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GENERATIONAL POLICY

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ABSTRACT

Generational policy is a fundamental aspect of a nation's fiscal affairs. The policy involves redistributing resources across generations and allocating to particular generations the burden of paying the government's bills. This chapter of the second edition of *The Handbook of Public Economics* shows how generational policy works, how it's measured, and how much it matters to virtual as well as real economies.

The chapter shows the zero-sum nature of generational policy. It then illustrates generational policy the difference between statutory and true fiscal incidence. It also illuminates the arbitrary nature of fiscal labels as well as their associated fiscal aggregates, including the budget deficit, aggregate tax revenues, and aggregate transfer payments. Finally, it illustrates the various guises of generational policy, including structural tax changes, running budget deficits, altering investment incentives, and expanding pay-as-you-go-financed social security.

Once this example has been milked, the chapter shows that its lessons about the arbitrary nature of fiscal labels are general. They apply to any neoclassical model with rational economic agents and rational economic institutions. This demonstration sets the stage for the description, illustration, and critique of generational accounting. The chapter's final sections use a simulation model to illustrate generational policy, consider the theoretical and empirical case for and against Ricardian Equivalence, discuss government risk sharing and risk making, and summarize lessons learned.

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I. Introduction

Generational policy – the government's treatment of current and future generations -- is a fundamental aspect of a nation's fiscal affairs. The policy involves two actions – redistributing resources across generations and allocating to particular generations the burden of paying the government's bills. Taking from one generation to help another or forcing one generation to pay for another's public goods raises a host of ethical as well as economic questions. How much of the government's bills should future generations be forced to pay? How should the government treat today's elderly versus today's young? Should those born in the future pay more because they will benefit from improved technology? Can the government redistribute across generations? If so, how does this work? Does relieving current generations of fiscal burdens let them consume more and, thereby, reduce or *crowd out* national saving and domestic investment? Should the government try to pool risks across generations?

Generational morality is the province of philosophers. But the positive questions surrounding the treatment of the old, the young, and unborn have captivated economists since the birth of the discipline. Their work has firmly embedded the analysis of generational policy within the broader theory of fiscal incidence.[1] This theory has three central messages. First, those to whom the government assigns its bills or designates its assistance are not necessarily those who bear its burdens or enjoy its help. Second, the incidence of policies ultimately depends on the economic responses they invoke. Third, apart from changes in economic distortions, generational policy is a zero-sum game in

[1] For surveys of tax incidence see Kotlikoff and Summers (1987) and Fullerton and Metcalf (this volume).

which the economic gains to winners (including the government) equal the economic losses to losers.[2]

Because the gulf between policy goals and policy outcomes can be so large, incidence analysis is both important and intriguing. This is particularly true for generational policy where a range of private responses can frustrate the government's initiatives. These include intra-family intergenerational redistribution, private changes in saving and labor supply, and the market revaluation of capital assets.

The admonishment of incidence theory that policy descriptions bear no necessary relationship to policy outcomes is particularly apt in considering the traditional measure of generational policy, namely official government debt. Notwithstanding its common use, official government debt is, as a matter of neoclassical economic theory, an artifice of fiscal taxonomy that bears no fundamental relationship to generational policy.

In contrast to deficit accounting, which has no precise objective, a relatively new accounting method, *Generational accounting*, attempts to directly assess generational policy. Specifically, it tries to measure the intergenerational incidence of fiscal policy changes as well as understand the fiscal burdens confronting current and future generations under existing policy.

Generational accounting represents but one way of trying to quantify the economic impacts of generational policy. Another is computer simulation. Each passing year sees the development of ever more sophisticated and carefully calibrated dynamic computer simulation models. These virtual environments are simplifications of economic

[2] Changes (including reductions) in economic distortions include policy-induced changes in the economy's degree of risk sharing to the extent that marginal rates of substitution and production are not equated across states of nature.

reality. But they allow economists to conduct stylized controlled experiments in studying the dynamic impacts of generational policies.

This chapter shows how generational policy works, how it is measured, and how much it matters to virtual as well as real economies. To make its points as quickly and simply as possible, the chapter employs a two-period, overlapping generations model. This model is highly versatile. It illustrates the central controversies surrounding generational policy, including its potential impact on national saving and its potential impotency due to *Ricardian Equivalence*. It exposes the vacuity of deficit accounting. And it elucidates the government's intertemporal budget constraint that provides the framework for generational accounting.

Section II begins the analysis by presenting the two-period life-cycle model, defining generational incidence, and showing the zero-sum nature of generational policy. Section III illustrates generational policy with a simple example, namely a policy of redistributing, in a non-distortionary manner, to the contemporaneous elderly from the contemporaneous young as well as all future generations. This example clarifies the difference between statutory and true fiscal incidence. It also illuminates, as described in Section IV, the arbitrary nature of fiscal labels as well as their resultant fiscal aggregates, including the budget deficit, aggregate tax revenues, and aggregate transfer payments. Finally, it illustrates the various guises of generational policy, including structural tax changes, running deficits, altering investment incentives, and expanding pay-as-you-go-financed social security.

Once this example has been fully milked, the chapter shows that its lessons about fiscal labels are general. They apply when fiscal policy, in general, and generational policy, in particular, is distortionary, when it is uncertain, when it is time inconsistent, and when segments of the economy are credit constrained. Indeed, they apply to any neoclassical model with rational economic agents and rational economic institutions (including the government). This demonstration sets the stage for Section V's description, illustration, and critique of generational accounting. This section also lays out the implications of generational policy for monetary policy.

Because generational policies play out over decades rather than years and can have major macroeconomic effects, understanding their impacts is best understood through computer simulation analysis. Section VI presents results from simulating two major generational policies – changing the tax structure and privatizing social security. The messages of this section are that generational policies can have significant effects on the economy and the well being of different generations, but that such policies take a long time to alter the economic landscape.

Having illustrated generational policy, its measurement, and the potential magnitude of its effects, the Chapter turns, in Section VII, to Ricardian Equivalence – the contention that generational policy, despite the government's best efforts, just doesn't work. The alleged reason is that parents and children are altruistic toward one another and will use private transfers to offset any government attempts to redistribute among them. Ricardian Equivalence has been assailed by theorists and empiricists. These attacks have paid off. As Section VII discusses, there are very good theoretical and empirical reasons to doubt the validity of Ricardian Equivalence, at least for the United States. Section VIII considers the government's role in improving or worsening intergenerational risk sharing. The final section, IX, summarizes and concludes the chapter.

To conserve space, the chapter makes no attempt to survey the voluminous literature on generational policy. But any discussion of the modern analysis of generational policy would be remiss if it failed to identify the four major postwar contributions to the field, namely Samuelson's (1958) consumption-loan model, Diamond's (1965) analysis of debt policies, Feldstein's (1974) analysis of unfunded social security, and Robert Barro's (1974) formalization of Ricardian equivalence. These papers and their hundreds, if not thousands, of offspring collectively transformed the field from a collection of intriguing, but poorly posed questions to an extremely rich and remarkably clear set of answers.

II. The Incidence of Generational Policy

The Life-Cycle Model

Consider a two-period, life-cycle model in which agents born in year s have utility U_s defined over consumption when young, c_{ys}, consumption when old, c_{os+1}, leisure when young, l_{ys}, and leisure when old, l_{os+1}.

(1) $$U_s = u(c_{ys}, c_{os+1}, l_{ys}, l_{os+1})$$

For this dynamic economy, consumption and leisure from a point in time, say the beginning of time t, onward is constrained by a constant returns production function satisfying

(2) $$F(c_{ot} + c_{yt} + g_t, c_{ot+1} + c_{yt+1} + g_{t+1}, \ldots, l_{ot} + l_{yt} - 2T, l_{ot+1} + l_{yt+1} - 2T, \ldots, k_t) = 0,$$

where g_s is government consumption in year s, k_t is the capital stock at the beginning of time t (before time-t production or consumption occurs), and T is the time endowment available to each generation in each period.[3] Since there are two generations alive at each point in time, the aggregate time endowment in each period is 2T. The arguments of (2) are the net (of endowments) demands for consumption and leisure at time t and in all future periods plus the beginning of time t endowment of capital.

Output is non-depreciable and can be either consumed or used as capital. Since there are no future endowments of capital, only the time-t endowment of capital enters (2). The fact that all of the leisure being demanded in a given period enters as a single argument independent of who enjoys this leisure implies that the amounts of labor supplied by different agents are perfect substitutes in production. Finally, the fact that the aggregate time endowment (T) is constant through time reflects the simplifying assumption that each cohort is of equal size – the value of which is normalized to unity.

Using the constant returns-to-scale property, the production function can be written as:

(3)
$$(c_{ot} + c_{yt} + g_t) + R_{t+1}(c_{ot+1} + c_{yt+1} + g_{t+1}) + \ldots + w_t(l_{ot} + l_{yt}) + R_{t+1}w_{t+1}(l_{ot+1} + l_{yt+1}) \ldots +$$
$$= \frac{k_t}{R_t} + w_t 2T + R_{t+1}w_{t+1}2T + \ldots ,$$

where R_{s+1} is the marginal rate of transformation of output in period s into output in period s+1 (the cost of an extra unit of output in period s+1 measured in units of output in period s); i.e.,

[3] To keep the notation simple, this presentation abstracts from uncertainty in leaving out subscripts that denote state of nature. Indexing commodities by the state of nature is straightforward.

(4) $$R_{s+1} \equiv \frac{F_{cs+1}}{F_{cs}},$$

and w_s is the marginal rate of transformation of output in period s into leisure in period s (the cost of an extra unit of leisure in period s measured in units of output in period s), i.e.,

(5) $$w_s \equiv \frac{F_{ls}}{F_{cs}}$$

The terms R_{s+1} and w_s – the respective time-s marginal products of capital at time s+1 and labor at time s -- are referenced below as pre-tax factor prices.

Equation (3) is the economy's intertemporal budget constraint. It requires that the value of current and future consumption and leisure, all measured in units of current consumption, not exceed the value of the economy's current and future endowments, also measured in units of current consumption.

In choosing their consumption and leisure demands, agents born in year $s \geq t$ maximize (1) subject to:

(6) $$c_{ys} + R_{s+1}c_{os+1} + w_s l_{ys} + R_{s+1}w_{s+1}l_{os+1} = w_s T + R_{s+1}w_{s+1}T - h_{ys} - R_{s+1}h_{os+1},$$

where h_{os} is the net payment of the old at time s.

Those agents born in t-1 maximize their time-t remaining lifetime utility subject to:

(7) $$c_{ot} + w_t l_{ot} = \frac{a_{ot}}{R_t} + w_t T - h_{ot}$$

In (6) and (7), h_{ys} is the net payment to the government by the young at time s, and a_{ot} represents the net worth of the initial elderly at the beginning of time t.

The Government's Intertemporal Budget Constraint

Substitution of (6) and (7) into the economy-wide budget constraint (3) yields the government's intertemporal budget constraint:

(8)

$$h_{ot} + h_{yt} + R_{t+1}(h_{ot+1} + h_{yt+1}) + R_{t+1}R_{t+2}(h_{ot+2} + h_{yt+2}) + \ldots = g_t + R_{t+1}g_{t+1} + R_{t+1}R_{t+2}g_{t+2} + \ldots + \frac{a_{ot} - k_t}{R_t}$$

The right-hand side of (8) is the government's bills -- the present value of it current and future projected consumption plus its net debt, which equals the difference between total private-sector net worth and the economy's aggregate capital stock, $(a_{ot} - k_t)/R_t$. The government's intertemporal budget constraint requires that either current or future generations pay for the government's bills, where its bills represent the sum of its projected future consumption plus its initial net debt. As discussed below, different ways of labeling government receipts and payments will alter h_{ot} (the remaining lifetime net payment, or *generational account*, of the time-t elderly) and $(a_{ot} - k_t)/R_t$ by equal amounts. In contrast, the lifetime net payments (the generational accounts) facing initial young ($h_{yt}+R_{t+1}h_{ot+1}$) and future generations ($h_{ys}+R_{s+1}h_{os+1}$, ,*for* $s>t$) are invariant to the government's vocabulary; i.e., the fiscal burden on current and future newborns is well defined, whereas the government's net debt is not.

The Incidence of Generational Policy

Suppose that at time t the government changes policy. The policy change will affect the generation born at time t-1 (the initial elderly), the generation born at time t (the initial young), and all generations born after time t (the future generations). The incidence of the policy for an affected generation born in year s is found by differentiating (1):

$$(9) \qquad dU_s = u_{cys} dc_{ys} + u_{\cos+1} dc_{os+1} + u_{lys} dl_{ys} + u_{los+1} dl_{os+1}$$

For the initial elderly, s=t-1, and $dc_{yt-1}=0$ and $dl_{yt-1}=0$, since consumption and leisure that occurred before the policy changed is immutable.

The incidence experienced by each generation born at for $s \geq t$ can be expressed in units of consumption when young by dividing (9) by the marginal utility of consumption when young.

$$(10) \qquad \frac{dU_s}{u_{cys}} = dc_{ys} + \frac{u_{\cos+1}}{u_{cys}} dc_{os+1} + \frac{u_{lys}}{u_{cys}} dl_{ys} + \frac{u_{los+1}}{u_{cys}} dl_{os+1}$$

Equation (10) traces generational incidence to changes in each generation's consumption and leisure when young and old valued in terms of their consumption when young. In the case of the initial elderly, the change in utility can be normalized by the marginal utility of consumption when old.

The Zero-Sum Nature of Generational Policy

Policy-induced changes in consumption and leisure experienced by the various generations alive at time t and thereafter must satisfy (11), which results from differentiating (2).

(11)

$$(dc_{ot} + dc_{yt} + dg_t) + R_{t+1}(dc_{ot+1} + dc_{yt+1} + dg_{t+1}) + R_{t+1}R_{t+2}(dc_{ot+2} + dc_{yt+2} + dg_{t+2}) + \ldots$$

$$+ w_t(dl_{ot} + dl_{yt}) + R_{t+1}w_{t+1}(dl_{ot+1} + dl_{yt+1}) + R_{t+1}R_{t+2}w_{t+2}(dl_{ot+2} + dl_{yt+2}) + \ldots = 0$$

Let E_t stand for the sum over all generations alive from time t onward (including the initial elderly born in t-1) of policy incidence measured in units of time-t consumption.

(12) $$E_t = \frac{dU_{t-1}}{u_{\cot}} + \frac{dU_t}{u_{cyt}} + R_{t+1}\frac{dU_{t+1}}{u_{cyt+1}} + R_{t+1}R_{t+2}\frac{dU_{t+2}}{u_{cyt+2}} + \ldots$$

Using (10) and (11), rewrite (12) as

(13)

$$E_t = (R^n_{t+1} - R_{t+1})dc_{ot+1} + R_{t+1}(R^n_{t+2} - R_{t+2})dc_{ot+2} + \ldots (w^n_{ot} - w_t)dl_{ot} + (w^n_{yt} - w_t)dl_{yt} +$$

$$(w^n_{ot+1}R^n_{t+1} - w_{t+1}R_{t+1})dl_{ot+1} + R_{t+1}(w^n_{yt+1} - w_{t+1})dl_{yt+1} + R_{t+1}(w^n_{ot+2}R^n_{t+2} - w_{t+2}R_{t+2})dl_{ot+2} +$$

$$R_{t+1}R_{t+2}(w^n_{yt+2} - w_{t+2})dl_{yt+2} + \ldots - dg_t - R_{t+1}dg_{t+1} - R_{t+1}R_{t+2}dg_{t+2} - \ldots$$

where

(14) $$R^n_s \equiv \frac{u_{\cos}}{u_{\cos-1}},\ w^n_{ys} \equiv \frac{u_{lys}}{u_{cys}},\ \text{and}\ w^n_{os} \equiv \frac{u_{los}}{u_{\cos}}$$

There are two sets of terms on the right-hand-side of (13). The first set involves differences between marginal rates of substitution (MRS) and marginal rates of transformation (MRT) multiplied by a) the change in the economic choice being distorted and b) a discount factor. These MRS-MRT wedges arise from distortionary fiscal policies and are often referred to as marginal tax wedges. This first set of terms is related, but not strictly identical to, the present value of the marginal change in economic efficiency (the change in excess burden) arising from the policy. The second set of terms measures the present value of the policy-induced change in the time-path of government consumption.

Thus (13) shows that fiscal-policy incidence summed over across all current and future generations equals a) the present value of the time-path of terms related to policy-induced changes in excess burden and b) the increase in the present value of government consumption. Thus, apart from efficiency effects, any change in government consumption must be fully paid for in terms of reduced welfare experienced by current or future generations. If the policy entails no efficiency change and no change in government consumption, E_t equals zero, and the policy simply redistributes fiscal burdens across generations. Hence, ignoring efficiency effects, policy changes are, generationally speaking, zero-sum in nature. Either current or future generations must pay for the government's spending and holding government spending fixed, any improvement in the wellbeing of one generation comes at the cost of reduced wellbeing of another generation.

It's important to note that (13) takes into account policy-induced changes in the time-path of factor prices. Apart from efficiency considerations, (13) tells us that *all* intergenerational redistribution, be it direct government intergenerational redistribution, arising from changes in the constellation of net payments it extracts from various generations, or indirect intergenerational redistribution, arising from policy-induced changes in the time-path of factor prices, is zero-sum in nature. Stated differently, the benefits to particular generations arising from policy-induced changes in wage and interest rates are exactly offset by losses to other generations from such factor-price changes.

Although the first set of terms in (13) involving MRS-MRT wedges arise only in the presence of economic distortions, their sum represents a precise measure of the change in excess burden only if the policy being conducted compensates all generations for the income effects they experience. To show how this compensation could be effected, take the case of a policy change that a) does not alter the time-path of government consumption, b) compensates members of each generation by keeping them on their pre-policy-change budget constraints, and c) does not require resources from outside the economy (i.e., leaves the economy on its intertemporal budget constraint).[4]

Since each generation remains on its initial budget constraint (defined in terms of its slope and intercept) the policy serves only to alter the choice of the position on that constraint. This change in the consumption/leisure bundle arises because of the policy's alteration in relative prices (i.e., because of changes in incentives). Hence, each generation's change in utility arises due to a change in how it allocates its budget, rather than a change in the size of its budget. The resulting change in utility is a pure change in economic distortion. Because these utility changes are measured in units of time-t output, adding them up, as (13) does, across all current and future generations indicates the amount (positive or negative) of time-t output that could be extracted from the economy by engaging in the policy, but using generation-specific non distortionary net payments that keep each generation at its pre-policy change level of utility.

To keep each generation on its initial budget constraint, the government must alter the net amounts it takes from each generation when young and old to offset all policy-induced income effects, including those arising from changes in relative prices of consumption and leisure when young and old. Assuming, without loss of generality, that the amount of distortionary net payments made by each generation are offset by non distortionary net payments of equal magnitude, the only income effects to be offset are those arising from changes in relative prices. This means setting dh_{ot} such that

(15) $$dh_{ot} = dw_t T - dw_t l_{ot}$$

[4] This is a Slutsky's compensation in an intertemporal setting.

and setting dh_{ys} and dh_{os+1} for $s \geq t$ such that

(16)

$$dh_{ys} + R_{s+1}dh_{os+1} = dw_s T + d(R_{s+1}w_{s+1})T - dR_{s+1}h_{os+1} - dR_{s+1}c_{os+1} - dw_s l_{ys} - d(R_{s+1}w_{s+1})l_{os+1}$$

Does this compensation policy satisfy the government's intertemporal budget constraint? The answer is yes. To see why, take the differentials of (3), (6), and (7). These equations plus (15) and (16) generate the differential of the government's budget constraint. Intuitively, the constant-returns property of the production function implies that factor-price changes are zero-sum in nature. Hence, the government can redistribute resources from generations experiencing beneficial factor-price changes to those experiencing adverse factor-price changes. This leaves each generation on its initial budget frontier, although, potentially, at a different point on that frontier.

When one applies (15) and (16) in conjunction with a policy change that leaves government spending unchanged, the resulting consumption and leisure differentials in (13) are compensated ones. For discrete, as opposed to infinitesimal, policy changes, one can integrate E_t over the range of the policy change. The resulting expression will be the present value sum of each period's Harberger excess burden triangle, if there are no initial distortions in the economy.[5]

III. Illustrating Generational Policy

A Cobb-Douglas Example

[5] Were one to expand the above analysis to incorporate uncertainty about future states of nature, all commodities at a particular point in time would be indexed by their state of nature and the discrepancies between marginal rates of substitution and marginal rates of transformation would capture the absence of risk-sharing arrangements associated with incomplete insurance markets.

A very simple Cobb-Douglas two period life-cycle model suffices to illustrate how generational policy works and why it cannot be uniquely described with conventional fiscal taxonomy. Let the utility of the young born at time s, U_s, be given by:

(17) $$U_s = \alpha \log c_{yt} + (1-\alpha) \log c_{ot+1}.$$

In (17), we make the assumption that labor supply is exogenous. Specifically the young work full time, and the elderly are retired. Also let the production function for output per worker satisfy:

(18) $$y_t = Ak_t^b$$

Each cohort has N members, so there is no population growth. Finally, assume that the government takes an amount $\bar{h}$ from each member of each young generation and hands the same amount to each member of the contemporaneous old generation.

At any time t+1, capital per old person equals capital per worker, k_{t+1}, because the number of old and young are equal. The amount of capital held at t+1 by each old person is what she accumulated when young; i.e.,

(19) $$k_{t+1} = w_t - \bar{h} - c_{yt}.$$

Given that consumption when young equals a share, α, of lifetime resources, we can write (19) as:

(20) $$k_{t+1} = w_t - \bar{h} - \alpha(w_t - \frac{r_{t+1}\bar{h}}{1+r_{t+1}})$$

Finally, using the fact that factor prices equal marginal products, we can express (20) as:

(21) $$k_{t+1} = (1-\beta)(1-\alpha)A_t k_t^{\beta} - \bar{h} + \alpha\left(\frac{\beta A_{t+1} k_{t+1}^{\beta-1}\bar{h}}{1+\beta A_{t+1} k_{t+1}^{\beta-1}}\right).$$

Equation (21) represents the transition equation for the capital labor ratio. Knowing the value of k_t, one can solve (by nonlinear methods) for the value of k_{t+1}.

The Crowding Out of Capital

Consider introducing the policy at time 0. Because α is between zero and one, the derivative of k_{t+1} for t = 0 with respect to $\bar{h}$ is negative evaluated at $\bar{h}$ equals zero. Hence, if we assume the policy is introduced at time 0, it reduces the economy's capital stock at each future date. What is the explanation for this crowding out of capital? The answer is the increased consumption of those who are old at the time of the reform – time 0. This cohort receives $\bar{h}$ for free; i.e., without being forced to hand over $\bar{h}$ when young. And the cohort immediately increases its consumption by $\bar{h}$ per person. This present value gain to the initial old is offset by a present value loss to the initial young and future generations of interest on $\bar{h}$; i.e., if one discounts, at the time path of the marginal product of capital, the sum of all the losses of interest on $\bar{h}$ by the initial young and future generations, the total equals - $\bar{h}$.

If the losses to the current young and future generations are equal in present value to the gains to the initial old, why is there an initial (time 0) net increase in consumption and a decline in national saving? The answer is that the increased consumption by the elderly at time 0 is only partially offset by the reduced consumption of the contemporaneous young. As just indicated, the contemporaneous young pay for only a small portion of the transfer to the initial elderly. Moreover, their propensity to consume, α, is less than one – the propensity to consume of the initial elderly. So the positive income effect experienced by the initial elderly exceeds in absolute value the negative income effect experienced by the initial young, who, in any case, have a smaller propensity to consume. Hence, consumption of the initial elderly rises by more than the consumption of the initial young falls, thereby reducing national saving and investment.

Although all future generations will be forced to reduce their consumption once they are born, that doesn't matter to the time-0 level of national consumption and saving. Moreover, the reason this policy has a permanent impact on the economy's capital stock is that there are always generations coming in the future whose consumption has not yet been depressed because of the policy; i.e., at any point in time, say t, the cumulated policy-induced net increase in the economy's aggregate consumption from time 0 through time t is positive. Another way to think about the policy is to note that as of time 0 the old are the big spenders, whereas the young and future generations are the big savers. Indeed, future generations have a propensity to consume at time 0 of zero. So the policy redistributes resources at time 0 from young and future savers to old spenders.

The Policy's Incidence

The incidence of the policy can be described as follows. The elderly at time 0 receive $\bar{h}$, and since factor prices at time 0 are unchanged, they experience no reduction in the return they earn from their capital. Hence, the policy unambiguously makes the initial elderly better off. Next consider the young at time 0. They give up $\bar{h}$ when young, but receive the same amount when old. On balance, they lose interest on the $\bar{h}$. This reduction in lifetime income is somewhat counterbalanced by the fact the policy drives up the return they receive on their savings. The reason is that the policy reduces k_1 relative to what it would otherwise have been. (Note that while the policy alters k_1 and subsequent levels of capital per workers, it doesn't change k_0, which means it doesn't change the wage earned by the initial young.) Finally, consider those born at time 2 and thereafter. Each of these generations loses interest on $\bar{h}$. In addition, each earns a lower wage on its labor supply and a higher rate of return on its saving than in the absence of the policy. On balance, these factor price changes make these generations worse off.

Since there is neither government consumption nor economic distortions in this example, the policy, according to (13), is zero-sum across generations with respect to welfare changes. Now the derivative of each generation's utility has two components – the change due to raising $\bar{h}$ (above zero) and the change due to policy-induced factor price changes. If we measure these two components in present value (in units of time-0 consumption) and add them up across all generations, equation (13) tells us that their sum is zero. However, as indicated above, the sum across all initial and future generations of the first component – the utility changes from raising $\bar{h}$ is, by itself, zero.[6] Hence, the present value sum of the utility changes experienced by initial and future generations from factor-price changes must also sum to zero. In concrete terms, this means that the gain to the initial young from receiving a higher rate of return in old age, measured in units of time-0 consumption, equals the sum of the net losses, measured in time-0 consumption, incurred by subsequent generations from receiving a lower real wage when young plus a higher return when old.

IV. Deficit Delusion and the Arbitrary Nature of Fiscal Labels

In presenting generational policy in the Cobb-Douglas model, no use was made of the terms "taxes," "transfer payments," "interest payments," or "deficits." This section points out that there are an infinite number of equally uninformative ways to label the above policy using these words. Each of these alternative sets of labels use the words "taxes," "transfers," "spending," and "deficits" in conventional ways. Consequently, no set of labels has a higher claim to relevance than any other.

The choice of a particular set of fiscal labels to use in discussing the model (the choice of fiscal language) is fundamentally no different than the choice of whether to discuss the model in English or French. The message of the model lies in its mathematical structure. And no one would presume that that message would differ if the model were discussed in English rather than French.

[6] Recall that the present value sum of the loss of interest on $\bar{h}$ by the initial young and future generations equals -$\bar{h}$ -- the gain to the initial elderly.

Showing that fiscal labeling is, from the perspective of economic theory, arbitrary establishes that the "deficit" is not a well defined measured of generational or, indeed, any other aspect of fiscal policy. It establishes the same point with respect to "taxes," "transfer payments," and "spending," where spending consists of "transfer payments" and "interest payments on government borrowing." Since the "deficit," "taxes," "transfer payments," and "spending" are, from the perspective of economic theory, content free, so too are ancillary fiscal and national income accounting constructs like "debt," "national income," "disposable income," "personal saving," and "social security." Given the ubiquitous use by governments and economists of these verbal constructs to discuss, formulate, and evaluate economic policy, the import of this point cannot be overstated.

Alternative Fiscal Labels

Consider first labeling the payment of $\bar{h}$ by members of the initial young and future generations as a "tax" and the labeling of the receipt of $\bar{h}$ by the initial and subsequent elderly as a "transfer payment." With these words, the government reports a balanced budget each period since "taxes" equal "spending." This is true despite the fact that the government is running a loose fiscal policy in the sense that it redistributes toward the initial old from the initial young and future generations. Furthermore, the budget remains in balance regardless of whether the policy is extremely loose ($\bar{h}$ is very large) or extremely tight ($\bar{h}$ is negative and very large in absolute value).

As a second example, let the government (1) label its payment of $\bar{h}$ to the elderly at time 0 as "transfer payments," (2) label its receipt of $\bar{h}$ from the initial young and subsequent generations as "borrowing," and (3) label its net payment of $\bar{h}$ to each elderly generation from time s=1 onward as "repayment of principal plus interest in the amount of $(1+r_s)\bar{h}$ less an old age tax of $r_s\bar{h}$." While each old person starting at time 0 still receives $\bar{h}$ and each young person still hands over $\bar{h}$, with this alternative set of words the government announces that its running a deficit of $\bar{h}$ at time 0 since time-0 spending on transfer payments equals $\bar{h}$ and time-0 taxes equal zero. At time 1 and thereafter, the deficit is zero since the old age tax equals the government's interest payments (the only government spending). Hence, the stock of debt increases from 0 to $\bar{h}$ at the beginning of time 1 and stays at that value forever.

The above two examples are special cases of the following general labeling rule: 1) label the receipt from the young of $\bar{h}$ as net borrowing from the young of $m\bar{h}$ less a net transfer to the young of $(m-1)\bar{h}$, 2) label the payment of $\bar{h}$ to the initial old as a transfer payment, and 3) label the payment of $\bar{h}$ to the old in periods s≥1 as return of principal plus interest of $m(1+r_s)\bar{h}$ less a net old age tax of $(m-1)\bar{h}+mr_s\bar{h}$. Note that in the first example, m equals 0. In the second, m equals 1. Also note that regardless of the value of m, the government, on balance, extracts $\bar{h}$ from the young each period and hands $\bar{h}$ over to the old each period.

The government's reported deficit at time 0 is $m\bar{h}$. At time s≥1, the reported deficit equals government spending on interest payments of $mr_s\bar{h}$ plus net transfer payments of $(m\text{-}1)\bar{h}$ minus government net taxes of $(m\text{-}1)\bar{h}+mr_s\bar{h}$; i.e., the reported deficit in $s\geq1$ is zero. Hence, from time 1 onward, the stock of government debt is $m\bar{h}$. Since m can be any positive or negative integer, the government can choose language to make its reported debt for s≥1 any size and sign it wants.

For example, if the government makes m equal to –30,000, it will announce each period that it is "taxing the young 30,001 $\bar{h}$ and lending the young $30{,}000\bar{h}$ and, in each period s≥1, that it is "receiving from the old principal and interest payments of $30{,}000(1+r_s)\bar{h}$ and making a transfer payment to the old of $30{,}001\bar{h}+30{,}000r_s\bar{h}$. In this case, the government reports a surplus at time 0 of $3000\bar{h}$.

Thus, each choice of m corresponds to a different choice of fiscal language. And since the government and private sector are always fully repaying those payments and receipts that are described as "government borrowing" and "government loans," one choice of m is no more natural than any other from the perspective of everyday parlance. From the perspective of economic theory, the choice of m is completely arbitrary as well; i.e., the equations of the model presented above do not contain m.

In addition to not pinning down the choice of m at a point in time, the model's equations provide no restrictions on changes in the choice of m through time. Let m_s stand for the choice of m applied to the receipt of $\bar{h}$ from the young at time s as well as the receipt of $\bar{h}$ by the old at time s+1. So m_s references the language used to describe the fiscal treatment of generations s. In this case, the deficit at time s will equal the quantity $(m_s\text{–}m_{s\text{-}1})\bar{h}$.

To summarize, regardless of the true size and nature of generational policy as determined by the size and sign of $\bar{h}$, the government can announce any time-path of deficits or surpluses it chooses. For example, the government can choose a sequence of ms that makes its reported debt grow forever at a faster rate than the economy. This means, of course, that the debt to GDP ratio tends to infinitely. It also means that the invocation in economic models of a transversality condition, which limits the ratio of debt to GDP, is a restriction about permissible language, not a restriction on the economy's underlying economic behavior.

At this point, an irritated reader might suggest that the above is simply an exercise in sophistry because as long as the government chooses its fiscal language (its m) and sticks with it through time, we'll have a meaningful and consistent language with which to discuss fiscal policy.

This is not the case. Even if the government were to choose an m and stick with it through time, the resulting time path of government deficits would have no necessary connection to actual fiscal policy. As we've seen in the above example, if the government chooses a large (in absolute value) negative value of m to label the $\bar{h}$ policy, it will announce over time that it has a huge level of assets, despite the fact that it is conducting loose policy. Moreover, the government's choice of fiscal labels isn't sacrosanct. The fact that the government has chosen a particular time-path for the value of m doesn't preclude each individual in society from choosing her or his own time-path of ms in describing the country's past and projected future fiscal affairs. Each of these alternative time paths has the same claim (namely zero) to explaining the government's actual past, present, and future fiscal position. Indeed, those who wish to show that deficits crowd out capital formation need only define a time path of m_s that produces a negative correlation between investment and the deficit. And those who wish to show the opposite can choose a time path of m_s that produces a positive correlation.

Finally, unless the government's fiscal policy is described in label-free terms, there is no way for the public to know what m the government has chosen or whether it is maintaining that choice through time. In our simple model, the reported deficit depends on the current period's choice of m, the previous period's choice of m, as well as the size of $\bar{h}$. Without independent knowledge of $\bar{h}$, the public can't tell if the deficit is changing because of changes in fiscal fundamentals or simply because of changes in fiscal labels. Nor can the public tell if the same labels are being used through time.

Other Guises of Generational Policy

In the above discussion, we've indicated that the our $\bar{h}$ intergenerational redistribution policy can be conducted under the heading "pay-as-you-go" social security, "deficit-financed transfer payments," or "surplus-financed transfer payments," where the deficits or surpluses can be of any size. This is not the limit of the language that could be used to describe the policy. The policy could also be introduced under the heading of "structural tax reform." To see this, suppose the government initially has in place a consumption tax that it uses to make transfers to the young and old which precisely equal their tax payments. Now suppose the government switches from consumption to wage taxation as its means of collecting the same amount of revenue to finance the transfer payments. Since the initial elderly are retired and pay no wage taxes, they will be relieved of paying any net taxes over the rest of their lives. Hence, this reform redistributes to them from the initial young and future generations. These latter generations find that the present value (calculated when young) of their lifetime net tax payments has been increased.

Our final example of fiscal linguistic license is particularly artful. As discussed in Auerbach and Kotlikoff (1987), it involves the government engineering a stock market boom and, thereby, raising the price at which the elderly sell their capital assets to the young. In so doing, the government can claim that market revaluation, rather than government policy, is responsible for improving the well being of the initial elderly at the cost of lower welfare for the initial young and future generations. Since we want to describe this outcome as a particular labeling of our $\bar{h}$ policy, we need to clarify the difference between capital assets and consumption goods. The difference arises not in the physical property of the two, since our model has only one good, but rather in the date the good is produced. The economy's capital stock at time t consists of output that was produced prior to time t. And the government can tax or subsidize the purchase of output produced in the past differently from the way it taxes or subsidizes output produced in the present.

In terms of the equations of our model, $\bar{h}$ stands for the higher price of capital (measured in units of consumption) that the young must pay to invest in capital. It also stands for the higher price (measured in units of consumption) that the old receive on the sale of their capital to the young.

How can the government engineer a stock market boom of this kind? The answer is by announcing a tax on the purchase of newly produced capital goods by the young. Since the young can either invest by buying new capital goods or by buying old capital from the elderly (the capital valued in the stock market), this will drive up the price of the capital the elderly have to sell to the point that the young are indifferent between the two options. To avoid the government retaining any resources, we can have it return to the young the equivalent of their investment tax payments, but in a lump-sum payment (a payment that is not related to the level of that investment. This, plus a couple of additional elements that leave the effective tax rate on capital income unchanged, will make the "investment tax policy" differ in name only from conducting our benchmark policy under the alternative headings "pay-as-you-go social security," "deficit-financed transfer payments to the elderly," "surplus-financed transfer payments to the elderly," and "structural tax change."[7]

Generalizing the Point that the Deficit is Not Well Defined

The above illustration of the arbitrary nature of deficit accounting was based on a simple framework that excluded distortionary policy, economic as well as policy uncertainty, and liquidity constraints. Unfortunately, none of these factors provide any connection between the measured deficit and fiscal fundamentals.

[7] To make this policy fully isomorphic to our benchmark policy, we need to include six elements: 1) a subsidy to capital income received by generation s when old that is levied at the same rate as the tax generation s pays when young on new investment, 2) a lump sum transfer paid to the elderly equal to the subsidy to capital income, 3) a lump sum transfer to the young equal to the proceeds of the investment tax, 4) the setting of the investment tax rate each period to ensure that the net cost of purchasing the capital rises by exactly $\bar{h}$, 5) if the elderly consume their own capital, the government provides them a subsidy at the same rate as the investment tax, and 6) if the young invest their own capital (the output they receive as wages), they will be forced to pay the investment tax. Element 1 ensures that there is no change in the effective rate of capital income taxation under this description of the policy. Elements 2 through 4 ensure that the budget constraints of the young and old each period are precisely those of the benchmark policy. Element 5 guarantees that the elderly are indifferent between consuming their own capital or selling it to the young, and element 6 guarantees that the young are indifferent between investing their own wages,

Distortionary Policy

To see that distortionary policy has no purchase when it comes to connecting deficits with fiscal fundamentals, consider again the general model that includes variable first period and second period leisure and net payments from the young and old in period t to the government of h_{yt} and h_{ot}. To introduce distortionary fiscal policy, we simply let h_{yt} and h_{ot} depend on how much generation t decides to consume and work when young and old, respectively. In maximizing its lifetime utility function subject to (6) or (7), agents take into account the marginal dependence of h_{yt} and h_{ot+1} on their consumption and leisure demands and this marginal dependence helps determine the marginal prices they face in demanding these commodities.

Our model with distortionary policy thus consists of a) government-chosen time-paths of the h_{yt} and h_{ot} functions and g_t (government consumption demands) that satisfy the government's intertemporal budget constraint, household demands for consumption and supplies of labor, and firms supplies of output and demands for capital and labor inputs. Market clearing requires that, in each period along the economy's dynamic transition path, a) firms' aggregate output supply cover the consumption demands of households and the government plus the investment demand of firms and b) labor supply equals labor demand.

The fact that we can formulate and discuss our model of distortionary fiscal policy making no use whatsoever of the words "taxes," "transfer payments," or "deficits" in itself tells us that the deficit has no connection to policy, even if that policy is distortionary. But to drive home the point, consider labeling h_{yt} as "government

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purchasing new capital for investment from other young people, or purchasing the capital owned by the borrowing" of $m_t h_{yt}$ from the young at time t less a "net transfer payment" to the young at time t of $(m_t\text{-}1)h_{yt}$. The corresponding labeling of the payment by the old of h_{ot+1} would be labeled as "repayment of principal and interest" of $-m_t h_{yt}\ (1+r_{t+1})$ (which is negative, because the government is doing the repaying) plus a "net tax payment" of $h_{ot+1} + m_t h_{yt}\ (1+r_{t+1})$. Notice, that regardless of the size of m_t, the net payments of generation t when young and old are h_{yt} and h_{ot+1}, respectively and its generational account is $h_{yt} + R_{t+1}h_{ot+1}$. Thus, the choice of the time path of the m_ts makes no difference to economic outcomes, although it leads to a sequence of "official" deficits, d_t, of

(22) $$d_t = m_t h_{yt} - m_{t-1} h_{yt-1}\,.$$

To make this math more concrete, suppose that the government finances its possibly time-varying consumption each period based on a net payment from the young of h_{yt}, which distorts each generation's first-period labor supply.[8] How can observer A report that the government is taxing only the labor earnings of the young from time 0 onward and always running a balanced budget? How can observer B report that the government runs a deficit of h_{y1} at time 0? And how can observer C report that the same government runs a surplus of h_{y1} at time 0?

The answer is that observer A sets m_s equal to zero for all s; observer B sets m_0 equal to zero and m_1 equal to 1; and observer C sets m_0 equal to zero and m_1 equal to -1. Observer A describes the government as taxing generation 1 *when it is young* on the amount it earns when young. Observer B describes the government as taxing generation 1 *when it is old* on the accumulated (at interest) amount it earns *when young*. Observer C describes the government as taxing generation 1 *when it is young* on its labor supply by

elderly.

[8] In this example, the net payment of the old each period is assumed to equal zero.

more than the amount needed to cover government spending. Observer C also describes the government as subsidizing generation 1 *when it is old* based on the accumulated (at interest) amount it earned *when young*. The key point here is that, although all three observers report different time-0 deficits, all three report that the government is imposing the same tax, at the margin, on labor supply *when young*.

The labels of observers B and C may, at first, seem a bit strained because they entail stating that the government is collecting revenue or making subsidies in one period based on economic choices made in another. There are, however, multiple and important examples of such elocution. Take 401k, IRA, and other tax-deferred retirement accounts. The tax treatment of these accounts is expressly described as taxing in old age the amount earned when young plus accumulated interest on those earnings. Another example comes from the Social Security System, which provides social security benefits in old age based on the past earnings of workers in a manner that connects marginal benefits to marginal past contributions. A third example is the U.S. federal income tax which taxes social security benefits and thus, indirectly, taxes in old age the labor supplied by retirees when they were young.

Moreover, such cross-period references aren't essential. Take B's observation that generation 1 pays zero taxes when young and $(1+r_2)h_{y1}$ taxes when old. B can describe the zero taxes that generation 1 pays when young as "revenues from a tax on labor supply *when young* less a lump-sum transfer payment made to the young at time 1 of equal value." And B can describe the taxes generation 1 pays when old as a "lump sum tax."[9]

[9] Recall that, according to observer B, this second-period lump-sum tax is offset by the second-period repayment of principal plus interest on the government's borrowing, so that the agent makes no net

Although the model discussed above has only a single type of agent per generation, the argument about the arbitrary nature of fiscal labels is equally valid if agents are heterogeneous. In this case, the net payments to the government, h_{yt} and h_{ot}, will differ across agents. If the government cannot observe individual characteristics, like innate talent, these functions will be anonymous. On the other hand, the labeling convention – the choice of m_t can be individual specific; i.e., we are each free to describe our own and our fellow citizens' net payments to the government with any words we like.

Ghiglino and Shell (2000) point out that if the government were restricted in its choice of words to, for example, announcing only anonymous tax schedules, those restrictions might, in light of limits on reported deficits constrained the government's policy choices. This point and their analysis, while very important, is orthogonal to the one being made here, namely that whatever is the government's policy and however the government came to choose that policy, it can reasonably (in the sense of using standard economic terminology) be described by men and women, who are not encumbered by government censors, as generating any time path of deficits or surpluses.

Liquidity Constraints

Another objection to the above demonstrations that "deficit" policies are not well defined is that they ignore the possibility that some agents are liquidity constrained. If some young agents can't borrow against future income how can they be indifferent between a policy that involuntarily "taxes" them and one that voluntarily "borrows" from them? There are two answers.

payment in the second period. Thus, if the agent dies prior to reaching the second period, observer B can claim that the agent's estate used the proceeds of the debt repayment to pay the second-period lump-sum

First, the government can compel payments with words other than "taxes." For example, government's all around the world are currently "reforming" their social security pension systems by forcing workers to "save" by making contributions to pension funds, rather than by making social security "tax" contributions. The governments are then "borrowing" these "savings" out of the pension funds to finance current social security benefit payments. When the workers reach retirement, they will receive "principal plus interest" on their compulsory saving, but, presumably, also face an additional tax in old age to cover the government's interest costs on that "borrowing." While this shell game alters no liquidity constraints, it certainly raises the government's reported deficit.

The point to bear in mind here is not that governments may, from time to time, opt for different words to do the same thing, but, rather that any independent observer can, even in a setting of liquidity constraints, reasonably use alternative words to describe the same fundamental policy and, thereby, generate total different time-paths of deficits.

The second reason why liquidity-constrained agents may be indifferent between "paying taxes" and "lending to the government" is due to Hayashi (1987). His argument is that private-sector lenders are ultimately interested in the consumption levels achieved by borrowers since the higher those levels, the greater the likelihood that those who can't repay will borrow and then default. When the government reduces its "taxes" on liquidity-constrained borrowers, private lenders reduce their own loans to those borrowers to limit the increase in their consumption. Instead of lending as much as it did to its borrowers, the private lenders make loans to the government. Indeed, in equilibrium, the private lenders voluntarily "lend" to the government exactly the amounts

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tax.

the liquidity-constrained agents were otherwise sending the government in "taxes." Hence, the borrowers find their private loans cut back by precisely their cut in taxes (i.e., they find their "tax cuts" being used to buy government bonds) and end up with the same consumption. Thus, changing language will not alter the degree to which any agent is liquidity constrained since these constraints will themselves be determined, fundamentally, by the unchanged level and timing of the agents' resources net of their net payments to the government.

Uncertainty

A third objection to the proposition that fiscal labels are economically arbitrary involves uncertainty. "Surely," the objection goes, "future transfer payments and taxes are less certain than repayment of principal plus interest, so one can't meaningfully interchange these terms." In fact the risk properties of government payments and receipts provide no basis for their labeling; i.e., the deficit is no better defined in models with uncertainty than it is in models with certainty. The reason is that any uncertain payment (receipt) $\tilde{X}$, where the ~ refers to a variable that is uncertain, can be relabeled as the combination of a certain payment (receipt) $\bar{X}$ plus an uncertain payment (receipt) $\tilde{X}$ - $\bar{X}$. So a net payment when young of h_{yt} and an uncertain receipt when old of $\tilde{h}_{ot+1}$ can be described as a net payment when young of h_{yt} plus a certain old age receipt of h_{yt}/R_{t+1} less an uncertain receipt of $\tilde{h}_{ot+1}$ - h_{yt}/R_{t+1}. Regardless of what one calls the uncertain component of this receipt, there are, as we've seen, an infinite number of ways to label the certain payment when young and the certain receipt when old. More generally, whatever are the risk properties of net payments that are labeled "borrowing" and "interest and principal repayment," these same net payments can be labeled as "taxes" and "transfer payments."

Take, as an example, Barsky, Mankiw, and Zeldes' (1986) demonstration that "a tax cut coupled with a future income tax increase (that pays off the associated borrowing) can stimulate consumer spending" and that "the marginal propensity to consume out of a tax cut, coupled with future income tax increases, can be substantial under plausible assumptions." In their two-period life-cycle model, agents' second period earnings are uncertain. According to the way they label their equations, the government cuts taxes by an amount T when workers are young and repays its borrowing by taxing workers when old in proportion to their earnings. Since agents have no way to insure their risky earnings, the policy provides an element of intragenerational risk sharing and, thereby, lowers precautionary saving and raises consumption when young. Barsky, Mankiw, and Zeldes view this increase in consumption in response to the "tax cut" as a Keynesian reaction to a Ricardian policy.

While the points Barsky, Mankiw, and Zeldes make about consumption under uncertainty are impeccable, their findings have nothing to do with "tax cuts," "deficit finance," or "the timing of taxation." One can equally well describe their equations as showing that there is a sizeable and very non-Keynesian consumption response to a tax hike of size T. How? By labeling the policy as "raising taxes on the young by T and making a loan to the young of T." When the young are old, the government "receives loan repayments of T plus interest" but makes a "transfer payment" of 2T less an amount that is proportional to earnings at the same rate described by Barsky, et. al. as the tax rate.

Time Consistency

Another question about the alleged arbitrary nature of fiscal labels is whether the timing of "taxes" is better defined in a setting in which government policy is subject to time-consistency problems.[10] One way to demonstrate that it is not is to show that time inconsistent policy can be modeled with no reference to "taxes," "transfers," or "deficits." Take, for example, an economy consisting of a generation that lives for two periods and is under the control of a time inconsistent government in both periods. Specifically, suppose the government has a social welfare function $W_y(u_1,u_{2,\ldots},u_n)$ that represents its preferences over the lifetime utilities of agents 1 through n when they are young. Let $W_o(u_1,u_{2,\ldots},u_n)$ represent the government's preferences when the agents are old. Further, assume that agent *i*'s utility is a function of her consumption when young and old, c_{iy} and c_{io}, her leisure when young and old, l_{iy} and l_{io}, and her enjoyment of public goods when young and old, g_y and g_o. Thus, $u_i = u_i(c_{iy},c_{io},l_{iy},l_{io},g_y,g_o)$. When the cohort is old, the government will maximize W_o taking as given the consumption and leisure and public goods that each agent enjoyed when young.

If the $W_o(\ , \ , \ , \ )$ and $W_y(\ , \ , \ , \ )$ functions differ, the government's preferences will be time inconsistent. In this case, the young government (the government when the cohort is young), will realize that the old government will exercise some control over the consumption and leisure that agents will experience when old and use that control to generate undesirable outcomes. Consequently, the young government will use dynamic programming to determine how the old government will make its decisions and the ways in which it can indirectly control those decisions.

[10] Note that time consistency problems can be potentially resolved by having successive governments purchase consistent behavior from their predecessors. See Kotlikoff, Persson, and Svensson (1988).

The government, both when it is old and young, can use non-linear net payment schedules to redistribute across agents and extract resources from agents. If the government is not able to identify particular agents, these net payment schedules will be anonymous. If government favors agents with particular unobservable characteristics, such as low ability, it will condition its net payments schedules on observables, such as earnings, that are correlated with those characteristics, and face self-selection constraitns as in Mirrlees (1971).

The government's second-period optimization is also constrained by the amount of second–period output, which depends on the economy's second-period capital stock as well as agents' second-period labor supplies. The solution to this problem includes the choice of g_o and as well as agent-specific second-period values of consumption and leisure. These choices are functions of second-period capital, and these functions are used by the young government in setting policy; i.e., the young government considers how its net payment schedules will affect the economy's capital in the second period and, thereby, the consumption, leisure, and the public goods enjoyed by different agents when old. In recognizing that the old government will control second-period outcomes, the young government formulates a time-consistent policy.

An Example

To make this point concrete, consider a simple model with two agents, a and b, both of whom would earn w when young and old were they to work full time. The young government supplies $2g_y$ and the old government $2g_o$ in public goods. The two governments differ with respect to their preferences over the utilities of the two agents, u_a and u_b. Specifically, assume that α>.5 and that

(23) $$W_o = \alpha u_a + (1-\alpha)u_b$$

(24) $$W_o = (1-\alpha)u_a + \alpha u_b$$

Suppose that utility is separable in public goods, consumption, and leisure and that the utility of consumption and leisure is given by

(25) $$u_i = \log c_{iy} + \log l_{iy} + \theta(\log c_{io} + \log l_{io}) \quad \textit{for } i = a \textit{ and } b$$

It's easy to show using dynamic programming that the consistent solution entails

(26) $$\frac{c_{ao}}{c_{ay}} = \frac{\alpha R\theta}{(1-\alpha)(1+\theta)}$$

(27) $$wl_{ay} = c_{ay}$$

(28) $$wl_{ao} = c_{ao}$$

(29) $$c_{ay} = \frac{(1-\alpha)(w + \frac{w}{R} - g_y - \frac{g_o}{R})}{1+\theta},$$

where R stands for 1 plus the rate of return. A symmetric set of equations holds for the consumption and leisure of agent *b* with α replaced by *(1*-α*)* and *(1*-α*)* replaced by α. These government choices for consumption and leisure can be compared with the private choices that would arise in the absence of government policy. Those private demands are found by setting α, g_y, and g_o to zero. Compared to the no-policy setting, the interaction of the two governments distorts the intertemporal allocation of consumption and leisure of the two agents. Agent *a (b)* ends up with higher (lower) ratios of consumption when old to consumption when young and leisure when old to leisure when young. The reason, of course, is that the old government redistributes toward agent *a*, while the young government redistributes toward agent *b*.

Having worked out the best lifetime allocations that it can achieve given the old government's ultimate control of second-period outcomes, the young government needs to implement this time-consistent solution. Because it can announce non-linear as well as non-differentiable net payment schedules, the above allocation can be decentralized in an infinite number of ways. One way is to announce agent-specific lump-sum payments, h_a and h_b, plus agent-specific payments per unit of expenditure on old-age consumption and leisure, p_a and p_b. In this case, the agents will perceive the following lifetime budget constraints:

(30) $$(c_{ay} + wl_{ay}) + \frac{p_a(c_{ao} + wl_{ao})}{R} = w + \frac{w}{R} - h_a$$

(31) $$(c_{by} + wl_{by}) + \frac{p_b(c_{bo} + wl_{bo})}{R} = w + \frac{w}{R} - h_b\,,$$

where

(32) $$h_a = (2\alpha - 1)(w + \frac{w}{R}) + 2(1-\alpha)(g_y + \frac{g_o}{R})$$

(33) $$h_b = (1 - 2\alpha)(w + \frac{w}{R}) + 2\alpha(g_y + \frac{g_o}{R})$$

(34) $$p_a = \frac{1-\alpha}{\alpha}$$

(35) $$p_b = \frac{\alpha}{1-\alpha}$$

Note that the two lump-sum payments add up to the present value of the government's purchase of public goods. Also note that since $\alpha > .5$, agent *a* faces a lower marginal payment on second-period expenditures than does agent *b*. It's easy to show that the marginal payments generate no net resources to the government.

The fact that one can, as just shown, model time-inconsistent government preferences without resort to the terms "deficit," "taxes," or "transfer payments" indicates that whatever are the policies that arise in the model just described or in similar models, they can be labeled any way one wants. Indeed, models of time consistency that cannot be relabeled freely may be predicated on fiscal irrationality. Consider, in this respect, Fischer's (1980) classic analysis of time-inconsistent capital-income taxation.

Fischer's model also features a single generation that consumes and works when young and old and a government that wants to provide public goods. But unlike the above model, all generation members are identical. Fischer permits his government to levy only proportional taxes on labor earnings when young and old and a tax on capital holdings when old. These restrictions may seem benign, but they're not. Why? Because Fischer is saying that the old government can levy what from the perspective of the second period is a non-distortionary tax on capital, but that it *can't* levy the same non-distortionary tax as part of a non-linear second-period earnings tax in which inframarginal earnings are taxed at a different rate than are marginal earnings.[11]

If one drops Fischer's restriction and allows non-linear net payment schedules, his model collapses to the above model with $\alpha = .5$. In this case the young and old governments agree and extract inframarginal net payments to pay for public goods. Hence, Fischer's economy ends up in a first-best equilibrium, in which no margins of

[11] Suppose, for example, that Fischer's old government levies a tax of 50 units of the model's good on capital and a 15 percent proportional tax on labor earnings. From the perspective of second-period agents, this is no different from a policy under which the government announces that it will not tax capital at all,

choice are distorted. This is a far cry from the third-best equilibrium Fischer proposes – an equilibrium in which the government can only tax second-period earnings in a distortionary manner and to avoid doing so, places very high, and possibly confiscatory taxes on agents' capital accumulation. Agents naturally respond by saving little or nothing.

Do Fischer's restrictions, which he doesn't justify, reflect economic considerations, or are they simply a subtle manifestation of fiscal illusion? One economic argument in their behalf is that the governments he contemplates don't have the ability to observe individual earnings or capital holdings and are forced to collect net payments on an anonymous basis. For example, the governments might be able to collect net payments from firms that are functions of the firms' aggregate capital holdings and aggregate wage payments, but not be able to collect net payments from individual agents. This doesn't immediately imply the absence of inframarginal labor earnings taxes since the governments could, in addition to taxing the firms' total wage bill at a fixed rate, levy a fixed payment per employee on each firm, assuming the government can observe the number of employees. But, for argument's sake, let's assume the government can't observed the number of employees.

In this case, can one still re-label fiscal flows in Fischer's model without changing anything fundamental? The answer is yes. Take the first of Fischer's two third-best equilibria. It entails a first-period proportional labor-earnings tax, a second-period proportional capital levy, and no second-period labor-earnings tax. Now starting from this tax structure, suppose the government wants to "run" a smaller surplus. It can do so

but instead assess a 50 unit tax on the first dollar earned and a 15 percent tax on each dollar earned thereafter.

by labeling first-period labor-income taxes of T_y as “a first-period “loan” to the government of T_y plus a “second-period tax” of $(1+r)T_y$, where r is the rate of interest. Since this second-period tax is calculated as a function of labor earnings when young, the re-labeling alters no incentives to work when young. Nor does it change the government’s cash flows, since the government still receives T_y in the first period as a “loan” and uses the $(1+r)T_y$ second-period “tax” receipt to repay “principal plus interest” on its first-period “borrowing.” The government has no reason to either a) renege on repaying this debt or b) tax these debt holdings because in the second period it is getting all the receipts it needs from its non-distortionary capital levy.[12]

If the government is effecting its transactions through firms, it can borrow from firms in the first period, repay the firms in the second period, and assess a tax in the second period on the firms based on their first-period wage payments. In this case, the firms will withhold and save enough of the worker’s first-period pre-tax wages so as to be able to pay these extra second-period taxes. The firms will invest in the government bonds and use the proceeds of those bonds to pay off the additional taxes.

Fischer’s alternative third-best tax structure entails a confiscatory tax on all physical capital accumulated for old age and positive first- and second-period labor-earnings taxes. Can the government, also in this setting, postpone its taxes on first-period labor earnings and get the young, or the firms on behalf of the young, to lend it what it

[12] If the government wants, instead, to announce a larger first-period surplus, it can raise the first-period labor-income tax, lend the additional proceeds back to the young, and provide a second-period subsidy on first-period labor earnings paid for with the proceeds of the loan repayment. Again, the old government has no reason to renege on this second-period subsidy because it is already collecting all the resources it needs via the non-distortionary capital levy. Alternatively, it can collect the second-period capital-income tax in the form of a first-period tax on the acquisition of assets and then lend these additional first-period receipts back to the young. This leaves the net payment of the young unchanged, and the second-period repayment of principal plus interest on the loan gives the government the same second-period net receipts it has under its initial wording.

would otherwise have collected as first-period taxes? The answer is yes. If the government reneges on its debt repayment in the second-period, by either repudiating the debt or levying a tax on holdings of debt, the old, or the firms on their behalf, won't be able to repay the taxes that are due in the second-period on first-period labor earnings unless the government violates Fischer's stricture against taxing second-period earnings at other than a fixed rate that is independent of the level of earnings. To see this, note that taxes levied on first-period labor earnings are, from the perspective of the second period, lump-sum since first-period labor supply decisions have already been made. So paying off the debt has no efficiency implications because the proceeds of this debt repayment are immediately handed back to the old government in the form of a lump-sum tax. If the government were to renege on its debt and also tax first-period labor earnings in the second period, it would force the old (the firms) to pay additional taxes from the proceeds of their second-period labor earnings (their second-period wage payments). This would require a non-linear tax, which, again, is something that Fischer seems to have ruled out a priori. The non-linear tax in this case would be a fixed payment, independent of second-period labor earnings, plus a payment based on the level of second-period labor earnings.

Voluntary vs. Involuntary Payments

A final issue is whether the voluntary nature of private purchases of government bonds makes debt labels meaningful. This proposition is indirectly advanced in a very interesting article by Tabellini (1991) on the sustainability of intergenerational redistribution. In his model, the government wants to finance uniform transfer payments to young parents by extracting payments from a subset of them, namely those that are rich. Unfortunately, Tabellini's government can't observe endowments, and were it to force all young parents to make the same payment, it would defeat its purpose. Instead, the government "borrows" from young parents, with the result that only those young parents with large endowments voluntarily "lend" to the government. Tabellini notes that these loans will be repaid when these rich parents are old. Why? Because their children will join with them in voting for debt repayment since much of that repayment will come from the children of the poor. In the course of showing that intragenerational distribution considerations can help enforce intergenerational redistribution, Tabellini claims that this same policy could not be implemented through a social security system, because a social security tax would be compulsory.

I disagree for the simple reason that social security tax payments need not be compulsory. Instead of announcing that is "borrowing," Tabellini's government could equally well announce a payroll tax that is the same function of the young parents' endowment as is their debt purchases. The government would also announce social security benefit payments that are set equal to the tax contributions plus the market rate of return that would otherwise be paid on government bonds. True, the government can't force the parents, when they are young, to pay social security taxes because the government can't observe the parent's initial endowments. But there is no need to enforce the tax collection; the same parents who would otherwise have purchased debt will want to pay the tax because it will ensure them an old age social security benefit in a setting in which they have no other means to save for old age.

Note that in many countries, payroll tax payments are in large part voluntary. Workers can choose to work in the formal sector and pay those taxes or they can choose to work in the informal sector and not pay. Another way to think about "enforcing" the "tax" is for the government to announce a penalty, namely, disqualification from receipt of the old-age transfer payment, so that formal-sector workers could choose not to contribute without the fear of being sent to jail. Note also that with this alternative labeling, the children of the rich will want to enforce the payment of social security benefits because their parents will otherwise lose out to the benefit of the children of the poor.

With Tabellini's fiscal labels (case a), the government reports a deficit when the parents are young. Under mine (case b), it reports a balanced budget. If it wanted to report a surplus, it could a) announce a social security tax schedule that was, say, double what would it announce in case b, but also announce that it would make loans to all tax payers equal to one half of their tax contributions. When old, in this case c, the parents would get twice the social security benefits that they'd get in case b, but they would have to pay back their loans with interest. If the government in Tabellini's model wants to report an even larger deficit (case d), it could borrow twice as much and announce that it would provide a special transfer payment to its lenders equal to, say, one half of the loans they provide. When old, these lenders would face an extra tax, equal to the special transfer plus interest, with the proceeds of this tax subtracted out of the government's repayment to the lenders.

In each of these cases, the net flows between each parent and the government in each period is the same, so the voting choices of the young won't change. The only change is the government's reported deficit/surplus.

Implications for Empirical Analyses of Deficits, Personal Saving, and Portfolio Choice

The above demonstration that government debt and deficits are not well defined has serious implications for the vast time-series literature that purports to connect these aggregates to consumption, interest rates, and other macroeconomic variables. This literature is reviewed in Elmendorf and Mankiw (1998). The problem with these studies is that they use wholly arbitrary measures of deficits and debts, which could just as well be replaced by other equally arbitrary measures that have the opposite correlation with the dependent variable. Moreover, in the absence of any theoretical ground rules for measuring the deficit, Eisner and Pieper (1984) and other economists have felt free to ”correct” the U.S. federal deficit in ways that substantiate their priors about the impact of deficits on the economy.

Empirical analysis of personal saving suffers from the same shortcoming. The measurement of personal saving is predicated on the measurement of personal disposable income, which, in turn, depends on the measurement of taxes and transfer payments. Since taxes and transfer payments can be freely defined, the nation’s personal saving rate can be anything anyone wants it to be. This fact casts a pall on studies like those of

Bosworth, Burtless, and Sabelhaus (1991) and Gale and Scholz (1999) that purport to "explain" or, at least illuminate, changes over time in the nation's rate of personal saving.

Finally, if government debt is not well defined, then the division of private portfolios between stocks and bonds, including government bonds, is a matter of opinion, not fact. This calls into question studies that purport to identify risk preferences and other portfolio determinants based on the shares of portfolios invested in bonds versus stocks.

V. Generational Accounting

Generational accounting was developed by Auerbach, Gokhale, and Kotlikoff (1991) in response to the aforementioned problems of deficit accounting. The objective of generational accounting's is to measure the generational incidence of fiscal policy as well as its sustainability and to do so in ways that are independent of fiscal taxonomy. Generational accounting compares the lifetime net tax bills facing future generations with that facing current newborns. It also calculates the changes in generational accounts associated with changes in fiscal policies. Both of these comparisons are label-free in the sense that generate the same answer regardless of how government receipts and payments are labeled.

Although academics have spearheaded development of generational accounts, much of the work has been done at the governmental or multilateral institutional level. The U.S. Federal Reserve, the U.S. Congressional Budget Office, the U.S. Office of Management and Budget, H.M. Treasury, the Bank of Japan, the Bundesbank, the Norwegian Ministry of Finance, the Bank of Italy, the New Zealand Treasury, the

European Commission[13], the International Monetary Fund, and the World Bank have all done generational accounting. Much of the interest in generational accounting by these institutions stems from the projected dramatic aging of OECD countries coupled with the commitments of OECD governments to pay very high levels of social security and health care benefits to the elderly.

Generational accounting has also drawn considerable interest from academic and government economists. Haveman (1994), Congressional Budget Office (1995), Cutler (1993), Diamond (1996), Buiter (1997), Shaviro (1997), Auerbach, Gokhale, and Kotlikoff (1994), Kotlikoff (1997), Raffelhuschen (1998), and others have debated its merits.

Much of the interest in generational accounting is motivated by the extraordinary aging of industrial societies that will, over the next few decades, make almost all of the leading countries around the world look like present-day retirement communities. Population aging per se is not necessarily a cause for economic concern, but population aging in the presence of high and growing levels of government support for the elderly makes early attention to the long-term fiscal implications of aging imperative.

While generational accounting is a natural for old and aging countries, developing countries, like Mexico and Thailand, which don't face aging problems, have their own reasons for examining generational accounting. In particular, they realize that their relative youth means they have more current and future young people to help bear outstanding fiscal burdens and that viewed through the lens of generational accounting,

[13] The European Commission has an ongoing project to do generational accounting for EU member nations under the direction of Bernd Raffelhueschen, Professor of Economics at Freiburg University. See Raffelhueschen (1998).

their fiscal policies might look much more responsible relative to those of the developed world.

This section lays out generational accounting's methodology, shows alternative ways of measuring generational imbalances, stresses the importance of demographics in generational accounting, discusses practical issues in constructing generational accounts, shows examples of generational accounts and measures of generational imbalances, points out the connection between generational accounting and traditional tax incidence analysis, and mentions, along the way, a variety of concerns that have been raised about this new form of fiscal appraisal.

The Method of Generational Accounting

Equation (36) rewrites the government's intertemporal budget constraint (equation 8) in terms of the generational accounts of current and future generations.

(36)

$$\sum_{s=1}^{\infty} N_{t,t+s} P_{t,t+s} (1+r)^{-s} + \sum_{s=0}^{d} N_{t,t-s} P_{t,t-s} = \sum_{s=0}^{\infty} G_{t+s} (1+r)^{-s} + D_t$$

In (36), $N_{t,k}$ stands for the per capita generational account in year t of the generation born in year k. For generations currently alive, $N_{t,k}$ denotes per capita remaining lifetime net taxes discounted to the current year t. For generations not yet born, $N_{t,k}$ refers to per capita lifetime net taxes, discounted to the year of birth. The term $P_{t,k}$ stands for the population in year t of the cohort that was born in year k. This first summation on the left-hand side of (36) adds together the generational accounts of future generations, discounted at rate r to the current year t. The second summation adds the accounts of existing generations. In actual applications of generational accounting, separate accounts are calculated for males and females, but this feature is omitted from (36) to limit notation.

The first term on the right-hand side of (36) expresses the present value of government purchases. In this summation the values of government purchases in year s, given by G_s, are also discounted to year t. The remaining term on the right-hand side, D_t^g, denotes the government's explicit net debt – its financial liabilities minus the sum of its financial assets and the market value of its public enterprises based on whatever arbitrary language conventions the government has adopted.

The Precise Formula for Generational Accounts

The generational account $N_{t,k}$ is defined by:

$$N_{t,k} = \sum_{s=\max(t,k)}^{k+D} T_{s,k} \frac{P_{s,k}}{P_{t,k}} (1+r)^{-(s-t)}, \tag{37}$$

where κ=max(t,k). The term $T_{s,k}$ stands for the projected average net tax payment to the government made in year s by a member of the generation born in year k.

The term $P_{s,k}/P_{t,k}$ indicates the proportion of members of cohort k alive at time t who will also be alive at time s.[14] Thus, it represents the probability that a particular member of the year-k cohort who is alive in year t will survive to year s to pay the net taxes levied, on average, in that year on year-k cohort members. Hence, $N_{t,k}$ is an *actuarial* present value. It represents the average value in the present of the amount of

[14] The population weights $P_{s,k}$ incorporate both mortality and immigration, implicitly treating immigration as if it were a "rebirth" and assigning the taxes paid by immigrants to the representative members of their respective cohorts. This approach does not, therefore, separate the burdens of natives and immigrants. See

net taxes that members of cohort k will pay in the future, where the averaging is over not just net tax payments, but also survivorship.

What Do Generational Accounts Exclude?

Note that generational accounts reflect only taxes paid less transfer payments received. With the exception of government expenditures on health care and education, which are treated as transfer payments, the accounts do not impute to particular generations the value of the government's purchases of goods and services. Why not? Because it is difficult to attribute the benefits of such purchases. Therefore, the accounts do not show the full net benefit or burden that any generation receives from government policy as a whole, although they can show a generation's net benefit or burden from a particular policy change that affects only taxes and transfers. Thus generational accounting tells us which generations will pay for the government spending not included in the accounts, rather than telling us which generations will benefit from that spending. This implies nothing about the value of government spending; i.e., there is no assumption, explicit or implicit, in the standard practice of generational accounting concerning the value to households of government purchases.[15]

Assessing the Fiscal Burden Facing Future Generations

Given the right-hand side of equation (36) and the second term on the left-hand-side of equation (36), generational accountants determine, as a residual, the value of the

Ablett (1999) and Auerbach and Oreopoulos (1999) for applications of generational accounting that make that separation as well as study a variety of fiscal issues associated with immigration.

[15] Raffelhüschen (1998) departs from this conventional approach to generational accounting of not allocating the benefits of government purchases. Instead, he allocates these purchases on a per-capita basis.

first term on the left-hand side of equation (36) -- the collective payment, measured as a time-t present value, required of future generations. Given this amount, one can determine the average present value lifetime net tax payment of each member of each future cohort under the assumption that these lifetime net tax payments rise for members of each successive future cohorts at the economy's rate of labor productivity growth, g. Now, if labor productivity grows at g percent per year, so will real wages. Hence, the lifetime labor income of each new cohort will be g percent larger than that of its immediate predecessor. So, in assuming that each successive cohort pays lifetime net taxes that are g percent larger than those of its predecessor, one is assuming that each successive future cohort pays the same share of its lifetime labor income in net taxes; i.e., one is assuming that each future cohort faces the same lifetime net tax rate.

Let $\bar{N}$ stand for the growth-adjusted generational account of future generations. $\bar{N}$ is the amount each member of a future cohort would pay in lifetime net taxes if her lifetime labor income were the same as that of a current newborn. The actual amount the cohort born in year t+1 will pay is $\bar{N}(1+g)$. The actual amount the cohort born in year t+2 will pay is $\bar{N}(1+g)^2$. The actual amount the cohort born in year t+3 will pay is $\bar{N}(1+g)^3$, and so on.

Equation (38) can be used to solve for $\bar{N}$.

(38)

$$\sum_{s=0}^{D} N_{t,t-s} P_{t,t-s} + \sum_{s=1}^{\infty} \bar{N}(1+g)^{s} P_{t,t+s} (1+r)^{t-s} = \sum_{s=t}^{\infty} G_{s} (1+r)^{t-s} + D_{t}$$

$\bar{N}$ is the lifetime net tax payment of future generations adjusted for growth, so it is directly comparable to that of current newborns, $N_{t,t}$. This comparison is also label-free because alternative labeling conventions leave unchanged lifetime net payments. If $\bar{N}$ equals $N_{t,t}$, generational policy is balanced. If $\bar{N}$ exceeds (is smaller than) $N_{t,t,}$ future generations face larger (smaller) growth-adjusted lifetime net tax burdens than do current newborns.

The assumption that the generational accounts of all future generations are equal, except for a growth adjustment, is just one of many assumptions one could make about the distribution across future generations of their collective net tax payments to the government. One could, for example, assume a phase-in of the additional fiscal burden (positive or negative) to be imposed on future generations, allocating a greater share of the burden to later future generations and a smaller share to earlier ones. Clearly, such a phase-in would mean that generations born after the phase-in period has elapsed would face larger values of lifetime burdens (the $N_{t,k}$s) than we are calculating here.

Alternative Ways to Achieve Generational Balance

Another way of measuring the imbalance in fiscal policy is to ask what immediate and permanent change in either a) government purchases or b) a specific tax (such as the income tax) or transfer payment (such as old-age social security benefits) would be necessary to equalize the lifetime growth-adjusted fiscal burden facing current newborns and future generations. Because such policies satisfy the government's intertemporal budget constraint, they also sustainable.

To be more precise about this type of calculation, suppose one wants to find the immediate and permanent percentage reduction in government purchases needed to achieve generational balance. Denote this percentage reduction by *z*. Next, use equation (39) to solve for *z* under the assumption that $\bar{N}$ equals $N_{t,t}$.

(39)

$$\sum_{s=0}^{D} N_{t,t-s} P_{t,t-s} + \sum_{s=1}^{\infty} \bar{N}(1+g)^{s} P_{t,t+s} (1+r)^{t-s} = \sum_{s=t}^{\infty} (1+z) G_{s} (1+r)^{t-s} + D_{t}$$

As a second example, consider the immediate and permanent percentage increase in income taxes needed to achieve generational balance. Call this percentage increase v.[16] To determine the size of v, try different immediate and permanent income tax hikes until you find the one with the following property: given the new values of generational accounts (the values inclusive of the tax hike), the calculated value of $\bar{N}$ equals $N_{t,t}$. In contrast to the calculation of *z*, in this calculation of v, $N_{t,t}$, the generational account of current newborns, is not held fixed. Like the accounts of all other existing generations, $N_{t,t}$ is higher because of the increase in the income tax. Consequently, so is $\bar{N}$.

[16] To introduce *v* in equation (4) we'd have to express the generational accounts of current generations as a) the present value of their future tax payments minus b) the present value of their future transfer payments and simply multiply the expression for the present value of future tax payments by (1+*v)*.

The Role of Demographics

As can be seen in equations (23)-(26), demographics play a central role in determining the size of the imbalance in generational policy. Other things equal, the larger the population sizes of future generations, the smaller will be the size of $\bar{N}$, and, therefore, the smaller will be the imbalance of generational policy. Ceteris paribus, larger population sizes of current generations will raise or lower $\bar{N}$ depending on the sign of the generational accounts these population totals are multiplying. For example, if the generational accounts of those over age 65 are negative, larger numbers of older people will make the calculated value of $\bar{N}$ larger. A negative account means that the government will, under current policy, pay more to a generation in transfer payments than it receives in taxes. Negative generational accounts for older generations is the norm in industrialized countries because these generations receive more in state pension, health, and other benefits over the remainder of their lives than they pay in taxes.

What is the impact of the large number of baby boomers on generational imbalance? Since these generations typically still have positive generational accounts, they are contributing, on balance, to lowering the size of $\bar{N}$ and, thus, the imbalance in generational policy. On the other hand, since these generations are close to receiving large net transfers from the government, the current values of their generational accounts are quite small. Hence, the contribution they are making toward lowering $\bar{N}$ is small. This is the channel through which the very sizable benefits that are due to be paid in retirement to the enormous baby boom generation in industrialized countries constitute a fiscal burden on young and future generations.

Inputs to Generational Accounting

Producing generational accounts requires projections of population, taxes, transfers, and government purchases, an initial value of government net debt, and a discount rate. Since generational accounting considers all levels of government -- local, state, and federal -- the measures of taxes, transfers, and government purchases must be comprehensive. Government infrastructure purchases are treated like other forms of purchases in the calculations. Although such purchases provide an ongoing stream, rather than a one-time amount, of services, they still must be paid for. Generational accounting clarifies which generation or generations will have to bear the burden of these and other purchases. Government net debt is calculated net of the current market value of state enterprises. This value is determined by capitalizing the net profits of those businesses. In contrast to the treatment of the market value of state enterprises, government net debt does *not* net out the value of the government's existing infrastructure, such as parks, highways, and tanks. Including such assets would have no impact on the estimated fiscal burden facing future generations because including these assets would require adding to the projected flow of government purchases an exactly offsetting flow of imputed rent on the government's existing infrastructure.

Taxes and transfer payments are each broken down into several categories. The general rule regarding tax incidence is to assume that taxes are borne by those paying the taxes, when the taxes are paid: income taxes on income, consumption taxes on consumers, and property taxes on property owners. There are two exceptions here, both of which involve capital income taxes. First, as detailed in Auerbach, Kotlikoff, and Gokhale (1991), one should, data permitting, distinguish between marginal and infra-marginal capital income taxes. Specifically, infra-marginal capital income taxes should be distributed to existing wealth holders, whereas marginal capital income taxes should be based on future projected wealth holdings. Second, in the case of small open economies, marginal corporate income taxes are assumed to be borne by (and are therefore allocated to) labor. The general rule for allocating transfer payments is to allocate them to those who directly receive them.

The typical method used to project the average values of particular taxes and transfer payments by age and sex starts with government forecasts of the aggregate amounts of each type of tax (e.g., payroll) and transfer payment (e.g., welfare benefits) in future years. These aggregate amounts are then distributed by age and sex based on relative age-tax and age-transfer profiles derived from cross-section micro data sets. For years beyond those for which government forecasts are available, age- and sex-specific average tax and transfer amounts are generally assumed to equal those for the latest year for which forecasts are available, with an adjustment for growth.

Equation (40) helps clarify the method of distributing annual tax or transfer aggregates in a particular year to contemporaneous cohorts. Again, to simplify the presentation we abstract from the distinction between sexes that we consider in the actual calculations.

(40) $$H_t = \sum_{s=0}^{D} T_{t,} R_{t,t-s} P_{t,t-s}$$

In (40), H_t stands for an aggregate tax or transfer amount in year t. Let's assume it stands for total income tax payments to make the example concrete. The term $T_{t,}$ is the average amount of income tax paid in year t. $R_{t,t\text{-}s}$ is the relative distribution profile for income taxes in year t. Specifically, it stands for ratio of the average income tax payment of members of the cohort born in year *t-s* to the average income tax payment in year t. Finally, $P_{t,t\text{-}s}$ stands for the number of people in year t who were born in year *t-s*, i.e., it is the population size of the age *t-s* cohort. Given H_t and the values of the $R_{t,t\text{-}s}$ and $P_{t,t\text{-}s}$ terms, one can use equation (41) to solve for T_t. To form $T_{t,t\text{-}s}$, the terms that enter equation (37) that are used to calculate each current generation's account, note that

(41) $$T_{t,t-s} = T_{t,t} R_{t,t-s} .$$

Discount Rates and Uncertainty

For base-case calculations, generational accountants typically use a real rate of discount around 5 percent, a rate that exceeds the real government short-term borrowing rate in most developed countries. This rate seems justified given the riskiness of the flows being discounted. However, the "right" discount rate to use is in sufficient question to merit presenting results based on a range of alternative discount rates – a practice routinely followed by those constructing generational accounts.

The appropriate discount rate for calculating the present value of future government revenues and expenditures depends on their uncertainty. If all such flows were certain and riskless, it would clearly be appropriate to discount them using the prevailing term-structure of risk-free interest rates. However, even in this simple and unrealistic case, such discounting could be problematic since it would require knowing the values of this term structure. To discern these values, one might examine the real yields paid on short-term, medium-term, and long-term inflation-indexed government bonds. But this presupposes the existence of such bonds. Many countries do not issue indexed bonds, and those that do don't necessarily issue indexed bonds of all maturities.

In the realistic case in which countries' tax revenues and expenditures are uncertain, discerning the correct discount rate is even more difficult. In this case, discounting based on the term structure of risk-free rates (even if it is observable) is no longer theoretically justified. Instead, the appropriate discount rates would be those that adjust for the riskiness of the stream in question. Since the riskiness of taxes, spending, and transfer payments presumably differ, the theoretically appropriate risk-adjusted rates at which to discount taxes, spending, and transfer payments would also differ. This point carries over to particular components of taxes, spending, and transfer payments, whose risk properties may differ from those of their respective aggregates.[17] Moreover, if insurance arrangements are incomplete, the appropriate risk adjustments would likely be generation-specific. Unfortunately, the size of these risk adjustments remains a topic for fortune research. In the meantime, generational accountants have simply chosen to estimate generational accounts for a range of discount rates.

Illustrating Generational Accounts -- the Case of the U.S.

In their recent calculation of U.S. generational accounts, Gokhale, Page, Potter, and Sturrock (2000) used the latest long-term projections of The Congressional Budget Office (CBO) with one modification. They assumed that U.S. federal discretionary

[17] To see this, consider a government policy in the two-period life-cycle model of borrowing from the young at time t and using the proceeds to purchase stock from the young. When the young are old the government repays the principal it borrowed by selling its shares and making up the difference between its interest obligations and the return (including capital gain) on its stock as a net tax payment. This entire set of transactions entails no net payments from the government to generation t either when it is young or old. However, net tax payments will, on average, be negative when generation t is old, since stocks average a higher return than bonds. If one discounts the safe and risky components of the net tax payments at their appropriate and different risk-adjusted discount rates, the present value of future net tax payments will be zero. This is what one would want generational accounting to show, since the policy simply involves the government borrowing stock from the young and returning it (including its return) when they are old; i.e., the policy entails no increase in lifetime net payments. But were one to mistakenly discount the total of

spending would grow with the economy. Table 1 reports generational accounts on this basis, constructed using a 4.0 percent real discount rate and assuming a 2.2 percent rate of growth of labor productivity. This discount rate is roughly the current prevailing rate on long-term inflation-indexed U.S. government bonds, and the productivity growth rate is the one currently being projected by the CBO. The accounts are for 1998, but are based on the CBO projections available as of January 2000.

Table 1 shows, for males and females separately, the level and composition of the accounts. Recall that the accounts are present values discounted, in this case, to 1998. As an example, consider the $112,300 account of 25 year-old males in 1998. This amount represents the present value of the net tax payments that 25 year-old males will pay, on average, over the rest of their lives.

The generational accounts for both males and females peak at age 25 and become negative for females at age 50 and for males after at age 60. The accounts for those younger than age 25 are smaller because they have a longer time to wait to reach their peak tax-paying years. The accounts are also smaller for those above age 25 because they are closer in time to receiving the bulk of their transfer payments. By age 10 for males and age 30 for females, Medicare and Social Security benefits are the two most important forms of transfer payments, if one uses the government's fiscal taxonomy.

The only figures in this table that aren't a function of labeling conventions are the lifetime net tax rate of future generations and of newborns. The denominators in these lifetime tax rates are the present value of lifetime earnings. And they are constructed by pooling the net tax payments and labor earnings of males and females. In the case of

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expected net taxes in old age at a single discount rate, the value of the change in the generational account would be non zero.

future generations, the present value to 1998 of all future net taxes of all future generations is divided by the present value to 1998 of the labor earnings of all future generations.

The Imbalance in U.S. Generational Policy

For newborns the lifetime net tax rate is 22.8 percent. For future generations it is 32.3 percent. So future generations face a lifetime net tax rate that is 41.6 percent higher than that facing current newborns.[18] Stated differently, future generations, according to current policy, are being asked to pay almost a dime more per dollar earned than are current newborns.

In thinking about the magnitude of the U.S. generational imbalance, it's important to keep in mind that the lifetime net tax rate facing future generations under current policy assumes that *all* future generations pay this same rate. If, instead, one were to assume that generations born, say, over the next decade are treated the same as current newborns, the net tax rate for generations born in 2010 and beyond would be higher than 32.3 percent.

Policies to Achieve Generational Balance in the U.S.

Table 2 considers five alternative policies that would achieve generational balance in the U.S. The first is a 31 percent immediate and permanent rise in federal personal and corporate income taxes. Had the U.S. adopted this policy in 2000, the federal surplus

[18] This is a very sizeable imbalance, but it's nevertheless smaller than the imbalance estimated in the early 1990s. The decline in the imbalance reflects policy changes and much more optimistic long-term fiscal projections.

reported by the government for that year would have more than doubled. Hence, based on the government's fiscal language, the year-2000 surplus was far too small compared to that needed to achieve generational balance.

Rather than raising just federal income taxes, one could raise all federal, state, and local taxes. In this case, an across-the-board tax hike of 12 percent could deliver generational balance. Cutting all Social Security, Medicare, Medicaid, food stamps, unemployment insurance benefits, welfare benefits, housing support, and other transfer payments by 21.9 percent is another way to eliminate the generational imbalance. Two final options considered in the table are immediately and permanently cutting all government purchases by 21 percent or cutting just federal purchases by 66.3 percent.

Cutting government purchases to achieve generational balance would leave future generations paying in net taxes the same 22.8 percent share of lifetime earnings as current newborns are expected (under current policy) to pay. In contrast, either raising taxes or cutting transfer payments would mean higher lifetime net tax rates for those now alive. As Table 2 indicates, these alternative policies would leave newborns and all future generations paying roughly 27 cents out of every dollar earned in net taxes. This net tax rate is over 4 cents more per dollar earned than newborns are now forced to pay. The payoff from having newborns as well as everyone else who is currently alive pay more in net taxes, is a reduction in net tax rate facing future generations by 5 to 6 cents per dollar earned.

Achieving Generational Balance in 22 Countries

The United States is certainly not alone in running imbalanced generational policies. Table 3, abstracted from Kotlikoff and Raffelhüschen (1999), reports alternative immediate and permanent policy changes that would achieve generational balance in 21 countries. According to the second column in the table, 13 of the 22 countries need to cut their non-educational government spending by over one fifth if they want to rely solely on such cuts to achieve generational balance. This group includes the United States and Japan and the three most important members of the European Monetary Union: Germany, France, and Italy. Four of the 13 countries – Austria, Finland, Spain, and Sweden -- need to cut their non-education purchases by more than half, and two countries -- Austria and Finland – need to cut this spending by more than two thirds! Bear in mind that generational accounting includes regional, state, local, and federal levels of government. So the cuts being considered here are equal proportionate cuts in all levels of government spending.

Not all countries suffer from generational imbalances. In Ireland, New Zealand, and Thailand future generations face a smaller fiscal burden, measured on a growth-adjusted basis, than do current ones given the government's current spending projections. Hence, governments in those countries can spend more over time without unduly burdening future generations. There are also several countries in the list, including Canada and the United Kingdom, with zero or moderate generational imbalances as measured by the spending adjustment needed to achieve perfect balance. What explains these tremendous cross-country differences? Fiscal policies and demographics differ dramatically across countries. The U.S., for example, has experienced and is likely to continue to experience rapid health-care spending. Japan's health care spending is growing less rapidly, but it's aging much more quickly. The United Kingdom has a policy of keeping most transfer payments fixed over time in real terms. Germany is dealing with the ongoing costs of reunification.

One alternative to cutting spending is cutting transfer payments. In Japan, education, health care, social security benefits, unemployment benefits, disability benefits, and all other transfer payments would need to be immediately and permanently slashed by 25 percent. In the U.S., the figure is 20 percent. In Brazil, it's 18 percent. In Germany, it's 14 percent. And in Italy it's 13 percent. These and similar figures for other countries represent dramatic cuts and would be very unpopular.

So too would tax increases. If Japan were to rely exclusively on across-the-board tax hikes, tax rates at all levels of government (regional, state, local, and federal) and of all types (value added, payroll, corporate income, personal income, excise, sales, property, estate, and gift) would have to rise overnight by over 15 percent. In Austria and Finland, they'd have to rise by over 18 percent. If these three countries relied solely on income tax hikes, they had to raise their income tax rates by over 50 percent! In France and Argentina, where income tax bases are relatively small, income tax rates would have to rise by much larger percentages. In contrast, Ireland could cut its income tax rates by about 5 percent before it needed to worry about over burdening future generations. The longer countries wait to act, the harder will be their ultimate adjustment to fiscal reality. As an example, the United Kingdom needs to raise income taxes by 9.5 percent if it acts immediately. But if it waits 15 years, the requisite income tax hike is 15.2 percent.

How Well Does Generational Accounting Measure True Fiscal Incidence?

One concern about generational accounting is the accuracy of its implicit incidence assumptions. Fehr and Kotlikoff (1997) use the Auerbach-Kotlikoff (1987) dynamic general equilibrium life-cycle model, described below, to compare changes in generation accounts with true fiscal incidence. Tables 3 and 4, taken from their paper, use the closed-country version of the Auerbach-Kotlikoff model to illustrate the relationship between changes in generation's utilities, measured in units of current consumption, and changes in their generational accounts. The tables consider the effect of a shift in the tax structure. Specifically, the economy switches from having a 20 percent income tax to having a 15 percent income tax plus a consumption tax where the revenue loss from lowering the income-tax rate is covered by the consumption tax. Government spending on goods and services is held fixed per capita in the simulation.

In the first year of the economy's transition the consumption tax rate is 6.4 percent. Over time it drops to 6.1 percent. In the long run, the economy's capital stock, wage rate, and interest rate end up 8.2 percent higher, 2.1 percent higher, and 5.6 percent lower, respectively. This crowding-in of the capital stock reflects the shift in the tax burden from initial young and future generations to initial older generations. Table 4 shows how key economic variables evolve other time in the model.

Table 4 compares changes in generational accounts with the true policy incidence. As is clear from the table, generational accounts, in this case, do a very good job in capturing the general pattern of the generation-specific utility changes. They do less well for certain generations in capturing the precise magnitude of their welfare changes. The changes in generational accounts match up fairly closely to the changes in utility for those initially over age 25. For younger and future generations, the match is much less good. In this simulation, generational accounting provides a lower bound estimate of the absolute change in welfare of those born in the long run. The reason is that policy that raise the economy's capital stock are generally policies that redistribute from the initial old to the initial young and future generations. Since a higher long-run degree of capital intensity means a higher long-run wage, the direct redistribution from those alive in the long run, captured by generational accounting, will understate the improvement in welfare of those born in the long run. In addition to missing this long-run general equilibrium action, Fehr and Kotlikoff show that generational accounting, as conventionally applied, omits the efficiency gains and losses arising from fiscal reforms. For particular reforms these efficiency effects can be important components of the policy's overall incidence effects. Fehr and Kotlikoff conclude that the incidence assumptions used in generational accounting needs to be augmented to incorporate both efficiency and general equilibrium feedback effects.

Generational Accounting and Monetary Policy

One of the net taxes that are allocated in forming generational accounts is the seignorage the government collects from the private sector in printing and spending money. When it prints and spends money, the government acquires real goods and services, but it also precipitates a rise in the price level that would not otherwise have occurred. This real gain to the government is a loss to the private sector that comes in the form of a reduction in the real value of their holdings of money.

The government can also garner resources from the private sector by deflating the real value of its official nominal liabilities as well as implicit nominal transfer payment obligations. On the other hand, it can lose resources by deflating away the real value of tax receipts that are fixed in nominal terms. Finally, governments can use the printing of money and its associated inflation to reduce the real value of their spending on goods and services to the extent this spending is fixed in nominal terms. Each of the ways in which governments use monetary policy as a fiscal instrument can and have been incorporated in generational accounting. For example, the hidden seignorage tax is allocated across cohorts by using data on average real money balances by age and sex.

Generational accounting can also be used to help determine the likely course of future monetary policy. Countries with very large generational imbalances are countries that are likely to have to print large quantities of money to help "pay" their bills. Indeed, generational accounting can be used to determine the amount of money creation needed to achieve a generationally balanced and sustainable policy. Hence, generational accounting should be of as much importance and interest to monetary authorities as it is to fiscal authorities.

VI. Simulating Generational Policy

The advent of high-speed computers has transformed generational policy analysis. Today researchers around the world are constructing large-scale dynamic simulation models to assess how policy changes would affect macroeconomic outcomes as well as the intra- and intergenerational distributions of welfare.[19] This section illustrate the

[19] Arrau (1990), Hamann (1992), Arrau and Schmidt-Hebbel (1993), Raffelhuschen (1989, 1993), Huang, He, Selo ¤mrohoro–lu, and Thomas Sargent (1997), Imrohoroglu, Imrohoroglu, and Joines (1995, 1998a, and 1998b), Altig and Carlstrom (1996), Heckman, Lochner, and Taber (1997, 1998), Hirte and Weber (1998), Schneider (1997), Fougere and Merette (1998, 1999), Merette (1998), Lau (1999), Knudsen, Pedersen, Petersen, Stephensen, and Trier (1999), Bohringer, Pahlke, and Rutherford (1999), and Schmidt-Hebbel (1999) are examples in this regard.

effects of two generational policies – the wholesale shift from income to consumption taxation and the wholesale privatization of social security, with the accrued liabilities of the old system financed via a consumption tax. Both of these policies effect major redistributions across generations. Indeed, it is hard to contemplate policies with greater potential to redistribute across generations.

There are three key questions that these and similar simulations address. First, how large are the macroeconomic effects of policies of this magnitude? Second, how long does it take for these effects to occur? Third, how large are the welfare changes visited on different generations as well as on particular members of those generations?

The illustration is based on the Auerbach-Kotlikoff-Smetters-Walliser (AKSM) model. The AKSM model descended from the Auerbach-Kotlikoff (1987) (AK) model. The AK model featured 55 overlapping generations with a single representative agent in each cohort. Unlike the steady-state and myopic transition models developed by Upton and Miller (1974), Kotlikoff (1979), Summers (1981), Seidman (1983), Hubbard and Judd (1987), and others, the AK model solved for the economy's perfect foresight transition path. The solution is found using an iterative convergence algorithm that begins by guessing the time-paths of factor demands, endogenous tax rates, and other key endogenous variables. The algorithm then uses these guesses to generate the time-path of factor prices and marginal net prices. These variables are fed into the supply side of the model where households determine how much to save and work. These micro decisions, when aggregated, deliver a time-path of economy-wide factor supplies that is compared with the initial guess of the time-path of factor demands. If the supply of factors equals the demand for factors each period, a dynamic equilibrium has been determined.

Otherwise, the algorithm averages the initial guessed time-path of factor demands and the associate time-path of factor supplies to form a new guess of the time-path of factor demands, and the iteration continues.

The AKSM model uses the same solution technique of the original AK model, but it differs in two important respects.[20] First, it follows the lead of Fullerton and Rogers (1993) by incorporating intra- as well as intergenerational inequality. Specifically, the model posits 12 different earnings groups within each cohort. The groups are labeled 1 through 12, with earnings higher for groups referenced with a higher number. Groups 1 and 12 represent the lowest and highest 2 percent of earners. Groups 2 and 11 are the next lowest and next highest sets of earners, but each constitutes 8 percent of earners. And groups 3 through 10 each constitute 10 percent of earners. The new model also approximates U.S. fiscal institutions much more closely. Second, it includes an array of tax-base reductions, a progressive Social Security system, and a Medicare system.

Switching from Income to Consumption Taxation

Tables 5 and 6, extracted from Altig, et. al. (2001), shows some of the AKSW model's results from simulating the complete replacement of the current U.S. personal and corporate federal income taxes with an equal revenue proportional consumption tax. Given the above discussion of deficit delusion, it's important to point out that the term "revenue" here is based on the U.S. federal government's fiscal language. Under alternative labeling conventions, reported tax revenue would be dramatically larger or smaller than what the government says it is collecting and a "revenue-neutral" switch in tax bases, which did not try to preserve the same changes in generational accounts and economic incentives, would have different economic effects. That said, the tax reform considered here entails a major redistribution across generations because it confronts those rich and middle class retirees alive at the time of the reform with a much greater remaining lifetime net tax burden than would otherwise be the case. Low-income retirees are, on the other hand, largely insulated from the policy because their social security benefits are adjusted in the model to retain their original purchasing power.

Table 5 reports macroeconomic effects, while Table 6 shows welfare effects for five of the twelve lifetime earnings classes. Note that income class 1 refers to the poorest members of each cohort (those with the smallest endowment of human capital), and income class 12 refers to the richest members of each cohort (those with the largest endowment of human capital.) The horizontal axis locates cohorts by their years of birth measured relative to the reform, which occurs in year zero. The welfare change are measured as equivalent variations, specifically the percentage change in full remaining lifetime economic resources that an agent living under the old policy regime (living in the initial steady state) would need to achieve the same level of remaining lifetime utility as she/he experiences under the new policy.

The macroeconomic effects of the tax reform are significant. In the long run, the economy's capital stock, labor supply, and output are larger by 25.4 percent, 4.6 percent, and 9.4 percent, respectively. However, getting reasonably close to this new steady state takes a while. For example, achieving half of the ultimate increase in the capital stock takes about 15 years.

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[20] There is also a new demographic version of the AKSM model (Kotlikoff, Smetters, and Walliser 2000), not used here, that provides a much more realistic modeling of fertility and lifespan than in the original AK

The policy's capital deepening raises pre-tax wages by 4.6 percent and lowers the pre-tax return to capital by 100 basis points. The expansion of the economy permits a decline in the consumption tax rate from an initial rate of 16.6 percent to a final rate of 14.5 percent. Measured on a wage-tax equivalent basis, the long-run consumption tax rate is 12.7 percent. This is substantially below the initial steady-state's 21.4 percent average marginal tax rate on wage income. It's even further below the 34.0 percent peak marginal wage tax faced by those in the top earnings class.

As Table 6 shows, the tax reform effects a major redistribution across generations, but one that differs markedly for the lifetime poor and rich. In forcing rich (e.g., earnings class 12) initial retirees to pay a high consumption tax rate, the policy, in effect, taxes their accumulated wealth. This lowers their remaining lifetime utility.[21] In contrast, members of this earnings class that are born in the new long-run steady state experience a 4 percent increase in their lifetime utilities measured relative to their welfare in the absence of the reform. For the lowest earnings class, the generational incidence pattern is the opposite. The initial poor retirees experience a small welfare improvement, but future members of this class are worse off. The reason is that the consumption-tax structure is much less intragenerationally progressive than the original income-tax structure. The generational incidence pattern for the other earnings groups in the top (bottom) half of the earnings distributions is similar, but less pronounced than that for earnings group 12 (1).

Social Security's Privatization

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model and that can initial simulations from non steady-state positions.

[21] The simulated model includes capital adjustment costs, which limit the economic losses to initial elderly generations. The reason is that they own much of the economy's existing capital stock and this capital

The U.S. Social Security System faces a grave long-term financial crisis, the full dimension of which is not well known. Paying out benefits on an ongoing basis requires an immediate and permanent increase of roughly 50 percent in the OASDI payroll tax rate.[22] The United States is now embarked in a national debate about how to save Social Security. Options here include cutting benefits, raising the payroll tax, and privatizing all or part of the system by allowing people to contribute to individual accounts. The key issues in this debate are how any policy, including maintaining the status quo, will affect the macro economy as well as rich and poor members of current and future generations.

Table 7 extracted from Kotlikoff, Smetters, and Walliser (2001), illustrate the A-K OLG Model's analysis of the effects of social security's privatization. The table considers privatizing the U.S. system and financing the 45-year transition, during which social security benefits are gradually phased out, with a consumption tax. The policy generates sizeable long-run increases of 39 percent and 13 percent in the economy's capital stock and output, respectively. But the half-life of the policy is 30 years, roughly twice the half-life of the tax reform just considered. The transition takes longer because the policy phases in gradually over time.

Table 8 shows that these long-run gains are not free. They come at the price of lower utility to initial older and middle-aged generations. All those alive in the long run, including the richest (group 12) and poorest (group 1) agents, are better off. Since the system being privatized features a highly progressive benefit schedule, but also a highly regressive tax schedule (due to the ceiling on taxable earnings), the fact that the long-run poor are better off is particularly interesting. It shows that paying off the existing

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experiences a rise in its relative price because it is a relatively scarce factor with respect to installing additional capital.

system's benefit liabilities in a more progressive manner (by making initial rich and middle income elderly contribute to that cause) outweighs the loss the long-run poor incur from not receiving benefits based on social security's progressive benefit schedule.

The long-run poorest earnings group experiences a 6.0 percent rise in lifetime utility. This is a substantial welfare change; it means that were social security not to be privatized, providing this group with the same welfare improvement would require a 6 percent increase in their consumption and leisure in each year they are alive. The long-run richest earnings group enjoys a 4.4 percent improvement in its lifetime utility. The biggest winners from the reform are those in the upper middle classes (groups 6 though 9) alive in the long run. Their welfare gains are roughly 8 percent. Like their poorer contemporaries, these groups enjoy the higher real wages delivered by the privatization. But the removal of social security means more because, compared with their contemporaries, they faced the highest rate of lifetime net social security taxation. The costs of delivering these long-run welfare gains are visited on the initial middle-class and high-income elderly as well as all initial workers. The largest losses amount to about 3 percent of remaining lifetime resources.

The two simulations just presented provide a sense of the maximum potential macroeconomic and redistributive effects of generational policy. The reasons are a) the policies are radical, b) they entail major intergenerational redistribuiton, and c) they significantly improve marginal economic incentives to work and save. But as described in Altig, et. al. (2001) and Kotlikoff, Smetters, and Walliser (2001), the benefits available to future generations from tax reform or social security's privatization can easily be dissipated by providing transition relief to early generations. In the case of consumption-

[22] See Gokhale and Kotlikoff (2001).

tax reform, such relief could come in the form of exempting the initial elderly from paying taxes when they purchase consumption with existing assets.[23] In the case of privatizing social security, transition relief could come in the form of the delaying the imposition of a new tax to cover the loss of revenues arising from having workers make their social security contributions to private accounts. Such a policy permits workers close to retirement to gain at the expense of subsequent generations.

VII. Ricardian Equivalence

Ricardian equivalence refers to the proposition that private intergenerational transfers will undo government intergenerational transfers making generational policy entirely ineffectual and generational accounting a waste of time. The proposition is appropriately attributed to David Ricardo who, in discussing whether to borrow or tax to finance a war, wrote that "in point of economy, there is no real difference in either of the modes …"[24] More precisely, in comparing a one-time war tax of £1,000 and a perpetual tax of £50 to pay interest on borrowing of £1,000, Ricardo said that "if he (the payee) leaves his fortune to his son, and leaves it charged with this perpetual tax, where is the difference whether he leaves him £20,000, with the tax, or £19,000 without it?"[25]

While Ricardo realized that bequests could be raised or lowered to undo government intergenerational redistribution, he was skeptical that such behavior would arise in practice. For in his next sentence he says "The argument of charging posterity

[23] If consumption taxation was instituted (i.e., labeled) by the government as a tax on income with 100 percent expensing of new investment/saving (i.e., as taxing output minus saving, which equals consumption), transition relief could come in the form of grandfathering the investment incentives provided to existing capital under the prior tax structure.
[24] Ricardo (1951), 4:185-6. Also see O'Driscoll's (1977) discussion of why Ricarado rejected Richardian equivalence as an empirically relevant phenomenon.
[25] Ricardo (1951), 4:187.

with the interest on our debt, or of relieving them from a portion of such interest, is often used by otherwise well informed people, but we confess we see no weight in it."[26]

Barro's Proof of the Irrelevance Proposition

Ricardo would presumably have included Robert Barro (1974) in the category of "otherwise well informed people," notwithstanding the latter's elegant and influential derivation of the former's irrelevance proposition. Barro's derivation begins by positing that the utility of one generation depends not only on the goods (including leisure) it consumes over its lifetime, but also the utility of its children. In the two-period model, this function is

(42) $$u_t = u(c_{yt}, c_{ot+1}, l_{yt}, l_{ot+1}, u_{t+1}) .$$

Writing the corresponding expression for u_{t+1} and substituting into (42) and then doing the same for u_{t+2} and all other future utility functions leads to the following infinite horizon utility function whose arguments consist of all future values of consumption and leisure:

(43) $$u_t = u(c_{yt}, c_{ot+1}, l_{yt}, l_{ot+1}, c_{yt+1}, c_{ot+1}, l_{yt+1}, l_{ot+2}, ...)$$

Thus, Barro's simple and seemingly quite natural formulation of intergenerational altruism has the striking implication that those alive today will care not only about their own levels of consumption and leisure, but also the consumption and leisure of their children, grandchildren, and all subsequent descendents. The generation alive at time t takes its inheritance, b_t, as given and chooses consumption when young and old as well as bequests (or intervivos transfers) when old, b_{t+1}, to maximize (43) subject to

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[26] Ibid.

(44) $c_{yt} + w_t l_{yt} + R_{t+1}(c_{ot+1} + w_{t+1} l_{ot+1} + b_{t+1}) = b_t + w_t T + R_{t+1}(h_{t+1} + w_{t+1} T)$,

where R_{s+1} discounts flows at time $s+1$ to time s.

To make Barro's point about the irrelevance of generational policy, (44) includes a policy, announced at time t, of giving an amount h_s at time $s \geq t+1$ to the contemporaneous old and taking that same sum from the contemporaneous young. The generation alive at time $t+1$ faces the analogous budget constraint, except it includes the receipt when young of the government's net payment.

(45) $c_{yt+1} + w_{t+1} l_{yt+1} + R_{t+2}(c_{ot+2} + w_{t+2} l_{ot+2} + b_{t+2}) = b_{t+1} - h_{t+1} + w_{t+1} T + R_{t+2}(h_{t+2} + w_{t+2} T)$

If one solves for b_{t+1} in (45) and substitutes for that variable in (44), the terms involving h_{t+1} drop out. The resulting expression now involves b_{t+2}, which can be eliminated by solving for b_{t+2} from the time $t+2$ version of (45). Doing so leads h_{t+2} to drop out. Proceeding indefinitely in this manner leads to the extended family's infinite horizon constraint:

(46)

$$c_{yt} + w_t l_{yt} + \frac{c_{ot+1} + w_{t+1} l_{ot+1}}{1+r_{t+1}} + c_{yt} + w_t l_{yt} + \frac{c_{ot+1} + w_{t+1} l_{ot+1}}{1+r_{t+1}} + \ldots = b_t + w_t T_t + \frac{w_{t+1} T}{1+r_{t+1}} + \ldots .$$

The extended family maximizes (43) subject to (46). Since all the terms involving the government's generational policy have dropped out of (46), generational policy has no impact whatsoever on the economy. Operationally, the extended family nullifies generational policy by raising its bequests at time $s \geq t+1$ by h_s. Note that h_s can be positive or negative. Generations that receive a positive net payment when old bequeath these receipts to their children. The children, in turn, use this inheritance to make their net payments to the government; i.e., the children's payment to the government is given to their parents who hand it back to the children. Since bequests can be negative as well as positive, we can also describe the change in bequests as the children reducing their own private transfers to their parents. If the government's net payment to the elderly is negative, the elderly will respond by cutting back on their bequests to their children; alternatively, their children will hand the positive net payment they receive from the government to their parents.

Theoretical Objections to the Barro Framework

Barro's model ignores four interrelated issues whose consideration undermine, if not vitiate, his result. First, the model ignores marriage. Second, it ignores differences in preferences among extended family members. Third, it assumes symmetric information across family members about each others' incomes. Fourth, it ignores uncertainty.

The fact that it takes two to tango means that marriage entails at least two sets of parents, both of which may be altruistically linked to the married couple, but may have no particular interest in each other. One way to model intergenerational transfers in this context is to assume that each set of in-laws takes the other's transfers to their children as given. But as shown in Kotlikoff (1983) and Bernheim and Bagwell (1988), this Nash assumption implies the effective altruistic linkage of the two sets of in-laws. And if the in-laws have other children, the original in-laws will become altruistically linked with the all of the other children's in-laws as well. Hence, if altruism were as widespread as Barro posits, essentially everyone would be altruistically interlinked with everyone else around the world as a consequence of marriage within groups and intermarriage across racial, ethnic, religious, and national lines.

The resource sharing arising from altruistic linkage means that each interlinked household's consumption and leisure is determined by the collective resources of all extended family members. State differently, the distribution of resources across extended family members makes no difference to the distribution of consumption and leisure of those members. Thus, the Barro model implies that the consumption of a randomly chosen person in Nashville, Tennessee should depend on the income of a randomly chosen person in Almati, Kazakhstan.

The source of this patently absurd prediction is the assumption that each extended family takes the transfers of other extended family members as given. The difficulty with this assumption becomes apparent if one compares two parties who each care so strongly about each other that each wants to transfer to the other. Taking each other's transfers as given may lead to an infinite handing back and forth of funds between the two parties; i.e., the problem may have no solution. Of course, in the real world, such situations are handled by would-be recipients simply refusing to receive the funds they are handed. As Kotlikoff, Razin, and Rosenthal (1990) point out, the power to refuse a transfer if it is too big or, indeed, if it is too small as well as the power to refuse to make a transfer is someone else's transfer is too small or too large changes the bargaining game fundamentally. In particular, threat points matter and Ricardian Equivalence no longer holds because when the government redistributes across generations, it alters their threat points.

Conflicts over who loves whom and by how much may also lead parties to withhold information about their economic positions. Kotlikoff and Razin (1988) point out that altruistic parents trying to transfer to children whose abilities and labor efforts are unobservable will condition their transfers on their children's earnings. In this setting, government redistribution between parents and children can modify the self-selection constraints under which parents operate in establishing their earnings-related transfer functions. In this case, the policy will be non neutral.

Feldstein (1988) raised another important theoretical objection to the Barro model, namely that, in the context of uncertainty, Ricardian equivalence will only hold if transfers are operative in all states of nature in which the government's redistribution occurs. Take parents who are altruistic, but whose altruism is not strong enough to lead them to make transfers to their children if their children end up with higher incomes than their own. Then government redistribution from children to parents will generate no private offset in the form of higher bequests or intervivos gifts in those states of nature in which the children would otherwise be better off than the parents. In developed economies in which per capita incomes grow through time, one would expect Feldstein's point to be particularly applicable.

Testing Intergenerational Altruism

As mentioned, the Barro Model of intergenerational altruism predicts that the consumption of altruistically linked individuals is independent of the distribution of resources across those individuals. This implication has been tested in a variety of ways with a variety of data. Boskin and Kotlikoff (1985) took the Barro model as the null hypotheses and used dynamic programming to determine the level of annual consumption that would be demanded by Barro dynasties given earnings and rate of return uncertainty. They estimated their model on postwar U.S. time series data and tested whether the crosscohort distribution of resources matters to aggregate consumption given the level of consumption predicted by the Barro Model. The authors report a very strong dependence of aggregate consumption on the intergenerational distribution of resources.

Abel and Kotlikoff (1994) pointed out that altruistically linked households will automatically share risk and, therefore, experience identical shocks (Euler errors) to their marginal utilities of consumption. They also showed that changes in the average Euler error by cohort would share this property if, as Barro believed, the economy was dominated by intergenerational altruists. Abel and Kotlikoff aggregated by cohort U.S. consumer expenditure data to test for the commonality of Euler errors. Their test strongly rejects intergenerational altruism; cohorts that experience positive income shocks spend, rather than share, their good fortune.

Altonji, Hayashi, and Kotlikoff (1992) and Hayashi, Altonji, and Kotlikoff (1996) use Panel Study of Income Dynamics data on the consumption of extended family members to test whether a) the distribution of consumption of extended family members depends on the distribution of resources among those members and b) whether extended family members share risk – an implication not simply of altruism, but also selfish risk sharing. The data strongly reject both propositions. Another study by the three authors (Altonji, Kotlikoff, and Hayashi 1997) considers the subset of extended PSID families who were actively making transfers among themselves. They showed that taking a dollar from a child and giving it to a parent who is giving the child money results in an increase in transfers to the child of only 13 cents – an amount that is not only small, but also insignificantly different from zero.

Additional compelling evidence against the Barro view is provided by Gokhale, Kotlikoff, and Sabelhaus (1996). This article documents that the dramatic postwar decline in U.S. saving has been the result of an equally dramatic increase in intergenerational transfers to the elderly that have led to an enormous increase in their absolute and relative consumption. Since 1960 the consumption of the elderly, on a per person basis, has roughly doubled relative to that of young adults. A related finding, developed in Auerbach, Gokhale, Kotlikoff, Sabelhaus, and Weil (2001), is the dramatic postwar increase in the annuitization of the resources of the elderly. This increased annuitization has been engineered primarily by the government, which provides the elderly substantial resources in old age in the form of cash and medical benefits that continue until they die, but aren't bequeathable. If Barro were right, and the elderly were altruistic, they would have responded to their being forced to acquire more annuities by purchasing more life insurance. In fact, the life insurance holdings of the elderly have not increased in the postwar period as a share of their remaining lifetime resources. They've declined.

VIII. The Government's Role in Intergenerational Risk Sharing

Samuelson's (1958) classic consumption-loan model pointed out the inherent incompleteness in markets arising from the fact that agents alive at one point in time can't contract with those who will be born well after those agents are deceased. This market failure is manifest primarily in the area of risk sharing. Were they able to contract, agents alive today and those born in the future could form risk-sharing arrangements by buying or selling state-contingent contracts of various kinds. The question raised by these missing markets is whether the government can redistribute across generations to emulate, if not replicate, the risk-sharing arrangements that members of different cohorts would privately conclude.

As shown in Kotlikoff (1993), it's an easy matter to extend the two-period model of Section III to include uncertainty both with respect to the economic environment and government policy. Kotlikoff (1993) considers uncertain technology, specifically the coefficient of total factor productivity, as well as uncertain (i.e., state-contingent) government net payments each period from the young to the old. The role for government intergenerational risk sharing in this model is to transfer resources from the contemporaneous young to the contemporaneous old at time t if the technology at time t is better than at time t-1. The degree of redistribution would also be conditioned on the economy's time-t capital stock.

The fact that government's can pool risks across generations doesn't mean they necessarily do so. Indeed, governments may exacerbate the degree of uncertainty facing generations by randomly distributing among them. As Auerbach and Hassett (1999) point out, this manufacturing of uncertainty may come in the form of simply delaying the decision of who will pay the government's bills. Take, as an example, the current failure of the U.S. government to determine how it will close the very sizeable imbalance in U.S. generational policy. The government can either place a larger fiscal burden on the current elderly, on middle-aged baby boomers, on the current young, or on future generations. The size of the bill is reasonably clear. But in failing to specify immediately which generations will pay what, the U.S. government is generating uncertainty for all generations, where none intrinsically exists.

Can one say whether the government is, on balance, pooling risk across generations? Yes and no.[27] Abel and Kotlikoff (1994) stress that their study tests and strongly rejects intergenerational risk sharing, no matter whether that risk sharing is arising from a) altruistic extended family behavior, b) selfish extended family arrangements, c) the purchase of contracts and securities in private insurance and financial markets, or d) government policy. But Abel and Kotlikoff's study doesn't tell us the precise role, if any, played by the government in frustrating or improving intergenerational risk sharing.

IX. Conclusion

Generational policy – the question of which generation will pay the government's bills -- lies at the heart of most fiscal policy debates. The importance of this issue has stimulated a prodigious amount of theoretical, empirical, and simulation research. This research has delivered some important findings. First, which generation pays the government's bills is, apart from efficiency considerations, a zero-sum game. Second, generational policy works not just by redistributing resources directly across generations, but also by redistributing resources indirectly via policy-induced general equilibrium changes in factor prices. Third, the same generational policy can be conducted under a variety of headings and operate through surprising channels, including asset markets. Fourth, notwithstanding its ubiquitous use, the budget deficit is not a well-defined measure of generational or any other aspect of economic policy. The same is true of taxes and transfer payments as well as their associated constructs, such as disposable

[27] Note that the government may pool risks within generations at the same time it generates risks across generations. Hubbard, Skinner, and Zeldes' (1995) and Eaton and Rosen (1980) are two important studies

income and personal saving. Fifth, generational accounting represents an important, but far from perfect method of assessing generational policy. Sixth, generational policies in non-altruistic economies can effect major redistribution across generations and major changes in the long-run values of key macroeconomic variables. Seventh, generational policies take a fairly long time to effect the economy. Eighth, intergenerational altruism can nullify the impact of generational policy, but the theoretical conditions under which it would arise are highly unlikely to prevail. Ninth, there is a plethora of evidence, at least for the U.S., that intergenerational redistribution, be it across cohorts or between older and younger members of the same extended families, materially raises the well being to those receiving the transfers and materially harms those making the payments. Tenth, at least in the U.S., government policy does not achieve intergenerational risk sharing. Indeed, U.S. government policy may, on balance, be an important, if not the primary source of generational risk. Finally, and most important, a variety of countries around the world are running generational policies that will dramatically reduce the economic well being of their future generations. Achieving generational balance in those countries requires immediate, major, and highly painful policy responses.

of government intragenerational risk sharing.

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Table 1 The Composition of Male U.S. Generational Accounts

(present values in thousands of 1998 dollars)

	Tax Payments					Transfer Receipts			
Age in 1998	**Net Tax Payment**	**Income Taxes**	**Income Taxes**	**Payroll Taxes**	**Excise Taxes**	**OASDI**	**MEDICARE**	**MEDICAID**	**Welfare**
0	249.7	128.3	61.8	107.3	93.4	45.2	24.0	58.1	13.7
5	256.4	136.3	66.0	114.1	97.4	48.0	35.9	58.9	14.6
10	272.3	147.1	71.8	123.1	102.1	51.7	44.2	60.2	15.8
15	291.4	158.4	77.9	132.8	105.9	55.4	50.5	60.6	17.1
20	318.7	171.2	85.4	143.8	107.5	59.0	51.9	59.9	18.3
25	327.3	174.5	91.6	145.7	102.4	61.2	52.5	55.2	17.8
30	313.7	167.8	98.2	138.1	95.9	64.6	55.2	49.9	16.5
35	279.2	153.9	104.5	124.3	89.4	69.4	63.7	45.0	14.9
40	241.4	137.1	110.0	108.9	83.2	76.4	67.4	40.4	13.5
45	194.2	116.1	113.0	91.2	75.5	85.5	67.9	35.9	12.3
50	129.7	93.0	112.4	71.8	65.6	95.6	75.4	31.0	11.1
55	66.2	65.5	108.4	50.4	56.0	108.1	69.7	26.3	10.0
60	-5.8	38.0	100.5	29.1	46.4	123.1	66.1	21.8	9.0
65	-77.5	16.6	89.5	12.7	37.2	138.5	69.3	17.7	8.0
70	-91.0	6.8	76.3	5.1	28.4	129.7	56.2	14.8	7.0
75	-75.1	3.3	61.3	2.4	20.8	106.5	38.2	12.5	5.7
80	-56.3	1.4	46.1	1.2	14.6	85.7	20.2	9.7	4.0
85	-42.4	.5	33.0	.5	10.1	67.0	9.0	8.0	2.6
90	-25.6	.4	28.5	.4	7.9	51.7	3.1	6.0	2.0

Growth-Adjusted Net Tax Payment of Future Generations 361.8

Lifetime Net Tax Rate on Future Generations 32.3 percent
Lifetime Net Tax Rate on Newborns 22.8 percent
Generational Imbalance 41.7 percent

Note: Table assumes a 4 percent real discount rate and 2.2 percent growth rate.

Table 1 (continued)

The Composition of Female U.S. Generational Accounts

(present values in thousands of 1998 dollars)

		Tax Payments				Transfer Receipts			
Age in 1998	**Net Tax Payment**	**Labor Income Taxes**	**Capital Income Taxes**	**Payroll Taxes**	**Excise Taxes**	**OASDI**	**MEDICARE**	**MEDICAID**	**Welfare**
0	109.6	67.8	21.6	64.1	89.0	42.3	24.6	44.0	22.0
5	104.6	72.1	23.0	68.2	92.7	45.0	38.3	44.7	23.4
10	104.6	77.9	25.1	73.7	97.0	48.7	48.8	46.1	25.6
15	105.4	84.1	27.2	79.6	99.9	52.4	57.9	46.9	28.2
20	113.7	91.0	29.8	86.2	100.9	56.4	61.1	46.9	29.9
25	112.3	91.5	31.8	86.4	96.6	58.9	63.7	45.2	26.2
30	95.6	85.1	33.9	79.9	91.2	61.9	68.0	43.2	21.3
35	65.6	75.6	35.9	70.8	85.7	65.7	78.6	41.1	17.0
40	37.9	66.0	37.9	62.0	79.7	71.4	83.7	39.3	13.3
45	7.9	55.4	39.2	52.1	72.7	78.8	84.7	37.6	10.4
50	-37.7	42.2	39.6	39.6	64.4	87.7	94.1	33.5	8.2
55	-73.9	28.3	39.1	26.6	55.2	99.0	87.5	29.8	6.8
60	-115.0	15.6	37.4	14.7	46.0	112.7	84.0	26.2	5.8
65	-157.6	6.6	34.6	6.1	36.9	124.6	89.3	22.6	5.2
70	-155.9	2.5	30.8	2.2	28.7	116.8	78.7	20.0	4.6
75	-131.8	.9	26.3	.9	21.3	100.0	59.6	17.9	3.8
80	-99.2	.3	21.5	.3	15.3	82.1	36.9	14.5	3.1
85	-70.5	.2	16.9	.1	11.1	63.4	20.6	12.5	2.4
90	-44.4	.1	14.1	.1	8.3	47.3	9.0	8.9	1.8
Future Generations	158.8								

Note: Table assumes a 4 percent real discount rate and 2.2 percent growth rate.

Table 2 Alternative Policies to Achieve Generational Balance* in the U.S.

Policy	**Immediate and Permanent Percentage Change in Policy Instrument**	**Equalized Lifetime Net Tax Rate**
Raise All Taxes	12.0	27.5
Raise Fed. Inc. Taxes	31.3	27.3
Cut All Transfers	21.9	26.5
Cut All Govt. Purchases	21.0	22.8
Cut Federal Purchases	66.3	22.8

* Generational imbalance is the percentage difference in lifetime net tax rates of newborns and future generations.

Table 3 Alternative Ways to Achieve Generational Balance in 22 Countries

Country	Cut in government purchases	Cut in government transfers	Increase in all taxes	Increase in income tax
Argentina	29.1	11.0	8.4	75.7
Australia	10.2	9.1	4.8	8.1
Austria	76.4	20.5	18.4	55.6
Belgium	12.4	4.6	3.1	10.0
Brazil	26.2	17.9	11.7	74.0
Canada	0.1	0.1	0.1	0.2
Denmark	29.0	4.5	4.0	6.7
Finland	67.6	21.2	19.4	50.8
Germany	25.9	14.1	9.5	29.5
Ireland	-4.3	-4.4	-2.1	-4.8
Italy	49.1	13.3	10.5	28.2
Japan	29.5	25.3	15.5	53.6
Netherlands	28.7	22.3	8.9	15.6
New Zealand	-1.6	-0.6	-0.4	-0.8
Norway	9.9	8.1	6.3	9.7
Portugal	9.8	7.5	4.2	13.3
Spain	62.2	17.0	14.5	44.9
Sweden	50.5	18.9	15.6	41.9
Thailand	-47.7	-114.2	-25.0	-81.8
France	22.2	9.8	6.9	64.0
United Kingdom	9.7	9.5	2.7	9.5
United States	21.0	21.9	12.0	31.3

na – not available
Source: Kotlikoff and Leibfritz (1999), Raffelheuschen (1998), and Gokhale and Kotlikoff (2000).

Table 3

Structural Tax Reform in the Auerbach-Kotlikoff Model

Year	Capital	Labor	Output	Wage	Interest Rate	Consumption Tax Rate	Saving Rate
1	89.9	19.2	25.7	1.000	.071	.000	.035
2	89.9	19.5	25.9	.997	.072	.064	.054
3	90.4	19.5	25.9	.998	.072	.064	.053
4	90.8	19.5	25.9	1.000	.071	.064	.052
5	91.3	19.4	26.0	1.001	.071	.064	.051
10	91.7	19.4	26.0	1.003	.071	.063	.050
20	95.5	19.3	26.1	1.015	.068	.061	.042
60	97.2	19.2	26.1	1.021	.067	.061	.037
∞	97.3	19.2	26.1	1.021	.067	.061	.037

Source: Fehr and Kotlikoff (1997)

Table 4

Comparing Changes in Generation's Utility and their Generational Accounts
(changes, expressed as percent of remaining lifetime economic resources)

Generation's Year of Birth	Change in Generational Account	Change in Utility
-54	-2.39	-2.41
-50	-2.13	-2.03
-45	-1.64	-1.60
-40	-1.16	-1.22
-35	-0.72	-0.87
-30	-0.36	-0.55
-25	-0.06	-0.26
-20	0.17	-0.01
-15	0.32	0.21
-10	0.40	0.37
-5	0.41	0.49
0	0.37	0.55
5	0.36	0.68
10	0.35	0.80
20	0.34	0.94
50	0.33	1.04
∞	0.33	1.05

Source: Fehr and Kotlikoff (1997)

Table 5

Proportional Consumption-Tax Reform

Impact on Macro Variables

	1996	1997	2010	2145
Aggregates				
National Income Index	1.000	1.044	1.063	1.094
Capital Stock Index	1.000	1.010	1.108	1.254
Labor Supply Index	1.000	1.063	1.054	1.046
Net Saving Rate	0.051	0.073	0.067	0.059
Wage Rates, Interest Rates, and Asset Values				
Before-Tax Wage Index	1.000	0.987	1.013	1.046
After-Tax Wage	0.775	0.817	0.843	0.881
Interest Rate	0.083	0.079	0.076	0.073
Federal Consumption and Payroll Tax Rates				
Consumption Tax Rate[3]	0	0.166	0.160	0.145
Payroll Tax Rate	0.146	0.140	0.140	0.141

Source: Altig, Auerbach, Kotlikoff, Smetters, and Walliser (2001)

Table 6

Welfare Effects of Proportional Consumption-Tax Reform

Lifetime Earnings Class	Cohort Born in Year -54	Cohort Born in Year -30	Cohort Born in Year 0	Cohort Born in Year 30	Cohort Born in Long Run
1	1.01	.97	.94	.95	.96
3	1.00	.99	.98	.99	.99
6	1.00	1.00	1.00	1.01	1.01
9	.99	1.0	1.01	1.02	102
12	.99	1.02	1.03	1.04	1.04

Note: Welfare is measured relative to the no-reform equilibrium. A value, for example, of .97 means that the group in question experiences a welfare change from the reform that is equivalent to their experiencing a 3 percent decline in consumption and leisure at each age under the initial fiscal structure.
Source: Altig, Auerbach, Kotlikoff, Smetters, and Walliser (2001)

Table 7

Privatizing Social Security with Consumption-Tax Transitional Finance

Percentage Change in Macro Variables Relative to Initial Steady State

Year of Transition:	5	10	25	150
Macro Variable				
National Income	.6	1.3	4.9	13.0
Capital Stock	1.8	4.1	12.8	39.0
Labor Supply	.3	.4	2.4	5.5
Before-Tax Wage	.4	0.9	2.4	7.1
Interest Rate	-1.1	-2.7	-6.9	-18.9

Source: Kotlikoff, Smetters, and Walliser (2001)

Table 8

Privatizing Social Security – Percentage Change in Remaining Lifetime Utility for Selected Income Classes by Cohort

Cohort Year of Birth Relative to Initial Steady State

Class	**-54**	**-25**	**-10**	**1**	**10**	**25**	**150**
1	.7	-2.1	-.6	.5	1.3	3.2	6.0
3	-.4	-2.0	.0	1.2	2.1	4.2	7.4
6	-.9	-1.7	.3	1.6	2.6	4.8	8.0
9	-1.2	-1.6	.5	1.7	2.7	4.9	8.1
12	-1.5	-2.5	-1.8	-1.0	-.1	1.7	4.4

Source: Kotlikoff, Smetters, and Walliser (2001)