Will Social Security and Medicare Remain Viable as the U.S. Population is Aging?

Henning Bohn *

Department of Economics

University of California at Santa Barbara

Santa Barbara, CA 93106

Phone: (805)-893-4532

E-mail: bohn@econ.ucsb.edu

Revised, June 1998

* I would like to thank the conference participants and especially Douglas Joines and Charles Plosser for their comments. The usual disclaimer applies.

ABSTRACT

Yes, subject to concerns about Medicare cost and potentially self-confirming skepticism. The U.S. social security system (broadly defined, including Medicare) faces significant financial problems as the result of an aging population. But demographic change is also likely to raise savings, increase wages, and reduce interest rates. Viewed in this context, the fiscal problems of retirement insurance seem overrated. A more serious issue is the rapid growth of Medicare spending. Up to a point, a growing GDP-share of medical spending is an efficient response to an aging population. But Medicare growth might be excessive due to moral hazard problems. Except for this caveat, social security is almost certainly economically viable. To examine the political viability of social security, I focus on intertemporal cost-benefit tradeoffs in a median voter setting. For a variety of assumptions, I find that social security will retain majority support. I also discuss the role of altruism, redistribution, and multi-dimensional voting and find that they provide additional voter support for social security.

Introduction

The U.S. social security system--broadly defined to include Medicare--faces tremendous financial problems as the population is aging.[1] According to Social Security Administration (SSA) projections, the ratio of workers to retirees will fall from 3.9 in 1997 to 2.3 in 2030 (Fig. 1). The cost of retirement benefits (OASI) will rise from 4% of GDP in 1997 to about 5.5% by 2030 (Fig. 2). Medicare cost will grow even faster, from 2.7% to 7.0% of GDP by 2030. Though long run projections are always uncertain, the underlying demographics are firmly in place: The growth rate of the labor force has declined sharply and life-expectancy is rising (Fig. 3 and 4).

Not surprisingly, these alarming projections have created doubts about the system's viability. According to opinion polls, many young Americans do not expect to receive any social security benefits when they are old. Economists have voiced similar concerns. Some have concluded that continuing social security is simply infeasible (CBO 1996); others are mainly thinking about radical reforms, apparently taking the existing system's demise for granted. To anticipate, I find that despite the rising cost, social security remains viable, economically and politically. To the extent caveats are required, the most likely source of trouble is Medicare and not retirement insurance.

The biggest challenge in modeling social security is perhaps the lack of consensus about the basic nature of the system. Does the government have an obligation--moral or otherwise--to take care of the retirees who previously contributed to social security? If so, does this "entitlement" include an open-ended promise to cover all "necessary" medical expenses even when health care cost are rising sharply? Or is social security just a transfer program that Congress could repeal at any time?

Such interpretational questions are especially relevant for social security because the existing laws do not provide a coherent plan for the future. Instead, the law specifies fixed benefits and fixed tax rates (which are almost surely inconsistent in the long run) that are periodically modified to adapt to changing circumstances. The question to what extent benefits and taxes can be adjusted within the system are therefore important for the system's overall viability.

I should emphasize at this point that the paper is not about the normative desirability of marginal, system-saving adjustments versus more fundamental social security reforms or privatization plans, nor primarily about forecasting the future of social security. A negative answer to the viability question would course be relevant for forming expectations and it might increase the momentum for reforms, but a positive answer would not rule out the feasibility of other reforms.

In discussing marginal changes, the interpretation of the promised benefits is a key issue. To those who believe that social security represents an irrevocable obligation, the question of viability is about economic feasibility, about honoring a moral commitment, and not about politics. To discuss the politics of terminating social security might even be viewed as immoral, no less outrageous than a debate about defaulting on Treasury bills. To those who consider social security a transfer program without meaningful intertemporal dimension, questions about viability are entirely about politics, about the odds that social security retains majority support; and any comment about moral obligations might be viewed as unscientific or politically naive.[2]

All sides apparently agree that Congress is legally sovereign and has the ability to modify social security at will.[3] Hence, majority support is a necessary condition for the existence of social security. From this perspective, the politics of social security should be a legitimate topic even if one views social security as a moral commitment.[4] On the other hand, if one views social security as discretionary, an economic analysis of voter behavior cannot ignore that rational voters have to form expectations about the likely voting behavior of others. This creates a potential for multiple equilibria and for public debate--perhaps revolving around moral obligations--to serve as an equilibrium selection mechanism. From this perspective, social security can be given an intertemporal dimension without assuming a moral commitment.[5]

Thus, the viability question is ultimately political. Is social security likely to maintain majority support as the population ages? To obtain robust answers, I will examine several different political-economy models. Purely economic concerns play a role in this context as voters weigh the cost and benefits of social security: How expensive would it be to continue the current system? Is it even feasible? To put the politics in context, I will first examine the allocational implications of an aging population and of rising medical cost. The main points are (a) that aging has basically favorable implications--increasing the savings rate, wages, and the capital-labor ratio--and (b) that an efficient allocation will likely display a growing GDP-share of medical spending.

Thereafter I will examine the politics of social security. Two key issues are altruism and the intertemporal dimension of the social security system. (Comments on other issues, notably the role of differing preference intensity, interest groups, lobbying effort, are in a final section; see Olsen, 1965; Patton, 1978; Wildasin, 1990.)

Altruism is almost too powerful to be interesting: Social security is obviously viable if the young are eager to make transfers to the old. But if social security were based on pure altruism, why should high-income workers receive higher transfers in retirement than low-income workers? The linkage between benefits and prior contributions suggests that intertemporal arguments play a role. Hence, I will focus on intertemporal models of social security and, to make it challenging, abstract from operational altruism.[6]

In any intertemporal model of social security, the main task is to explain why working-age voters can rationally expect future benefits in exchange for their current transfers to retirees. Following Cooley and Soarez (1996, 1997), I interpret the intertemporal linkage as a repeated voting game with trigger strategies. To support social security as a sequential equilibrium, one has to show that for the median-age voter the present value of future benefits exceeds the value of payroll taxes until retirement. In a partial equilibrium setting, I find that the net present value (NPV) of social security is positive for the median voter (about age 45) for a variety of specifications. General equilibrium arguments provide additional support for social security, because a vote against social security would raise the capital-labor ratio and reduce interest rates, making private savings a less attractive alternative to social security. Overall, I find that Cooley and Soarez’ (1997) approach provides substantial evidence in favor of viability, contrary to their own (1996) conclusions.

Throughout the political-economy analysis, the criterion for viability is that social security finds majority support at all times against the alternative of ending social security. To limit the scope of the paper, I do not explicitly examine more elaborate transition paths or reforms that replace social security with some other government-sponsored retirement system. I show, however, that social security gains substantial voter support if partial payments to current retirees would be continued after a no vote. Since the reform plans in the current policy debate largely protect current retirees, the paper suggests that their political prospects are either doubtful or really due to other features (e.g., implicit capital-income tax reform via tax-favored retirement accounts).

The paper is organized as follows. Section 2 reviews the demographic and financial trends. Section 3 examines efficiency issues with particular emphasis on Medicare. Section 4 considers intertemporal models of social security without operational altruism. Section 5 briefly comments on alternative political economy models. Section 6 concludes.

The Demographic Problem

The aging of the U.S. population is driven by two main forces, declining birth rates and increasing life-expectancy. Both of these demographic changes increase the ratio of social security beneficiaries to workers. Their economic effects are somewhat different. At a fixed life-expectancy, declining fertility would reduce the number of workers per retiree, but not the expected time each person spends in retirement. Rising life-expectancy increases the length of retirement and therefore the per-capita cost. The per-capita cost increases are especially severe for Medicare because medical cost are strongly increasing with age.

While the demographic projections until about 2030-40 are relatively clear (the 20-year ahead labor force has already been born) there is considerable uncertainty about further-ahead projections. As is common in the literature, I focus on the SSA's Intermediate Projection as the baseline forecast and use their alternative projections as a suggestive measure of uncertainty.

Figures 3-5 show the SSA's three alternative projections for the growth rate of the labor force, the life expectancy at age 65 (averaged male and female), and the ratio of retirees to contributors. In all cases, the population growth rate is expected to stabilize once the baby boom has passed through, but at different levels depending on the projection. Life expectancy, in contrast, is rising persistently but slowly. Combining the two trends, the ratio of retirees to contributors will increase sharply between 2010 and 2030 as the baby boom retires. The path beyond 2030 is more uncertain, but the growth seems to slow down considerably, except in the most pessimistic alternative.

The financial implications are best examined separately for the different components of the social security system. Fig.6 shows the projected rise in the cost of retirement (OASI) benefits as share of GDP. Since the cost rises while revenues/GDP are constant or slightly declining, the OASI program faces a funding shortfall after about 2014, as shown in Fig.7. In the baseline case, funding gap grows quickly until about 2030 and then stabilizes at about 30% of benefits or 1.4% of GDP.[7] The alternative projections show a similar path until about 2030 (with level differences largely due to different business cycle assumptions in the very short run), but then diverge. Except in the most pessimistic case, the funding gap stops rising after about 2030, consistent with the demographic trends.

In terms of economic feasibility, a funding gap of about 1.5% of GDP for 2030-2070 (intermediate case) is a serious shortfall. But since we have more than 30 years advance warning, it does not seem an insurmountable problem, if one really wants to find a solution. Beyond 2030, the cost increases are largely due to slow growth in life-expectancy. This suggests that an indexation of retirement age to life-expectancy might be sufficient to stabilize the OASI cost rate permanently, provided the shortfall of 2030 is somehow covered.

The projections for Medicare look much more troubling in comparison. Fig.8 shows the projected outlays and revenues of the HI fund (Medicare Part A). Revenues are grossly insufficient even in the most optimistic scenario. In the baseline case, the benefit cost as fraction of GDP will more double by 2030. The cost will exceed revenues by a ratio of more than 3:1. The overall cost of Medicare (HI+SMI; see Fig. 2) will exceed the OASI cost by 2010. By 2070, HI alone is almost as costly as OASI, and its share of GDP keeps increasing. Since OASI and Medicare are subject to similar demographic pressures, the relative growth of Medicare must be attributed to increased per-capita medical spending (see CBO 1998a). These data suggests that studies of intergenerational redistribution should pay at least as much attention to Medicare as to retirement insurance.

These trends raise a number of questions. First, what are the economic consequences if the growing cost of social security is financed through rising taxes on the young? Second, is it politically viable to continue social security? If voters care about cost-benefit tradeoffs, the answer will depend on the economic consequences, but it is ultimately a question about politics.

The next section will address the economic questions, leaving politics to Sections 4-5. Throughout, the analysis builds on an overlapping generations (OG) framework. For pure economics, I use the standard two-period OG model. For politics in partial equilibrium, I use a “many-period” version to examine in more detail how social security affects agents over their life cycles. And for policy analysis in general equilibrium, I use a three period OG model to highlight the median voter role of the middle-age. The common structure is that individuals work and consume for a number of periods and then retire. Individual lifetimes are stochastic, but to maintain tractability, aggregate variables will be deterministic.

Efficient Responses to Demographic Change

This section examines some basic economic questions about demographic change: What are the macroeconomic effects of lower population growth and higher life expectancy? How are they modified in the presence of social security? And how should we interpret the rising GDP-share of Medicare? The answers may surprise those who see demographic change as a huge problem: Lower population growth and rise life-expectancy will raise wages and reduce interest rates even if rising taxes crowd out capital. A growing GDP-share of medical spending is an efficient response to these demographic changes. And after one generation, welfare is unambiguously improved.

Demographic Change without Government

For the basic analysis, consider a standard Diamond (1965) two-period OG model.[8] Generation t consists of N_t members who consume and work (earning w_t) in period t and retire in period t+1. Individuals survive into retirement with probability μ_{t+1}, which is also the aggregate fraction of survivors (deterministic). Individuals have utility

$$U_t = u(c^1_t) + \rho\ \mu_{t+1}\, u(c^2_{t+1}) \qquad (1)$$

where c^1_t and c^2_{t+1} are the first and second period consumption and ρ is the discount factor; u( ) is increasing, concave, and (to obtain a steady state) homothetic.

With stochastic survival, the availability of annuities is important for savings decisions. If fair annuities are available, a market interest rate r_{t+1} would translate into return on savings conditional on survival of $(1+r_{t+1})/\mu_{t+1}$. Empirically, private annuity markets are highly imperfect (CBO 1998b). But since imperfect private annuities would favor social security, I will nonetheless assume fair annuities in some of the analysis below, to be conservative. To model annuities in general, let the survival-contingent return on assets a_t be $(1+r_{t+1})/\mu_{t+1}{}^{1-\lambda}$, where $\lambda \geq 0$ is the "charge" on annuities ($\lambda=0 \Leftrightarrow$ fair annuities, $\lambda=1 \Leftrightarrow$ no annuities).

The budget equations are then $c^1_t = w_t - a_t$ and $c^2_{t+1} = (1+r_{t+1})/\mu_{t+1}{}^{1-\lambda}\, a_t$. Combined with the first order condition $u'(c^1_t) = \rho\ \mu_{t+1}\, u'(c^2_{t+1})\,(1+r_{t+1})/\mu_{t+1}{}^{1-\lambda} = \rho\, u'(c^2_{t+1})\,(1+r_{t+1})\ \mu_{t+1}{}^{\lambda}$, they imply a savings function $a_t = s(1+r_{t+1},\mu_{t+1})\, w_t$. The savings rate s( ) is unambiguously increasing in μ_{t+1}, i.e., individuals save more when the life-expectancy rises.

To close the model, suppose output is produced with a Cobb-Douglas technology with capital share α, full depreciation between (generational) periods, and exogenous productivity growth g:

$$Y_t = K_t^{\alpha} (A_t N_t)^{1-\alpha}, \text{ where } A_t=(1+g)^t \text{ and } N_t=N_{t-1}(1+n_t). \qquad (2)$$

Then the capital-labor ratio $k_t = K_t/(A_t L_t)$ determines the interest rate $1+r_t = \alpha k_t^{\alpha-1}$, the wage $w_t = (1-\alpha) A_t k_t^{\alpha}$, and all other relevant variables; its dynamics are characterized by

$$k_t = \frac{1-\alpha}{(1+n_t)(1+g)} \; s(\alpha k_t^{\alpha-1}, \mu_t) \; k_{t-1}^{\alpha}. \qquad (3)$$

As in Diamond (1965), one has to assume a positive or “not too negative” interest elasticity of savings to ensure uniqueness, dynamic stability, and monotone convergence. Under this assumption, equation (3) shows that any reduction in the population growth n_t and any increase in the survival rate μ_t will raise the capital-labor ratio, hence raise wages and lower interest rates.

What about welfare? While higher wages are clearly a plus, lower interest rates are negative for savers. A decline in n_t is definitely welfare-reducing for generation t-1 because it reduces r_t without changing w_{t-1}. This is the U.S. baby boomers problem.

A rise in μ_t will also reduce c^2_t, but assuming people like to live, their utility should nonetheless rise. For all future generations t+i (i≥1), a lower n_t and/or a higher μ_t and are unambiguously positive: One can show that their utility increases, provided the economy is dynamically efficient and the model displays monotone convergence ($0<dk_{t+1}/dk_t<1$).[9] It is also true that a permanent reduction in population growth and/or a permanent increase in μ_t will increase the utility in steady state.

Overall, I conclude that (a) the demographic changes observed in the U.S. are basically good news for future generations; and (b), lower population growth reduces the welfare of the "last" cohort prior to the decline--the baby boomers.

Government Debt and Social Security

How does government activity modify the above conclusions? From a positive perspective, social security and government debt are likely to dampen the macroeconomic effects of demographic change, because the existing national debt and social security obligations will impose a lighter (heavier) per-capita burden on larger (smaller) cohorts. From a normative perspective, Smith (1982) has argued that a defined-benefits social security system therefore provides a valuable insurance against demographic changes.

To examine the positive role of government, suppose there is a social security system with payroll tax θ_t and benefit rate b_t and a fiscal authority that imposes net taxes τ^1_t and τ^2_t on young and old (both expressed as wage-shares) to service a debt D_t and/or to make transfers (most likely from young to old). Real government spending is ignored to avoid being sidetracked into public finance issues. A constant spending-GDP share could be added easily, but variable spending would raise distracting tax-smoothing and distributional issues.

An accounting for the regular budget is essential here, because social security, debt, and direct transfers are close substitutes for purposes of intergenerational redistribution (Auerbach et al. 1991). To examine the effect of demographic change on social security, one has to be explicit about how the same changes affect the regular budget. (For the same reason, it is difficult to examine OASI without studying

Medicare.) For the U.S., the regular budget is also practically important because the social security trust fund holds Treasury securities. If they are--as planned--redeemed between 2015-2030, who pays?

In general, let gross debt D_t and the trust fund TR_t denote start-of-period quantities. Then the regular and the social security budget equations are

$$D_t = D_{t+1}/(1+r_{t+1}) + N_t\, \tau^1_t\, w_t + N_{t-1}\, \mu_t\, \tau^2_t\, w_t, \text{ and} \tag{4}$$

$$N_{t-1}\, \mu_t\, b_t\, w_t + TR_{t+1}/(1+r_{t+1}) - TR_t = N_t\, \theta_t\, w_t. \tag{5}$$

Initial debt is financed by taxes and new debt. Social security benefits and trust fund accumulations are financed by payroll taxes.

Individual consumption levels $c^1_t = w_t(1-\theta_t-\tau^1_t)-a_t$ and $c^2_{t+1} = (b_{t+1}-\tau^2_{t+1})\, w_{t+1} + (1+r_{t+1})/\mu_{t+1}^{1-\lambda}\, a_t$ depend on taxes and social security only through total taxes $\theta_t+\tau^1_t$ and net benefits $b_{t+1}-\tau^2_{t+1}$. Hence, individual behavior depends only on the unified government budget equation

$$(D_{t+1}-TR_{t+1})/(1+r_{t+1}) + N_t(\tau^1_t+\theta_t)\, w_t = (D_t-TR_t) + N_{t-1}\, \mu_t\, (b_t-\tau^2_t)\, w_t \tag{6}$$

and not on its components. This shows that the net (or publicly held) debt D_t-TR_t is the only essential debt variable. Capital market equilibrium requires $N_t\, a_t = K_{t+1} + (D_{t+1}-TR_{t+1})/(1+r_{t+1})$, i.e., also involves net debt. According to equations (4-6), trust fund redemptions must either be financed by taxes on the old τ^2_t, or by taxes on the young τ^1_t, or they raise the net debt $D_{t+1}-TR_{t+1}$, imposing a burden on future generations.

A tax on the old would obviously alleviate the burden of debt and social security. But such taxes are likely limited in practice and they are theoretically uninteresting. (Debt and social security are irrelevant in general if the government can simply tax its creditors; see Bohn 1992.) Here, the most relevant element of τ^2_t is the general funds subsidy to Medicare Part B (SMI). To model it explicitly, let $\tau^2_t=-m^{SMI}_t<0$ be the Medicare subsidy as a share of wages. Similarly, let $b_t = \beta_t + m^{HI}_t$, the benefits financed through payroll taxes, be the sum of retirement benefits β_t and Hospital Insurance (Medicare A) m^{HI}_t.

In the OG model, the macroeconomic effects of alternative policies depend critically on their impact on savings and capital accumulation. The case of log-utility, $u(c)=\ln(c)$, is most instructive here because it yields easily interpretable formulas. Specifically, one finds

$$k_t = \frac{1-\alpha}{(1+n_t)(1+g)} \frac{\rho \mu_t}{1+\rho \mu_t+(1-\alpha)/\alpha\, d^{++}_t} [1-d^+_{t-1}]\, k_{t-1}^{\alpha}, \qquad (7)$$

where $d^+_t = \frac{(D_t-TR_t)}{Y_t(1-\alpha)} + \frac{\mu_t}{1+n_t}(b_t-\tau^2_t)$ and $d^{++}_t = d^+_t + (b_t-\tau^2_t)(1-\mu_t^{\lambda})\frac{\mu_t^{1-\lambda}}{1+n_t}$

are summary measures of intergenerational redistribution. The variable d^+_t, a sum of explicit debt, social security claims, and net transfers to the old scaled by total wages, can be interpreted as a generational account (Auerbach et al. 1991). With perfect annuity markets, all means of intergenerational redistribution are equivalent and d^+_t is the only relevant policy variable $(\lambda=0 \quad \mu_t^{\lambda}=1 \quad d^+_t=d^{++}_t)$. With imperfect annuities, the survival-contingent social security benefits $b_t-\tau^2_t = \beta_t+m^{HI}_t+m^{SMI}_t$ have a separate impact ($d^+_t \neq d^{++}_t$ if $\mu_t^{\lambda} \neq 1$).

Equation (7) provides answers about the impact of alternative policies. If d^+_t and d^{++}_t are held constant, lower population growth and higher survival rates will raise the capital-labor ratio, reduce interest rates, and raise wages, as in the model without government.[10]

At a constant debt-GDP ratio, holding d^+_t constant is equivalent to keeping tax rates constant. Social security is, however, a defined-benefits system. With constant benefits, d^+_t and d^{++}_t will increases as

μ_t rises and/or n_t falls (unless the debt-GDP ratio happens to decline). This implies a crowding-out effect that raises interest rates and reduces wages. But unless the fixed benefits are huge, the net effect of the demographic changes is still to reduce interest rates and to raise wages, just somewhat less than without a defined-benefits social security system.[11]

Thus, I conclude that <u>a defined-benefit social security system dampens the macroeconomic effects of demographic change</u>, without realistically overturning them. Hence, one should not be overly concerned about the economic viability of U.S. social security as a defined-benefits system.

There is one significant caveat, however, which relates to Medicare. Current SSA (1997) and CBO (1998a) projections imply growing per-capita medical benefits $m^{HI}_t+m^{SMI}_t$. This would independently increase d^+_t and therefore reduce the capital labor-ratio, depress wages, and raise interest rates. This motivates the next section, which will take a closer look at Medicare. An possibly offsetting factor is the scheduled increase in the OASI retirement age, which effectively amount to a decline in the replacement rate β_t, i.e., a reduction in d^+_t.

Another caveat concerns distortionary taxation. At fixed benefits, tax rates would rise as μ_t rises and n_t falls, perhaps triggering increased tax-avoidance. Feasibility may become an issue as one approaches the peak of the Laffer curve. This is a valid concern in theory, but I consider it a remote possibility for the U.S., since the total U.S. tax burden is well below that of many other countries (Hansson and Stuart, 1998). Hence, I do not attempt to model tax distortions or the Laffer curve.

The Rising Cost of Medical Care

Medical cost are worth modeling separately, because they are the fastest growing component of social security and because health insurance raises separate efficiency issues. Does Medicare create viability problems?

For the analysis, I reinterpret old-age consumption in the two-period OG model as a CES-composite of health care consumption h_{t+1} and "regular" consumption c^*_{t+1},

$$c^2_{t+1} = [c^*_{t+1}{}^{\varepsilon} + \eta_{t+1}{}^{1-\varepsilon} h_{t+1}{}^{\varepsilon}]^{1/\varepsilon}, \tag{8}$$

where $1/(1-\varepsilon)$ is the elasticity of substitution and η_{t+1} parametrizes the weight of medical care in utility. Empirically, medical spending is strongly correlated with age, suggesting that η_{t+1} will increase over time as μ_{t+1} rises. Working-age medical cost are omitted because they do not affect social security (ignoring disability).

Retiree medical care is funded by three sources, payroll taxes covering Medicare hospital insurance, a Medicare SMI subsidy from general taxes (about 75% of SMI cost), and the retirees themselves. Let p_t be the exogenous relative price of medical services, let h^{HI}_t and h^{SMI}_t be the real medical services provided by HI and tax-funded SMI, and let $h^*_t = h_t - h^{HI}_t - h^{SMI}_t$ be the privately-funded medical services. The Medicare A-B cost as shares of the wage are then $m^{HI}_t = p_t\, h^{HI}_t/w_t$ and $m^{SMI}_t = p_t\, h^{SMI}_t/w_t$. The individual budget constraints are

$$c^1_t = w_t\,(1-\theta_t-\tau^1_t) - a_t \tag{9}$$

and

$$c^*_{t+1} + p_{t+1}\, h^*_{t+1} = \beta_{t+1}\, w_{t+1} + (1+r_{t+1})/\mu_{t+1}\, a_t. \tag{10}$$

To simplify, I assume log-utility over c^1_t and c^2_{t+1}, and--as an efficiency benchmark--perfect annuities. Then the first order conditions for h^*_{t+1} and a_t are

$$h_{t+1}/c^*_{t+1} = \eta_{t+1}\, p_{t+1}{}^{-1/(1-\varepsilon)} \tag{11}$$

and $1/c^1_t = \rho\, c^*_{t+1}{}^{\varepsilon-1}/c^2_{t+1}{}^{\varepsilon}\,(1+r_{t+1})$, which can be simplified to

$$c^*_{t+1} = \frac{\rho\,(1+r_{t+1})}{1+\eta_{t+1}\,p_{t+1}{}^{-\varepsilon/(1-\varepsilon)}}\;\; c^1_t. \qquad (12)$$

It is a non-trivial exercise to translate the policy debate about the “cost explosion” in Medicare into a preference-technology framework. While it seems undisputed that demand (η_t) is rising rapidly as result of new treatment options, the role of price changes is more obscure. Some argue that rising relative prices (p_t) combined with a low elasticity of substitution contribute to the observed growth in medical spending (Cutler 1997). But it is difficult to believe that rapid technical progress would not lead to declining relative prices if one properly adjusts for quality improvements. In any case, it seems clear that the relevant composite of demand and price $\eta_{\,t+1} \equiv \eta_{t+1}\, p_{t+1}{}^{-\varepsilon/(1-\varepsilon)}$ that determines the spending share of medical services ($p_{t+1}\, h_{t+1}/c^*_{t+1}$) is rising.

And that is the main point: <u>An efficient response to a rising life-expectancy and improvements in medical technology will likely include a growing consumption-share of medical spending</u>. Like increases in μ_{t+1} in the previous section, any rise in $\eta_{\,t+1}$ (due to η- or p-changes) will increase individual savings, the capital-labor ratio, and wages, and reduce interest rates.

For government finance, the key issue is then the efficiency of actual Medicare spending. Most optimistically, one may assume that Medicare pays for an efficient level of services, avoiding moral hazard and other distortions. Suppose further that hospital services are an approximately constant fraction of total medical needs (an explicit model with several medical goods would be too elaborate here), so that the services covered by Medicare Part A (HI) grow at the same rate as total needs. The per-beneficiary cost $m^{HI}{}_t = \sigma^{HI} p_t h_t/w_t = \sigma^{HI} \eta^*_t c^*{}_t/w_t$ is then an increasing function of $\eta^*{}_t$, i.e., rising over time and requiring a rising payroll tax rate. If SMI (Part B) similarly covers a constant share of the non-hospital cost, $m^{SMI}{}_t = \sigma^{SMI} \eta^*_t c^*{}_t/w_t$ will also rise over time. Unless other components of $d^+{}_t$ move in the opposite direction, the rising Medicare cost will put downward pressure on the capital-labor ratio. The net impact on k_t is still ambiguous, however, because individuals will save more if they anticipate increased out-of-pocket spending $h^*{}_t$, and because some of the increased medical demand $\eta^*{}_t$ may be due to higher life-expectancy.[12]

To summarize, it is worth noting for the political economy analysis that growing Medicare spending is not a sign of increasing inefficiency. Along an efficient path, such growth will certainly not endanger the economic viability of social security. (Optimal choices are obviously feasible, if the constraint set is defined correctly.)

The real problem is therefore that Medicare spending might be seriously inefficient. Indeed, much of the Medicare policy debate seem to be about moral hazard--the incentives of insured patients to overuse medical services (see Cutler 1997). A failure to address moral hazard problems <u>could</u> raise feasibility issues. It could also seriously harm the political viability of social security by adversely affecting voters cost-benefit calculations.

To illustrate the potentially drastic implications of moral hazard, suppose there are two states of nature for individuals' health care needs, H and L (high/low), parametrized by $\eta_t(H)>\eta_t(L)$. Individuals are in state H with probability π, which is also the fraction of old in state H. If the state is observable, an efficient contract would provide full insurance for state-contingent services $h_t(s)/c^*_t = \eta_t(s)\, p_t^{-1/(1-\varepsilon)}$ at an actuarially fair cost rate $\pi\, m_t(H)+(1-\pi)\, m_t(L)$. The state-dependence of individual needs would average out and be inessential for aggregate Medicare cost.

Suppose, however, that individual health care needs are private information. Patients will always claim state H if fully insured. Then an efficient insurance system must impose a copayment in state H sufficient to induce revelation (or promise a side-payment in state L). The problem with Medicare may be that it is too rigid (too politicized) to impose efficient copayments. This is a realistic concern, because Medicare is struggling even to protect existing copayments from being evaded by “medigap” insurance (Frech 1998). Since health insurance is unlikely to be perfectly efficient, one should note, however, that a fixed, truly unavoidable inefficiency would not affect the growth trends at issue here, nor would it affect voters valuation of Medicare relative to private insurance. Hence, the most dangerous scenario for Medicare is likely one where the difference between $\eta_t(H)$ and $\eta_t(L)$ is growing over time. (Unfortunately, innovations in medical technology may well have this property.) Then the revelation mechanism needs strengthening (and private insurance companies would presumably revise their contracts accordingly), and rigidity becomes a problem.

Perhaps worse, the political economy of social security is likely to <u>require</u> some “rigidity”--called precommitment. Hence, a discretionary intervention to resolve a moral hazard problem may actually undermine the system’s political viability.

If one interprets Medicare as a system that must pay a share $\sigma^{HI}+\sigma^{SMI}$ of all cost and if revelation-inducing copayments cannot be enforced, Medicare cost will jump from the efficient level $(\sigma^{HI}+\sigma^{SMI})[\pi\, m_t(H)+(1-\pi)\, m_t(L)]$ to $(\sigma^{HI}+\sigma^{SMI})\, m_t(H)$. If $h_t(L)\approx 0$ and $\pi<<1$, the cost will jump by a factor $1/\pi$, possibly a huge amount that might endanger the system's economic viability. Even if overuse is less rampant, the cost-benefit tradeoff to voters will deteriorate as beneficiaries end up using medical services when they have low marginal utility (in state L).

The other policy option, if revelation cannot be induced, is for Medicare to provide only $h_t(L)$ in all states of nature. This would prevent overuse, but it would also reduce the insurance benefits of the system and again provide a less attractive cost-benefit tradeoff to voters. Restricting benefits may also cause political-economy problems if voters view "unfair" restrictions as a breach of an intergenerational commitment--a signal that social security cannot be trusted (see below).

Overall, Medicare policy raises significant allocational issues that may interfere with the politics of social security. Even in the optimistic scenario of efficient spending, Medicare cost as share of wages are likely to rise and to create distributional conflict within a PAYG system. An inefficient management of the system's insurance features would make these conflicts worse. Medicare has, however, an important advantage over private insurance in that its mandatory nature avoids adverse selection.

In the political economy analysis below, my benchmark calculations will simply assume that Medicare outlays are valued by the beneficiaries at cost, to avoid a repetition of the same arguments (but an "inefficiency discount" is applied in the sensitivity testing).

The Political Economy of Social Security

From the perspective of voting theory, the existence of social security is a mystery. Since retirees are a minority, standard median voter arguments imply that workers should not let themselves be taxed for the benefit of the retirees. To rationalize social security in a democracy, the key task is to explain why a substantial fraction of workers vote in favor of social security.

The literature has provided several explanations. The most prominent ones are based on intertemporal considerations and altruism. Intertemporal models build on the fact that individual social security benefits are linked to past contributions. Hence, workers may be induced to vote in favor, if they expect future benefits that outweigh the current payroll tax. This argument is consistent with the political rhetoric surrounding social security, but it is logically tricky. If there is a sequence of votes, each about whether or not to pay a transfer to current retirees, it is not obvious why current voters should care about past voting outcomes. By the same logic, current workers should not expect future voters to compensate them for their current support of social security. The centerpiece of virtually all intertemporal models of social security is therefore an expectational linkage between current and future voting outcomes.

I will examine models of this kind below. The focus will be on pure age-dependent voting. This is not to deny other considerations, but to see if intertemporal arguments alone can provide majority support for social security. (They can.) In Section 5, I will comment on altruism, heterogeneity, and non-median voter models to show that they further strengthen the case for viability.

While early intertemporal models such as Browning (1975) and Boadway and Wildasin (1989a,b) simply assume static expectations, recent models have used an explicitly game-theoretic reasoning that imposes sequential rationality--notably, Cooley and Soarez (1996, 1997).[13] The task is to show that an equilibrium with social security is a sequential equilibrium in an infinitely repeated voting game. The critical support mechanism is provided by trigger strategies. The failure of any cohort to adhere to the proposed equilibrium triggers a negative change in voters' expectations about future benefits that destroys social security. Since survival and collapse are discrete alternatives, trigger strategy models provide a natural definition of what is meant by social security being viable.[14]

Since the U.S. social security system is a defined-benefit system, I will assume throughout this section that a collapse would be triggered by a failure to pay promised benefits to old. The main steps in determining the viability of the system are then

(a) to sort voters by age, to determine the age of the median voter; and

(b) to determine if the median-age voter would keep social security under the working assumption that the system is viable in the future.

If these two conditions are satisfied now and in the future, there is sequential equilibrium with a majority for social security.

How Old Is the Median Voter?

Without altruism, voters decide about social security by comparing the present value of benefits to the present value of their own current and future contributions. Retirees are obviously in favor. Workers will be increasingly in favor as they approach retirement age. To obtain a majority for social security, benefits must be high enough for the median-age voter that they outweigh the remaining contributions. To determine the relevant present values, the first question is: How old is the U.S. median voter?

Figure 9 shows the U.S. age distribution for 1996, and the steady-state age distributions for 0.0% and 0.5% population growth. The comparison highlights the baby boom phenomenon. As of 1996, the median age of the U.S. voting-age population was 42 years. This estimate might be too low, however, because voter registration and actual voter participation are strongly correlated with age. Table 1 shows the raw population shares of different age groups and the shares of voters that were (a) registered to vote and (b) actually voted in recent elections. If one assumes that voting participation within age-groups is constant, the median age of actual voters is in the 45-48 range. These numbers should be interpreted cautiously, however, because the young might start to vote more in the future if social security becomes more expensive.

Table 2 illustrates how the age of the median voter will rise over time as the U.S. population ages and the baby boom passes through retirement. Two estimates are provided for each year, one based on population size and one corrected for age-dependent participation rates. The raw median is more conservative because it does not rely on the empirical correlation of age and voter participation. But the corrected number is more accurate if voter participation remains unchanged.

As the baby boomers age, the median age rise from 42 to 48. Age 48 is also the median of the 0%-growth steady-state distribution in Figure 9. If U.S. population growth is near zero in the long-run, as projected by the SSA beyond 2030, this limiting distribution provides a conservative estimate of the post-baby boom median age (conservative, because life-expectancy is likely to increase). At historical participation rates, the age of the median actual voter rises from 45 to 52. Overall, the median-age of U.S. voters is currently around 45 (with age-dependent participation) and likely rising to around 50 by 2030.

Voting in Partial Equilibrium

This section examines how the net present value of social security varies with voters age and over time, assuming voters take interest rates and wages as given. As noted by Cooley and Soarez (1997) and explained below, this is likely to underestimate the voter support for social security. A partial equilibrium analysis is nonetheless instructive because it allows a more detailed modeling of the life-cycle than a more parsimonious general equilibrium model. In addition, the partial equilibrium analysis provides a useful perspective on how voters should evaluate social security in an open economy (a conservative perspective, if the economy is “large”).

The setting is a “many-period” OG model with stochastic survival. Cohort t enters the workforce at time t and consists of N_t members. Age is indexed by $i=1,...,I_{max}$ (with upper bound I_{max}). The unconditional survival probability to age i is $\mu_{t,i}$. Over time, the size of cohorts grows at the rate $n_t = N_t/N_{t-1}-1$. One may interpret this setting as a time-disaggregated version of the OG model of Section 3. The retirement age $I_{ret}<I_{max}$ is assumed exogenous.[15] To focus on intertemporal issues, I abstract from within-cohort heterogeneity. In any period, all workers of the same cohort earn the same wage and all retirees of the same cohort obtain the same benefits.[16]

Generally, the net present value of social security is computed by discounting some benefits $b^*_{t,i}$ and taxes $\theta^*_{t,i}$ (to be specified below). Let $P^i_{t,j}$ be the set of discount factors for j-period-ahead survival-contingent claims at time t and age i. Then the present value of benefits at retirement is

$$NPV^*_{t,Iret} = \sum_{j=1}^{I_{max}I_{ret}} P^{Iret}_{t,t+j}\, b^*_{t+j}\, w_{t+j} > 0. \qquad (13)$$

For individuals of age $i<I_{ret}$, the net present value of benefits is

$$NPV^*_{t,i} = P^i_{t,Iret-i}\, NPV^*_{t+Iret-i,Iret} - \sum_{j=i}^{I_{ret}-1} P^i_{t,j-i}\, \theta^*_{t+j-i}\, e_j\, w_{t+j-i}. \qquad (14)$$

where e_j are the relative earnings of an age-j worker. Since the years between median-age and retirement are empirically years with relatively high earnings, age-earnings variations are a likely negative for social security and should not be omitted.

Going backwards a year, benefits are discounted and a year of contributions is deducted. Hence, the net present value series satisfy the backwards recursion

$$NPV^*_{t,i} = P^i_{t,1}\, NPV^*_{t+1,i+1} - \theta^*_t\, e_i\, w_t \qquad (15)$$

for all ages $i<I_{ret}$. If $NPV^*_{t+1,i+1}<0$ for any i, then $NPV^*_{t,i}<0$. Hence, there is either a unique age i^* at which a worker becomes net beneficiary ($NPV^*_{t-1,i^*-1}<0$ and $NPV^*_{t,i^*}>0$) or workers anticipate net benefits as they enter the labor force. (If the latter were true for all cohorts, social security would be beneficial in the Pareto sense, an unlikely scenario for the U.S.)

What are the relevant taxes and benefits? Overall, social security imposes payroll taxes for OASI, DI, and HI (at rates θ_t^{OASI}, θ_t^{DI}, θ_t^{HI}, including the employer share) to pay for retirement benefits $\beta_{t,i}$ and for Medicare HI benefits $m^{HI}_{t,i}$ to individuals of age $i \geq I_{ret}$, and for disability benefits to ages $i < I_{ret}$. If voters view the entire system as a unit, they will weigh the sum of taxes against the sum of benefits.[17] If not, each component must prove its own viability. Since the latter is a more stringent requirement, I will examine OASI and HI separately. Disability insurance is excluded from most calculations (except for robustness checks) because taxes and benefits involve the same working-age cohorts.

Social security benefits vary over time and over age-groups. Retirement benefits are indexed to aggregate wages at retirement (actually, age 60) and inflation-indexed thereafter. If real wages are growing, the replacement rate in terms of current wages is declining over time, $\beta_{t+i,i} = \beta_{t+Iret,Iret}\, w_{t+Iret}/w_{t+i}$. From 2002 to 2027, the regular retirement age is scheduled to increase from 65 to 67. I capture this by varying I_{ret} over time, which leaves $\beta_{t+Iret,Iret}$ roughly constant; at any given retirement age, the replacement rate would fall over time. The value of medical benefits is, in contrast, rising with age and likely rising over time. To examine the viability of Medicare, the NPV of HI benefits is weighted against the NPV of HI contributions.

It is not obvious how individuals value survivors benefits. To systematically abstract from altruism, one has to disregard such benefits, even though this is probably unrealistic.[18] To be conservative, I will indeed exclude survivor benefits from the benchmark calculations and weigh the total OASI contributions against the “OAI” benefits paid to workers and their families during the worker’s lifetime.

As discussed above, current payroll tax rates are insufficient to finance the rising cost of promised benefits. To determine if the existing defined-benefit system is viable, my benchmark assumption is that future payroll taxes will be increased to match the projected cost whenever the cost rate exceed the current contribution rate (in 2014 for OASI, immediately for HI), without relying on trust fund sales.[19] Throughout, taxes on benefits are treated as benefit reductions and not as revenues; this is economically appropriate but differs from SSA accounting.

A final issue is the choice of discount rates. This is important because a high discount rate will inevitably depress the NPV of future benefits. The SSA Intermediate Projection assumes a 2.7% real interest rate. To be conservative, I will use a higher 3.7% real rate as benchmark and even higher rates in the sensitivity analysis.[20]

With these assumption, what is the critical age i^* for the U.S. social security system. And how is it likely to change as the U.S. population ages?

Table 3 shows the critical ages for different voting dates in a set of benchmark calculations. The economic and demographic assumption are taken from the SSA Intermediate Projection. To be conservative, I further assume a zero value of survivor benefits, an average income, retirement at the normal retirement age (except in the final row), and no explicit correction for incomplete annuities. Table 3 shows that the critical ages for OASI and HI are rising over time as the baby boom generation retires, but they remain well below the median ages (shown in Table 2). Currently, critical age is below 40. Even if one charges the DI cost to retirement insurance and assumes a zero value of benefits, the critical ages stay below the median (see the OASDI column). Since all columns show values below the median age, the NPVs are also positive if one treated old-age retirement, HI, and/or DI as a unit.[21]

Tables 4-5 provide a sensitivity analysis. Table 4 shows critical ages for the SSA's High Cost and Low Cost projections and for a scenario with fixed tax rates and pro-rated benefits. Interestingly, the High Cost scenario yields more near-term voter support for social security than the Intermediate or (even less) the Low Cost scenario. Intuitively, rising benefits increase the ratio future benefits to current payments, provided the system remains viable. This applies especially to Medicare as health care cost rise, and it applies to OASI as the baby boom passes through. The ranking of voter support reverses after 2030, when taxes and benefits stabilize under most projections. Because expansion helps, the constant-tax calculations serve as an instructive "worst case" scenario: For OASI, the critical ages are higher than under the other assumptions, but remain below the median age, suggesting that the "expansionist" logic is not a major factor, except perhaps for the 1997-2020 period. (In some cases, the critical age equals the median age. But since critical age is defined such that net benefits are positive at the start of the year, these cases satisfy the viability condition.)

For HI, fixed tax rates imply sharp cuts in benefits that drive the critical ages above the median age for 1997-2020, confirming that Medicare is more troubled than retirement insurance. But even in this rather extreme scenario (HI benefits are reduced by 16% in 1997, 24% in 2000, and 65% by 2030, and survivor benefits are ignored) the critical ages for OASI+HI (not shown) remain below the respective participation-adjusted median age values of Table 2 and no more than a year above the raw medians.

Table 5 examines specification issues. To save space, this is done only for 2030, the peak of the baby boom retirement. To start, note that the calculations are robust against a substantial number of changes. Social security looks better if workers value the survivors component (line 1) or if one includes an explicit surcharge λ=0.25 on private annuities (line 2). It looks worse, if Medicare is inefficient (line 3), if one considers a high-income worker (line 4) or if voters are males with lower survival rates (line 5). But all these changes are minor in comparison to the next two.

The first critical issue is whether a vote against social security really ends all payments to the old. By abstracting from altruism, this was implicitly assumed. But if a substantial fraction of the old would be destitute without social security, a small amount of latent altruism (not operational when social security operates) would be sufficient for voters to maintain some welfare support. This would reduce the benefits of voting against social security.[22] Lines 6-7 show that the critical ages are reduced drastically if just 20-40% of social security cost are unavoidable. Under current law, retirees without income are entitled to Supplemental Social Security (SSI) and Medicaid benefits. As of 1995, SSI benefits to individuals amount to about 22% of average wages, i.e., about half of the average 43.6% replacement rate under OASI. If one views SSI as revealing voter preferences towards poverty, it suggests that canceling social security would avoid only about half the cost, even less than I assume in lines 6-7.

The second critical issue is the choice of interest rates. For interest rates in the 4-6% range--e.g., motivated by stock returns, disregarding risk--the critical age rises towards or even above the median (lines 8-10). But even then, majority support for social security remains plausible if one uses somewhat less conservative assumptions along other dimensions of the model, e.g., a small unavoidable welfare cost (lines 11-12) or imperfect annuities (lines 13-14).[23] Nonetheless, it is indisputable that the support for social security is weakened if individuals become convinced that private savings will deliver huge real returns. Excessive optimism about the stock market is therefore a potential problem for social security--perhaps a relevant one in the current bull market.

Real interest rates are, however, a general equilibrium issue. To address it properly, I will next examine social security in general equilibrium. Overall, I interpret this section as positive about social security. Even under quite adverse assumptions, the NPV of social security is positive for a clear majority of the population. The majority support for social security is overwhelming if partial payments to retirees after a no vote cannot be avoided.

General Equilibrium Analysis

General equilibrium (GE) considerations are important here, because endogenous interest rates fundamentally change the calculus for voting decisions. If social security crowds out capital and raises interest rates, a vote to end social security would increase capital accumulation and thereby reduce interest rates. Voters who understand this linkage are LESS likely to vote no, because they must realize that a successful no vote would reduce the return on their own retirement savings.[24]

It follows that individuals may rationally support an existing mandatory social security system but privately like to opt out. Individual opt-out decisions are partial equilibrium decisions at a give interest rate, whereas rational voters cannot ignore the aggregate implications of a vote about the system. Hence, widespread individual dissatisfaction with social security does not mean that voters are about to abolish it.

Another interesting aspect of GE analysis is that it provides an upper bound on the size of social security and therefore a setting in which the size of the system can be determined endogenously. The logic is that as social security grows, capital is crowded out and interest rates are rising, until social security benefits are discounted so much that the median voter's net benefits fall to zero. Then the system would loose majority support if it were expanded further.

The analysis of this section builds on Cooley and Soarez (1996, 1997) and Bohn (1996).[25] Cooley and Soarez (1996) set up a stochastic OG model with agents living for four periods and assume that a state-contingent set of replacement rates is chosen by a utility-maximizing median-age voter in some initial period. In a calibration exercise, they show that a so-derived social security system will collapse when "a baby boom"-sized shock arrives, unless one assumes--rather arbitrarily--that the benefits of the old cannot be canceled.

While the model is intriguing, the results and some important technical details are somewhat odd. Notably, agents are supposed to form expectations about the survival of social security by looking at the economy's <u>expected</u> future path, not by examining the prospects for survival on a state-by-state basis. Since the initial median-age voter maximizes the size of social security subject to a viability constraint, imposing viability in expectation rather than on a state-by-state basis virtually ensures that the system will collapse under an adverse shock. In addition, Cooley and Soarez implicitly assume a median age of 36, which is far too low.[26] This section will show that Cooley and Soarez' (1997) conceptual framework supports the claim that social security will remain viable, provided it is implemented with somewhat "improved" assumptions.

To reexamine Cooley and Soarez' results, I use the deterministic three-period OG model developed in Bohn (1996), a model simple enough to yield some analytical results. If one interprets the age groups as "young" 20-42, "middle-age" 43-65, and "old" 66-89, the median voter is 43, which is still conservative, but not excessively so.[27] The focus here is on the conditions under which a social security system with an exogenous level of promised benefits b^* is viable.

One game-theoretic interpretation of exogenous benefits is Cooley and Soarez': The benefit level was fixed by voters at the creation of the system at the maximum viable level. Subsequent voters simply decide whether or not to keep the system. Bohn (1996) has provided an alternative interpretation: Voters in each period vote about the level of promised benefits for the next period (subject to some constraints) and on whether to honor the previous period's promises. In both models, a failure to honor promised benefits in any one period triggers a permanent collapse. My model is somewhat more flexible in that it allows for endogenous social security reform (voters may reduce their own future benefits below the ones promised to current retirees) and it allows benefits to be well below the maximum viable level (due to constraints on creating benefits).[28] The important point for assessing the viability of U.S. social security is that one should not presume that social security system necessarily operates at its maximum viable size, on the verge of collapse.

The economic model can be interpreted as a time-aggregated version of the I_{max}-period model or an expanded version of Section 3's model. To simplify, all agents live during the working-age periods 1-2 and have log-utility. With probability μ_t, they either live for the entire retirement period or die at the end of period 2; fair annuities are available. Production is Cobb-Douglas with 100% depreciation. The labor supply is exogenous, but possibly age-dependent (denoted by e for the young, normalized to 1 for the middle-aged). I abstract from aggregate uncertainty and from government activity other than PAYG social security. (Other activities could be added as in Section 3.)

For a given total labor supply $e\,N_t+N_{t-1}$ and a given number of surviving old, $\mu_t\,N_{t-2}$, the payroll tax rate is a function of benefits b_t and demographics,

$$\theta_t = \frac{N_{t-2}\,\mu_t}{N_t\,e + N_{t-1}}\,b_t = \frac{\mu_t}{[1+(1+n_t)\,e]\,(1+n_{t-1})}\,b_t. \tag{16}$$

Assuming fair annuities, the net present value of social security for the middle-aged median voter in period t is

$$NPV^2_{t-1} = \frac{b_{t+1}\,w_{t+1}}{(1+r_{t+1})/\mu_{t+1}} - \theta_t\,w_t, \tag{17}$$

an increasing function of benefits and wage growth and a decreasing function of interest rates and current payroll taxes.

The main point of the GE analysis is to show that a negative NPV^2_t at current interest rates does not mean that the middle-aged will vote against social security. Instead, rational voters will have to figure out how the macroeconomic changes in the aftermath of a successful no vote would affect their overall utility. The three-period OG model is just simple enough that the macroeconomic effects of ending social security can be worked out analytically (see Bohn 1996). The dynamics of the model can be characterized in terms of the capital-labor ratio k_t and the asset holdings of the young and the middle-aged ($a^1{}_t$, $a^2{}_t$). For given productivity and population growth, the next period's capital-labor ratio is determined by the "average" assets $\bar{a}_t$,

$$k_{t+1} = \bar{a}_t / A_{t+1} = \frac{a^1{}_t\,(1+n_t)+a^2{}_t}{[1+e\,(1+n_{t+1})]\,(1+n_t)\,A_{t+1}}. \tag{18}$$

Through k_{t+1}, the savings decisions of both cohorts determine future interest rates and wages. Hence, each young cohort must form expectations about the savings of the next cohort to determine the interest rates relevant for it's own savings, i.e., savings decisions are interdependent. The savings decisions along a perfect foresight path therefore depend on all current and future demographic parameters $\{n_s, \mu_s\}_{s\geq t}$ and replacement rates $\{b_s\}_{s\geq t}$. For given paths of these variables, the economy follows a Markov process with state vector (k_{t-1}, $a^1{}_{t-1}$, $a^2{}_{t-1}$).

Let $U_t(b^*)$ be the utility of cohort t-1 (the period-t median voter) along the path associated with the existing social security system ($b_s=b^*$). If a no vote at the start of period t triggers a permanent collapse of social security, the economy would shift to the equilibrium path associated with replacement rates $b_s=0$ for all $s\geq t$. Let $U_t(0)$ be the median voter's utility along this path. Then the utility difference

$$U_t(0) - U_t(b^*) = \int_0^{b^*} \frac{1}{c^2{}_t}\,\Delta N(b;k_t,a^1{}_{t-1},a^2{}_{t-1})\,db \tag{19}$$

can be written as an integral over the utility effects of marginal changes in the benefit level b, which are

$$\Delta U(b;k_t,a^1_{t-1},a^2_{t-1}) = -NPV^2_t/b + (1-\alpha)\left\{b - a^2_t/\bar{a}_t\right\}\left(-\frac{d\bar{a}_t}{db}\right). \qquad (20)$$

Thus, the marginal utility term ΔU includes the partial equilibrium term NPV^2_t plus a new general equilibrium term ("GE-term").[29] Provided a smaller social security system increases the average savings $\bar{a}_t$ (d¯),a)/db<0), the sign of the GE-term is given by $b-a^2_t/\bar{a}_t$. The negative component $a^2_t/\bar{a}_t$ reflects the fact that a reduction in social security reduces the interest earnings on all assets a^2_t held by the middle-aged. The positive b-term reflects that a crowding-in of capital raises the wage rate to which social security benefits are indexed. Empirically, U.S. households under 40 accumulate few retirement savings, suggesting that the middle-aged hold far more assets relative to earnings than the young, $a^1_t/e \ll a^2_t$. Then for $n_{t+1} \approx n_{t+2} \approx n \geq 0$, we have $a^2_t/\bar{a}_t \gg 1+n \geq 1$. Thus, the GE effect is unambiguously negative for replacement rates up to at least 100% (very conservatively estimated), discouraging a vote against social security. Hence: <u>Partial equilibrium calculations systematically underestimate the viability of social security</u>.

How quantitatively important is the GE-effect? A full simulation of the U.S. economy would be too ambitious here, since the equilibrium allocation depends on the entire path of the demographic variables $\{n_s, \mu_s\}_{s \geq t}$. A much easier exercise is to consider steady states with constant demographics (n,μ) and alternative replacement rates b^*. For any calibrated model, one can determine (a) the maximum replacement rate b^{GE}_{max} for which social security is viable in steady state and (b) the maximum replacement rate b^{PE}_{max} for which the partial equilibrium criterion $NPV^2_t \geq 0$ would be satisfied. Table 6 shows these values for two alternative parameter sets.

In Column 1, population growth is matched to the current social security worker/beneficiary ratio and the utility-weight on period-1 consumption is chosen to match current relative asset holdings a^2/a^1. For the sake of argument, the interest rate set to 5.5% (much higher than in Section 4.2) so that b^{PE}_{max} matches the current OASI+HI benefit rate (about 58%, if HI is valued at cost). From a partial equilibrium perspective, social security would be on the verge of collapse. But with the GE effect, the maximum viable replacement rate is actually above 220%.

Column 2 of Table 6 describes the steady state of the same economy, but with zero population growth and a 62% replacement rate (plausible parameters for the U.S. in 2030). At real interest rate of 5.26%, partial equilibrium voters would abolish social security--consistent with the high real rate results in Table 5. But the GE-effect is large enough to outweigh the negative NPV^2_t for replacement rates up to 94%. This value is well above even the most pessimistic SSA projections.

A replacement rate of 220% is of course too high to be taken literally.[30] But these calculations suggest that if one takes the GE effect seriously, the U.S. social security system is amazingly secure (cf. Cooley and Soarez 1996). The intuition is that in an OG model without bequests, the middle-aged are society’s main asset holders ($a^2_t >> a^1_t$). Hence, lower interest rates after a no vote on social security would drastically reduce their interest income--so much that the middle-aged support social security even at ridiculous replacement rates.

What Could Go Wrong?

The above analysis presents a strong case for the viability of social security. While I believe that the case in favor is indeed strong, the analysis would be unbalanced if I did not discuss some important caveats. This section focuses on multiple equilibria and uncertain medical cost, the two issues that I consider most troubling for the U.S.

The first concern is that a repeated voting game with trigger strategies has a huge number of sequential equilibria supported by different expectations. Intertemporal, trigger-type models of social security assume that voters agree on how to form expectations about future votes. Some variations in voting strategies could probably be accommodated (presumably anything that keeps the median voter in place). But the widespread skepticism about U.S. social security among the young suggests that a major shift in expectations cannot be ruled out.

To think about changing expectations, one might imagine an evolutionary process where some fraction of each new cohort is born with “mutant” expectations. The most interesting mutation would be the belief that future voters will abolish social security just when oneself reaches old age. If only a small fraction of voters hold such beliefs and vote against social security, social security will retain its majority and the skeptics will be proven wrong. In this sense, the equilibrium with social security is evolutionary stable. But if a large fraction suddenly starts to hold skeptical beliefs, they would be proven right. Note, however, that the popular skepticism about social security seems concentrated in the under-30 age group. This cohort is irrelevant in the median voter context, provided it has learned about the stability of the system by the time it turns 45.[31]

The second significant concern is the abstraction from uncertainty. This is not a serious concern if replacement rates are either far away from the maximum or if they can be revised every period (as in Bohn 1996) and the one-period ahead uncertainty is small. The latter is likely true for demographic uncertainty because individuals are born many years before entering the labor force. In addition, since retirement benefits are wage-indexed, the OASI system is approximately unaffected by shocks to economic growth. This leaves health care cost as perhaps the most dangerous source of uncertainty.

To explore the ramifications of such uncertainty, suppose next period's medical cost can take two states of nature, m^H_t (high, probability π) and m^L_t (low). If the Medicare cost shares σ^{HI} and σ^{SMI} can be state-contingent, the analysis is similar as in the deterministic model of Section 4.3. For each state of nature, voters (either at the start of the system or in the previous period, depending on the game theoretic setup) define the promised state-contingent benefits such that subsequent voters will honor them. Then cost uncertainty is not a serious problem.

A probabilistic collapse of Medicare cannot be ruled out, however, if one interprets Medicare as an unconditional promise to subsidize all possible medical care regardless of cost. Suppose the promised social security benefits are defined in terms of the OASI replacement rate β^* and the share of medical needs covered by Medicare σ^*. If (β^*,σ^*) is such that social security remains viable in period t+1 in both states of nature, the GE-viability condition in period t is

$$U_t(0) \le \pi U_t(\beta + \sigma\ m^H_{t+1}) + (1-\pi) U_t(\beta + \sigma\ m^L_{t+1}), \qquad (21)$$

which is similar as in Section 4.3 except for taking averages. But if social security collapses in state H, the viability condition changes to

$$U_t(0) \le \pi U_t^{fail} + (1-\pi) U_t(\beta + \sigma\ m^L_{t+1}) \qquad (22)$$

where U_t^{fail} denotes the utility realized if a cohort pays social security taxes without receiving benefits--presumably a very low value.

If generation t-1 can vary the level of promised benefits (enact reforms), it faces a non-trivial optimization problem. A collapse in state H can presumably be prevented by setting (β^*, σ^*) low enough, but since this would reduce the benefits in state L, voters may prefer high benefits in state L and a collapse in state H over a lower level of benefits in both states. The former is quite plausible if state H has low probability.

It is not obvious whether the U.S. Medicare system should be viewed as a system with contingent or non-contingent benefits. Perhaps significantly, only Part A (HI) is financed through payroll taxes, whereas Part B (SMI) is funded by the beneficiaries and from general revenues. Cost can and have been shifted across categories. (CBO 1998a even claims that managed care is blurring all distinctions between Parts A and B.) Hence, one may argue that state-contingent cost sharing is feasible. If Medicare HI is, however, viewed as a system that categorically promises to cover all hospital care, voters may interpret a too blatant cost shifting as a breach of commitment. To complicate matters further, if voters are smart enough to recognize that social security with state-contingent benefits is more robust against collapse than a non-contingent system, there may be an implicit understanding that increased copayments in response to unexpectedly high cost are part of the system and not a breach of promises. The right answer is unclear, and that is perhaps disturbing.

Finally, if Medicare is viewed as the most problematic part of the overall social security system, one may wonder to what extent Medicare's problems affect OASI and DI. I suspect, for example, that some of the voter skepticism about social security is due to the alarming cost projections for Medicare.

Additional Reasons why Social Security is Viable

For the sake of argument, the previous section has focused on purely intertemporal considerations. This is not meant to deny that social security may also be supported by other considerations. This section will comment on a few.

Altruism and Within-Cohort Heterogeneity

Intertemporal considerations can easily be combined with latent altruism or with income inequality. Both are likely to strengthen social security.

Within-cohort heterogeneity matters, because social security promises a replacement rate that declines with income. This is illustrated in Figure 10. Figure 10(a) shows that retirement benefits under current law are a concave function of average lifetime wages. Figure 10(b) shows the implied negative relationship between income and replacement rates. Income-independent Medicare benefits are an even better deal for low-income workers. Conditional on viability in the future, low-income workers will therefore vote for social security at a much younger age than predicted in Tables 3-5, while high income earners will not be supportive until a higher age. Since more than 50% of a cohort has below average incomes, given a skewed distribution, inequality is likely to increase the voter support for social security.

Within an intertemporal model, an altruistically motivated welfare system would clearly reduce the gains from voting against social security for the young, as noted in Section 4.2. More strikingly, Tabellini (1990) has shown that altruism and income inequality are sufficient to rationalize social security without reference to intertemporal arguments. He considers an OG model with heterogenous within-cohort incomes and mutual altruism between parents and children. In the model, a coalition of all the old plus the low-income young can provide a majority for social security. The young poor vote in favor, because their wage-proportional tax is small and they have altruistic feelings towards their parents.

Another argument based on altruism and within-cohort heterogeneity is that social security might serve as an insurance against risk of having long-lived parents. Prior to social security, children were expected to take care of their parents in old age. If the young know that they will end up supporting their parents in old age, it might be efficient for the members of a cohort to insure each other against the risk that their own parents life particularly long. Such insurance may be difficult to arrange privately because of adverse selection. Social insurance avoids this problem, but at the risk that agents whose parents have died early may try to renege. But if the young with living parents plus all the old are a majority, the system should (though this is a conjecture) be viable without requiring intertemporal arguments.

Can the Old Minority Control Social Security?

As noted above, all voting models of social security struggle with the fact that the immediate beneficiaries are a minority. Since the median voter theorem applies only to one-dimensional voting decisions, one way to avoid it is to consider a multi-dimensional setting. This is perhaps realistic, because politics is about more than social security. Unfortunately, multi-dimensional voting is notoriously difficult to model. Preliminary results by Bohn and Stuart (1998) suggests, however, that it can be done.

They key idea of Bohn and Stuart (1998) is that if young and old care equally about other issues, the votes of the old are relatively more responsive to party positions on social security because there are fewer retirees than workers.[32] The model is a simple two-party setting. Voters care about social security S and some other issue X. Two parties L and R offer positions X=L (left) or X=R (right) to which they are ideologically committed. In addition, each party can choose either to be in favor of a social security system with per-worker cost s (S=s) or to be against social security (S=0). Neither party cares about social security per se. Among voters, some fraction of the old and young prefers X=L, the remainder X=R. All place an equal value v on their preferred X-choice. The old gain βs from a social security system of size s, while the young loose θs, where $\theta<\beta$. The game is interesting if s, the size of social security, lies in the interval $(v/\beta, v/\theta)$ so that $\theta s < v < \beta s$. (We are working on endogenizing s.) Then the old are responsive to party differences in S, but not the young.

The resulting game between parties is illustrated in Table 7. If either both parties offer S=s or both offer S=0, all voters will support the party matching their X-preferences. But if, say, party R offers S=0 and party L offers S=s, then the old with preference R will prefer party L while the young with preference L will stick with party L; the converse applies if R offers S=s and party L offers S=0. Thus, if parties care about winning, setting S=s is the dominant strategy for both parties. This is true even though neither party cares about social security and the majority of voters dislike social security.

Overall, the model provides a purely static rationale for social security and provides some support for the popular notion that politicians do not dare to question social security because they are afraid to immediately loose the retirees' vote. But it relies on the presence of other issues and on ideologically driven parties.

Conclusions

Despite all the concerns about social security, I find that the system is almost certainty viable, economically as well as politically. The U.S. median voter is currently about 42-45 and will be about 48-50 at the peak of baby-boom retirement. Under a variety of assumptions and cost-benefit projections, in both partial and general equilibrium models, the net present value of social security is reliably positive for the critical age range. The system's viability is further reinforced by altruism, imperfect private annuity markets, within-cohort redistribution, and other considerations, but such considerations are probably not even necessary.

The most serious caveats to this conclusion are about self-confirming skepticism within the population and about Medicare's potential inability handle moral hazard problems effectively. Since retirees are a minority, a majority for social security requires the support of a significant fraction of working-age voters. If middle-aged voters believe that for a few more years of contributions, they earn retirement and medical benefits for the rest of their lives, their support can probably be taken for granted. But that might change, if a substantial fraction of the over-45 age group started to believe that social security is doomed.

Such skeptical beliefs may be fueled by the alarming cost projections for Medicare. While some growth in medical spending relative to GDP is likely an efficient response to demographic change, there is potential for excessive and inefficient growth because of the inherent moral hazard problems of health insurance. It would, however, take a quite significant mismanagement of Medicare to seriously endanger social security.

Footnotes

[1] The social security problem is sometimes defined narrowly as being about retirement insurance. But the question about viability is really about both retirement insurance and retiree medical insurance, because the two share the same payroll tax, have common beneficiaries, and raise similar public choice issues.

[2] Politicians seem to pick the best of both views, telling workers that payroll taxes entitle them to retirement benefits, but denying that the promised benefits should appear as liabilities in the budget (see Bohn 1992, 1997 for more discussion).

[3] Congressional sovereignty cannot be used to dismiss the moral commitment view of social security, however, because a sovereign Congress could also default on government bonds. Since entitlements are paid out automatically while it takes an act of Congress to raise the statutory debt ceiling, it would actually take a stronger political consensus among House, Senate, and President to end social security than to default on the national debt.

[4] Pursuing the analogy with debt, it is worth knowing under what conditions a government might default on bonds, even if one views the idea of defaulting on government bonds as outrageous. The same argument applies to social security.

[5] Cooley and Soarez (1997) provide the most convincing game-theoretic motivation for such an intertemporal dimension, though the tradition of assuming intertemporal linkages is much older; see Aaron (1966), Browning (1975), Boadway and Wildasin (1989a,b), Cukierman and Meltzer (1989), Hu (1982), and Kotlikoff et al. (1988).

[6] It is important to distinguish between operational altruism supporting transfers on the margin and “latent” altruism that might become operational if social security ever lost majority support. While I doubt that the current benefit structure can be justified by altruism, the existence of general welfare and SSI (supplemental social security) suggests latent altruism. This is important for the politics of social security because the young gain less from abolishing social security if most retirees would still be entitled to SSI benefits (presumably motivated by altruism towards the poor).

[7] Until about 2030, the projected OASDI cash-flow shortfall could be covered out of interest income and asset sales from the social security trust. But since the trust fund holds Treasury securities, its value is questionable. To be conservative, I will generally avoid relying on the trust fund. The disability component (DI) of OASDI is excluded here and in most of the analysis below, because DI covers the working age population and is therefore not really an intergenerational program; The DI program also shows deficits at a given 1.7% of payroll revenue base, since outlays rise from 1.5% of payroll in 1997 to 2.5% in 2030. Since disability insurance covers the population under 65, this growth cannot be attributed to the aging process.

[8] An alternative approach would be to set up a large-scale simulation model such as Auerbach and Kotlikoff (1987), Imrohoroglu et. al. (1995, 1998), Huang et al. (1997), De Nardi et. al. (1998). Instead, I generally use simple models to focus on the conceptual implications of different issues and modeling choices, and I will refer to the existing large-scale models for quantitative answers on specific issues.

[9] That is, the positive wage effect dominates the negative interest rate effect. (See the appendix for a proof.) The dominance of the wage- over the interest rate effect generalizes to OG models with more than two periods, provided the age-earnings distribution lies to the left of the age-asset distribution.

[10] At a constant d^{+}_{t}-value, a decline in population growth will again increase the utility of all cohorts except the one just before the decline. Hence, demographics-contingent variations in intergenerational transfers may have insurance benefits as suggested by Smith (1982). A rigorous analysis of this point would require a stochastic model and distract from the positive and political-economy focus of this paper. (Smith just presents a numerical example.) But it is worth noting that there is no clear normative argument against higher payroll taxes in response to lower population growth.

[11] The best support for this quantitative claim is provided by the simulation evidence in larger-scale models, notably De Nardi et al. (1998). De Nardi et al. simulate alternative policies in a 69-period OG model over the period 1975-2060 and show that interest rates decline in every scenario. Given this evidence, an attempt to calibrate the two-period model would not be worthwhile.

[12] An endogenous increase in the retirement age is another possible complication. If retirement is motivated at least in part by health considerations, the efficient retirement age should rise with improved health care.

[13] There is a long literature on intertemporal models. Aaron (1966) first suggested that median-aged voters compare their contributions to

the present value of future benefits, treating past contributions as sunk. Hu (1982) recognized the re-voting problem. Sjoblom (1985) presents a first model of social security as a dynamic game. Note that one can give the early static-expectations models (where voters believe the current system will remain in place for their lifetimes) a modern game-theoretic interpretation, because a static majority for social security at all times means that the system is supported by the simple trigger strategy of voting in favor as long as all prior votes have gone in favor.

[14] Kotlikoff et al.'s (1988) generational contracting explanation for social security is differently motivated, but represents a similar approach. Kotlikoff et al. assume that cohorts pass on a "generational contract" obliging each generation to receive benefits from their successor. The assumption that non-payment by the young invalidates the "contract" is essentially a trigger mechanism.

[15] An endogenous retirement age would be technically cumbersome because early retirees would face a different voting problem than workers of the same cohort. This is practically inessential, however, because for social security to have any hope of surviving, all workers near retirement age (say, 60 and above) will have to vote in favor.

[16] Homogeneity is probably a conservative assumption. Given the skewness of the income distribution and a benefit formula biased towards lower incomes, voter support for social security is likely strengthened by heterogeneity (see Section 5). The ramifications of variable family structure--differences in benefits for single, married, and widowed participants--are left for future research.

[17] Game-theoretically, this means that a failure to pay one type of benefits triggers a shift in expectations about all categories of future benefits in the sense of Cooley and Soarez (1996, 1997). In Kotlikoff et al.'s (1988) contracting context, it means that there is one comprehensive social contract.

[18] Most people will have some level of concern for their closest relatives; spouses have a vote, too; and the relevant decision unit may well be the family. Also, federal law requires spousal consent for married workers to choose single-life annuities (Diamond 1998), so that even in a model of selfish workers, survivor benefits should not be excluded when one compares the return to social security with the return on annuitized private savings.

[19] The specific assumptions about taxes are inessential, provided social security pays all promised benefits. Then workers will face rising taxes, either explicitly through higher payroll taxes or indirectly through higher general taxes (e.g., to redeem trust fund securities). In the sensitivity analysis below, I also examine the voter support for social security with constant taxes and reduced benefits.

[20] The 3.7% rate is motivated by the observed market yields on inflation-indexed Treasury bonds. It is nonetheless a conservative assumption, because demographic changes are likely to reduce the level of U.S. interest rates in the future (see Section 3) and because interest rates would fall after a no vote on social security (see below).

[21] Supplemental medical insurance is excluded throughout, because it is not financed by payroll taxes. If one nonetheless included SMI and

arbitrarily assumed that the entire SMI cost falls on workers through general taxes subsidizing SMI (and a zero value of DI and survivors insurance), the critical age for the entire OASDI+HI+SMI system would rise to 48 for 2030-50, matching the median age. Even more extreme assumptions would be needed to push the critical age beyond 48.

[22] The history of Cooley and Soarez (1996) paper highlights the relevance of this issue: In a draft circulated at the Carnegie-Rochester conference, they argued that social security is not viable assuming all cost are avoided by a no vote. In the published version, they assert that the old simply cannot be cut off at all, and find--not surprisingly--that social security is viable. The existence of general welfare raises some deeper issues, however, notably about the need for forced savings to avoid moral hazard.

[23] As motivation, note that private annuities are typically fixed income products. A real return on private savings in the 5-6% range presumably requires significant stock market investments. Hence, the higher return one assumes, the more likely it is that the return cannot be annuitized. Questions of risk-adjustment are beyond the scope of this deterministic model.

[24] The capital accumulation effect is also a common argument for why “privatizing” social security would be good for the U.S. economy. Advocates of privatization do not seem to realize that for savers, lower interest rates are an argument against privatization.

[25] Cukierman and Meltzer (1989) and Hansson and Stuart (1989) provide alternative political-economy models for the size of social security (or government debt), but their models take for granted that debt and social

security claims are always honored. Cukierman and Meltzer (1989) also note the role of endogenous factor prices for voting decisions.

26 Their median voter is in the second of four 15-year periods covering ages 21-80. Since decisions are made at the start of a period, the median voter is 36 and faces 30 years of contribution.

27 Throughout, I assume that population growth and survival rates are such that the middle-aged are the median voter. Since there are fewer old than young for $n \geq 0$ and $\mu \leq 1$, the relevant restriction is that population growth must not be so high that more than half the population is young. Given current trends, this is not restrictive.

28 A detailed description of how benefits change is omitted because it is largely irrelevant for the viability of an existing system. Briefly, the historical motivation is that whenever benefits were increased during the expansion phase of U.S. social security (1937-72), the higher benefits were immediately granted to current retirees. In Bohn (1996), I treat this regularity as part of the game, i.e., assume that a cancellation of “new” benefits would not trigger a collapse of social security. The key to establishing an entitlement is then to grant benefits to the currently old, so that after retiring, one can claim that workers have a duty to maintain those benefits. Since granting new benefits to retirees is costly, there is an range of benefit levels over which voters will keep the formula unchanged. In this range, benefits are effectively predetermined; this is my favorite interpretation of b^*.

29 Note that the integral over NPV^2_t/b is not quite the same as NPV^2_t evaluated along the b^* path, because the r_{t+1}- and w_{t+1}-values in NPV^2_t depend on b.

30 It's easy to find reasons why the GE effect is smaller in practice. First, the GE-effect is reduced if one models the U.S. economy as open. While international capital flows have been rather small in the past, it is worth noting for the future that increasing capital mobility is a negative for social security. Second, the GE-effect relies on large asset holdings by the middle-aged; they would be reduced in a model with bequests. Third, the GE-effect is largest if social security is viewed as a unit, so that a no vote triggers a large shift in interest rates. If one viewed retirement insurance and Medicare as separate, a vote against, say, Medicare would have a much smaller GE effect.

31 Another stabilizing factor is the built-in inertia of the U.S. political system. To change an entitlement program, one needs a majority in the House, the Senate, and approval by the President; they often represent different parties. Hence, a repeal of social security may in effect require a super-majority; see Hansson and Stuart (1988) for the implications.

32 The idea that a minority can win if preference intensities or "lobbying" abilities matter has a long history; see Olsen (1965), Patton (1978). I have not emphasized this literature because most public choice models have a somewhat "reduced form" appearance. Following Lucas' (1976) advice, I would be reluctant to make predictions about the impact of major demographic changes on that basis. See Wildasin (1990) for a public choice perspective on aging.

References

Aaron, H.J.

(1966) The Social Insurance Paradox, Canadian Journal of Economics and Political Science 32, 371-76

Auerbach, A., and Kotlikoff, L.

(1987) Dynamic Fiscal Policy, Cambridge: Cambridge University Press.

Auerbach, A., Gokhale, J., and Kotlikoff, L.

(1991) Generational Accounts: A Meaningful Alternative to Deficit Accounting, in: Bradford, David (ed.) Tax Policy and the Economy 5, MIT Press: 55-111.

Boadway, R., and Widasin, D.

(1989) A Median Voter Model of Social Security. International Economic Review 30: 307-328. (a)

____

(1989) Voting Models of Social Security Determination, in: B.A. Gustafsson and N.Anders Klevmarken (eds.) The Political Economy of Social Security, Amsterdam: North-Holland: 29-50. (b)

Bohn, H.

(1992) Budget Deficits and Government Accounting, Carnegie-Rochester Conference Series on Public Policy 37: 1-84.

____

(1996) Social Security in a Three-period-life Overlapping Generations Model, mimeo, UCSB.

____

(1997) Social Security Reform and Financial Markets, in: Steven Sass and Robert Triest, eds., Social Security Reform, Boston: Federal Reserve Bank of Boston.

Bohn, H., and Stuart, C.

(1998) Why Do "Single-Issue" Voters Get Their Way? An Application to Social Security, mimeo, UC Santa Barbara.

Browning, E.K.

(1975) Why the Social Insurance Budget is too large in a Democratic Society, Economic Inquiry 13: 373-388.

Congressional Budget Office

(1996) The Economic and Budget Outlook: Fiscal Years 1997-2006, Washington, D.C.: U.S. Government Printing Office.

____

(1998) The Economic and Budget Outlook: Fiscal Years 1999-2008, Washington, D.C.: U.S. Government Printing Office. (a)

____

(1998) Social Security Privatization and the Annuities Market, Washington, D.C.: U.S. Government Printing Office. (b)

Cooley, T., and Soarez, J.

(1996) Will Social Security Survive the Baby Boom?, Carnegie-Rochester Conference Series on Public Policy 45: 89-121.

____

(1997) A Positive Theory of Social Security Based on Reputation, mimeo, University of Rochester.

Cukierman, A., and Meltzer, A.

(1989) A Political Theory of Government Debt and Deficits in a Neo-Ricardian Framework, American Economic Review 79: 713-732.

Cutler, D.

(1997) Public Policy for Health Care, in: A. Auerbach (ed), Fiscal Policy: Lesson from Economic Research, Cambridge: MIT Press.

Diamond, P.

(1965) National Debt in a Neoclassical Growth Model, American Economic Review 55: 1126-1150.

____

(1998) Economics of Social Security Reform - An Overview, mimeo, MIT.

De Nardi, M., Imrohoroglu, S., and Sargent, T.

(1998) Projected U.S. Demographics and Social Security, mimeo.

Frech, H.E.

(1998) Reform of Fee-for-Service Medicare: The Forgotten Opportunity, mimeo, University of California, Santa Barbara.

Hansson, A., and Stuart, C.

(1998) Measurement of Transfers and Peaking of Fiscal Sizes of Government, mimeo, University of California, Santa Barbara.

Hansson, I., and Stuart, C.

(1989) Social Security as Trade Among Living Generations, American Economic Review 79, 1182-1195.

Hu, S.C.

(1982) Social Security, Majority-Voting Equilibrium and Dynamic Efficiency, International Economic Review 23: 269-287.

Huang, H., Imrohoroglu, S., and Sargent, T.

(1997) Two Computations to Fund Social Security, Macroeconomic Dynamics 1: 7-44.

Imrohoroglu, A., Imrohoroglu, S. and Joines, D.

(1995) A Life Cycle Analysis of Social Security, Economic Theory 6: 83-114.

____

(1998) Social Security in an Overlapping Generations Economy with Land, mimeo, USC.

Kotlikoff, L., Persson, T., and Svennson, L.

(1988) Social Contracts as Assets: A Possible Solution to the Time-Consistency Problem, American Economic Review 78, 662-677.

Lucas, R.

(1976) Econometric Policy Evaluation: A Critique, Carnegie-Rochester Conference Series 1, 19-46.

Olsen, M.

(1965) The logic of Collective Action, Cambridge: Cambridge University Press.

Patton, C.

(1978) The Politics of Social Security, in: M.Boskin (ed), The Crisis in Social Security, San Francisco: Institute for Contemporary Policy Studies.

Social Security Adminstration

(1997) Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Fund, Washington, D.C.: U.S. Government Printing Office.

Sjoblom, K.

(1985) Voting for Social Security, Public Choice 45: 225-240.

Smith, A.

(1982) Intergenerational Transfers as Social Insurance, Journal of Public Economics 19: 97-106.

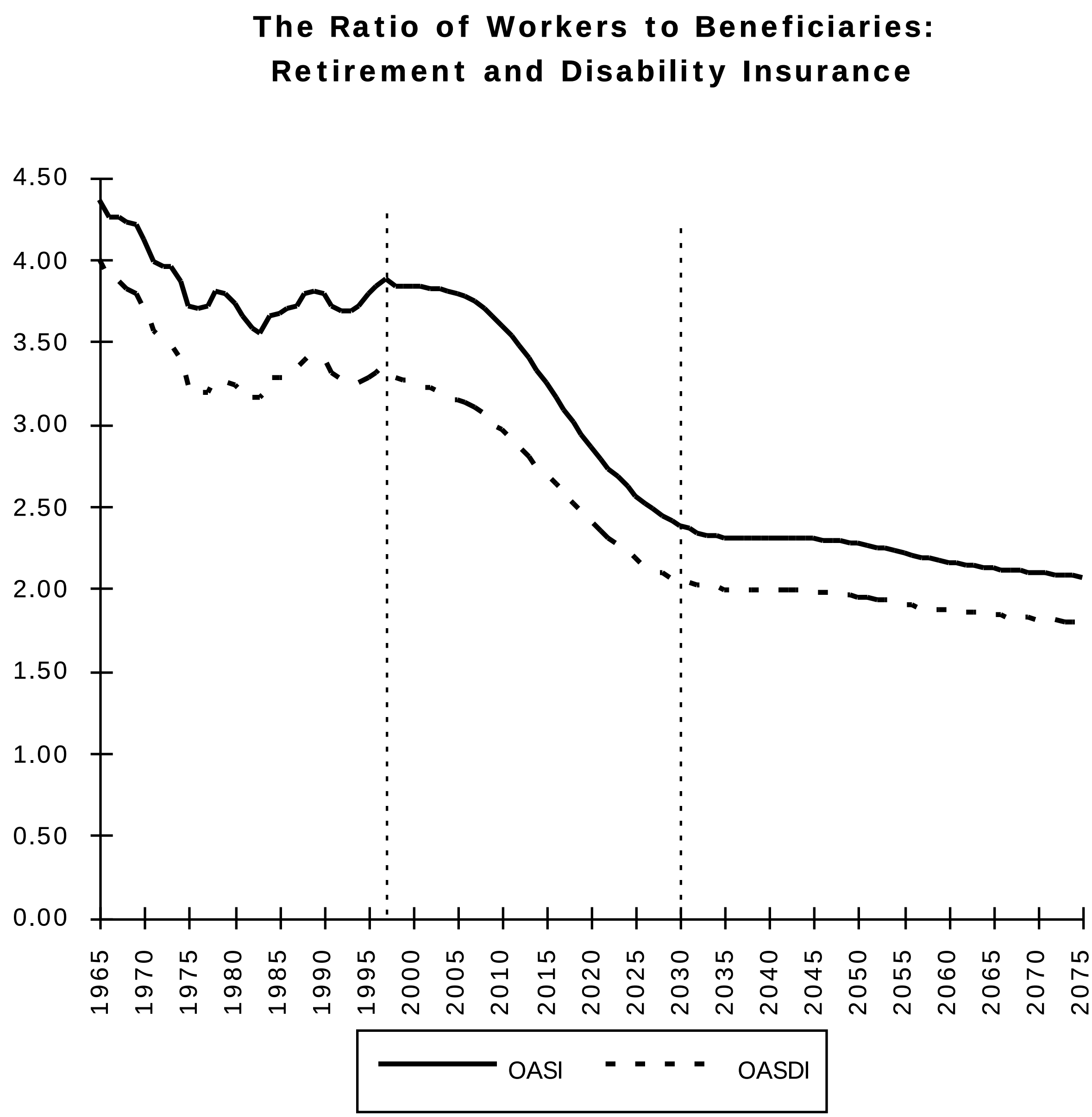
Tabellini, G.

(1990) A Positive Theory of Social Security, NBER working paper No. 3272.

Wildasin, D.

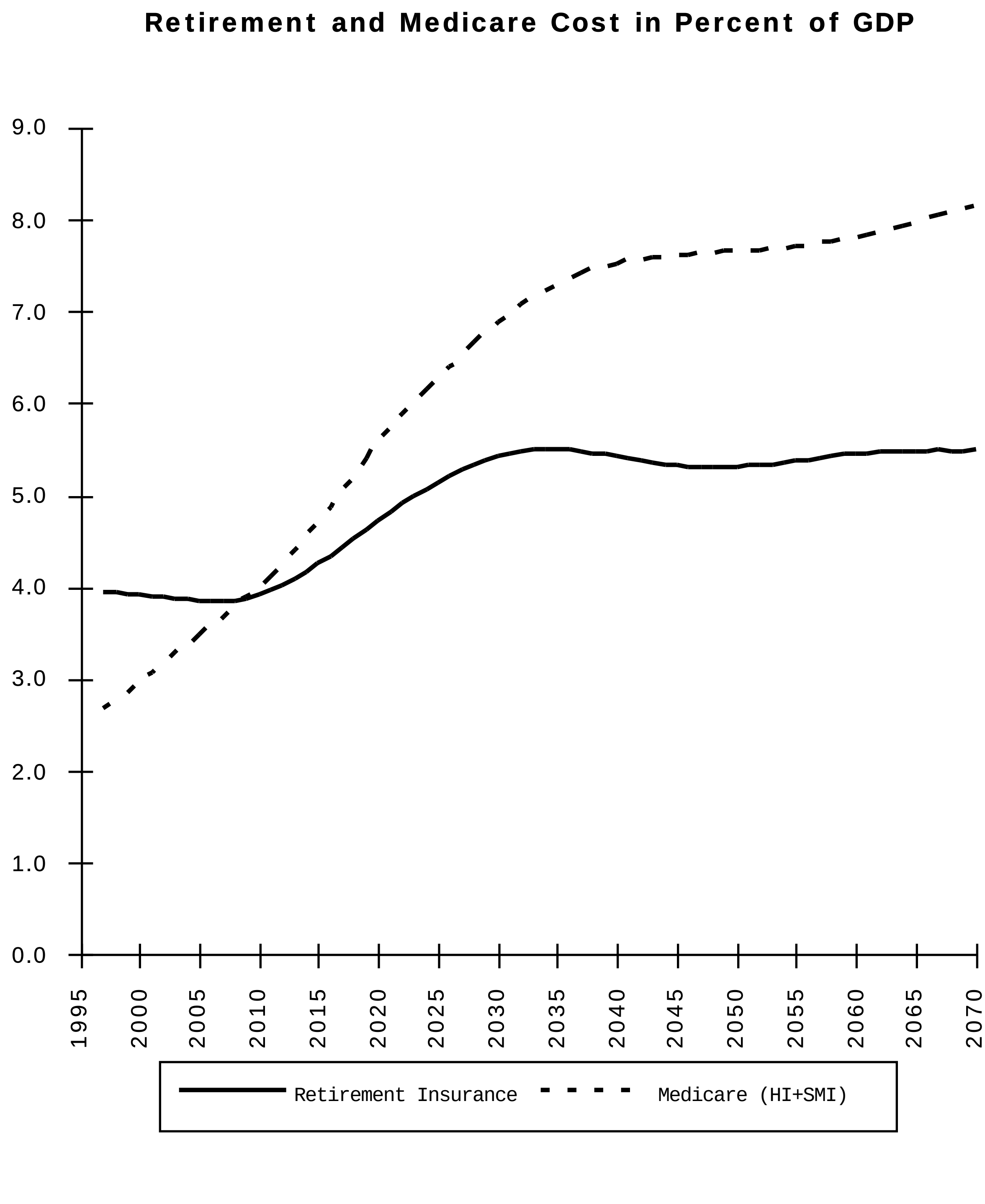
(1990) The Political Economy of Public Expenditure with an Aging Population, mimeo, Indiana University.

Figure 1



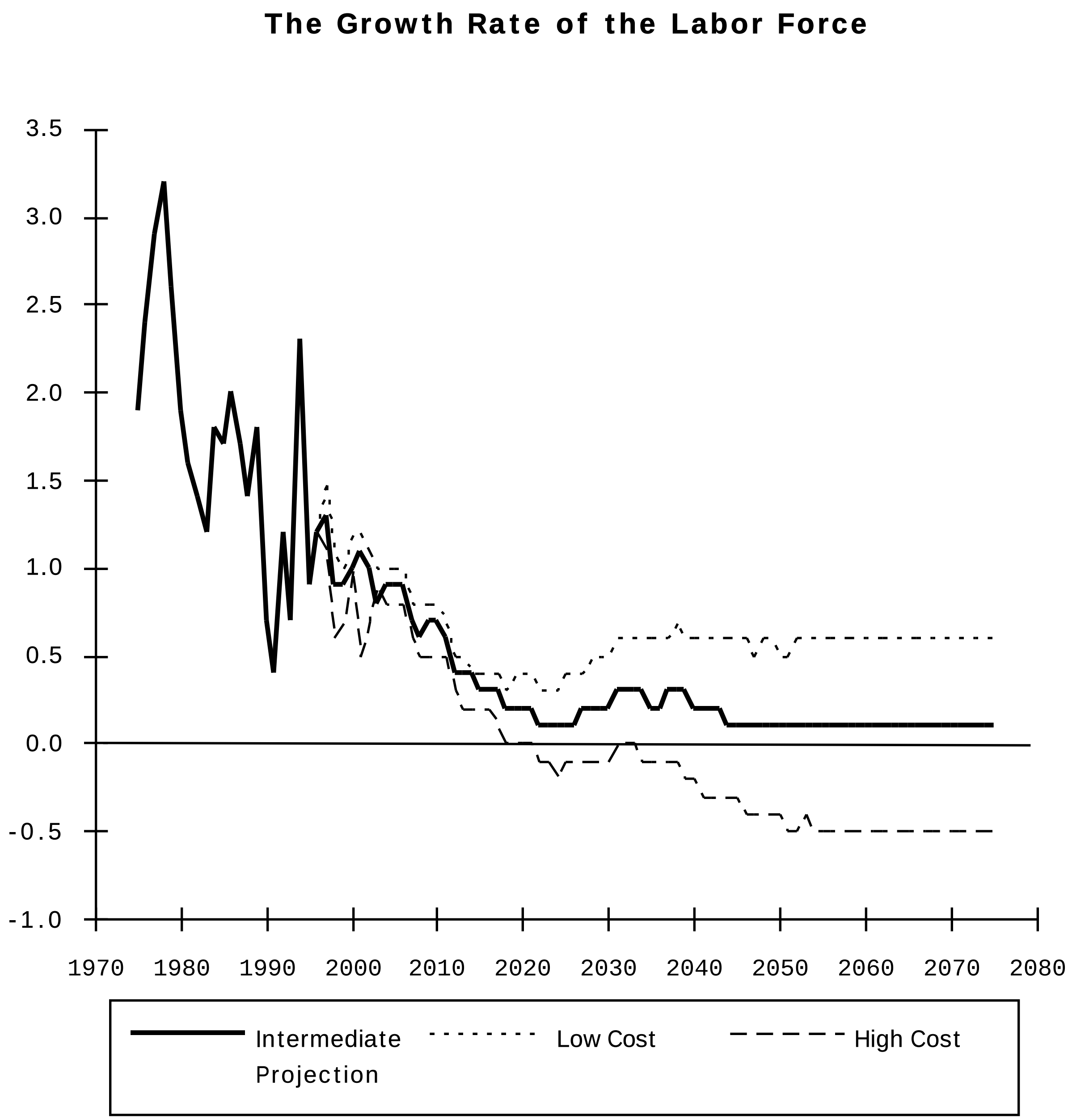
Notes: The chart illustrates the rapid decline in the worker-retiree ratio between now and 2030 under the SSA (1997) Intermediate Projection. The OASDI series is lower than the OASI series because it includes the disabled. See Section 2 for more explanation.

Figure 2



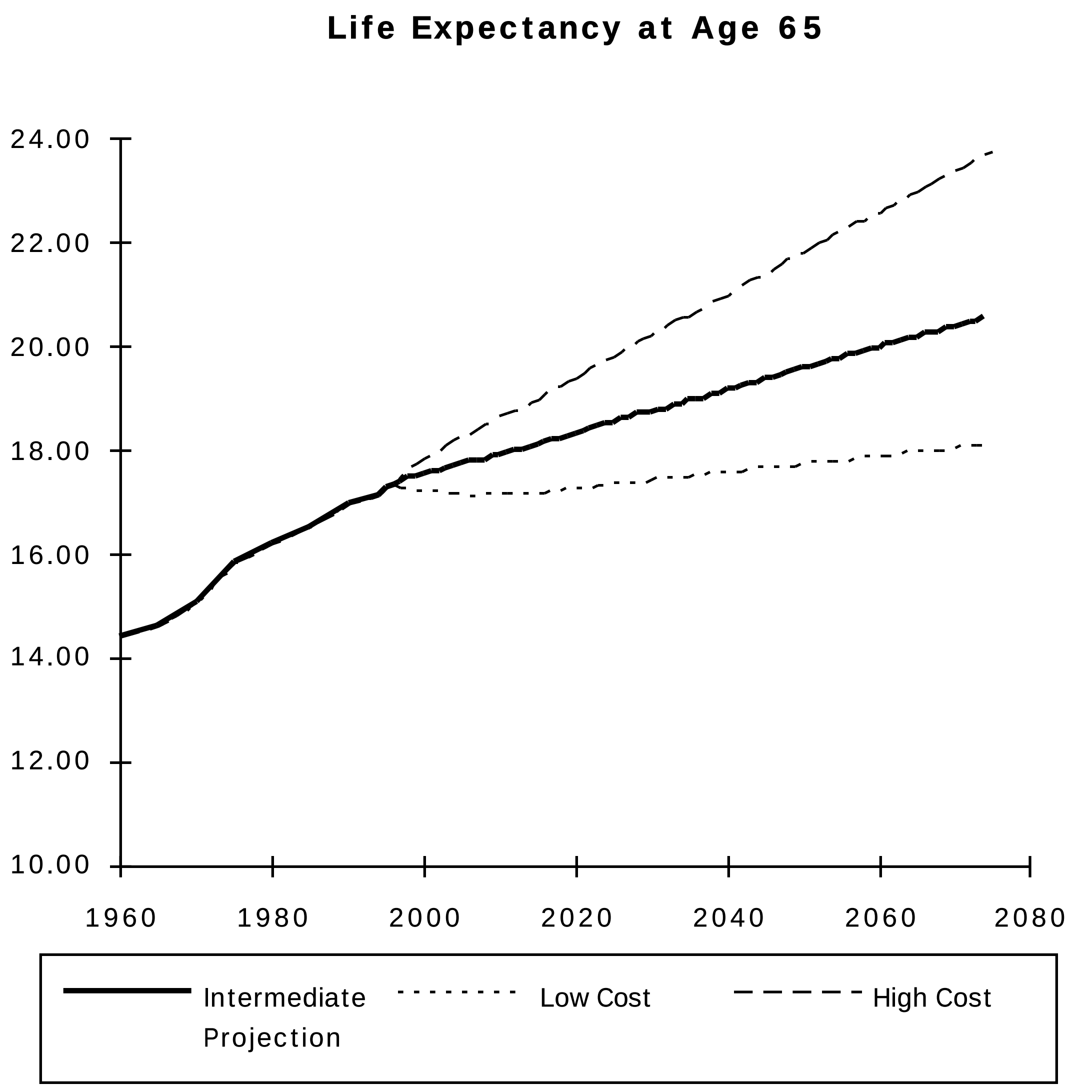
Notes: SSA (1997) Intermediate Projection. See Section 2 for more explanation.

Figure 3



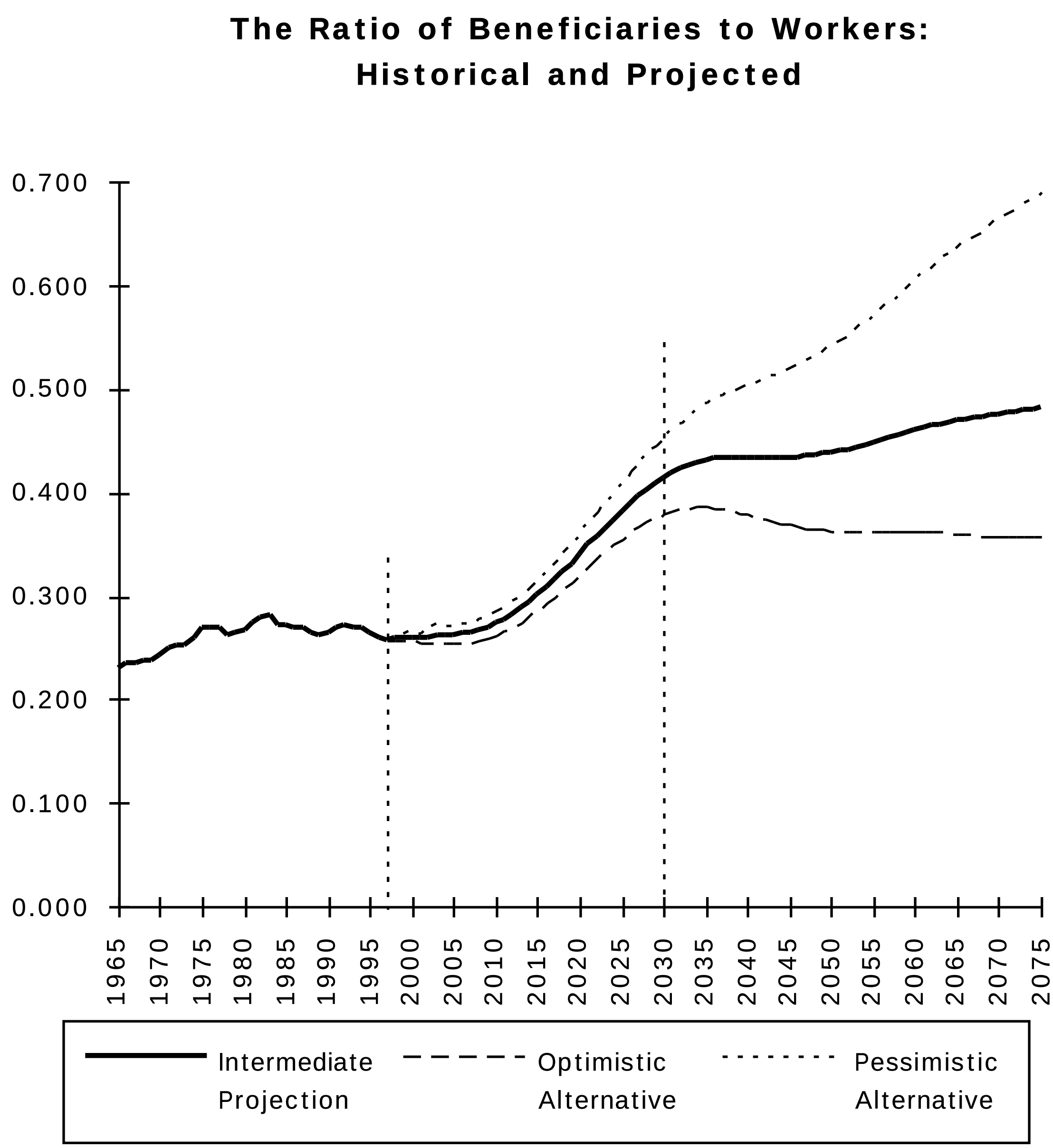
Notes: Historical data and alternative projections from SSA (1997).

Figure 4



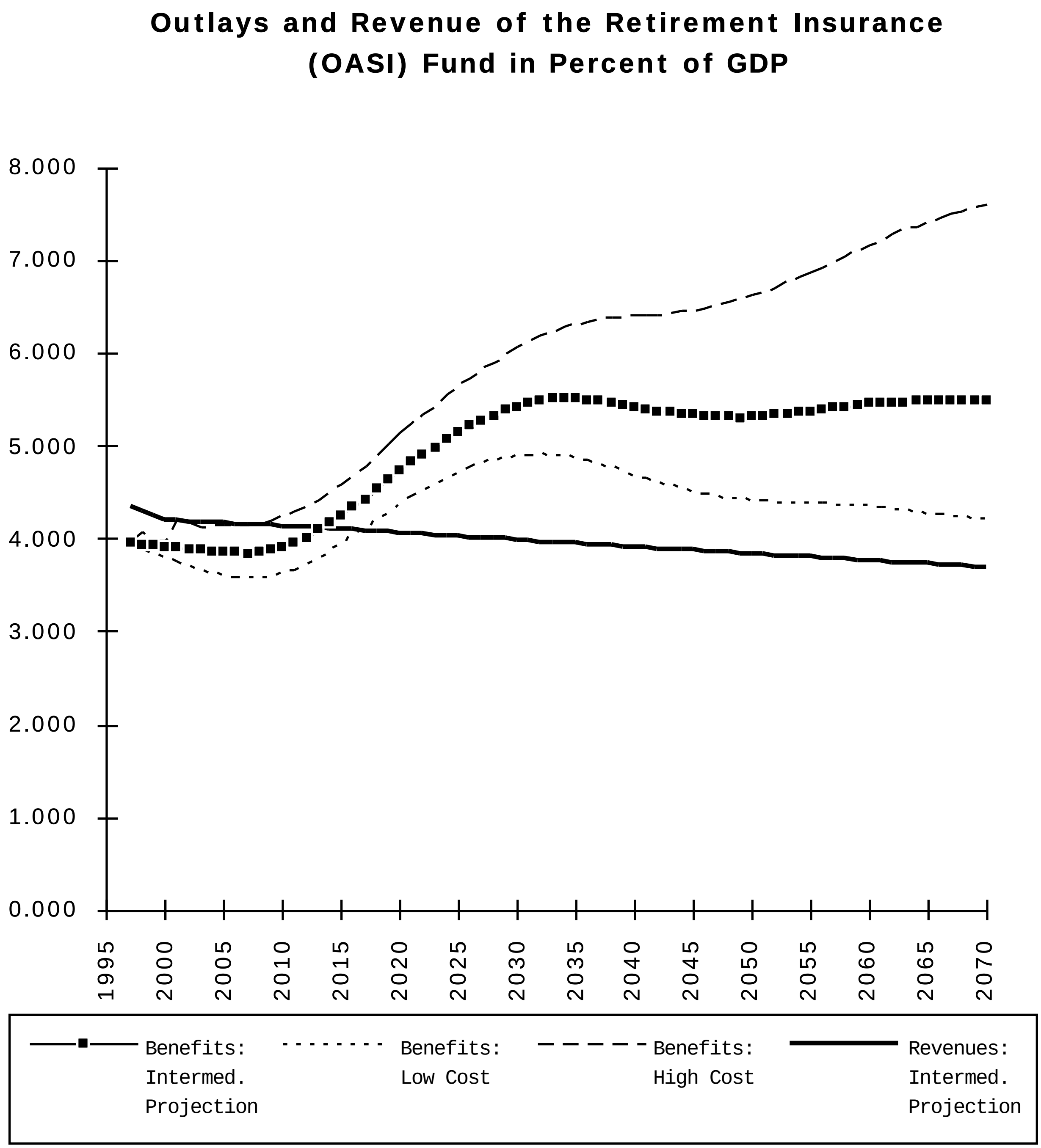
Notes: Average of male and female life expectancy. SSA (1997).

Figure 5



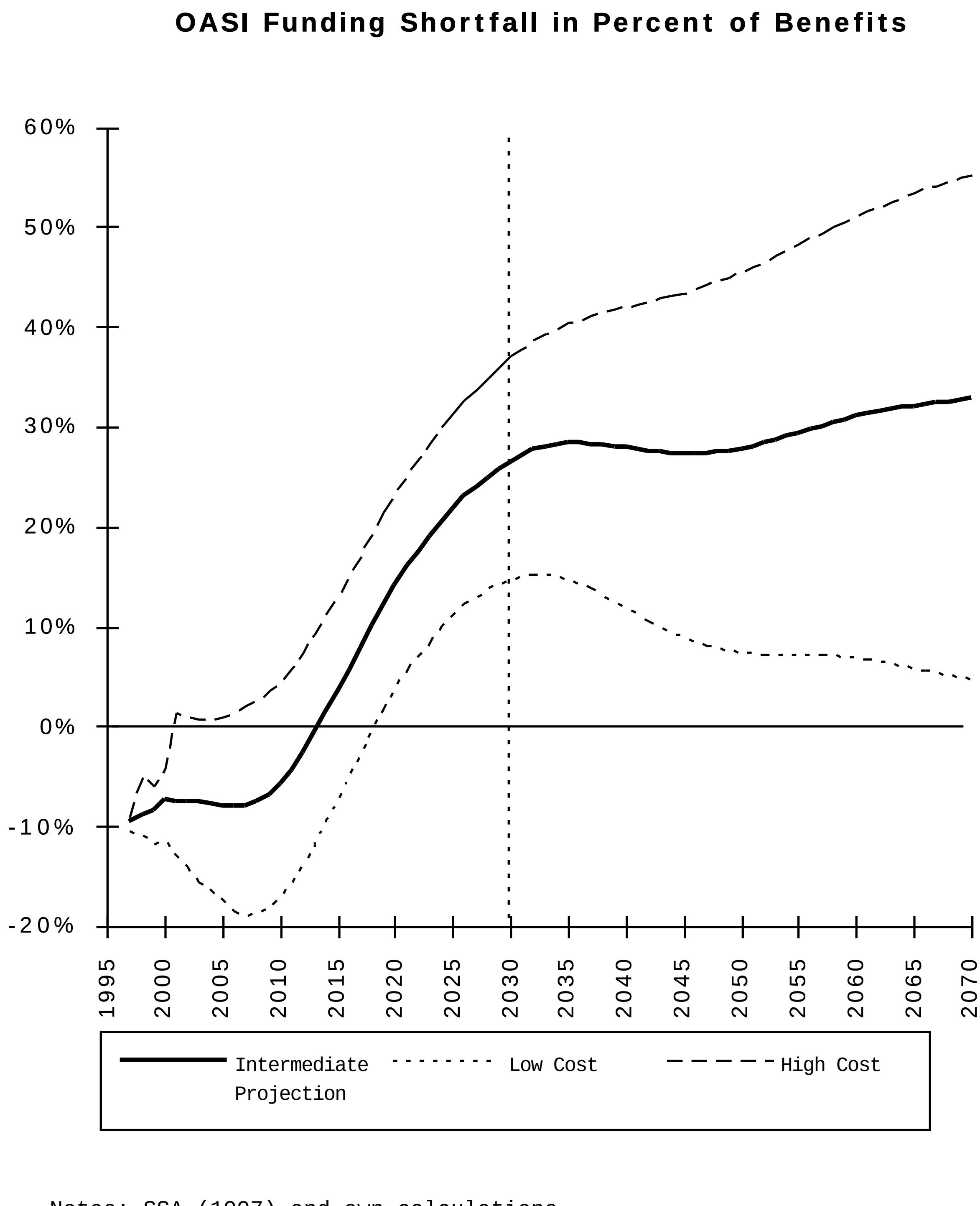
Notes: Projections from SSA (1997).

Figure 6



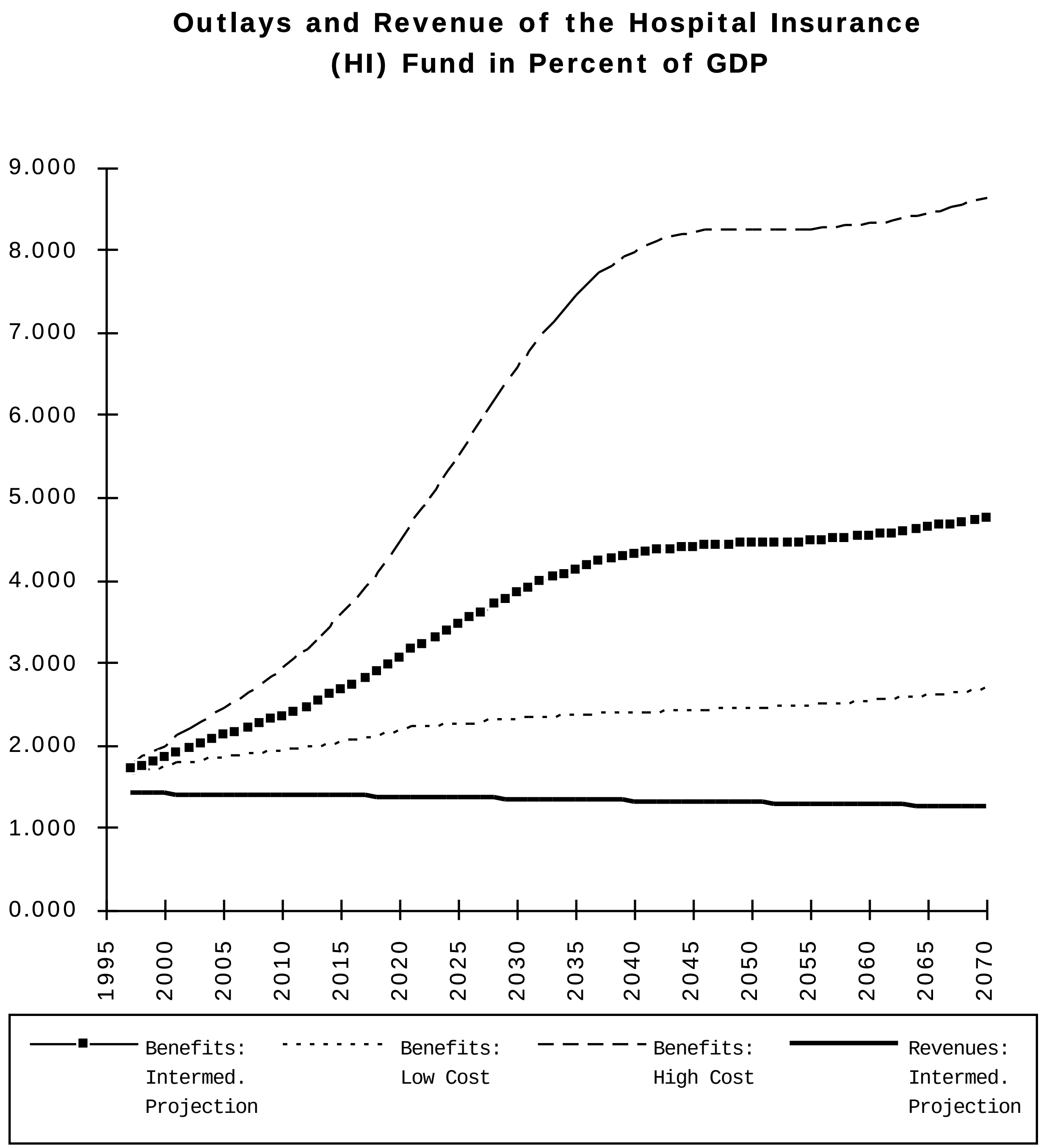
Notes: Data from SSA (1997). Trust fund transactions and taxes on benefits are excluded.

Figure 7



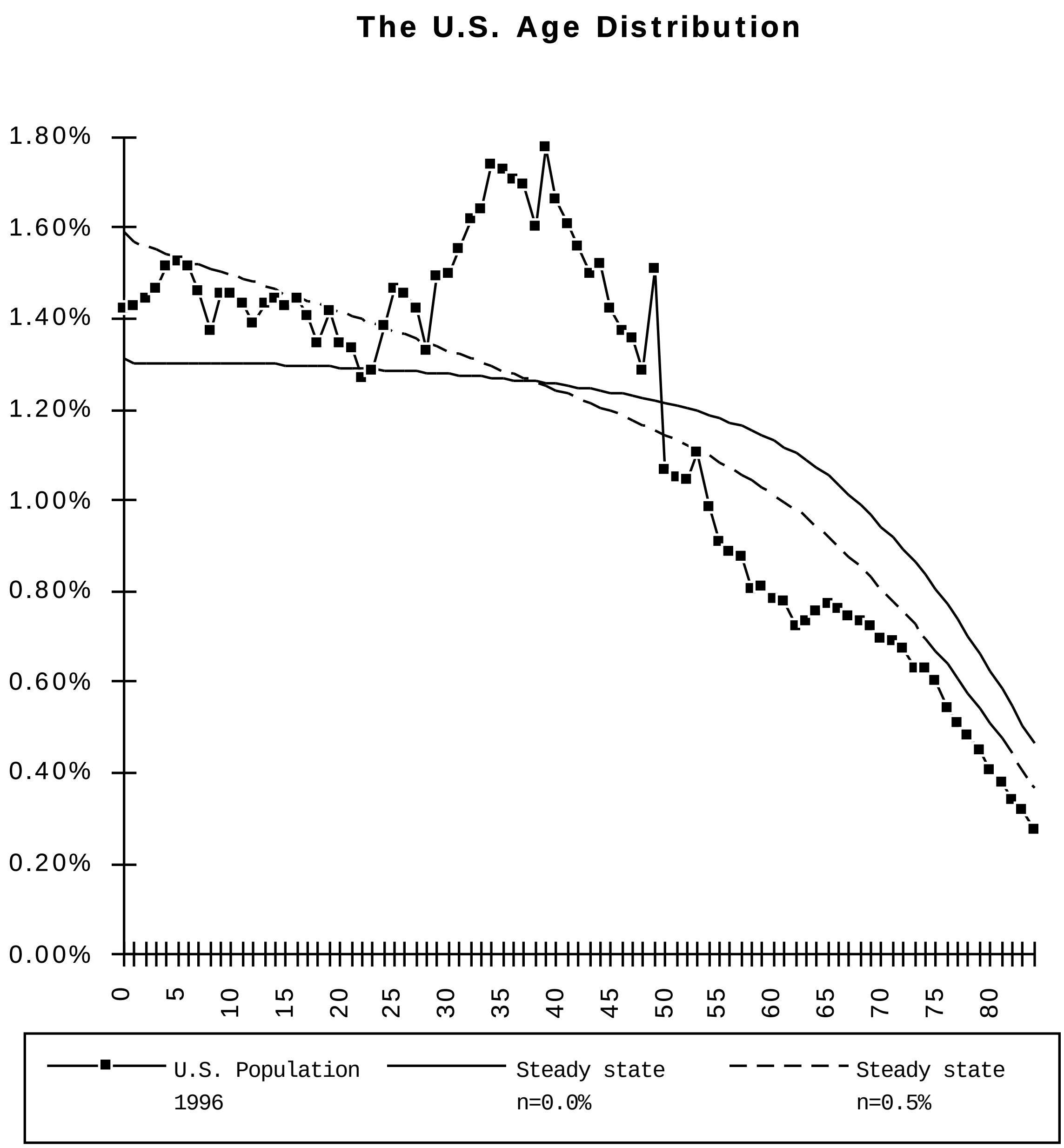
Notes: SSA (1997) and own calculations.

Figure 8



Notes: Data from SSA (1997). Trust fund transactions and taxes on benefits are excluded.

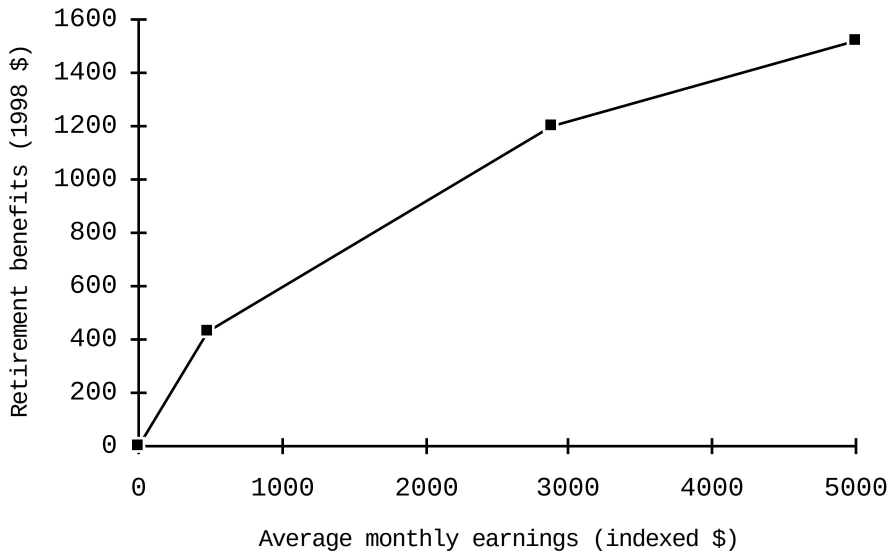
Figure 9



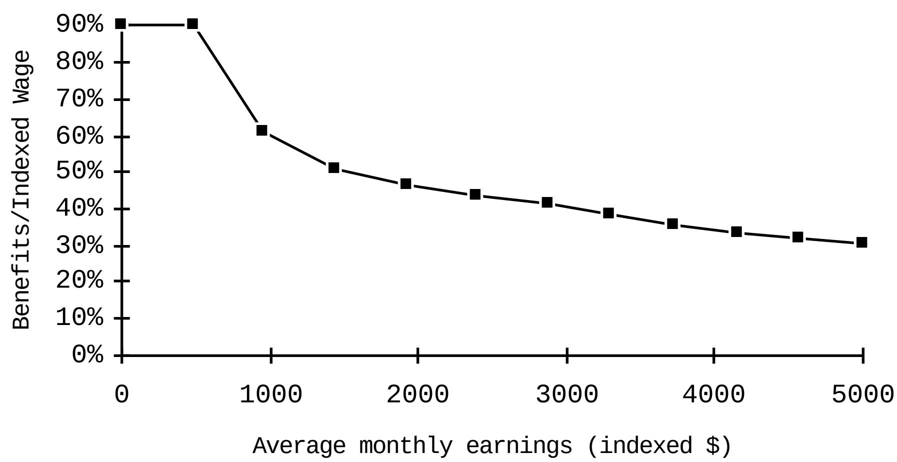
Notes: Actual distribution: Statistical Abstract of the United States, 1997. Steady states: SSA Period Life Table for 1994 and own calculations, assuming unchanged mortality.

Figure 10

A. Monthly Retirement Benefits as Function of Lifetime Wages



B. Replacement Rate



Note: SSA (1997) and own calculations.

Table 1: How Old Is the U.S. Median Voter?

Age Groups	Voting-age Population (1996)	Percent of Age Group that is: Registered Nov.1996	Voting Nov.1992	Registered Nov.1994	Voting Nov.1994
18-20	**5.6%**	45.6%	38.5%	37.2%	16.5%
21-24	**7.1%**	51.2%	45.7%	45.5%	22.3%
25-34	**20.6%**	56.9%	53.2%	51.5%	32.2%
35-44	**22.1%**	66.5%	63.6%	63.3%	46.0%
45-64	**27.4%**	73.5%	70.0%	71.0%	56.0%
65+	**17.3%**	77.0%	70.1%	75.6%	60.7%
Voters 65+	17.3%	20.1%	19.6%	20.9%	23.2%
Voters 45+	44.6%	50.6%	50.7%	52.1%	57.2%
Median Voter	**42**	**45**	**45**	**45**	**48**

Notes: Statistical Abstract of the United States, 1997. To compute the age of the median voter, the voting participation is assumed constant within each age bracket.

Table 2: How old are median voters in the future?

	Equal Participation		Participation as in 1992	
Year	Median Voter	Share 65+	Median Voter	Share 65+
1997	42	17.2%	45	19.6%
2000	43	17.0%	46	19.3%
2010	46	17.5%	49	19.8%
2020	47	21.7%	51	24.4%
2030	48	26.3%	51	29.4%
2040	48	26.8%	51	29.9%
2050	48	26.5%	52	29.6%
Zero Growth	48	24.4%		

Notes: Statistical Abstract of the United States, 1997; SSA Period Life Table for 1994; and own calculations, using SSA (1997) intermediate assumptions about increasing survival rates.

Table 3: When Do Voters Benefit from Social Security? Partial Equilibrium Answers

Year	OASI	HI	OASDI
1997	39	37	42
2000	41	38	42
2010	43	41	45
2020	44	45	47
2030	45	46	47
2040	45	47	47
2050	45	47	47
2030 Early Retirement	*44*	*46*	*47*

Notes: The table shows critical age-values i^* based on the SSA intermediate projections (except for a 3.7% real discount rate, 1% above the SSA assumption). Whenever benefit cost exceed revenues under current law, payroll taxes are assumed increased to cover cost, i.e., to keep the PAYG system.

OASI: Weighs retirement benefits against OASI taxes, assuming a zero value of survivor benefits.

HI: Weighs hospital insurance benefits against HI taxes, excluding the disability component.

OASDI: Weighs retirement benefits against OASDI taxes, assuming a zero value of survivor and disability benefits.

Table 4: Alternative Projections

	Low Cost		High Cost		Fixed Tax Rates	
Year	OASI	HI	OASI	HI	OASI	HI
1997	41	43	38	29	42	46
2000	41	44	39	32	43	47
2010	43	45	41	38	46	48
2020	44	46	44	43	46	48
2030	44	46	45	47	46	48
2040	43	45	46	48	46	48
2050	43	46	47	48	47	48
2030 Early Retirement	*44*	*46*	*44*	*47*	*45*	*48*

Notes: The table shows critical age-values i^* like Table 3, except for the following changes:

Low cost = SSA low cost projection (with 1% higher real rate).

High cost = SSA high cost projection (with 1% higher real rate).

Fixed tax rates = SSA intermediate projection (with 1% higher real rate), but prorated benefits to keep payroll taxes frozen at 1997 levels.

Table 5: Sensitivity Analysis

	Assumptions:	Critical Ages i^* for: OASI	HI
	Benchmark Values for 2030:	45	46
A.	**Changes with minor impact:**		
1	Voters value OASI Survivor Insurance	40	N/A
2	Imperfect annuities: 25% surcharge over the actuarially fair level	43	44
3	Inefficient Medicare: 80% Value/cost	N/A	49*
4	High income: Reduced replacement rate at 160% of average wage	48	52
5	Lower survival: Male life table	47	48
B.	**Latent Altruism: i^* down**		
6	Unavoidable welfare cost 20%	41	43
7	Unavoidable welfare cost 40%	34	37

Table 5 (cont.)

C.	**Higher Discount rates: i^* up**		
8	Real rate r = 5%	49*	50*
9	Real rate r = 6%	51++	52++
10	r = 5% & Welfare cost = 20%	46	49*
11	r = 6% & Welfare cost = 40%	45	48*
12	r = 5% & Annuity surcharge = 50%	46	47
13	r = 6% & Annuity surcharge = 100%	44	44

Notes: Critical valued based on the SSA intermediate projection (with 1% higher real rate), as in Table 3, for votes taking in the year 2030.

* = Majority for social security is questionable with equal voter participation (Median age of population = 48 in 2030).

++ = Majority for social security is questionable with historical voter participation (Median age of likely voters = 51 in 2030).

Table 6: Social Security in General Equilibrium

Data	(1) Current Data	(2) Data for 2030
Labor Force Growth	1.5% Annual	0.0% Annual
Return on Capital	5.5% Annual	5.26% Annual
Workers/Retirees	3.37	2.05
Asset ratio a^2/a^1	2.23	2.25
Assumed tax rate θ^*	17.4%	30.3%
Assumed benefits b^*	58.5%	62.0%
Upper Bound b^{PE}_{max}	59.3%	(-)
Upper Bound b^{GE}_{max}	229%	94%
Return on Capital after a no vote	4.65% Annual	3.84% Annual

Notes: The parameters in Column 1 are motivate by current data, as explained in the text. Column 2 show results for the same model parameters combined with labor force growth and benefits as projected for 2030.

Common parameters are: Generational period=23 years, survival rate μ=0.83, relative earnings of the young e=0.7, capital share α=0.35, basic time preference 0.71% annual, consumption weight on first period γ=1.4, perfect annuity markets.

Table 7: A Simple Multi-Dimensional Voting Model

Voter Support as function of party choices:	Party R takes position AGAINST social security (S=0)	Party R takes position FOR social security (S=s)
Party L takes position AGAINST social security (S=0)	YL, OL support L YR, OR support R	YL supports L YR, OL, OR support R
Party L takes position FOR social security (S=s)	YL, OL, OR support L YR supports R	YL, OL support L YR, OR support R

Notes: Each cell shows the voter support for parties L and R by the following voter groups:

YL = Young and prefers position L on other issues (other than social security).

YR = Young and prefers position R on other issues.

OL = Old and prefers position L on other issues.

OR = Old and prefers position R on other issues.

The size s of social security is such that the old switch parties in response to differences in social security positions, but not the young (see Bohn and Stuart, 1998).

Appendix

Methodology for Tables 3-5

Unless otherwise noted, the cost projections and economic/demographic assumptions are taken from SSA (1997) and the analogous HI and SMI Reports. The OASI replacement rates are taken from SSA (1997), Table III.B5. The per-beneficiary HI and SMI benefits are computed by multiplying the respective cost rates by the worker-retiree ratio to obtain the average benefit per retiree. For the age-adjustment, I combine data from the Health Care Financing Review, 1997 Medicare and Medicaid Statistical Supplement, on per-capita Medicare cost in the age brackets 65-74, 75-84, and 85-up and the 1997 Statistical Abstract on the population shares of these age brackets. For each year, I compute the per-capita cost of Medicare in each of these three age bracket so that the relative cost match the HCFR data and the average cost match the projected cost rates. Average worker contributions are assumed to match the cost rates, as explained in the text. To compute age-specific contributions, I assume that the age-earnings profile follows the profile of “Earnings of full time male workers” in the Current Population Report (Census Publ. P60-184, Table 30). Survival rates are taken from the SSA’s 1994 Period Life Table, updated over time by the projected change in survival rates.

To be consistent about excluding DI, the benchmark HI calculations exclude Medicare spending on under-65 year olds (1995 cost shares 12.5% HI, 14.6% SMI) when valuing Medicare benefits. But DI is included in both the OASDI and HI+SMI columns of Table 3. In a unitary perspective on social security, excluding DI would amount to an implicitly assumption that DI offers an actuarially fair insurance.

Derivations in Section 3

The argument why a reduction in n_t raises utility of all generations $t+i$, $i\geq 1$, is as follows. The derivative of utility evaluated at the optimal savings level is

$$\frac{dU_{t+i}}{dn_t} = u'(c^1_{t+i})\frac{dw_{t+i}}{dn_t} + \rho\ \mu^{\lambda}_{t+1}\, u'(c^2_{t+i+1})\, a_{t+i}/\mu_{t+i+1}\frac{dr_{t+i+1}}{dn_t}$$

$$= u'(c^1_{t+i})\frac{dk_{t+i}}{dn_t}\left[\frac{dw_{t+i}}{dk_{t+i}} + \frac{a_{t+i}}{1+r_{t+i+1}}\frac{dr_{t+i+1}}{dk_{t+i+1}}\frac{dk_{t+i+1}}{dk_{t+i}}\right]$$

$$= u'(c^1_{t+i})\frac{dk_{t+i}}{dn_t} A_{t+i}(1-\alpha)\left[1+r_{t+i} - (1+n_{t+i})(1+g)\frac{dk_{t+i+1}}{dk_{t+i}}\right].$$

The bracketed expression is positive, if the economy is dynamically efficient, $1+r>(1+n)(1+g)$, and $0<dk_{t+1}/dk_t<1$. Hence, the derivative is negative (lower n raises U) if $dk_{t+i}/dn_t<0$. Since $dk_{t+1}/dn_t<0$, this is satisfied if convergence is monotone, $0<dk_{t+i}/dk_{t+i-1}$ for all i.

The capital accumulation equation with government is derived as follows. The individual budget constraint

$$c^1_t + \frac{c^2_{t+1} - (b_{t+1}-\tau^2_{t+1})\, w_{t+1}}{(1+r_{t+1})/\mu_{t+1}^{1-\lambda}} = w_t(1-\theta_t-\tau^1_t)$$

and the first order condition $c^2_{t+1} = \rho(1+r_{t+1})\ \mu^{\lambda}\, c^1_t$ imply

$$c^1_t(1+\rho\ \mu^{\lambda}_{t+1}) = w_t(1-\theta_t-\tau^1_t) + \frac{(b_{t+1}-\tau^2_{t+1})\, w_{t+1}}{(1+r_{t+1})/\mu_{t+1}^{1-\lambda}}$$

$$\Rightarrow \quad a_t = \frac{\rho\ \mu^{\lambda}_{t+1}}{1+\rho\ \mu^{\lambda}_{t+1}} w_t(1-\theta_t-\tau^1_t) - \frac{\mu_{t+1}^{1-\lambda}(b_{t+1}-\tau^2_{t+1})}{1+\rho\ \mu^{\lambda}_{t+1}}\ \frac{w_{t+1}}{1+r_{t+1}}$$

Define $d_t = D_t/Y_t$, so that

$$\tau^1_t = 1/(1-\alpha)\,[d_t - (1+n_{t+1})/(1+r_{t+1})\, w_{t+1}/w_t\, d_{t+1}] + (-\tau^2_t)\ \mu^{\lambda}_t/(1+n_t)$$

Also, $\theta_t = b_t\ \mu^{\lambda}_t/(1+n_t)$. Hence,

$$a_t = \frac{\rho\ \mu^{\lambda}_{t+1}}{1+\rho\ \mu^{\lambda}_{t+1}}[1-(b_t-\tau^2_t)\ \mu^{\lambda}_t/(1+n_t)-d_t/(1-\alpha)]\, w_t$$

$$- \frac{\mu_{t+1}^{1-\lambda}(b_{t+1}-\tau^2_{t+1})}{1+\rho\ \mu^{\lambda}_{t+1}}\ \frac{w_{t+1}}{1+r_{t+1}} + \frac{\rho\ \mu^{\lambda}_{t+1}}{1+\rho\ \mu^{\lambda}_{t+1}} d_{t+1}/(1-\alpha)(1+n_{t+1})\ \frac{w_{t+1}}{1+r_{t+1}}$$

Since $K_{t+1} + D_{t+1} = N_t\, a_t$, one obtains

$$a_t/w_t = k_{t+1}(1+n_{t+1})A_{t+1}/w_t + d_{t+1}/(1-\alpha)\frac{w_{t+1}/w_t}{1+r_{t+1}}(1+n_{t+1})$$

$$= \frac{\rho\ \mu^{\lambda}_{t+1}}{1+\rho\ \mu^{\lambda}_{t+1}}[1-(b_t-\tau^2_t)\ \mu^{\lambda}_t/(1+n_t)-d_t/(1-\alpha)] - \frac{\mu_{t+1}^{1-\lambda}(b_{t+1}-\tau^2_{t+1})}{1+\rho\ \mu^{\lambda}_{t+1}}\ \frac{w_{t+1}/w_t}{1+r_{t+1}}$$

$$+ \frac{\rho\ \mu^{\lambda}_{t+1}}{1+\rho\ \mu^{\lambda}_{t+1}} d_{t+1}/(1-\alpha)(1+n_{t+1})\ \frac{w_{t+1}/w_t}{1+r_{t+1}}$$

Next, note that

$$\frac{w_{t+1}/w_t}{1+r_{t+1}} = \frac{(1-\alpha)\,A_{t+1}\,k_{t+1}{}^{\alpha}/w_t}{\alpha\,k_{t+1}{}^{\alpha-1}} = \frac{1-\alpha}{\alpha}\,A_{t+1}\,k_{t+1}/w_t$$

Hence, $k_{t+1}(1+n_{t+1})\,A_{t+1}/w_t = \frac{\rho\ \mu_{t+1}}{1+\rho\ \mu_{t+1}}\,[1-(b_t-\tau^2{}_t)\ \mu_t/(1+n_t)-d_t/(1-\alpha)]$

$$- \frac{\mu_{t+1}{}^{1-\lambda}\,(b_{t+1}-\tau^2{}_{t+1})}{1+\rho\ \mu_{t+1}}\ \frac{w_{t+1}/w_t}{1+r_{t+1}} - \frac{1}{1+\rho\ \mu_{t+1}}\,d_{t+1}/(1-\alpha)\,(1+n_{t+1})\ \frac{w_{t+1}/w_t}{1+r_{t+1}}$$

Define $d^+{}_t = d_t/(1-\alpha) + (b_t-\tau^2{}_t)\ \mu_t/(1+n_t)$. Then

$$k_{t+1}(1+n_{t+1})\,A_{t+1}/w_t = \frac{\rho\ \mu_{t+1}}{1+\rho\ \mu_{t+1}}\,[1-d^+{}_t] - \frac{1+n_{t+1}}{1+\rho\ \mu_{t+1}}\,d^+{}_{t+1}\ \frac{w_{t+1}/w_t}{1+r_{t+1}}$$

$$+ (\mu_{t+1}-\mu_{t+1}{}^{1-\lambda})\,(b_{t+1}-\tau^2{}_{t+1})\ \frac{1}{1+\rho\ \mu_{t+1}}\ \frac{w_{t+1}/w_t}{1+r_{t+1}}$$

$$= \frac{\rho\ \mu_{t+1}}{1+\rho\ \mu_{t+1}}\,[1-d^+{}_t] - \frac{1+n_{t+1}}{1+\rho\ \mu_{t+1}}\ \frac{w_{t+1}/w_t}{1+r_{t+1}}\left\{d^+{}_{t+1} + (b_{t+1}-\tau^2{}_{t+1})\,\frac{\mu_{t+1}{}^{1-\lambda}-\mu_{t+1}}{1+n_{t+1}}\right\}$$

$$\Leftrightarrow\ k_{t+1}/w_t\,A_{t+1}\,(1+n_{t+1})\left(1+\frac{1-\alpha}{\alpha}\,\frac{1}{1+\rho\ \mu_{t+1}}\left\{d^+{}_{t+1}+(b_{t+1}-\tau^2{}_{t+1})\,(1-\mu_{t+1}{}^{\lambda})\,\frac{\mu_{t+1}{}^{1-\lambda}}{1+n_{t+1}}\right\}\right)$$

$$= \frac{\rho\ \mu_{t+1}}{1+\rho\ \mu_{t+1}}\,[1-d^+{}_t]$$

If $\lambda=0$, this depends on policy only through d^+, which is consistent with Auerbach et al. (1991); if $\lambda>0$, the survival-insurance provided by the net benefits $b_{t+1}-\tau^2{}_{t+1}$ is separately valued. Define

$$d^{++}{}_t = d^+{}_t + (b_t-\tau^2{}_t)\,(1-\mu_t{}^{\lambda})\,\frac{\mu_t{}^{1-\lambda}}{1+n_t}$$

then one obtains

$$k_{t+1}\left(1 + \frac{1-\alpha}{\alpha}\,\frac{1}{1+\rho\ \mu_{t+1}}\,d^{++}{}_{t+1}\right) = \frac{1-\alpha}{(1+n_{t+1})\,(1+g)}\ \frac{\rho\ \mu_{t+1}}{1+\rho\ \mu_{t+1}}\,[1-d^+{}_t]\,k_t{}^{\alpha}$$

$$\Rightarrow\quad k_{t+1} = \frac{1-\alpha}{(1+n_{t+1})\,(1+g)}\ \frac{\rho\ \mu_{t+1}}{1+\rho\ \mu_{t+1}+(1-\alpha)/\alpha\ d^{++}{}_{t+1}}\ [1-d^+{}_t]\,k_t{}^{\alpha}.$$

Hence, the capital labor ratio rises in μ, falls in n, and falls in d^+.