxation as opposed to income taxation is the shift in the tax burden from later to earlier generations, a point stressed by Summers (1981a) and Bradford (1980). Take the age 55 life cycle agent as an example. In his last year in the 15 percent income tax steady state he consumes the principal plus 85 percent of the capital income earned from his terminal period assets. Since the after-tax interest rate in the initial steady state is 5.7 percent, terminal consumption is 1.057 times terminal assets plus any after-tax labor income. If the economy switches abruptly to a consumption tax, the first year consumption tax rate is 19.2 percent, and the 55 year old's terminal assets will purchase only .839 units of consumption times the amount of these assets. While the equivalent negative variation in *lifetime* utility for the 55 year old in the consumption tax simulation is less than one third of a percent, the equivalent variation is negative 15.2 percent if one considers only the remaining life span of the 55 year old. The loss in welfare to these early generations plus the use of a more efficient tax structure are what pays for the higher level of welfare of later generations, including those in the new steady state, under consumption taxation.

B. *Simulated Structural Tax Policy—Sensitivity Analysis*

The sensitivity of the Table 3 results to assumed parameter values and functional form for preferences and production is of obvious importance for their evaluation. The empirical literature suggests extreme values for γ, the intertemporal elasticity of substitution, of between .1 and .5, and values for ρ, the static elasticity of substitution of between .1 and 1.5. Holding all other parameter values constant, combinations of these values generate percentage increases in the long-run capital-labor ratio under the structural shift from income to consumption taxation ranging from 22.6 to 26.9. The baseline ($\gamma = .25$, $\rho = .8$) simulation generated a 24.0 percent increase.

There is more sensitivity to these parameter values in the case of structural wage tax policy. Here the baseline increase in capital intensity is 8.0 percent with extreme values of 3.8 percent and 11.1 percent over the specified range of values for γ and ρ. The third structural tax policy described in Table 3, a shift from income to capital income taxation, produces a 42.0 percent drop in the capital-labor ratio for baseline values of γ and ρ and a sensitivity range of 28.6 to 51.5 percent.

Evans' 1983 article suggests that life cycle simulation results may be highly sensitive to assumptions concerning the rate of time preference. This appears not to

be the case for a structural change from income to consumption taxation. The baseline simulation that incorporates a 1.5 percent rate of time preference, yields a 24.0 percent change in capital intensivity. Lowering the time preference rate to negative 3 percent produces a 24.8 percent increase, while raising it to 4 percent yields a 24.6 percent increase. Similar experiments for shifting to wage taxation led to respective changes in capital-labor ratios of 2.23 percent and 12.9 percent compared with the 8 percent baseline change. In the case of a structural shift to capital income taxation, the sensitivity to time preference rates is quite substantial. The percentage decrease in capital intensity is 12.5 percent when the time preference rate, δ, is $-.03$, it is 42.0 percent when δ is .015, and it is 56.5 percent when δ is .04.

A final parameter value to consider in the context of this model is the elasticity of substitution in the production function. Lowering this rate in the CES production function from 1 to .8 led to 19.8 percent, 9.6 percent, and 50.7 percent long-run changes in capital-labor ratios respectively, from consumption, wage, and capital income structural tax changes. These numbers can be compared with 24.0 percent, 8.0 percent, and 42.0 percent in the baseline case.

The following points summarize these results concerning structural changes in proportional tax bases in the standard CES life cycle model. First, for a set of plausible parameter values a shift from income to consumption taxation generates significant increases in long-run savings, wage rates, and economic welfare. The opposite is true for capital income taxation. Structural wage tax policy, on the other hand, while it stimulates some additional savings, can lower long-run economic welfare. Second, long-run gains or losses in economic welfare are paid for, in part, by opposite changes in the welfare of certain generations alive during the transition induced by the new tax structure. Third, the impact of a shift to consumption taxation is quite insensitive to reasonable variations in parameter values. The effects of these structural wage and capital income tax policies are more sensitive to deviations in baseline parameter values, but such deviations do not alter the sign of their impact on long-run savings. Finally, substitution effects appear to dominate offsetting cross-cohort income effects in altering long-run savings rates. The move to capital income taxation provides a good example. Here the negative income effects of an increased tax burden faced by the elderly and the corresponding positive income effects of decreased taxation experienced by young and middle-aged cohorts, which serve to stimulate saving (because of generational differences in marginal propensities to consume goods and leisure), are outweighed by the negative substitution effects that induce more current and less future consumption and leisure. These substitution effects are determined not only by preferences, but also by the household's time path of full-time earnings capacity; i.e., as stressed by Summers (1981a), a given change in after-tax interest rates will produce different revaluation of the worker's endowment of full-time earnings if these full-time earnings arrive more in the future than in the present. Summers' "human-wealth effect" plays a role in determining both income and substitution effects of changes in discount rates.

A final issue of sensitivity analysis involves choice of functional form. Presently there appear to be no studies comparing structural tax changes in life cycle models using different general functional forms for preferences and technologies. Such a study would be quite informative. Starrett (1983) uses the Stone-Geary generalization of the CES utility function in a study of tax-financed changes in govern-

ment consumption. He finds smaller increases in national wealth arising from reductions in government consumption that are financed by cuts in capital income taxation than does Summers (1981a) who employs the standard CES functional form. Whether Starrett's nonhomothetic preferences are more plausible than those considered here is obviously an issue to be determined empirically.

C. *Structural Tax Policy—Increasing the Progressivity of the Rate Structure in a Life Cycle Model*

The impact of progressive tax schedules on savings is illustrated, in part, by considering an equal revenue switch from proportional to progressive taxation. There is obviously no unique progressive tax schedule to compare with proportional taxation, but consideration of the linear marginal tax schedule given in (13) provides a sense of potential affects.

$$\tau_m = \alpha_1 + \alpha_2 B. \qquad (13)$$

In (13) B stands for the tax base, and α_1 and α_2 are two coefficients that are chosen each year subject to the constraint that the new tax schedule produces the same annual revenue as the proportional tax structure.

The baseline life cycle simulation model outlined above was used to examine the consequences of switching from 30 percent proportional taxation to a progressive tax schedule featuring a marginal rate of 20 percent (i.e., $\alpha_1 = .2$) at zero income. Pegging α_1 at .2 leaves the annual revenue constraint to determine α_2 in (13). Households in the model fully incorporate the time path of changes in progressive tax schedules (annual changes in α_2 occurring during the transition) in making their intertemporal consumption and leisure decisions. With the exception of the income tax, this type of progressive structural tax change produces rather small changes in capital-labor ratios and savings rates. The percentage change in capital intensity (saving rates) is −36 (−46) percent in the case of income taxation, it is −10 (−7) percent under capital income taxation, and −6 (−4) percent under wage taxation. There is a positive 3.7 (2.8) percentage change in capital intensity (the net national saving rate) in the case of the switch from proportional to progressive consumption taxation. Since the reduction in capital intensity and, therefore, the reduction in the tax base per capita is greatest under the progressive income tax, the level of α_2 needed to generate the requisite per capita revenues is substantially larger (over 3 times) under progressive income taxation than under wage or consumption taxation, and almost twice as large as the α_2 obtained in the case of progressive capital income taxation. Marginal tax rates peak at 82 percent, 51 percent, 45 percent, and 33 percent, respectively, under the progressive income, wage, capital income, and consumption tax regimes.

The increase in savings in the progressive consumption tax simulation reflects, in large part, the intergenerational transfer from the initial elderly implied by this policy. Since consumption rises with age in the initial steady state, the first generation of aged face a larger tax burden under the equal revenue progressive consumption tax than under the proportional consumption tax; i.e., the initial elderly find themselves in higher marginal consumption tax brackets than younger cohorts. In contrast, the shift from proportional income to progressive income taxation reduces the tax burden of the initial elderly, since their income (capital plus wage) is low relative to that of middle-aged workers, although their capital income is relatively high. Hence the intergenerational income effects reinforce the substitution effects of lowering savings under progressive income taxation. Similar income effects do not arise in the case

of increasing the progressivity of either a wage tax or a capital income tax.

D. *Structural Tax Policies—Proportional Taxation in an Infinite Horizon Model*

Barro's (1974) article describes how overlapping intergenerational altruism generates a utility function in which each household effectively acts as if it were infinitely lived. The argument is clarified in (14) which assumes that generation t's utility, U_t, depends on its own consumption and leisure and the utility of its immediate offspring, U_{t+1}. For simplicity generations are assumed to live for only one period.

$$\begin{aligned} U_t &= U(C_t, \ell_t, U_{t+1}(C_{t+1}, \ell_{t+1}, \\ &\quad U_{t+2}(C_{t+2}, \ell_{t+2}, \ldots) = \\ &= V(C_t, \ell_t, C_{t+1}, \ell_{t+1}, \ldots). \end{aligned} \tag{14}$$

The utility linkage of generation t to generation $t+1$ effectively connects generation t to all future generations, and (14) collapses into a function of the entire future time path of consumption and leisure of the current household and its descendants. If this utility function is homothetic then the marginal rate of substitution $(\partial V_t/\partial C_{t+1})/(\partial V_t/\partial C_t)$ is independent of the stationary state levels of C_t and ℓ_t. Utility maximization requires an equality between this rate of substitution and 1 plus the after-tax real rate of return, denoted here as $r(1-\tau_r)$, where τ_r is the marginal tax rate on capital income. Hence the long-run after-tax rate of return is equal to the time preference rate, $(\partial V_t/\partial C_{t+1})/\partial V_t/\partial C_t) - 1$, a constant for a homothetic utility function that is independent of the levels of consumption and leisure. The term r, however, is determined in general equilibrium by the marginal product of capital. Assuming constant returns to scale in production, it is easy to show that the long-run capital-labor ratio is independent of marginal wage or consumption taxes, but depends simply on the capital income tax rate, the constant steady state rate of time preference and parameters of the production function. For example, if the production function is Cobb-Douglas with a capital share of .25, a switch from a 15 percent income tax to either a wage or consumption tax increases long-run capital intensity in general equilibrium by 24 percent; starting with a 30 percent income tax, the long-run percentage increase is 61 percent. A switch to capital income taxation from a 10 percent income tax steady state lowers long-run capital intensity by 47 percent; structural shifts to capital income taxation starting with a larger initial income tax are not feasible long-run policies for this model. The reason for the reduction in capital intensity in the case of a structural shift to capital income taxation is the higher tax on capital income, 44 percent instead of 10 percent required to satisfy the revenue constraint. Using a .8 elasticity of substitution in production, σ, reduces these changes in capital intensity by about 30 percent; the sensitivity of tax policy to this parameter value is discussed in Chamley (1981). The fact that a lower value of σ reduces the impact of structural tax policy is intuitive, at least in the limit; when σ equals zero, capital and labor are used in fixed proportions, and the distinction between capital and labor income taxes disappears.

In the case of progressive taxation, homothetic preferences of the form given in (14) still imply a steady state equality between the after (marginal) tax return to capital and the time preference rate. If the progressive tax structure exhibits monotone increasing tax rates, marginal tax rates will exceed average tax rates, and the steady state marginal tax rate under the progressive tax structure must differ from that in the initial proportional tax steady state due to the equal revenue requirement. While it seems likely that a switch from proportional to progressive taxation of all income, or simply capital

income, will be associated with higher marginal taxation of capital income and, therefore, smaller values of capital per worker, this remains an area for future investigation. A related set of apparently unexplored structural tax questions is the consequence of switching from proportional to progressive wage or consumption taxation. The results in each of these cases will depend on assumptions concerning legal restrictions and additional tax obligations confronting altruistic households in shifting taxable income to family members in lower marginal tax brackets.

E. *Structural Tax Policy in a Small Open Economy*

The foregoing discussion applies to closed economies or to a world economy consisting of countries that are identical up to a scale factor and that simultaneously engage in the same fiscal policy. To see how strikingly different the impact of particular structural tax policies can be in an open economy, consider switching from wage to capital income taxation under the following four simplifying assumptions. First, the economy in question is small and places no restrictions on imports or exports of perfectly mobile financial and physical capital. Second, there are only two factors of production, capital and labor. Third, labor is mobile domestically, but not internationally. Fourth, foreign governments do not engage in any fiscal policy whatsoever.

Under these circumstances the foreign pretax rate of return is given and domestic residents will change their mix of foreign and domestic investment to maximize their after-tax return. If the home country taxes the capital income of domestic residents regardless of where that income is earned, the switch from wage to capital income taxation will have the type of effects on savings just described, except that general equilibrium changes in before-tax factor prices will be trivial because the home country is small. If, on the other hand, the home country taxes both its own residents and foreigners at the same rate on income earned only on domestic capital, capital will flow out of the home country until after-tax rates of return are equalized internationally. The domestic pretax wage will fall in response to a reduction in the capital-labor ratio. If labor is supplied inelastically, the pretax wage will decline until the fall in pretax labor income exactly equals the government's tax revenue; i.e., labor bears the entire burden (incidence) of the capital income tax. Hence, "the shift to capital income taxation" in this case simply replaces an explicit wage tax with an implicit wage tax. If labor is elastically supplied the wage will differ somewhat across the two tax regimes, but the basic point holds that the economy effectively ends up with a wage tax despite the reported change in tax structure.

The degree of international capital mobility at the margin is particularly important for determining whether to try to stimulate savings through changes in corporate or personal capital income taxation. If the personal capital income tax is levied on such income regardless of where it is earned, while the corporate income tax is levied only on capital income earned domestically, a switch from wage to corporate profits taxation may simply replace an explicit wage tax with an implicit one. Switching to personal taxation on capital income earned either at home or abroad, on the other hand, could have major impacts on intertemporal prices confronting domestic households, and, therefore, major impacts on household consumption and national savings.

V. *The Impact of Contemporaneous Tax-Financed Increases in Government Consumption*

A. *Results for the Life Cycle Model*

This section considers changes in government consumption under the assumption that such consumption either is not

an argument of private utility functions or that the utility of government consumption is separable from that of private consumption and leisure. In either case the choice of government consumption does not directly affect private marginal rates of substitution between current and future consumption and leisure. Hence, changes in government consumption affect private choices of these variables only indirectly by altering variables (e.g., tax rates) entering private budget constraints. In life cycle economies increases in the level of government consumption, financed on a contemporaneous basis by increases in tax rates have quite different impacts on national savings depending on the tax base in place. For example, using the baseline parameter values of Section IV, a permanent doubling of the level of government consumption per capita (from an initial level equal to 15 percent of the specified tax base) leads to respective reductions between initial and final steady states in capital-labor ratios and national savings rates of 26.2 percent and 20.4 percent under the income tax, 12.3 percent and 9.7 percent under the wage tax, 14.5 percent and 11.0 percent under the capital income tax, but only 1.2 percent and .01 percent under the consumption tax. Long-run crowding out of capital per dollar increase in government consumption is 5.9 dollars under income tax finance, 4.8 dollars under wage tax finance, 6.5 dollars under capital income tax finance, but negative 3 cents under consumption tax finance.[17]

Different income and substitution effects experienced by particular cohorts are important for understanding these results. Compare, for example, the consumption and wage tax results. In the consumption tax case initial elderly generations, with high marginal propensities to consume, share immediately and significantly in the burden of the higher taxes and reduce their consumption and leisure accordingly. Younger cohorts also lower their current consumption and leisure in response to their lower effective lifetime resources; however, they spread this lifetime loss over the future as well as the present. These private changes significantly offset the increased rate of government consumption; in the first year of the economic transition each dollar increase in government consumption is offset by 89 cents less in private consumption.

In contrast, the contemporaneous wage tax-financed increase in government consumption has little impact on the elderly who are largely out of the workforce; while younger cohorts do reduce their current consumption and leisure in response to the increased lifetime tax burden, their immediate response is limited because of their ability and desire to smooth these reductions over the remainder of their lives. In addition, the substitution effects leading to reduced labor by the young and middle-aged are significantly greater under wage taxation than under consumption taxation; the reason is the higher effective tax on labor earnings and lower effective net wage, when the net wage is measured in terms of additional consumption that can be attained by working an additional hour. The fact that initial elderly generations pay for little if any of the additional government consumption means higher effective marginal taxation of labor supply for younger and future generations.

In the first year of the wage tax transition there is over a 3 percent reduction in the simulated economy's labor supply. This implies, of course, less current output, and less current saving even holding aggregate consumption constant. These initial effects are not transitory; they are part of an equilibrium shift to a permanently different economy. The reduction

[17] Section V. This crowding in of capital in the consumption tax case is consistent with a reduced capital-labor ratio because labor supply rises by a larger percentage than capital.

in current saving means lower capital-labor ratios in subsequent periods, lower pretax wages, and higher wage tax rates given the prespecified revenue requirement of the government.

Substitution effects also play a major role in the simulation of income tax and capital income tax financed increases in government consumption. The higher capital income taxes here lead households to substitute current consumption and leisure for future consumption and leisure. In the income tax case, each dollar of increased government consumption in year 1 of the transition is offset by only 73 cents of reduced private consumption; in addition there is a 1.5 percent reduction in employment. Under a pure capital income tax regime the private consumption offset is only 10 cents on the dollar; however, the initial change in employment is minimal.

These results are presented to illustrate rather than exhaustively examine the savings impact of contemporaneous tax financed increases in government consumption. As in the case of structural tax policy some of these results are sensitive to certain parameter values and the functional form of the utility function (Starrett 1983).

B. *Tax-Financed Increases in Government Consumption—The Infinite Horizon Model*

Under the assumption of a homothetic, infinite horizon utility function and constant returns to scale in production the discussion in Section IV indicated that steady state capital intensity is independent of wage or consumption income taxes since neither tax structure directly alters the marginal return to saving in the steady state. Hence, an immediate permanent increase in government consumption will have no long-run affects on capital-labor ratios to the extent this consumption is financed by wage or consumption taxation. The absolute levels, however, of capital and labor supply may change both in the short and long run in response to the increased taxation. This clearly depends on variability in labor supply. If labor supply is exogenous and the utility function is time separable, the private sector immediately reduces its own consumption by an amount exactly equal to the increase in government consumption and the capital stock, a closed economy's wealth in a one good model, remains unchanged.[18] When labor supply is variable or the increase in government consumption is financed, at least partially, by capital income taxation, there will be short- as well as long-run effects on the absolute amount of savings.

Illustrative simulations of steady-state changes in levels of government consumption for the infinite horizon version of the CES utility function in (12), assuming Section IV's baseline parameter values and government consumption initially financed by a 15 percent tax rate, produce the following results. Doubling government consumption decreases the economy's long-run per capita wealth by 22 percent if financed by income taxation, by .5 percent if financed by wage taxation, by 22 percent if financed by capital in-

[18] To see this, note that under the stated assumptions and ignoring, for simplicity, productivity growth, steady state private consumption, C, is proportional to the present value of resources over the infinite horizon, R. Thus we can write: $C = \theta R$. The proportionality factor θ equals $r/1 + r$, where r is the steady state interest rate. This follows from the infinite horizon budget constraint $\sum_{\tau=0}^{\infty} C(1 + r)^{-\tau} = \sum_{\tau=0}^{\infty} \theta R(1 + r)^{-\tau} = R$, where C is not indexed by time because of the assumed steady state. Let ΔG be the permanent increase in government consumption. Then, since consumption or wage taxation are equivalent to lump sum taxation in this steady state, the change in private consumption, ΔC, equals $-\theta T$, where T is the equivalent present value lump sum tax needed to finance the permanent stream ΔG, i.e., $T = \sum_{\tau=0}^{\infty} \Delta G(1 + r)^{-\tau} = \Delta G\ (1 + r)/r$. Hence, $\Delta C = -\theta T = - -r/(1 + r)\ T = \Delta G$ as asserted.

come taxation, and by −2 percent if financed by consumption taxation.

VI. *The Savings Impact of Intergenerational Tax Policy*

A. *Major Themes in the Literature*

Feldstein's (1974b) article on social security and savings sparked an intensive empirical and theoretical analysis of the savings impact of intergenerational transfers. Much of this research has focused on the particular effects of unfunded social security on savings (Alicia Munnell 1974, Feldstein and Anthony Pellechio 1979, Kotlikoff 1979a, 1979b; Barro 1978, Darby 1979, Mordecai Kurz 1981, Selig Lesnoy and Dean Leimer 1981, Feldstein 1980, 1982a; Blinder, Gordon and Donald Wise 1981, Kurz 1982, Diamond and Hausman 1983, Auerbach and Kotlikoff 1983d). But this research also stimulated economists to search for other subtle, but potentially quite powerful mechanisms by which the government transfers resources across generations. In his second seminal contribution to this literature Feldstein (1977) demonstrates how tax-induced revaluation of land transfers resources intramarginally across generations. While such asset revaluations have no effect in infinite horizon economies (Barro 1974, Calvo, Kotlikoff and Carlos Rodriguez 1979), they are important in the life cycle model; for middle-aged and elderly cohorts who are the principal owners of land and other assets, government-induced capital losses lower the value of nonhuman wealth measured in terms of consumption goods. It is important to realize that these capital losses can far exceed the current explicit tax payments which induce such revaluations. In the case of a land rent tax, the price of land falls by the present value of the infinite stream of current and future tax payments. For young and unborn generations the reduced land price is equivalent to a lump sum subsidy, since they now purchase this fixed productive asset by surrendering fewer consumption goods to their predecessors.[19] As mentioned in Section III, such intergenerational redistribution in life cycle models alters current saving because of cross-cohort differences in marginal propensities to consume goods and leisure.

Just as unfunded social security constitutes a hidden way for governments to run *economic* deficits, tax-induced asset revaluation constitutes a hidden way for governments to run *economic* surpluses. If they so chose, governments could explicitly report very sizeable official surpluses without changing any real economic policy: Rather than covertly taxing the wealth of older generations and indirectly handing the receipts to young and future generations, they could explicitly levy a one-time wealth tax, collecting proceeds that exactly equal each household's capital loss under the corresponding implicit policy, and distribute the funds over time in a lump sum fashion to young and future generations. While this change in accounting procedures, if properly enacted, alters no one's intertemporal budget constraint, including the government's, the increase in current period receipts from the wealth tax would be reported as a surplus.

Feldstein's (1977) essay was followed by analyses by King (1977), Auerbach (1979), and Bradford (1980, 1981) demonstrating that if corporations are prohibited from repurchasing their shares, one may still observe corporations paying dividends despite the fact that personal income taxation favors capital gains relative to dividend income. The advantage to capital

[19] A more precise explanation of the redistribution to young and future generations is that they gain the government's disbursement through time of the land rent tax revenues (since government consumption is assumed fixed) and the higher pretax wages that would arise in a closed economy from the increased capital accumulation induced by the land rent tax.

gains is arbitraged away, in equilibrium, by equity values that rise by less than a dollar for every dollar of retained earnings. That is, shareholders are indifferent at the margin between receiving dividends, or having corporations retain earnings. Dividends are taxed at higher rates, while retained earnings lead to less than dollar-for-dollar capital gains, but are taxed at a lower rate when realized. In such economies where dividends are being paid, equity values always adjust to provide the same effective rate of return on investments yielding dividends as on investments yielding capital gains. In these models the marginal after-tax return to capital income is a direct function solely of the tax rate on capital gains. The tax rate on capital gains is the rate that influences marginal capital income taxation because it is lower than the dividend tax rate; i.e., the return on dividends is forced to adjust to the return on retained earnings via equity valuation. A corollary of this result is that increasing the dividend tax rate has no direct impact on the after-tax return to capital. Increasing dividend taxation does, however, lead to a fall in stock market values and an associated intergenerational redistribution of resources that stimulates life cycle savings.

This surprising result in which increasing a particular capital income tax instrument unambiguously stimulates savings in a life cycle model is characteristic of a much broader class of policies than simply increases in dividend taxation. Summers (1981c) describes the implications for asset valuation of a variety of fiscal policies, pointing out that the price of old capital declines in response to investment incentives that discriminate in favor of new capital. Auerbach and Kotlikoff (1983c) demonstrate in a general equilibrium context that investment incentives, such as accelerated depreciation or investment tax credits, stimulate saving (investment in a closed economy) through implicit one-time wealth taxation of preexisting capital; in addition, in the presence of significant investment incentives, such as those now in place in the U.S., raising either corporate or personal tax rates on capital income also lowers stock market values, thereby redistributing resources intergenerationally and stimulating savings in life cycle economies.

The example of introducing 100 percent expensing of new capital in an economy with a τ percent proportional income tax permits an intuitive explanation of these results. Assume, for simplicity, that there is a single homogeneous form of capital that does not physically depreciate. Then the legislated and effective marginal tax rate on capital income is τ prior to the introduction of expensing. Introducing full expensing completely eliminates the effective marginal tax on capital income; for new capital, the immediate subsidy of τ cents per dollar invested offsets in present value the stream of taxes that are paid on the return to this marginal infinitely lived investment.[20]

By assumption, preexisting capital is either ineligible for expensing, or is effectively ineligible because of recapture taxes. Hence, in order to provide the same after-tax return to investors as new capital, the market value of old capital must fall by τ cents on the dollar; i.e., the value of capital relative to its replacement cost, "Tobin's q," is given by $q = 1 - \tau$. If 100 percent expensing is initially in place, raising τ has no impact on the marginal return to capital, since investing in new capital provides a larger initial subsidy to offset the now larger future taxes on the investment's return. On the other hand, raising τ induces additional capital losses to old capital according to the formula for q. This covert redistribution from older to

[20] The government can be thought of as lending the investor τ dollars today, which is returned with interest in the future in the form of positive capital income taxes.

young and future generations reduces current national consumption and increases savings in the life cycle model because of cross-cohort differences in marginal consumption propensities.

Hidden *economic* surpluses of this type can be quite sizeable relative to officially reported deficits. Auerbach and Kotlikoff (1983c) estimate that the 1981 U.S. Tax Act imposed an implicit tax, in the form of a 1981 capital loss to holders of the U.S. capital stock of roughly $260 billion. Had the government explicitly imposed this wealth tax, reported tax receipts would have risen by approximately $260 billion, and the government would have reported a $202 billion surplus for 1981. Such a change in the reported 1981 deficit notwithstanding, real policy would have remained unchanged had the government also redistributed the $260 billion tax on stockholders in a nondistorting fashion to young and future generations according to the benefits that would otherwise have accrued to them under the implicit surplus policy.

The estimated $260 billion capital loss assumes zero marginal costs of adjusting the economy's capital stock, i.e., zero costs to physically installing new capital or training workers to use new capital. The assumption of substantial adjustment costs is likely to reduce this $260 billion figure by roughly one quarter (Auerbach and Kotlikoff 1983c). The relationship between investment and stock market valuation dates from the "q" theory of Tobin (1969). Papers by Andrew Abel (1979) and Fumio Hayashi (1982) analyze the firm's optimal investment strategy in the presence of adjustment costs, producing a simple linear relationship between a firm's investment rate and q when adjustment costs are quadratic. James Poterba's (1980) study of housing investment appears to be the first inclusion of taxation in the q investment model. Summers (1981b) and Michael Salinger and Summers (1983) employ this partial equilibrium model to study the impact of corporate and personal taxation on investment in plant and equipment.

The general equilibrium implication of this research is that, apart from policies such as investment incentives that have a direct depressing affect on stock values, fiscal policies that increase (decrease) national capital formation will likely be associated with temporary increases (decreases) in stock market values; such capital revaluations arise because capital that has already been installed is a quasi-fixed factor that earns intramarginal rents on its ability to aid in the installation of additional capital. As indicated, even in the case of investment incentives, the presence of adjustment costs can significantly mitigate the fall in stock values associated with tax policies which discriminate against old capital. In a life cycle model the income effects of asset revaluation arising from adjustment costs appear to lengthen fiscal policy transitions as well as reduce the size of short-run changes in most economic variables; however, their impact on long-run outcomes appears minor (Auerbach and Kotlikoff 1983c). The slower transitions reflect not only the adjustment costs of varying capital stocks over a short period of time, but also the intergenerational income affects of the capital gains and losses associated with the short-term asset revaluation.

B. *Empirical Research on Savings and Intergenerational Transfers*

Time series analysis of the effect of intergenerational transfers on aggregate consumption has proved inconclusive. Estimates of the impact of unfunded social security on consumption vary from very large positive effects (Feldstein 1974b) to negative effects (Lesnoy and Leimer 1981).

If one takes the life cycle model as the maintained hypothesis of these studies,

the econometrics is plagued by special problems of aggregation, simultaneity, misspecification, and errors in measuring indices of intergenerational transfers, such as Social Security wealth (Samuel Williamson and Warren Jones 1983). The standard procedure ignores differences by cohort in marginal consumption propensities, producing coefficients of the resulting aggregated equation that are a weighted average of cohort-specific coefficients. There is no reason to suspect the weights will be constant through time. The simultaneity problem arises from the inclusion of aggregate disposable income as an explanatory variable that is presumed exogeneous from current consumption. Misspecification arises from using disposable total income, rather than the after-tax present value of future labor earnings as an explanatory variable. In addition, even at the cohort level, the specified coefficients are not, in general, constant; rather they are variables that depend on the anticipated time paths of future tax rates and benefit levels, and such anticipations change through time.

Auerbach and Kotlikoff (1983c) demonstrate the problem of the time series statistical approach for the life cycle model by running the standard time series specification on simulated data that conform perfectly to this theory's predictions concerning the impact of unfunded social security on savings. The coefficients on the critical social security wealth variable as well as many other variables are extraordinarily sensitive to the choice of sample period as well as the speed with which unfunded social security is phased into the economy; the social security coefficients ranged from 10.8 to −11.4. This exercise suggests that the conventional time series approach has very little power with respect to rejecting the strict (no altruism) life cycle model of saving. In addition, even if one improved the econometric specification and estimated the equation with instrumental variables, the absence of cohort-specific time series data appears to preclude resolving problems of aggregation.

Surprisingly, there seems to have been no attempts to use time series data to reject the alternative hypothesis, namely that of intergenerational altruism. This model, which in its simplest formulation reduces to the case of a single infinitely lived household, is more suited to aggregate data and has the following testable implications. First, the economy's stocks of human and nonhuman wealth (discounted at pretax rates of return) should have identical predicted effects on aggregate consumption (assuming human wealth can be properly measured, which is particularly difficult given the potential degree of uncertainty concerning earnings), and the present value of the stream of future government consumption should have an equal negative effect: see equation 11. Second, the distribution of resource ownership by age should have no impact on aggregate consumption;[21] Boskin and Lau (1984) have recently constructed time series data on the distribution of resource ownership by age which should permit tests of this type.

Cross-section analyses have also been hampered by limited data; in addition, many studies (including those of the author) proceed without clearly formulating rejectable hypotheses concerning altruism. These particular studies involve regressions of household private wealth on social security tax and transfer variables. The central question posed in much of this literature is whether households reduce their private asset accumulation when young because of the anticipation of receiving net windfall transfers when old. The evidence here is mixed, but even if each of these studies had strongly confirmed the proposition that expected future windfalls lead to higher current con-

[21] Lawrence Weiss suggested using this variable in a discussion with the author.

sumption and, therefore, less private wealth accumulation, the results would still leave unresolved the issue of intergenerational altruism; the altruistic hypothesis, like the life cycle hypothesis, suggests that increases in the future resources of a particular household should raise that household's consumption and lower its own savings.[22] In the altruistic case, however, the future windfall to the household in question would presumably also raise the consumption of all other altruistically linked households in the extended family. Unfortunately, this latter proposition is not tested in the existing literature, nor does it appear capable of being tested given current data sources. If one had data on the consumption and resources of potentially altruistically linked households, one could test for such linkages by examining whether the consumption of one household depended on the resources of the other.

To summarize, the empirical literature on intergenerational transfers has focused very narrowly on the predicted impact of particular policies, primarily Social Security. Many of the broader implications of selfish, finite horizon behavior or altruistic, infinite horizon models have not yet been directly tested. Blinder, Gordon and Wise (1981) and Boskin and Lau (1984) are notable exceptions. Their papers consider the fundamental prediction of the life cycle model that the elderly have larger marginal propensities to consume goods and leisure than the young. The evidence presented by Blinder et al. is weakly supportive of this proposition, while that of Boskin and Lau provides stronger support.

C. *Intergenerational Tax Policy—Simulation Analyses*

Presumably as a consequence of standard accounting conventions much of the concern about intergenerational transfers has focused on the impact of "official deficits" on investment, economic growth, and interest rates. As stressed in Section III, whether officially reported current deficits are associated in life cycle models with actual intergenerational redistribution requires close scrutiny of changes in household lifetime budget constraints. Conventionally reported deficits can certainly coincide with real economic deficits, where economic deficits are defined as net intergenerational transfers from younger to older generations. Holding other fiscal policies constant, short-run tax cuts, leading to the accumulation of debt, the interest on which is paid for by higher future taxes (rather than reduced government consumption) provide one example in which a higher reported official deficit is associated with a real redistribution of resources across generations; for the current elderly the short-term tax cut expands their lifetime budgets because they will either not be alive when taxes are increased or they will be alive for a relatively short period of time after the tax increases.

The simulation model outlined in Section IV produces the following effects of temporary tax cuts followed by a policy of maintaining constant the government's resulting accumulated per capita stock of official debt. The baseline tax regime involves a 15 percent proportional income tax. A one-year cut in the income tax rate from 15 to 10 percent (a 5 percent of GNP deficit) has no significant impact on the economy in the long run. This debt policy lowers the long-run capital stock by slightly less than 2 percent and reduces the before-tax wage by close to .5 percent. The long-run income tax rate is 15.3 percent, the rate needed to finance the interest payments on the endogeneously accumulated stock of debt as well as pay for government consumption. Interestingly, the long-run path to a "crowded out" capital stock involves short-run "crowding in"

[22] Robert Barro pointed this out in a 1979 conversation with the author.

of capital. In year one of the transition when the income tax rate is 10 percent, labor supply increases by 3.7 percent while consumption rises by only 1.7 percent. The increase in income exceeds the increase in consumption producing a 32 percent increase in the saving rate in year one relative to the initial steady state. In year two of the transition the income tax rate is raised to 15.2 percent to avoid a further increase in the stock of per capita debt; labor supply now falls below its initial steady state value as does the saving rate. In comparison with the long-run effects of this policy, the immediate effects are quite striking. Sizeable short-run saving effects from temporary life cycle wage appear consistent with several of MaCurdy's (1981) longitudinal findings. This example, in which the saving rate first rises, then falls, indicates that short-run "supply side" responses may be quite poor predictors of long-run supplies of capital and labor and of the size of the long-run tax base.

A twenty-year income tax cut from 15 to 10 percent has much more dramatic long-run effects; the decline in capital across steady states in this case is 49 percent, with every dollar of long-run debt associated with 1.2 dollars less in long-run capital. The pretax wage ultimately declines by 14 percent in the simulation, while the after-tax falls by 30 percent reflecting, in part, the 30 percent income tax rate required for long-run budget balance. The long-run real interest rate rises by 4 percentage points in this experiment.

The year one response in the twenty-year tax cut simulation involves a 2.5 percent increase in labor supply, but a 2.6 percent rise in private consumption. Consequently national saving per worker falls and crowding out begins in year one. The crowding out process is, however, quite slow; in the first ten years the per capita capital stock falls by less than 2 percent; it falls by an additional 4 percent between years 10 and 20. In the subsequent decade after the income tax is raised, which induces a substitution away from labor supply and saving, there is an additional 14 percent decline in per capita capital relative to its initial value. Thus less than one half of the total drop in capital per person occurs during the first 30 years of the perfect foresight economic transition. By year 60 about four-fifths of the transition is complete.

The short-run differences in these two tax cut simulations clearly reflect the predominance of substitution over income effects in the case of the short period tax cuts and the converse for the twenty-year tax cut; in the case of the one-year tax cut, all but the oldest generation alive in the first year will face higher tax rates through the rest of their lives. Young generations will face the higher tax rates for such a long period of time that their budget possibilities and levels of welfare are actually reduced. While the income effects experienced by most current age groups from the change in the time path of tax rates in the one-year tax cut are trivial, if not negative, the substitution effect leading to less current consumption and more current labor supply at the time of the tax cut are nontrivial. A key lesson of these two simulations is that policies that inevitably crowd out saving and investment can look quite effective in promoting capital formation if one evaluates such policies using only the first few years of information.

It is instructive to compare these results arising from presumably explicitly reported deficits with those arising from the unreported deficits embedded in unfunded Social Security. Starting out from the same initial equilibrium, introducing a "pay as you go" Social Security system with a 40 percent replacement rate and financed by payroll taxes leads to a 19 percent long-run decline in capital per person and a 5 percent drop in the pretax wage.

Hence, in its ability to crowd out capital in this life cycle model, introducing an unfunded Social Security system with a substantial benefit replacement rate can have as deleterious an impact on capital formation as officially reported economic deficit policies arising from multi-year tax cuts.

The importance of considering unreported intergenerational transfers is further highlighted by a final simulation experiment. Suppose the economy's initial fiscal policy is a 15 percent income tax with 100 percent expensing of new capital. As argued above, this tax structure involves no marginal taxation of capital income, and increases in the capital income tax simply produce capital losses for elderly owners of capital, with large marginal consumption propensities, thus transferring resources to young and future generations, with low or zero current marginal consumption propensities. Consider a permanent increase in the tax rate on capital income from 15 to 50 percent coupled with a 20-year cut in the wage tax rate from 15 to 10 percent. While the government reports official deficits in the first few years of the economic transition in excess of 4 percent of GNP, the unreported economic surplus associated with the asset revaluation crowds in more capital than the wage tax cut crowds out. By the twentieth year of the transition the increase in the government's tax base has sufficed to retire the official debt issued in the early years of this policy, and the government finds itself running a very sizeable surplus. To balance its budget after 20 years the wage tax rate must be cut; the new long-run wage tax rate is only 2 percent. The long-run per capita capital stock is 70 percent larger than its initial steady state value, and the government (stock) surplus equals close to 7 percent of private wealth.

These results illustrate the variety of outcomes, many of which are quite surprising, that the standard CES life cycle model can produce in response to intergenerational tax policies. They should, however, be viewed cautiously; augmenting this type of model with liquidity constraints on unsecured borrowing, as in Dolde and Tobin (1981) can significantly diminish the simulated response to such policies in life cycle economies.

VII. *The Savings Impact of Intragenerational Tax Policy*

Recent papers by Heckman (1981), Hausman (1979, 1981), and Diamond and Hausman (1983) suggest a great deal of heterogeneity in household preferences. While these and other articles carefully model taste differences, virtually all applied microeconometric studies successfully employ demographic and related variables to "control" for differences in household behavior. This evidence, as well as casual observation, suggests a within cohort distribution of time preference rates and, therefore, of differences in marginal propensities to consume goods and leisure. For the issue of savings and intragenerational redistribution, the important empirical question is whether transfer recipients within an age group have, on average, greater marginal propensities to dissave out of transfers than their contemporaries who are the source of such transfers. Since the intent of intragenerational transfers is presumably to improve the lot of the poor, attention has naturally focused on the correlation of spending propensities with levels of economic resources. Blinder (1975), using aggregate time series data finds that equalizing incomes is more likely to stimulate than retard savings. On the other hand, Paul Menchik and Martin David's (1983) study as well as that of Diamond and Hausman (1983) supports a view that marginal spending propensities decline with economic resources.

Even if the poor do not systematically

differ from the rich in their intertemporal preferences, the poor may be liquidity constrained at the margin; i.e., they may face different shadow prices for intertemporal consumption than the rich. Other within cohort differences in intertemporal relative prices could, however, be offsetting. For example, under a progressive income tax the poor face lower marginal taxes on capital income and, through this channel, lower relative prices of future consumption and leisure.

There is mounting evidence that liquidity constraints are binding for lower income households. Diamond (1977) and Diamond and Hausman (1983) stress the low levels of liquid wealth held by a significant fraction of the middle and low income population. Kotlikoff, Spivak and Summers (1982) demonstrate that the timing of the receipt of lifetime resources significantly influences patterns of lifetime wealth accumulation. Michael Hurd and Boskin (1984) present evidence that retirement probabilities depend on the level of tangible wealth. Hall and Frederic Mishkin (1982) test the Euler conditions of unconstrained intertemporal maximization and conclude that such a model is inappropriate for roughly 20 percent of U.S. households. King and Dicks-Mireaux (1982) reach a similar conclusion using Canadian data. Hayashi (1982) focuses directly on the issue of liquidity constraints. His novel approach is to see whether the consumption function of presumably unconstrained households systematically differs from that of constrained households. Hayashi's answer is strongly in the affirmative. Over half of the households in his sample of the 1963–1964 Federal Reserve Survey of Financial Characteristics meet his definition of potentially liquidity constrained; this group reported receiving close to 40 percent less in disposable income than the unconstrained group. While this group as a whole appears to be consuming only about 3 percent less than they would in the absence of such constraints, for the 18 to 33 year old constrained households, actual consumption is close to 10 percent less than predicted unconstrained consumption.

Emily Gilde (1983) examines the long-run, general equilibrium savings impact of intragenerational transfers in a 55 period life cycle model with exogenous labor supply, a utility function that is additively separable and isoelastic in consumption, and a Cobb-Douglas production function. The model contains two sets of agents, low earners and high earners. The populations of each group are identical. The high earners have time preference rates of 1.5 percent while the low earners have rates of 6 percent. Thus low earners have larger marginal consumption propensities than high earners. In examining the impact of within cohort transfers, Gilde considers cases in which the poor both are and are not liquidity constrained. Gilde finds that very significant levels of intragenerational redistribution have rather minor impacts on her economy's long-run stock of wealth. For example, a uniform lump sum transfer to each poor worker during each working year that raises that worker's lifetime resources by close to 25 percent and which is financed by a uniform lump sum tax on rich workers of the same generation during each working year reduces the stock of wealth by less than 4 percent in the case of no liquidity constraints and less than 7 percent when liquidity constraints are binding. The finding of rather small savings effects of redistributing to the poor appear to be quite robust in the face of reasonable variations in the intertemporal elasticity of substitution in consumption, but they are rather sensitive to the ratio of rich to poor workers.

The explanation for these small changes in the case of no liquidity constraints is simply that neither the differences in marginal consumption propensities across the

two groups nor the size of the transfers are sufficiently large to have much impact on the economy's total wealth accumulation. In the case the poor are liquidity constrained, their marginal consumption propensities are unity, but the resource increment multiplying their unitary propensities is only the current year's transfers. For rich, unconstrained young workers making the transfers, their reduction in current consumption equals their much smaller marginal propensity to consume multiplied by the present value of the annual transfers, typically a much larger number than simply the current year payment.

VIII. *Fiscal Policy and the Government's Implicit Provision of Insurance*

Governments explicitly provide a variety of forms of insurance including unemployment insurance, disaster insurance, disability insurance, health insurance, etc. But they may also provide insurance in more subtle, unreported ways. The interpretation of a variety of fiscal policies as potentially implicit provision of insurance is illustrated by the following simple example. Imagine an economy in which each identical risk averse agent owns a home worth $10,000 and faces an exogenous 10 percent probability of losing his home through fire. Assume the probability of having a fire is independent across households and that exactly 10 percent of all houses in the economy burn down each year. In such a setting a competitive insurance market, absent transaction costs, would fully insure each homeowner, and the fire insurance premium would be $1,000. Now suppose the government passes a law taxing each household $1,000. At the same time the government announces a relief program for households hit by fire which pays $10,000 to each affected household. Obviously, this fiscal policy replicates and would replace private provision of fire insurance. If the government tax is set at $500 rather than $1,000, and the relief payment is $5,000 rather than $10,000, private insurers would find a ready market for $5,000 of additional fire insurance at a competitive premium of $500. Rather than underinsuring the private sector, the government might overinsure by placing a $2,000 tax on each household and providing $20,000 in housing relief payments. In this case the private market would respond by selling insurance against *not* having a fire; i.e., the original full insurance equilibrium is restored by having each household pay a premium of $9,000 for a policy that pays zero in case of fire and $10,000 in case of no fire.

This example illustrates two points. First, fiscal policies could, except for their accounting labels, constitute insurance markets. Second, such implicit insurance provision may have no impact whatsoever on the economy because equivalent private insurance is available at the margin.

This result does not hinge on the assumption of no risk in the aggregate economy. Assume for example that with equal probability either 10 percent or 20 percent of all homes will burn. In this case the competitive market premium for $10,000 of fire protection is $1,500 with a $500 surcharge if 20 percent of the houses ignite and a $500 rebate if only 10 percent catch fire. The government could obviously replicate this outcome by imposing a $2,000 head tax in a bad year (20 percent of houses catch fire) and a $1,000 head tax in a good year (10 percent of houses catch fire). These funds would, of course, be used to finance the $10,000 relief payments to fire victims. As in the case of no economy-wide risk, over or under provision of insurance by the government in these two states of nature will be fully offset by perfect private insurance markets to the extent such markets exist. It should be noted, of course, that while

the government, like the private insurance market, can efficiently pool aggregate risks across the populace, neither it nor the private market can provide complete insurance against economy-wide risks.

In providing insurance in this example, the government need not even mention the word "fire" in its fiscal operations. Indeed, capital income taxation (with full loss offset) can potentially provide the type of fire insurance just described. To see the connection between this example and capital income taxation, think of this same economy as having two assets, *A* and *B*. *A* pays $10,000 if 20 percent of the houses, including one's own, burn down and nothing if only 10 percent of the houses burn down. *B* pays $11,000 if 10 percent of the houses burn, including one's own, and zero if 20 percent are destroyed. If the price of both assets is $1,000 then an agent who purchases each of these assets will end up with the same fire protection previously described.

Now assume the government places a 50 percent tax on the gross return to each asset. Hence, if 20 percent of the houses, including one's own, catch fire the government collects $5,000 from each affected agent on his return of asset *A*. Similarly, the government's receipts per affected agent when only 10 percent of the houses burn down, including one's own, equals $5,500. Next assume that these receipts are returned to each affected agent in the two states of nature in the form of a lump sum subsidy. If each agent responds to this fiscal policy by simply continuing to purchase the two assets, he will end up in exactly the same situation as if the government had not imposed the capital income tax cum lump sum subsidy; i.e., if 20 percent of the houses catch fire, each agent whose house burns is left with $8,000, corresponding to an after-tax return of $5,000, on asset *A*, plus the government subsidy of $5,000, less the $2,000 initial investment. If only 10 percent of the houses burn down, each agent whose house burns ends up with $9,000, representing $5,000 earned after tax on asset *B* plus a $5,500 government subsidy, less the $2,000 investment.

Obviously, there is nothing intrinsic in this example of capital income taxation as implicit insurance that necessarily relates to the number of fires. One could just as well consider assets *A* and *B* as paying off contingent upon some other event or set of events, such as the weather, changes in demand conditions, etc., that adversely affect some agents and benefit others. As Gordon (1981) emphasizes the assumption that the government's revenue is handed back to the agents in a lump sum is also not critical to the result that capital income taxation could effectively represent superfluous government risk pooling in capital and insurance markets that has no independent effect on the economy. Rather than returning the capital income tax revenues to the private sector, suppose the government spends these receipts on consumption. One can, for convenience, think of the government as handing the revenues out as a lump sum subsidy and then retrieving them through a separate lump sum tax to pay for its consumption. In this case the replacement of capital income taxation by lump sum taxation leaves the economy unaffected, since the private market, by assumption, steps in to provide the risk pooling that was previously arising under the capital income tax.

Varian (1980) and Eaton and Rosen (1980) demonstrate that wage taxation and subsidization, in the presence of earnings uncertainty, can analogously be viewed as government provision of human capital insurance. Social Security's provision of annuity, disability, and life insurance through its benefit structure is fairly obvious, and Social Security "taxes" could easily be relabeled insurance premia for the purchase of these policies. At

first glance, however, many of Social Security's provisions appear at odds with efficient insurance provision. Social Security's earnings test for receipt of benefits is one example. Diamond and Mirrlees (1978), on the other hand, argue that this provision is plausibly a component of optimally configured government insurance against the risk of old age disability in cases where disability is very difficult to verify. Just as fire insurance pays off only to those experiencing a fire, the earnings test makes sure that only those who are not working (or are not working much), presumably the disabled, are the only elderly to receive benefits. Merton (1981) develops one of the more ingenious of these arguments that fiscal policy is a veil for government insurance. In his model the government combines both unfunded social security and a consumption tax to pool human capital risk and nonhuman capital risk optimally across young and old generations.[23]

In assessing the savings impact of these potential forms of government insurance provisions, the key question appears to be the extent to which the private market would otherwise provide each particular form of insurance. Since capital markets, at least in developed countries, appear to offer substantial risk sharing opportunities, it appears unlikely that eliminating capital income taxation would significantly alter the pooling of risky returns to nonhuman capital. This conclusion seems much less plausible in the case of human capital risk. Ignoring possible risk pooling within families and firms, there are no private markets in which one can sell off a portion of his or her future earnings and purchase that of others.

Assuming that the government is the sole effective insurer of human capital, the savings impact of this insurance is assessed by considering an alternative hypothetical state of no human capital insurance. Articles by Leland (1968), Sandmo (1970), Bruce Miller (1974, 1976), Skinner (1983a, 1983b) and Robert Barsky, N. Gregory Makiw and Stephen D. Zeldes (1984) suggest that increased earnings uncertainty is likely to lead risk averse agents to reduce their current consumption and leisure holding the expected level of earnings constant. In addition, earnings risk that is specifically related to the returns from training may inhibit human capital formation, leading to less training and more labor supply when young. This implies a steeper age consumption profile and flatter age earnings profile, on average, in the economy than would occur with earnings insurance. This suggests more savings in the form of nonhuman capital in the no insurance stochastic steady state. Estimates of the extent of such differences in long-run wealth stocks would contribute both to understanding how potential government earnings insurance as well as government-generated earnings uncertainty associated with random taxation (Weiss 1976, Stiglitz 1982, Eaton 1981, Skinner 1983b) affects savings.

There are now a number of articles dealing with saving behavior in the absence of private annuity insurance. Sheshinski and Yoram Weiss (1981) is the first analysis of the pure insurance effects of government pensions on national saving. They demonstrate that when private arrangements for pooling the uncertainty of longevity are unavailable, the government's provision of fully funded old age annuities alters household consumption possibilities. In their model in which agents have a bequest motive, the short-

[23] In Merton's model elderly generations pay for their receipts of positive, but variable social security benefits by paying positive, but variable amounts of consumption tax. Since social security's benefits are proportional to earnings in Merton's model and variations in consumption tax receipts depend, in part, on the random return to capital, these fiscal instruments provide the elderly with a share of the economy's human capital risk and the young with a share of the economy's physical capital risk.

run saving impact of such provision is ambiguous. Glen Hubbard (1983) points out that this provision will likely reduce national saving if agents have no bequest motive. The insurance provision reduces the precautionary demand for saving, inducing a higher rate of consumption. A fuller description of life cycle (zero bequest motive) economies, in the absence of annuity insurance, is presented in Zvi Eckstein, Martin Eichenbaum and Dan Peled (1983) and Abel (1983). Both papers independently derived the stochastic steady state properties of economies in which agents involuntarily leave bequests to their children. Abel also considers the effects of introducing a fully funded social security system in such an economy, his chief finding being that such a policy reduces savings. A related article by Kotlikoff, Shoven and Spivak (1983) compares the long-run stock of wealth prevailing in economies with and without perfect annuity insurance. In the latter type of economies there is partial insurance provided by family members; older family members selfishly trade title to their equally selfish children for support if they live longer than average. In contrast to the perfect insurance steady state, these authors find that wealth in the stochastic steady state can be significantly higher in an economy with imperfect family annuity insurance. Their estimates suggest that social security's provision of annuity insurance is potentially as important as its method of finance in reducing wealth accumulation.

IX. *Policy Announcements and Policy Perceptions—The Problem of Dynamic Inconsistency*

Sections IV through VII analyzed the impact of new tax policies assuming such policies take "rational" agents by surprise and that the public fully believes these policies will be implemented through time. The proposition that "rational" agents can systematically be "taken by surprise" sounds, and is, a contradiction in terms. Fischer (1979) nicely illustrates the problem of intertemporal change in government policy; he points out that rational agents who are cognizant of the government's future objectives will be able to predict future policy changes. Thus an announced program to stimulate saving may have the opposite effect on private behavior if the public conjectures that once additional wealth has been accumulated the government in power will find this a convenient source of explicit or implicit revenues. Stated differently, a current wealth tax would depress current consumption and leisure and raise saving if households believe such a tax will not be imposed again in the future. The alternative perception of continued future wealth taxes translates into very high implicit present prices of future consumption and leisure and leads households to substitute toward current consumption and leisure.

Of course the private sector may be incapable of accurately predicting future fiscal policy. If such were the case, one would expect (especially in a neoclassical setting with well-functioning capital markets) the private sector to take steps to self-insure against changes in government fiscal policy, in particular against inter- and intragenerational redistribution.

Indeed, if the economy consisted of a large number of households with Barro-type intertemporal preferences, equation (14), these families could conceivably write binding contracts to hedge themselves through eternity against intramarginal redistribution. If one further assumed that all such families were interlinked through marital ties, they could conceivably share the same altruistic objective function. In this case they would fully internalize the government's budget constraint and treat all government taxes as lump sum levies no matter

how they were levied. Thus the government would be powerless to alter the set of marginal prices entering household budgets. Finally, if this household sector viewed government consumption as a perfect substitute for private consumption, changes in government consumption would also have no impact on the economy. In such a hypothetical economy the government's fiscal policy has no influence whatsoever on national saving.

This example and the prior discussion is obviously extreme, but it highlights the fact that most neoclassical studies of savings and taxation appear implicitly to assume away the existence of particular insurance markets and/or the ability of otherwise rational agents to learn from the past in considering the government's impact on their future.

X. *Concluding Comments*

Economics is most exciting when it challenges conventional views; it is ultimately most persuasive in relating theory to fact when the theory is based on fundamental notions of optimization, and it is most important when it addresses macro-relationships. Recent neoclassical analyses of taxation and earnings are exciting, persuasive, and important. In contrast to conventional notions, properly designed fiscal policy can have clear and powerful savings affects in most neoclassical models. Efficacious application of such policies appears as much a question of choice and timing of changes in fiscal instruments as it is a question of exact values of preference parameters. In addition, the extent of market and family credit and insurance arrangements is critical for determining the savings impact of policy; fiscal instruments may, themselves, constitute government insurance provision. Alternatively, frequent, unexpected changes in these instruments may be a major source of private uncertainty.

The findings of recent research provide important lessons for the conduct of fiscal policy. First, this research warns that official reporting of fiscal policy can be highly misleading, with economic deficits reported as surpluses and effective marginal subsidization officially reported as positive taxation. Second, in the presence of certain policy instruments, changes in other instruments can have effects exactly the opposite to that intended and normally presumed (e.g., raising capital income tax rates might stimulate savings in the presence of 100 percent expensing). Third, short-run impacts of fiscal policy may be exactly the opposite of long-run impacts, suggesting that policy assessment based only on current outcomes may be highly misleading. Fourth, although the precise amount of "crowding out" associated with economic deficits remains unresolved, the potential major reductions in national wealth associated with explicit and implicit economic deficits make such policies very risky gambles for future generations. Fifth, from the perspective of neoclassical models, frequent changes in policy instruments appear undesirable; once the private sector begins to anticipate fiscal revisions, it will attempt to insure against such changes, reducing the effectiveness of policy, if not reversing the direction of its intended impact. Finally, both the insurance and risk generating properties of fiscal policy are important, if not primary considerations in policy design.

As in other fields of economics, theoretical advances in the analysis of taxation and savings have outpaced the acquisition of data of sufficient detail to discriminate among theories. Resolution of questions as basic as the burden of the debt turns on quite subtle types of behavior, such as the extent of mutual caring within families, that will require new data to fully discern. Private beliefs about precise future government policies, while difficult to ascertain, are crucial determinants of

current incentives to work and save. Such beliefs need to be identified as part of any empirical assessment of the impact of particular fiscal measures. There are other deeper questions that will make savings and taxation an exciting field for years to come. The most fundamental question is surely the applicability of the neoclassical paradigm to actual household savings behavior. There is as yet no convincing empirical evidence and certainly no professional consensus that households make saving decisions in accordance with the dictates of neoclassical optimization. The assumption of continuous equilibrium, particularly in labor markets, and the extensive information processing requirements of certainty as well as uncertainty models are two characteristics of neoclassical models that raise frequent objections. These and other concerns about the neoclassical framework recommend caution both in assessing the extensive recent research in neoclassical savings and in relying on these findings in the actual setting of fiscal policy.

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