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7 Simulating the Privatization of Social Security in General Equilibrium

Laurence J. Kotlikoff

The privatization of social security is one of the hottest policy issues currently under discussion in the United States. Much of this interest seems motivated by a desire to find a way out of the U.S. social security system's long-run financing problem. But there is also a growing awareness among Americans of Chile's success in privatizing social security and the fact that countries all over the world are trying to replicate it. Chile's privatization coincided with the spectacular takeoff of its economy and has led some observers to suggest that privatizing social security was the key to Chile's economic growth. The truth here is hard to know. The Chilean economy benefited from a number of concomitant economic reforms. It also benefited from a stable government and from improvements in external economic conditions. Given the potential for exaggerating the effect on Chile of privatizing social security, it is important to take a hard-nosed look at what economic analysis tells us privatization can and cannot do.

This paper does this. It draws and builds on Kotlikoff (1996a, 1996b, 1996c) in trying to identify the economic arguments for and against privatization. One of the main, although certainly not novel, points in these papers is that, absent

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efficiency improvements, welfare improvements accruing to particular generations as the result of privatization come at the expense of welfare losses to other generations. Moreover, absent efficiency gains or intergenerational redistribution, making some members of a generation better off requires making other members worse off. Policy makers should, presumably, be interested in identifying and immediately enacting any reforms that constitute Pareto improvements. Hence, understanding the potential pure efficiency gains from privatization is important. But policy makers also routinely trade off the welfare of one generation against that of another. Consequently, they also need to understand the potential role of privatization in redistributing resources across and within generations.

This paper uses the Auerbach-Kotlikoff (1987) dynamic fiscal policy model (the AK model) to simulate the macroeconomic and efficiency effects of privatization. Most of the results reported are based on the single-agent version of the model in which all cohort members are identical. But the final section of the paper reports some preliminary results based on a multiagent version of the model in which cohort members differ with respect to their earnings abilities. This new version of the AK model builds on the important work of Fullerton and Rogers (1993), which appears to represent the first serious attempt to incorporate intragenerational heterogeneity in a life-cycle simulation model.

This paper adds to a growing literature on the economics of privatizing social security. Feldstein (1995) uses a partial equilibrium framework, and Arrau (1990) and Arrau and Schmidt-Hebbel (1993) use a version of the AK model to make a number of the points argued here. The AK model used by Arrau and Arrau and Schmidt Hebbel takes labor supply as exogenous. This is a significant shortcoming since the efficiency gains from privatizing social security arise, in large part, from eliminating social security's distortion of labor supply decisions. Raffelhueschen (1993) does include variable labor supply in his simulation analysis of privatizing social security, and his qualitative conclusions are quite similar to those reached here. But Raffelhueschen's model contains only two periods, which limits the applicability of his quantitative findings. Like this study, Imrohoroglu, Huang, and Sargent (1995) use a multiperiod life-cycle model to simulate the effects of privatizing social security. Although their model is more elaborate than the one used here, it does not include variable labor supply, which precludes separating efficiency gains from intergenerational redistribution. Nonetheless, their general findings concerning noncompensated social security privatization transitions accord with those presented here.

The paper proceeds in section 7.1 by discussing the potential macroeconomic and efficiency effects of pay-as-you-go social security. Section 7.2 describes the AK model and its parameterization for this study. Sections 7.3 and 7.4 report results for a one-income-class and multi-income-class versions of the AK model. The final section summarizes and concludes the paper.

7.1 Social Security's Privatization and the Macro Economy

7.1.1 Social Security and Saving

Most industrialized economies and a good many developing countries have spent the postwar period dramatically expanding their pay-as-you-go social security programs. Although this expansion has reduced poverty rates among the elderly, it has also redistributed tremendous sums from young and future generations, as a group, to contemporaneous older generations, as a group.

The mechanism underlying the redistribution to the initial elderly is clear. Generations that are retired or close to retirement at the time pay-as-you-go social security benefits are increased receive windfalls. Initial young as well as all future generations are then left contributing to a retirement system whose rate of return is dictated by the total earnings of subsequent contributors and, thus, the economy's rate of growth of labor earnings. In the United States, this growth rate appears to be about one-third the rate of return available from investing in the market.[1]

This intergenerational redistribution, which produces a very big windfall for the initial elderly and imposes a smaller, but still substantial, loss on all subsequent generations, has a major macroeconomic fallout. It raises the current consumption of the elderly by more than it reduces the current consumption of the current young as well as that of future generations, whose current consumption is obviously zero. Consequently, the policy lowers national saving. The consumption of the elderly rises by more than that of the young for two reasons. First, the elderly have higher propensities to consume out of remaining lifetime resources than do the young.[2] Why? Because the elderly are closer to the ends of their lives and have, therefore, fewer years over which to spend each dollar of remaining lifetime resources. Second, as mentioned, the windfalls to the current elderly are paid for, not only by the current young, but also by future generations. So the resource loss to the initial young is smaller than the resource gain to the initial elderly.

Figure 7.1, based on data developed in Gokhale, Kotlikoff, and Sabelhaus (1996), documents the difference by age in propensities to consume. It shows that propensities to consume of American cohorts are roughly constant through age sixty and then rise dramatically. Figures 7.2 and 7.3 use the same data to show how relative age-consumption and age-resource profiles for American cohorts have changed since the early 1960s. Note that the very substantial in-

1. In a setting in which the growth rate of earnings as well as the market return on capital are risky, the comparison between the return paid by social security and that paid by the market requires appropriately adjusting for risk. It seems unlikely, however, that such an adjustment would make pay-as-you-go social security a better investment than investing in the market.

2. The term *resources* refers to the present value of all remaining lifetime nonasset income (net of taxes and gross of transfer payments received) plus current net wealth.

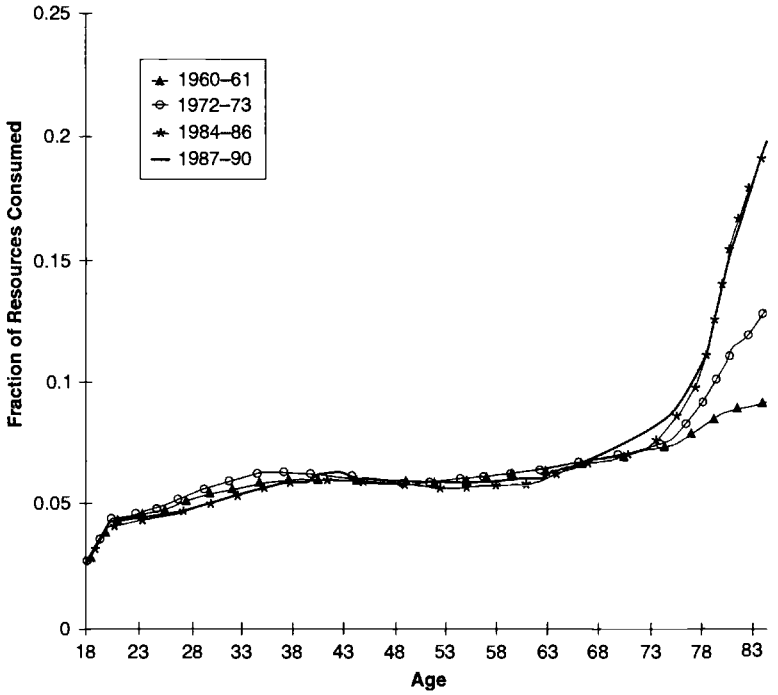

Fig. 7.1 Average propensities to consume out of total resources (r = 6 percent)
Source: Authors' calculations.

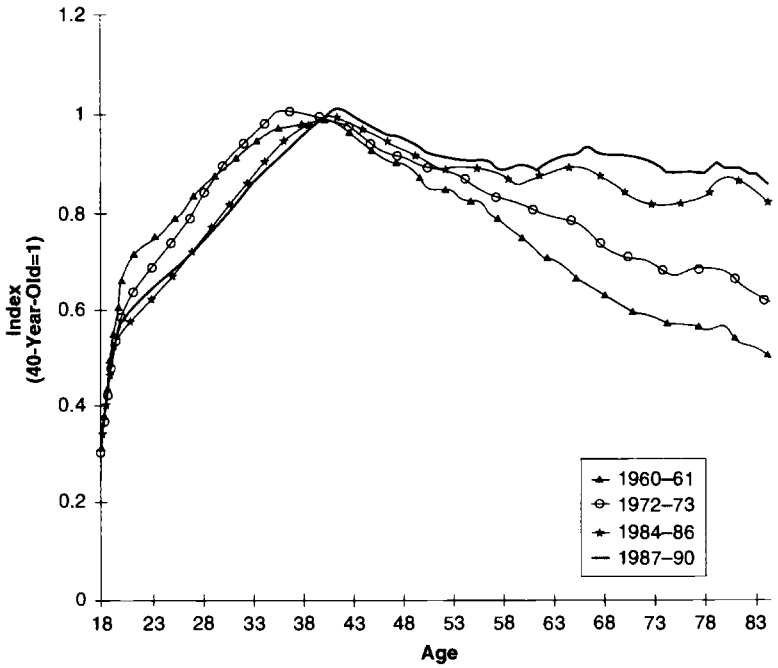

Fig. 7.2 Relative consumption profiles
Source: Authors' calculations based on the Consumer Expenditure Survey.

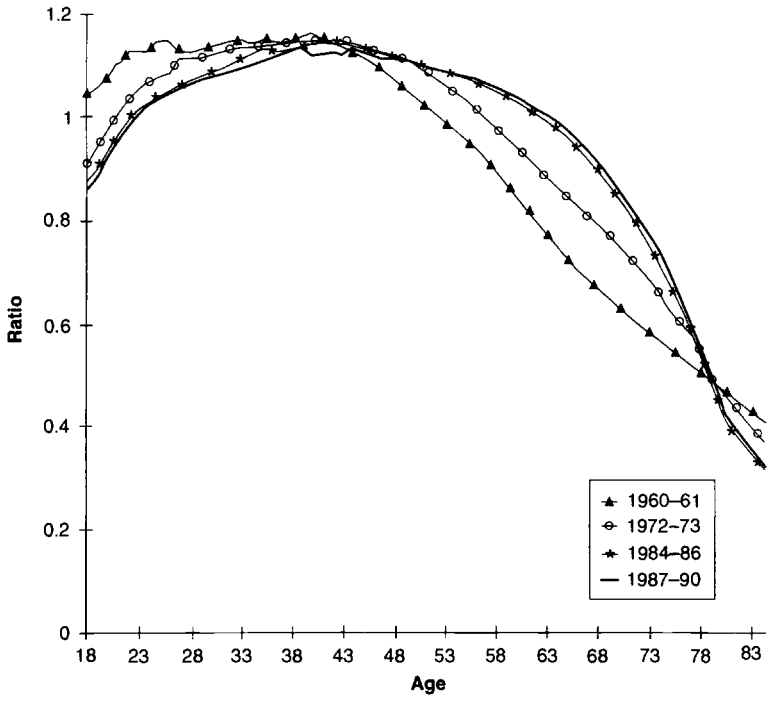

Fig. 7.3 Cohort resources per capita/per capita resources
Source: Authors' calculations.

crease in the resources of the elderly relative to the young has coincided with an equally substantial increase in their relative consumption. The secular increase in the relative resources of the elderly reflects many factors. But the predominant factor is direct government redistribution to the elderly through social security, Medicare, and Medicaid.

As figure 7.4 shows, U.S. intergenerational redistribution has led to precisely what the life-cycle model predicts—a decline in the rate of U.S. saving. The greater than two-thirds decline in the rate of U.S. saving since the 1950s and 1960s has meant a much lower rate of U.S. domestic investment. This, in turn, has raised real interest rates and reduced labor productivity and real wage growth substantially below what would otherwise have been the case (see fig. 7.5). Thus, these general equilibrium feedback effects have exacerbated the direct redistribution from young and future generations to the initial old through pay-as-you-go social security.[3]

The fiscal burdening of young and future generations through pay-as-you-go social security can occur just as well in settings with stable as well as unstable

3. For a simulation analysis showing how alternative government policies affect the welfare of current and future generations, see Auerbach and Kotlikoff (1987).

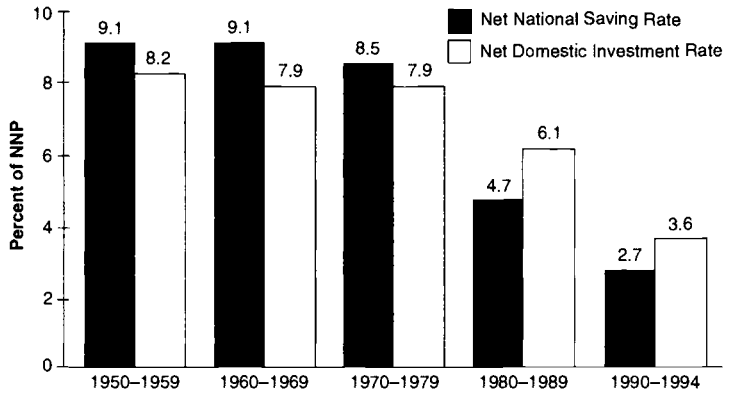

Fig. 7.4 The postwar decline in U.S. saving and investment

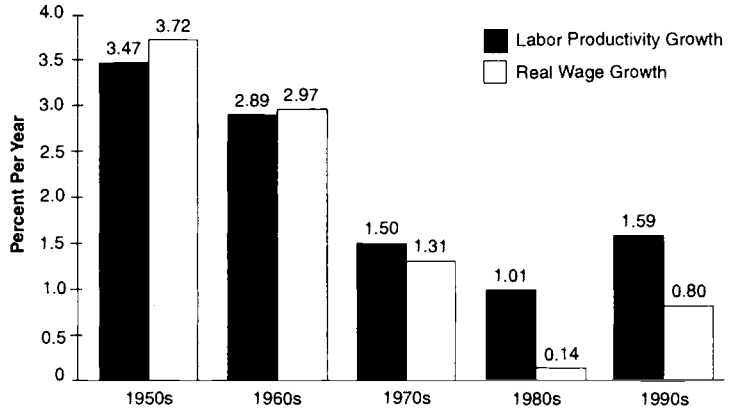

Fig. 7.5 Labor productivity and real wage growth

demographics. But a baby boom followed by a baby bust of the kind being experienced by most developed economies places greater stress on the social security chain letter. Indeed, the United States, Japan, Germany, Italy, France, and a host of other countries now face the unpleasant prospect of either dramatically raising their payroll tax rates over the next few decades or dramatically reducing their social security benefits. It is this impending demographic/social security crunch, rather than a real appreciation of the intrinsic problem with running unfunded social security programs, that seems to be leading politicians to consider privatizing social security.

7.1.2 The Saving, Investment, and Growth Effects of Privatization

If privatization ends up placing a larger fiscal burden on initial older generations, it will lower the fiscal burden not only of the initial young but also of all

future generations. In this case, the initial elderly, with their high propensities to consume, will reduce their consumption by more than the initial young will raise their consumption. Thus, the net effect will be a rise in national saving, investment, and, at least in the short run, real wage growth.

The personal security system described in Kotlikoff (1996b) provides an example of how privatization may produce *income effects* that are conducive to more national saving. In this scheme, social security benefits are phased out over a forty-five-year period. Since payroll contributions to social security are immediately privatized (i.e., the contributions are made to and invested within private accounts), an alternative fiscal instrument is needed to finance social security benefits during the transition. The personal security system uses a consumption tax, specifically a federal retail sales tax, to pay for transitional benefits. Since the elderly account for a larger share of consumption than they do of social security payroll contributions, this policy imposes a larger fiscal burden on them.

In addition to altering national saving via income effects, privatization may also change saving incentives in a way that either encourages or discourages current consumption. Suppose, for example, that income tax financing is used to pay for interest on debt issued in the course of privatizing social security. The higher effective rate of capital income taxation that results from higher income tax rates raises the price of consuming in the future relative to the present and provides the young and old alike an incentive to substitute current for future consumption, that is, to save less.[4] Indeed, such positive *substitution effects* on current consumption could outweigh the negative income effects on current consumption arising under particular privatization schemes, producing, on balance, a decline in national saving.

Since the saving, investment, and growth effects of privatizing social security are theoretically ambiguous, depending on how privatization is achieved, simulation analysis is needed to understand the net macroeconomic effect of privatization. Before turning to such analysis, let us consider other issues involved in privatizing social security.

7.1.3 Are There Efficiency Gains from Privatizing Social Security?

Economic efficiency concerns the structure of economic incentives, such as the incentive to consume now rather than later or the incentive to work rather than enjoy leisure. Since privatization of social security will generally alter economic incentives, the possibility arises that privatization could make the economy more efficient—that it could improve the structure of incentives and, in the process, make some generations better off without making others worse off.

The most important incentive affected by social security is the incentive to

4. Changes in the relative of price of current and future consumption may also produce income effects, unless households are compensated for such relative price changes.

work. By financing social security benefits via payroll taxation, social security reduces this incentive, although the degree to which it does so depends on the nature of its marginal linkage between social security benefits and contributions. This linkage can be positive, negative, or zero. Zero linkage occurs when social security benefits are determined, at the margin, independent of contributions or when workers incorrectly perceive that contributing more to social security will not raise their future social security benefits. In the United States, misconception of the true nature of benefit-tax linkage seems plausible given the complex nature of the U.S. social security benefit formula.

In a "pay-as-you-go" system with zero actual or perceived linkage, workers will consider 100 percent of their payroll tax contribution to be a tax on their labor supply. Nonetheless, in a pay-as-you-go program with stable growth, workers will, on average, receive some return on their contributions to social security—a return that is governed by the rate of growth of the economy. So, on average, social security contributions are not just a tax.

This point notwithstanding, there is no necessary relation between the average and marginal returns to social security contributions. To see this, suppose the social security payroll tax rate is 15 percent. If benefits are provided as a lump sum independent of past contributions, the marginal return from an extra dollar of contributions is zero, and social security adds 15 percentage points to the total effective marginal tax rate on labor supply. If, on the other hand, the government were to provide, in present value, two dollars for every dollar contributed to social security above some contribution level, social security would represent a marginal subsidy to labor supply for all those contributing above that level. Such a subsidy would reduce the total effective marginal tax rate on labor supply by 15 percentage points.

Although providing 100 percent or greater marginal benefit-tax linkage to some contributors is certainly feasible, providing such linkage to all contributors may be politically impossible because of equity considerations. Ignoring other fiscal instruments, providing such high marginal benefit-tax linkage on each dollar contributed to social security requires imposing a large inframarginal tax. Since this large inframarginal tax would be independent of labor earnings, low-wage earners would face a higher average tax from social security than would high-wage earners, making the system regressive.

7.1.4 The Potential Efficiency Gain from Eliminating the U.S. Social Security Payroll Tax

The smaller is a social security system's marginal benefit-tax linkage, the larger are the chances that privatizing social security can support an efficiency gain. To see this, consider a preprivatization situation in which social security benefits are provided to workers independent of their past contributions; marginal linkage is therefore zero, and workers view all their payroll tax contributions as a marginal tax on their labor supply. Also assume that privatization is accomplished by paying only those social security benefits owed to existing retirees as well as those benefits that current workers have accrued as of the

date of the privatization. In this case, the payroll tax will, over time, disappear as a smaller and smaller number of original retirees and workers with accrued benefits remain alive. As the payroll tax rate falls, the total effective tax on labor supply will fall as well. Since the government's distortion of labor supply is reduced over time, this method of privatizing social security has the potential of improving economic efficiency.

Distortions of economic decisions rise with the square of the total effective marginal tax on the decision, so the contribution of the payroll tax to distorting labor supply depends on the size of marginal income taxes as well as other effective marginal labor taxes. In the United States, workers who earn less than social security's covered earnings ceiling (currently $62,500) are subject to the full 15.3 percent marginal social security payroll tax.[5] Most of these workers are likely to be in the 15 percent federal marginal income tax bracket. They are also likely to face a 5 percent state marginal income tax and state sales taxes as well as federal excise taxes, which together effectively tax their labor earnings at about 5 percent.

In combination, these non–social security marginal taxes total 25 percent. The 15.3 percent U.S. social security payroll tax rate raises the total effective marginal tax rate on labor supply from 25 to 39 percent once one takes into account the fact that half the payroll tax contribution (the employer's contribution) can be deducted from the federal income tax. Now, .25 squared equals .0625, and .39 squared equals .1521. Since the distortion of labor supply is proportional to the square of the total effective marginal labor tax rate, the U.S. social security payroll tax may be raising labor supply distortions of low-income workers by 143 ([(.1521/.0621) − 1]) × 100) percent even though it raises the total effective marginal labor tax rate by only 56 ([(.39/.25) − 1] × 100) percent.[6]

7.1.5 The Linkage at the Margin of Benefits to Earnings[7]

This analysis may overstate social security's actual distortion of labor supply and the efficiency gains from privatization because of marginal benefit-tax linkage under the current system. In the United States, marginal benefit-tax linkage varies enormously across the population. Many secondary earners in two-earner couples and all nonworking spouses in single-earner couples col-

5. The 15.3 payroll tax rate includes the Medicare (hospital insurance) tax.

6. For low-income workers covered by the earned income tax credit, the payroll tax's marginal distortion is even larger. Such workers lose twenty cents of their earned income tax credit for every dollar that they earn. Hence, their total effective marginal labor tax rate is 45 percent absent the social security payroll tax and 59 percent with the payroll tax. For such workers, the payroll tax raises their total effective marginal tax rate by 31 percent, but their labor supply distortion by 72 percent. Compared to workers who face the earned income tax credit, the incremental distortion from the payroll tax (which is proportional to the difference between .3481 and .2025) is 62.5 percent larger than the incremental distortion for workers who do not face the earned income tax credit (which is proportional to the difference between .1521 and .0625).

7. This section draws on Kotlikoff (1996c).

lect dependent retirement and survivor benefits based solely on their spouse's earnings histories. Consequently, they receive zero additional benefits in exchange for their marginal payroll tax contributions to social security.[8] The same is true for workers under age twenty-two since their earnings are not included in the calculation of average indexed monthly earnings for purposes of determining retirement benefits. On the other hand, benefit-tax linkage for many primary earners in two-earner couples is significant.

Table 7.1 presents net marginal tax rates on social security contributions for six different household types taking into account benefit-tax linkage. These data were provided by Andrew Samwick and are based on a benefit-calculating program developed in Feldstein and Samwick (1992).[9] The calculations assume a 6 percent real rate of discount, a 1.2 percent rate of real wage growth, and a 3.5 percent rate of inflation and consider the net rate of social security benefit taxation arising from a permanent increase in monthly earnings by $1.00. The table considers only the old age and survivors (OASI) components of social security, and its net tax rates should be compared with the 11.2 percent OASI payroll tax. Negative values refer to subsidies.

The table shows three things. First, it confirms that marginal OASI net tax rates differ greatly across different Americans. For example, at age fifty, the table's low-earner, single-earner husband faces a 12 percent social security subsidy, whereas a high-earner (in the 15 percent benefit bracket), single male age fifty faces a 10 percent marginal tax. Second, OASI net tax rates decline, often substantially, over the life cycle. Consider again the low-earner, single-earner husband. His net tax rate falls from 2 to −23 percent between ages twenty-five and sixty. The reason for the decline in net tax rates with age is that, the closer one gets to collecting marginal benefits arising from additional labor earnings, the less severe is the discounting of those benefits.

Third, as one goes from low- to high-earner households who are earning less than social security's covered earnings ceiling, net marginal tax rates rise substantially. For example, there is a 15 percentage point spread between the 5 percent subsidy facing fifty-year-old, low-earning, single males and the 10 percent tax facing fifty-year-old, high-earning, single males. On the other hand, once one passes the covered earnings ceiling, the marginal OASI net tax drops to zero. Workers earning more than social security's covered earnings ceiling face zero marginal OASI payroll taxation and also receive no marginal social security benefits.[10]

Do workers whose benefits are linked at the margin to additional earnings

8. This discussion abstracts from disability benefits.

9. Boskin et al. (1987) is an earlier study of the marginal net rate of social security taxation that reaches similar conclusions.

10. For this large group of workers, social security does, however, represent a substantial inframarginal tax. Indeed, it is this large inframarginal tax on high earners that is used to provide low earners, as a group, with low or negative marginal OASI net tax rates and average rates of return on their contributions that exceed the economy's growth rate.

Table 7.1 **Net Marginal OASI Tax Rate on $1.00 Rise in Monthly Wages (%)**

	Case					
Age in 1995	A	B	C	D	E	F
25	5	10	2	10	11	0
30	3	10	−0	10	11	0
35	1	10	−2	9	11	0
40	−1	10	−6	9	11	0
45	−3	10	−9	9	11	0
50	−5	10	−12	9	11	0
55	−8	9	−16	8	11	0
60	−12	9	−23	8	11	0

Source: Calculations by Andrew Samwick.

Note: The cases are defined as follows: A = single female, 90 percent benefit bracket, faces no federal income tax. B = single male, 15 percent benefit bracket, faces 85 percent benefit taxation at a 33 percent rate. C = husband in single-earner couple, 90 percent social security benefit bracket, faces no federal income tax. D = husband in single-earner couple, 15 percent social security benefit bracket, faces federal income taxation of 85 percent of benefits at a 33 percent rate. E = secondary earner collecting benefits based solely on spouse's earnings record. F = very high earner (earnings above social security's earnings ceiling).

understand the linkage? We do not know. However, we do know that correctly assessing the linkage is very difficult. Doing so requires knowledge of intricate OASI benefit provisions and the ability to make sophisticated actuarial calculations. Since very few workers have such knowledge or an actuarial background, the vast majority are, presumably, guessing about the degree to which their benefits are linked at the margin to their additional earnings. If they are overassessing the degree of linkage, the present social security system may be less distortionary than it appears. On the other hand, if they are underassessing the degree of linkage, the opposite will be true. In this case, privatizing social security can be beneficial by simply making clear that the true rate of marginal taxation of labor supply is less than the perceived rate.

7.1.6 Other Efficiency Issues Raised by Social Security's Privatization

In addition to its effect on effective marginal tax rates on labor supply, privatization may also alter other effective marginal tax rates. For example, if privatization is accomplished by using income tax financing to pay, over time, the accrued benefits owed to current retirees and workers, there will be a temporary increase in effective marginal capital income taxation. If effective marginal capital income taxation is already quite high owing to, say, a high corporate income tax, privatization could well reduce economic efficiency. Thus, there is no guarantee that privatizing social security will improve economic efficiency. It all depends on the type of social security system being privatized, the nature of other fiscal distortions, and the manner in which privatization takes place.

An entirely different efficiency issue raised by social security's privatization is its effect on the availability to the elderly of longevity insurance (insurance against outliving one's resources). Social security provides this insurance by paying retirees benefits for as long as they live. Social security overcomes the adverse selection problem faced by private insurers in trying to sell annuities by simply forcing everyone into its insurance pool; that is, it effectively forces everyone to buy its annuities. The government has a second important advantage vis-à-vis private insurers, namely, the ability to provide inflation-indexed benefits. The U.S. government appears poised to assist private insurers in selling indexed annuities by following the example of England and several other countries in issuing indexed debt. Insurance companies will be able to purchase this debt to hedge their exposure in selling indexed annuities to the public.

Research is now under way to assess the potential efficiency costs of eliminating the compulsory purchase of annuities through social security, which would potentially leave the elderly with much less longevity insurance. These costs may be substantial because, as demonstrated in Kotlikoff and Spivak (1981), the value of longevity insurance can be very high even for households with moderate degrees of risk aversion. On the other hand, Kotlikoff and Spivak also show that extended families, for whom information problems are surely less severe, can insure their members against longevity risk to a surprising degree. The fact, recently documented by Hayashi, Altonji, and Kotlikoff (1996), that extended families do not self-insure does not preclude their choosing to do so in response to the privatization of social security. Anecdotal as well as hard evidence on extended family living arrangements suggests that self-insurance by extended families was much greater in the United States prior to the expansion of social security. In any case, until this important issue is resolved, it will be impossible to assess the net efficiency gains from privatizing social security.[11]

7.2 Using the Auerbach-Kotlikoff Model to Study Social Security's Privatization

7.2.1 The Auerbach-Kotlikoff Model

The Auerbach-Kotlikoff model (the AK model) can provide some sense of the potential saving, investment, and growth effects of privatizing social security.[12] The AK model calculates the time path of all economic variables in its economy over a 150-year period. The model has fifty-five overlapping genera-

11. Note that, in a privatized system, the government could limit the degree of adverse selection by (*a*) compelling each cohort to annuitize all its accumulated privatized account balances, say, at age sixty-five and (*b*) prohibiting insurance companies from restricting the sale of its annuities to individuals with particular characteristics.

12. For a detailed description of the AK model, see Auerbach and Kotlikoff (1987).

tions. Each adult agent in the model lives for fifty-five years (from age twenty to age seventy-five).

There are three sectors: households, firms, and the government. Households (adult agents) decide how much to work and how much to save based on the after-tax wages and after-tax rates of return they can earn in the present and the future on their labor supply and saving, respectively. The work decision involves not only deciding how much to work in those years that one is working but also when to retire. The AK model's time-separable, CES consumption and leisure preferences that underlie these decisions were chosen in light of evidence on actual labor supply and saving behavior.

As agents age in the model, they experience a realistic profile of increases in wages. This age-wage profile is separate from the general level of wages, the time path of which is determined in solving the model. Fiscal policies affect households by altering their after-tax wages, their after-tax rates of return, and, in the case of consumption taxes, their after-tax prices of goods and services. The model is equipped to deal with income taxes, wage taxes, capital income taxes, and consumption taxes. It is also able to handle progressive as well as proportional tax rates. Finally, and most important for this study, the model includes a pay-as-you-go social security system in which the perceived linkage between taxes and benefits can be set at any desired value.

The model's base-case population growth rate is set at a constant 1 percent rate, with the population of each new cohort being 1 percent larger than that of the previous cohort. All agents are assumed to have the same preferences, so differences in behavior across agents arise solely from differences in economic opportunities. Until section 7.4, all agents within an age cohort are assumed to be identical; that is, differences in economic opportunities are present only across cohorts. Section 7.4 considers a heterogeneous-agent version of the model, developed by Kent Smetters, Jan Walliser, and myself. This modified model considers twelve earnings groups within each cohort. Each earnings group experiences the same longitudinal growth in earnings but has a different level of earnings. This modified model facilitates the study of the effect of privatization on the intragenerational distribution of economic resources and welfare.

The AK model's output is produced by perfectly competitive firms that hire labor and capital to maximize their profits. These firms produce subject to a CES production function, which, for purposes of this study, is restricted to the Cobb-Douglas form. The government sector consists of a treasury that collects resources from the private sector to finance government consumption and an unfunded, "pay-as-you-go" social security system that levies payroll taxes to pay for contemporaneous retiree benefit payments. There is no money in the model and, thus, no monetary policy. There is, however, government debt, and the model can handle deficit-financed reductions in payroll and other taxes. It can also handle gradual phase-ins of one tax for the other. Finally, the model contains a lump sum redistribution authority (LSRA)—a hypothetical government agency that can use lump sum taxes and transfers to redistribute among

generations alive at a point in time as well as those who will be born in the future. The LSRA can be used (switched on) to study the pure economic efficiency effects of particular policy changes.

Although the model handles a great number of complex processes, it leaves out certain portions of reality, some small and some large. For one thing, there are no liquidity constraints. Leaving out liquidity constraints greatly facilitates the simulation of social security's privatization. The reason is that one can model the act of privatizing social security contributions as equivalent to simply eliminating the payroll tax. This reflects the fact that agents in the model cannot be forced to save. Any attempt to do so simply leads them to borrow against their future wealth. This applies to forcing agents to invest their social security contributions in private accounts. Doing so would produce the same net saving as not doing so. This said, it is worth pointing out that, in the particular economies simulated here, agents do not actually seek to borrow. So, even if a liquidity constraint (specifically, a constraint against negative net wealth) were added to the model, it would not be binding.

The version of the model used here ignores saving for purposes other than retirement, such as bequests. The model also ignores uncertainty with respect to either individual or macroeconomic outcomes. These and other omissions suggest viewing the model's results cautiously.

7.2.2 Modeling Social Security's Privatization

As just mentioned, in the AK model, privatizing social security contributions just requires setting the model's social security payroll tax rate to zero.[13] Hence, there is no need to add a formal private pension system to the model. Beyond eliminating the payroll tax, privatizing social security benefits within the model involves three key decisions: how fast to phase out benefits, whether to issue explicit government debt for a period of time to make up for some or all of the loss in payroll tax revenue, and what tax instrument to use, during the benefit phase-out period, to pay for benefits that are not financed by explicit borrowing and to meet, during and after the benefit phase-out period, interest on new debt issued as part of the privatization.[14]

13. Again, this can be thought of as forcing agents to make their contributions to private pension accounts but permitting them to reduce their other saving and, indeed, borrow against these accounts if they so desire.

14. These three decisions are illustrated in Chile's privatization of social security. Chile's privatization honored benefit commitments to existing retirees. It also provided existing workers *recognition bonds*—explicit IOUs that would come due when workers reached retirement age. These recognition bonds compensated workers for the elimination of their claims to future social security benefits—claims that they had accrued as the result of past contributions. Because the timing of the payment of principal and interest on the recognition bonds is similar to the timing of the payment of the accrued social security benefits that these workers would otherwise have received, the Chilean reform can be viewed as paying off all accrued benefits under the old system but disallowing any further accrual of social security benefits. Consequently, it amounts to a particular benefit-phase-out policy. Chile used deficit finance to cover some of the losses in revenue arising from the discontinuation of the payroll tax. This deficit finance took the form of running smaller

Table 7.2 **Baseline Parameter Values and Spending and Tax Rates**

Parameter	Value
Intratemporal elasticity of substitution	.800
Intertemporal elasticity of substitution	.250
Weight of leisure	1.500
Pure rate of time preference	.015
Elasticity of substitution between labor and capital	1.000
Population growth rate	.010
Output share of government consumption	.224
Average income tax rate	.224
Average marginal income tax rate	.328
Payroll tax rate	.122

7.2.3 The AK Model Used to Study Social Security's Privatization

As reported in table 7.2, the preprivatization economy features a progressive income tax (with an average marginal tax rate of 33 percent) that finances government consumption equal to 22 percent of output, a 12 percent social security payroll tax, zero linkage between social security benefits and taxes, zero initial official government debt, a 1 percent population growth rate, zero technological change, a Cobb-Douglas production function, a CES utility function in consumption and leisure with intertemporal and intratemporal elasticities of substitution of .25 and .8, respectively, and a time preference rate of 1.5 percent.

Our baseline economy has a 2.5 percent rate of national saving and a ratio of social security outlays to output of .089.[15] The pretax interest rate (the marginal product of capital) is 10.3 percent. At the micro level, consumption more than doubles between ages twenty-one and seventy-five, which is consistent with the findings in figure 7.2 above. Social security benefits constitute between 55 and 60 percent of consumption for agents over sixty-five. Labor supply at age sixty-five is about 70 percent lower than labor supply at age twenty-one; it is virtually zero after age seventy-one.

The simulation phases out social security benefits in a linear manner over a forty-five-year period. This phase-out period starts eleven years after the payroll tax is eliminated, thus permitting all beneficiaries at the time of the reform to collect all their benefits. Social security benefits during the transition are financed by either a proportional consumption tax, a progressive income tax, a

surpluses than would otherwise have been the case. Finally, Chile used its income tax to make up the rest of the lost payroll tax revenue and, implicitly, to meet interest payments on its additional borrowing.

15. Note that this is higher than the 1994 5.2 percent NNP share of social security spending. It also exceeds the respective 7.5 percent for combined spending on Medicare and social security. This difference arises from the stylized assumption of constant 1 percent population growth. The current U.S. population, in contrast, reflects high birth rates in the 1950s and 1960s, and payroll taxes are levied on a relatively larger working population.

payroll tax, or initial deficit financing coupled with subsequent increases in either proportional consumption tax rates or progressive income tax rates. For each case, I present results in which the welfare (utility) of initial generations is allowed to change in response to the privatization as well as results in which the welfare of initial generations is held constant. In the latter simulations, the LSRA redistributes in a lump sum manner so as (*a*) to leave all generations alive at the time of the transition with precisely the same utility they would have enjoyed absent privatization and (*b*) to equalize the utility of all generations born after the policy is initiated. Finally, I consider alternative degrees of benefit-tax linkage.

7.3 Simulation Findings

7.3.1 Simulating a Cold-Turkey Privatization

To place subsequent privatization results in perspective, I first simulate the macroeconomic and efficiency effects of an immediate and complete elimination of social security benefits and taxes. Although such a privatization is unlikely ever to be undertaken, simulating it clarifies the maximum damage that could be done to initial older generations from privatization as well as the maximum efficiency gains available from privatization after initial older generations are fully compensated for their loss of benefits.

Figure 7.6 shows that this policy would have a major effect on the macro economy as well as the intergenerational distribution of welfare. The top panel in the figure provides an index of the policy's induced changes (relative to initial steady-state values) in the capital stock (K), output (Y), labor supply (L), the real wage (w), and the real interest rate (r). The first rows of tables 7.3–7.8 (run 1) record the values graphed in the figures.

As indicated, the "cold-turkey" elimination of social security leads to a 57 percent long-run increase in the economy's capital stock relative to its initial steady-state value. The long-run increases in labor supply, output, and the real wage are 6, 17, and 10 percent, respectively. The long-run reduction in the real interest rate is 25 percent, and the long-run increase in welfare (the increase in utility of those alive in the long run) is 10.79 percent. This percentage change in remaining lifetime utility is measured as the percentage increase in remaining lifetime consumption and leisure at each age needed in the initial steady state to produce the same level of utility for the generation in question as it enjoys under privatization.

Although figure 7.6 and the tables point to a very major long-run gain to the economy and its future inhabitants from a "cold-turkey" transition, they also show that these gains come at the cost of major utility losses to initial older generations. For example, the oldest members of society—those born fifty-four years before the reform—suffer a 26 percent reduction in remaining lifetime welfare.

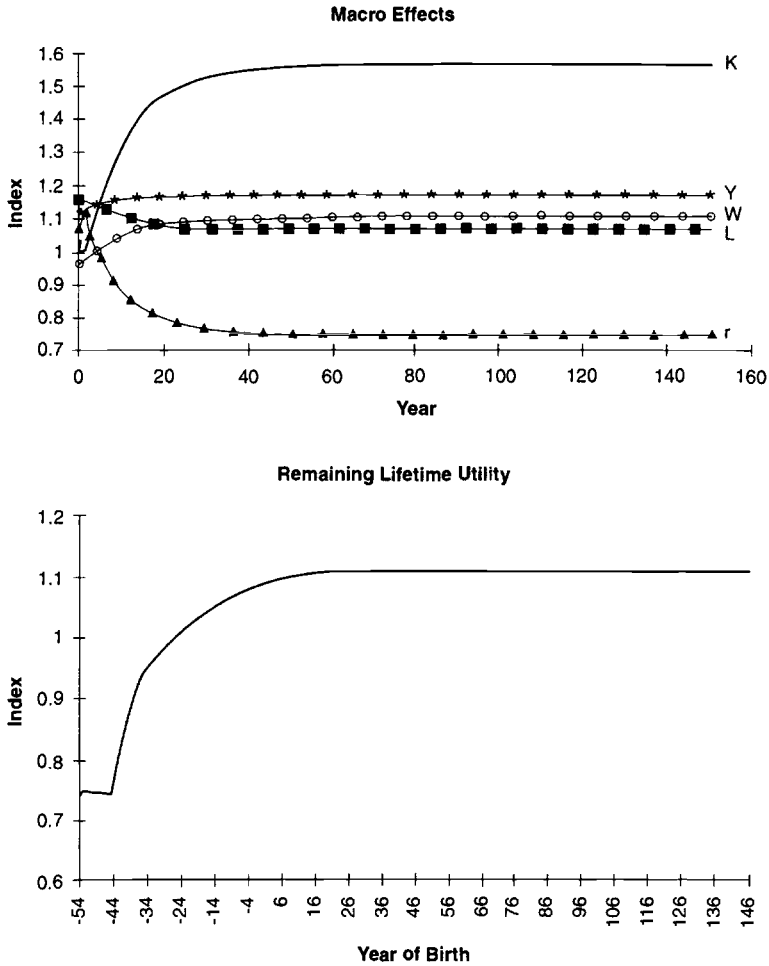

Fig. 7.6 Progressive income tax financing of benefits, benefits eliminated immediately

To investigate how much of the improvement in the welfare of future generations reflects efficiency improvements as opposed to simply redistribution away from initial generations, I repeated the "cold-turkey" simulation but instructed the LSRA to compensate all initial generations to prevent any loss in their utility levels. The results are shown in figure 7.7 and reported as run 2 in the tables. The long-run increase in the capital stock in this case is lower—36 rather than 57 percent—but still remarkably large. It is large enough to raise long-run output by 14 percent, raise the long-run real wage by 6 percent, lower the long-run real interest rate by 16 percent, and raise the utility levels of all

Table 7.3 **Percentage Change in Capital Stock Relative to Steady State**

Run	Tax Financing Soc. Sec. Benefits	Years Benefits Phased Out	LSRA	BTL	Years of Deficit Financing	Year of Transition			
						5	10	25	150
1	Yprog	0	No	0	0	16.11	31.68	50.28	56.67
2	Yprog	0	Yes	0	0	5.71	11.85	25.16	35.24
3	Yprog[a]	0	No	0	0	10.04	19.30	30.20	33.60
4	Yprog[a]	0	Yes	0	0	2.84	5.56	10.62	13.64
5	Yprog	0	No	.1	0	15.75	30.96	49.03	55.19
6	Yprog	0	Yes	.1	0	5.01	10.35	21.89	31.75
7	Yprog	0	No	.3	0	15.07	29.60	46.74	52.49
8	Yprog	0	Yes	.3	0	3.72	7.63	16.09	24.19
9	Yprog	55	No	0	0	−.52	−.57	4.96	56.67
10	Yprog	55	Yes	0	0	−1.72	−3.54	−4.90	8.82
11	W	55	No	0	0	.79	1.68	7.52	56.67
12	W	55	Yes	0	0	.01	−.45	−1.56	7.01
13	C	55	No	0	0	5.54	11.54	25.60	56.67
14	C	55	Yes	0	0	2.98	6.27	13.64	20.28
15	Yprog	55	No	0	5	4.32	1.43	−4.16	40.43
16	Yprog	55	Yes	0	5	3.98	0.70	−7.81	4.15
17	C	55	No	0	5	2.02	4.25	12.04	39.31
18	C	55	Yes	0	5	1.27	2.21	5.64	10.70
19	Yprog	55	No	.1	0	−.92	−1.34	3.74	55.19
20	Yprog	55	Yes	.1	0	−2.38	−4.92	−7.56	5.41
21	Yprog	55	No	.3	0	−1.68	−2.82	1.47	52.49
22	Yprog	55	Yes	.3	0	−3.60	−7.45	−12.45	−1.59
23	C	55	No	.1	0	5.17	10.82	24.41	55.19
24	C	55	Yes	.1	0	2.31	4.84	10.67	16.20
25	C	55	No	.3	0	4.48	9.49	22.22	52.49
26	C	55	Yes	.3	0	1.05	2.24	5.33	8.90

Note: LSRA = Lump sum redistribution authority. BTL = Benefit-tax linkage. Yprog = Progressive income tax. C = Proportional consumption tax. W = Payroll tax.
[a]Three percent population growth.

Table 7.4 **Percentage Change in Aggregate Labor Supply Relative to Steady State**

Run	Tax Financing Soc. Sec. Benefits	Years Benefits Phased Out	LSRA	BTL	Years of Deficit Financing	Year of Transition			
						5	10	25	150
1	Yprog	0	No	0	0	13.89	11.08	7.26	6.28
2	Yprog	0	Yes	0	0	10.74	10.08	8.63	7.36
3	Yprog[a]	0	No	0	0	7.68	6.15	4.05	3.58
4	Yprog[a]	0	Yes	0	0	5.37	5.07	4.46	4.14
5	Yprog	0	No	.1	0	12.69	9.94	6.22	5.28
6	Yprog	0	Yes	.1	0	9.42	8.85	7.56	6.56
7	Yprog	0	No	.3	0	10.42	7.80	4.25	3.37
8	Yprog	0	Yes	.3	0	6.97	6.54	5.55	5.00
9	Yprog	55	No	0	0	1.64	1.67	5.00	6.28
10	Yprog	55	Yes	0	0	1.05	1.22	4.83	8.28
11	W	55	No	0	0	.43	.14	3.87	6.28
12	W	55	Yes	0	0	−.13	−.49	3.35	8.49
13	C	55	No	0	0	5.13	4.48	4.97	6.28
14	C	55	Yes	0	0	4.38	4.06	4.91	7.61
15	Yprog	55	No	0	5	8.58	−2.53	2.11	5.18
16	Yprog	55	Yes	0	5	8.19	−2.73	1.82	6.42
17	C	55	No	0	5	7.15	1.51	2.98	6.05
18	C	55	Yes	0	5	6.67	1.18	2.72	6.04
19	Yprog	55	No	.1	0	.43	.53	4.00	5.88
20	Yprog	55	Yes	.1	0	−.20	.06	3.90	7.59
21	Yprog	55	No	.3	0	−1.83	−1.61	2.09	3.37
22	Yprog	55	Yes	.3	0	−2.59	−2.16	2.15	6.04
23	C	55	No	.1	0	3.95	3.36	3.96	5.28
24	C	55	Yes	.1	0	3.14	2.89	3.93	6.80
25	C	55	No	.3	0	1.73	1.26	2.02	3.37
26	C	55	Yes	.3	0	.77	.68	2.07	5.21

Note: For abbreviations, see table 7.3.

[a]Three percent population growth.

Table 7.5 **Percentage Change in Output Stock Relative to Steady State**

Run	Tax Financing Soc. Sec. Benefits	Years Benefits Phased Out	LSRA	BTL	Years of Deficit Financing	Year of Transition			
						5	10	25	150
1	Yprog	0	No	0	0	14.44	15.91	16.70	17.11
2	Yprog	0	Yes	0	0	9.46	10.52	12.54	13.95
3	Yprog[a]	0	No	0	0	8.27	9.29	10.05	10.39
4	Yprog[a]	0	Yes	0	0	4.73	5.19	5.96	6.44
5	Yprog	0	No	.1	0	13.45	14.86	15.47	16.00
6	Yprog	0	Yes	.1	0	8.30	9.22	10.97	12.36
7	Yprog	0	No	.3	0	11.56	12.88	13.55	13.92
8	Yprog	0	Yes	.3	0	6.15	6.81	8.09	9.58
9	Yprog	55	No	0	0	1.10	1.11	5.00	17.11
10	Yprog	55	Yes	0	0	.35	.01	2.31	8.42
11	W	55	No	0	0	.52	.53	4.78	17.11
12	W	55	Yes	0	0	−.09	−.48	2.10	8.11
13	C	55	No	0	0	5.23	6.20	9.79	17.11
14	C	55	Yes	0	0	4.03	4.61	7.03	10.65
15	Yprog	55	No	0	5	7.50	−1.55	.50	13.06
16	Yprog	55	Yes	0	5	7.12	−1.89	−.68	5.84
17	C	55	No	0	5	5.85	2.18	5.18	12.77
18	C	55	Yes	0	5	5.30	1.44	3.44	7.06
19	Yprog	55	No	.1	0	.09	.06	3.93	16.00
20	Yprog	55	Yes	.1	0	−.75	−1.21	.91	7.04
21	Yprog	55	No	.3	0	−1.79	−1.92	1.93	13.92
22	Yprog	55	Yes	.3	0	−2.84	−3.51	−1.71	4.08
23	C	55	No	.1	0	4.25	5.18	8.73	16.00
24	C	55	Yes	.1	0	2.93	3.38	5.57	9.08
25	C	55	No	.3	0	2.41	3.26	6.73	13.92
26	C	55	Yes	.3	0	.84	1.07	2.88	6.13

Note: For abbreviations, see table 7.3.

[a]Three percent population growth.

Table 7.6 **Percentage Change in Wage Relative to Steady State**

Run	Tax Financing Soc. Sec. Benefits	Years Benefits Phased Out	LSRA	BTL	Years of Deficit Financing	Year of Transition			
						5	10	25	150
1	Yprog	0	No	0	0	.48	4.35	8.80	10.19
2	Yprog	0	Yes	0	0	−1.16	.40	3.60	6.14
3	Yprog[a]	0	No	0	0	.54	2.96	5.77	6.57
4	Yprog[a]	0	Yes	0	0	−.61	.11	1.44	2.21
5	Yprog	0	No	0	0	−.54	−.56	.00	10.19
6	Yprog	0	Yes	0	0	−.70	−1.20	−2.41	.11
7	Yprog	0	No	0	0	−.34	−.47	−.06	10.19
8	Yprog	0	Yes	0	0	−.56	−1.27	−2.88	−.51
9	Yprog	55	No	.3	0	1.04	4.71	8.92	10.21
10	Yprog	55	Yes	.3	0	−.76	.25	2.41	4.26
11	W	55	No	0	0	.09	.38	.87	10.19
12	W	55	Yes	0	0	.03	.01	−1.21	−.34
13	C	55	No	0	0	−.25	1.65	4.59	10.19
14	C	55	Yes	0	0	−.34	.52	2.02	2.81
15	Yprog	55	No	0	5	−1.00	1.00	−1.57	7.49
16	Yprog	55	Yes	0	5	−.99	.87	−2.46	−.54
17	C	55	No	0	5	−1.22	.67	2.13	7.30
18	C	55	Yes	0	5	−1.29	.25	.70	1.11
19	Yprog	55	No	.1	0	−.34	−.47	−.06	10.19
20	Yprog	55	Yes	.1	0	−.56	−1.27	−2.88	.51
21	Yprog	55	No	.3	0	.03	−.31	−.15	10.21
22	Yprog	55	Yes	.3	0	−.26	−1.38	−3.79	−1.85
23	C	55	No	.1	0	.29	1.76	4.59	10.19
24	C	55	Yes	.1	0	−.20	.47	1.58	2.12
25	C	55	No	.3	0	.66	1.97	4.62	10.21
26	C	55	Yes	.3	0	.07	.38	.78	.85

Note: For abbreviations, see table 7.3.

[a]Three percent population growth.

Table 7.7 **Percentage Change in Interest Rate Relative to Steady State**

Run	Tax Financing Soc. Sec. Benefits	Years Benefits Phased Out	LSRA	BTL	Years of Deficit Financing	Year of Transition			
						5	10	25	150
1	Yprog	0	No	0	0	−1.44	−11.98	−22.35	−25.25
2	Yprog	0	Yes	0	0	3.55	−1.19	−10.08	−16.36
3	Yprog[a]	0	No	0	0	−1.61	−8.39	−15.48	−17.38
4	Yprog[a]	0	Yes	0	0	1.85	−.35	−4.21	−6.34
5	Yprog	0	No	.1	0	−1.99	−12.30	−22.43	−25.26
6	Yprog	0	Yes	.1	0	3.14	−1.02	−8.95	−14.71
7	Yprog	0	No	.3	0	−.3.04	−12.90	−22.61	−25.30
8	Yprog	0	Yes	.3	0	2.34	−.77	−6.88	−11.77
9	Yprog	55	No	0	0	1.62	1.69	.00	−25.25
10	Yprog	55	Yes	0	0	2.12	3.69	7.59	−.33
11	W	55	No	0	0	−.60	−1.13	−2.55	−25.25
12	W	55	Yes	0	0	−.09	−.02	3.73	1.03
13	C	55	No	0	0	−2.22	−4.78	−12.59	−25.25
14	C	55	Yes	0	0	1.03	−1.55	−5.81	−7.98
15	Yprog	55	No	0	5	3.05	−2.40	−4.87	−19.49
16	Yprog	55	Yes	0	5	3.03	−2.56	7.75	1.65
17	C	55	No	0	5	3.75	−1.98	−6.13	−19.06
18	C	55	Yes	0	5	4.00	−.75	−2.07	−3.27
19	Yprog	55	No	.1	0	1.02	1.43	.19	−25.26
20	Yprog	55	Yes	.1	0	1.68	3.92	9.17	1.55
21	Yprog	55	No	.3	0	−.11	.93	.45	−25.30
22	Yprog	55	Yes	.3	0	.80	4.27	12.28	5.75
23	C	55	No	.1	0	−.87	−5.10	−12.60	−25.26
24	C	55	Yes	.1	0	.62	−1.39	−4.59	−6.11
25	C	55	No	.3	0	−1.98	−5.69	−12.67	−25.30
26	C	55	Yes	.3	0	−.20	−1.13	−2.32	−2.59

Note: For abbreviations, see table 7.3.

[a]Three percent population growth.

Table 7.8 **Percentage Change in Remaining Lifetime Utility**

Run	Tax Financing Soc. Sec. Benefits	Years Benefits Phased Out	LSRA	BTL	Years of Deficit Financing	Year of Birth						
						−54	−25	−10	0	10	25	150
1	Yprog	0	No	0	0	−25.60	.43	6.09	8.70	10.04	10.59	10.79
2	Yprog	0	Yes	0	0	.00	.00	.00	7.23	7.23	7.23	7.23
3	Yprog[a]	0	No	0	0	−23.54	−1.83	2.27	4.07	4.92	5.27	5.39
4	Yprog[a]	0	Yes	0	0	.00	.00	.00	2.45	2.45	2.45	2.45
5	Yprog	0	No	.1	0	−25.70	.18	5.85	8.48	9.79	10.32	10.79
6	Yprog	0	Yes	.1	0	.00	.00	.00	6.32	6.32	6.32	6.32
7	Yprog	0	No	.3	0	−25.8	−.27	5.41	8.08	9.33	9.84	10.79
8	Yprog	0	Yes	.3	0	.00	.00	.00	4.65	4.65	4.65	4.65
9	Yprog	55	No	0	0	−.14	−1.67	.04	1.52	2.78	5.82	10.79
10	Yprog	55	Yes	0	0	.00	.00	.00	1.65	1.65	1.65	1.65
11	W	55	No	0	0	.00	−1.18	−.44	.33	1.86	5.35	10.79
12	W	55	Yes	0	0	.00	.00	.00	1.08	1.08	1.08	1.08
13	C	55	No	0	0	−4.71	−1.19	1.81	3.55	5.07	7.57	10.79
14	C	55	Yes	0	0	.00	.00	.00	4.33	4.33	4.33	4.33
15	Yprog	55	No	0	5	.10	−.91	.18	1.26	.55	3.18	8.67
16	Yprog	55	Yes	0	5	.00	.00	.00	1.27	1.27	1.27	1.27
17	C	55	No	0	5	.10	−1.01	1.26	2.66	2.63	5.03	8.52
18	C	55	Yes	0	5	.00	.00	.00	2.98	2.98	2.98	2.98
19	Yprog	55	No	.1	0	−.17	−1.95	−.23	1.24	2.48	5.53	10.79
20	Yprog	55	Yes	.1	0	.00	.00	.00	.66	.66	.66	.66
21	Yprog	55	No	.3	0	−.22	−2.46	−.77	.73	1.95	5.02	10.79
22	Yprog	55	Yes	.3	0	.00	.00	.00	−1.22	−1.22	−1.22	−1.22
23	C	55	No	.1	0	−4.76	−1.46	1.55	3.30	4.80	7.30	10.79
24	C	55	Yes	.1	0	.00	.00	.00	3.40	3.40	3.40	3.40
25	C	55	No	.3	0	−4.37	−1.94	1.06	2.85	4.30	6.80	10.79
26	C	55	Yes	.3	0	.00	.00	.00	1.64	1.64	1.64	1.64

Note: For abbreviations, see table 7.3.

[a]Three percent population growth.

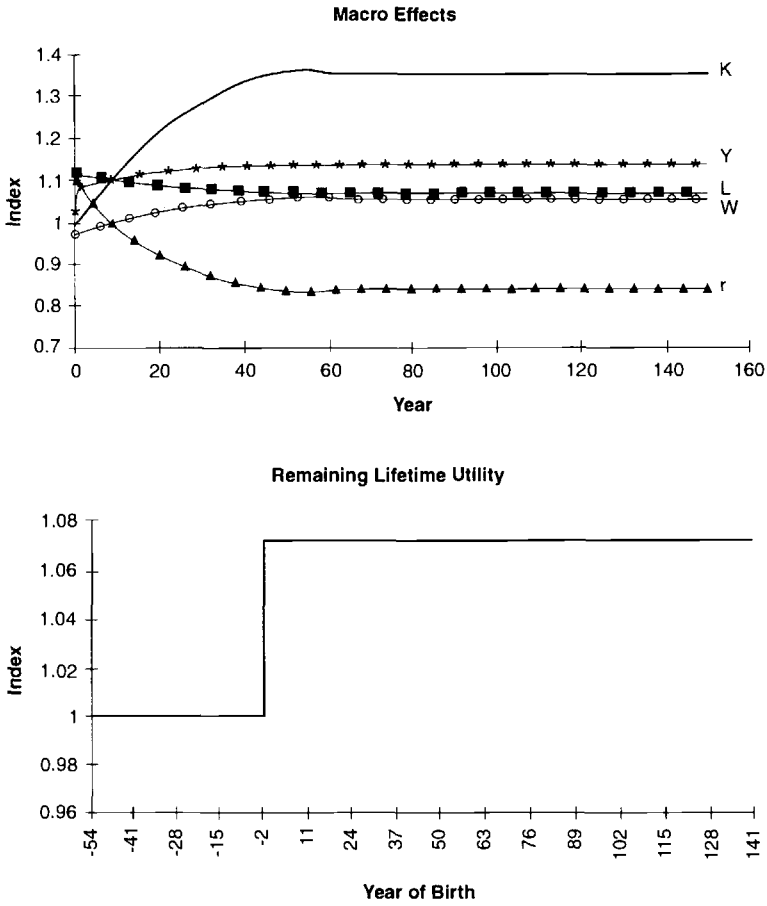

Fig. 7.7 Progressive income tax financing of benefits, benefits eliminated immediately, welfare of living generations constant
Note: K = capital stock; Y = output; W = the real wage; L = the labor supply; and r = the real interest rate.

those born after the reform by 7.23 percent. As excess burden calculations go, this is a very large efficiency gain.

The efficiency gains are measured here as the percentage increase in full lifetime income (the present value of expenditures on consumption and leisure). Since every generation born after the reform begins enjoys this efficiency gain, it represents an ongoing flow to the economy. This flow can readily be expressed as a percentage of initial GDP by simply multiplying the reported efficiency gain by the ratio of the steady-state present value of full income to GDP. The latter turns out to be .53 for all runs except the high-growth economy. In other words, the welfare gains expressed as a percentage

of GDP are about half as large as the welfare gains expressed as a percentage of discounted lifetime full income.

To check the sensitivity of the results to the assumed growth rate, I next repeated (in runs 3 and 4) both simulations assuming a 3 percent population growth rate. The payroll tax is held constant in this analysis. Consequently, the replacement rate is twice as high as with 1 percent population growth. Accordingly, income and consumption levels are much smaller in the initial steady state. "Cold turkey" privatization of social security without LSRA leads to a larger percentage increase in capital stock, income, and wages than with 1 percent population growth. The long-run welfare gain is 10.7 percent. With LSRA turned on, the high benefit level requires large transfers to the old, who would otherwise lose up to 41 percent of their lifetime utility. Therefore, the capital stock grows more slowly. Overall, the efficiency gain is 5.64 percent in the high-growth case compared to the 7.23 percent with 1 percent growth.

Runs 5–8 let us consider the extent to which the results in runs 1 and 2 depend on the degree of marginal benefit-tax linkage in the initial social security system. Runs 5 and 6 consider 10 percent marginal linkage, whereas runs 7 and 8 consider 30 percent marginal linkage. Thus, in these sets of simulations, the total effective marginal tax rate on labor supply includes either 90 or 70 percent of the social security payroll tax rate. As a comparison of runs 5 and 7 with run 1 indicates, macroeconomic effects of the no LSRA simulations are fairly similar to those without benefit-tax linkage. For example, with 30 percent benefit-tax linkage, there is a 52 percent long-run increase in the capital stock compared with 57 percent with zero linkage. The LSRA runs (runs 6 and 8) are more interesting. As shown in table 7.6, the efficiency gain from social security's privatization is 6.32 percent with 10 percent linkage and 4.65 percent with 30 percent linkage. These figures are smaller than the 7.23 percent efficiency gain found in run 2 when the economy features zero initial linkage. They indicate that even a small degree of benefit-tax linkage can have a substantial effect on social security's distortion of labor supply.

7.3.2 Progressive Income Tax or Wage Tax Financing of Transition Benefits

The next simulations, shown in figures 7.8 and 7.9, consider privatizing social security but raising progressive income tax rates to pay for transitional benefits. In the uncompensated (no LSRA) transition (run 9), the long-run position of the economy is exactly the same as in the corresponding cold-turkey transition. But the economy's short-term transition is quite different. The induced capital accumulation occurs much more slowly, and initial older generations suffer much smaller reductions in their levels of remaining lifetime utility. In the compensated transition (run 10), the efficiency gain is 1.65 percent compared with 7.23 percent in the cold-turkey run. Although this is a very big difference, a 1.65 percent efficiency gain is nontrivial.

The fact that the efficiency gain is positive may, itself, be surprising. Intuitively, raising progressive income tax rates to pay for social security benefits

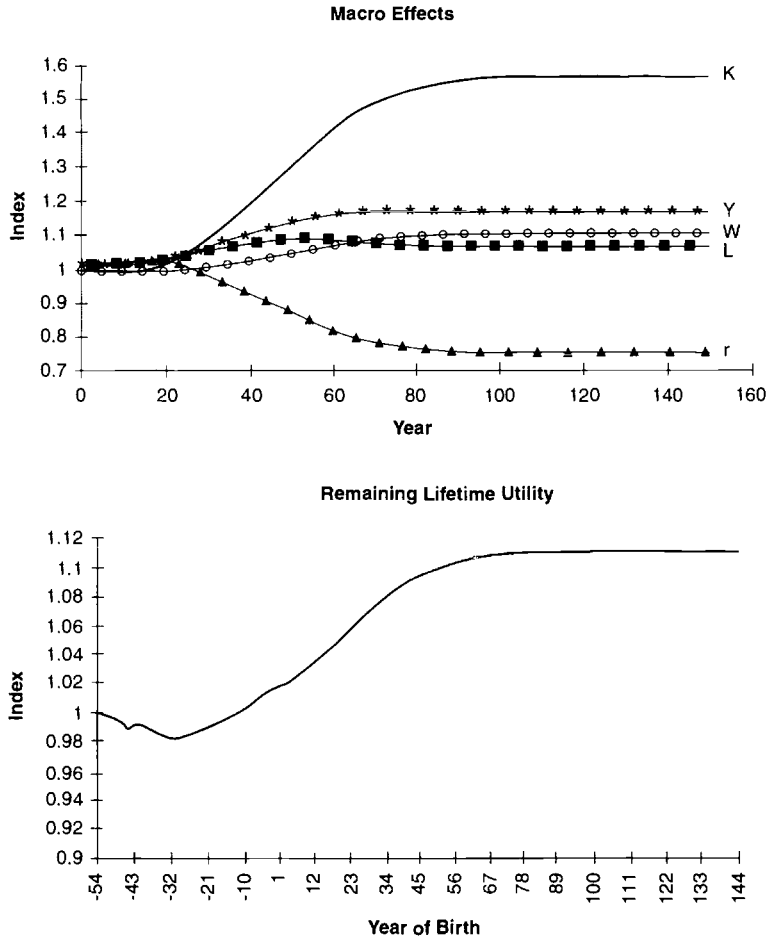

Fig. 7.8 Progressive income tax financing of benefits
Note: K = capital stock; Y = output; W = the real wage; L = the labor supply; and r = the real interest rate.

during the transition temporarily adds extra distortions to the fiscal structure at the same time it eliminates a permanent distortion from payroll taxation. These extra distortions involve both the labor-leisure decisions and intertemporal consumption decisions. Now, one might think that a tax structure with permanently low tax rates would be more efficient than one that collects, in present value, the same amount of revenue but does so with higher marginal tax rates in the short run than in the long run. This intuition follows from the fact that tax distortions rise with the square of the tax rate, with the result that smoothing tax rates over time provides a way of mitigating deadweight loss.

This intuition is correct as far as it goes. But switching from payroll tax to

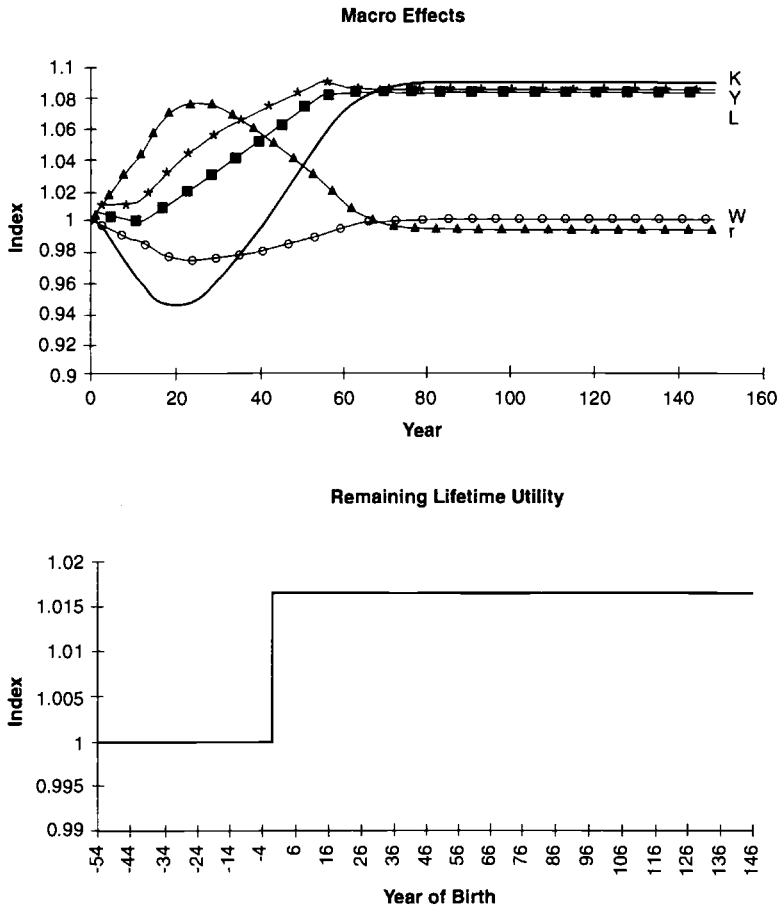

Fig. 7.9 Progressive income tax financing of benefits, welfare of living generations constant
Note: K = capital stock; Y = output; W = the real wage; L = the labor supply; and r = the real interest rate.

income tax financing of social security benefits in the short run has four additional features that need to be considered. First, the switch equalizes the marginal tax rates affecting labor-leisure and intertemporal consumption choices, so it smooths tax rates over economic choices.[16] Second, the capital income tax component of the progressive income tax has a lump sum tax element to it. In the short run, capital income is given, so taxing it via a higher rate of capital income taxation represents an implicit lump sum tax. Third, the decline over

16. In the initial steady state, the tax rate on the labor-leisure margin exceeds that on the intertemporal consumption margin because the payroll tax taxes only labor income.

time in progressive income tax rates as social security benefits are phased out acts like a negative capital income tax rate, which offsets the distortion caused by the capital income tax component of the progressive income tax that is financing government purchases. Fourth, if, as assumed in these simulations, social security benefits are provided independent of tax contributions, one could reduce the distortion of labor supply by linking benefits to marginal contributions. For example, one could provide a rate of return equal to the economy's growth rate on each dollar paid to social security. This marginal benefit-tax linkage would lower the effective rate of marginal payroll taxation. Although the current social security privatization simulations eliminate social security benefits over time rather than marginally linking them to contributions, the result, in the long run, is quite similar because this needless additional distortion is eliminated.

Runs 11 and 12 phase out benefits in the same manner as runs 9 and 10 but pay for them with a payroll tax rather than a progressive income tax. As table 7.3 shows, compared to income tax financing, payroll tax (wage tax) financing of transition benefits speeds up capital accumulation in the early phase of the transition. This reflects the greater saving disincentives associated with temporarily high capital income taxes.

The pattern of welfare gains and losses also differs. With income tax financing, there are bigger welfare losses to initial elderly cohorts in the non-LSRA runs (runs 9 and 11) but also bigger gains to initial younger cohorts as well as those born shortly after the reform. Given these differences, which financing mechanism is more efficient? The answer, given in LSRA runs 10 and 12, is progressive income tax financing. There is a 1.65 percent efficiency gain with progressive tax financing compared with a 1.08 percent gain with payroll tax financing.

7.3.3 Consumption Tax Financing of Transition Benefits

The next two simulations use a proportional consumption tax to finance transitional benefits. As figures 7.10 and 7.11 and runs 13 and 14 indicate, consumption tax financing produces much more favorable short-run macroeconomic effects in both the compensated and the uncompensated runs. For example, in the uncompensated run, the capital stock is 12 percent bigger in the tenth year of the reform than when the reform begins. With progressive income tax financing, the tenth-year capital stock is actually smaller, by .6 percent. After twenty-five years, the capital stock is 26 percent larger in the uncompensated consumption tax transition but only 5 percent larger in the uncompensated income tax transition. Since in both the uncompensated consumption and income tax runs the capital stock ultimately ends up 57 percent higher than its initial value, virtually all the crowding in of capital in the income tax financing run occurs more than a quarter century from the time the social security reform is initiated.

The better short-run macroeconomic performance in the no-LSRA con-

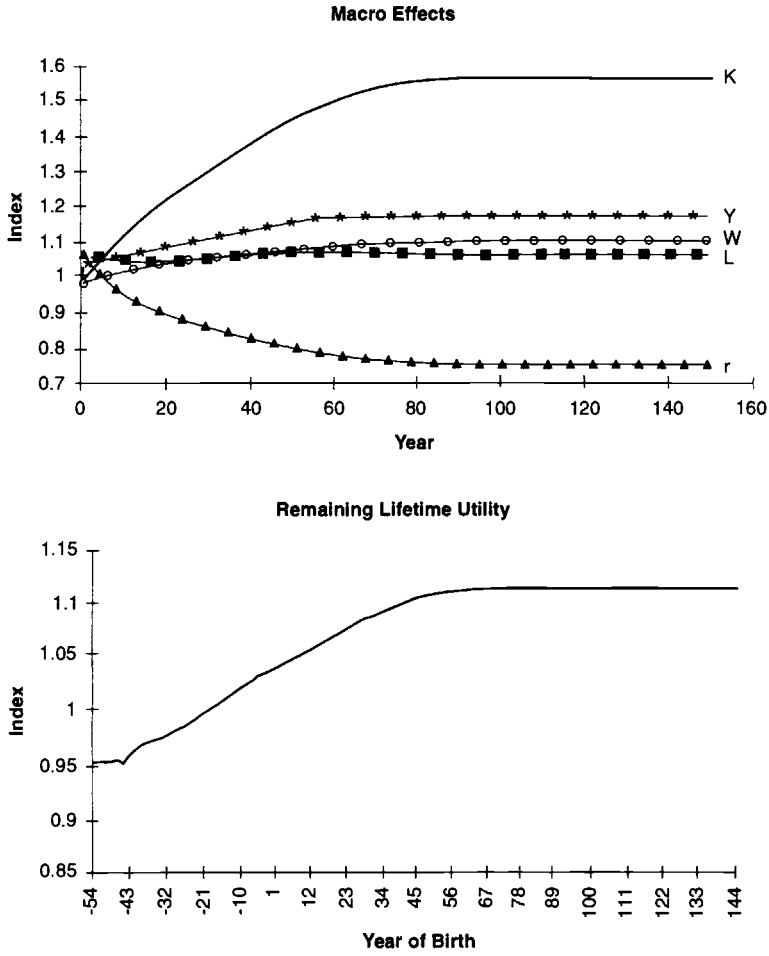

Fig. 7.10 Proportional consumption tax financing of benefits, progressive income tax finance of general revenues
Note: K = capital stock; Y = output; W = the real wage; L = the labor supply; and r = the real interest rate.

sumption tax run comes at the price of larger welfare losses to initial older generations. For example, the oldest generation at the time of the reform suffers a 4.7 percent welfare loss with consumption tax financing but only a -0.4 percent loss under income tax financing. The question begged by this result, of course, is whether consumption tax financing is more efficient than income tax financing; that is, whether there is still an advantage to consumption tax financing once initial generations have been fully compensated for the additional fiscal burden arising under consumption taxation.

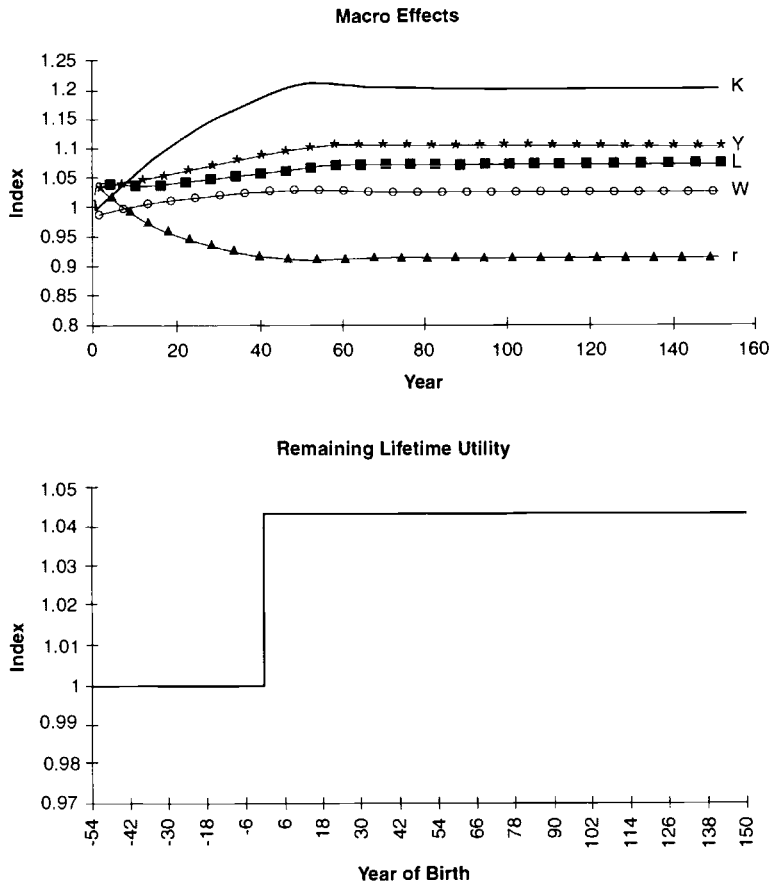

Fig. 7.11 Proportional consumption tax financing of benefits, progressive income tax finance of general revenues, welfare of living generations constant
Note: K = capital stock; Y = output; W = the real wage; L = the labor supply; and r = the real interest rate.

The answer is a strong yes. The efficiency gain available with consumption tax financing is a quite substantial 4.33 percent. This is almost two-thirds of the maximum efficiency gain achievable from privatizing social security and 2.5 times the efficiency gain available under income tax financing! As discussed in Chamley (1981) and Auerbach and Kotlikoff (1987), consumption taxation is more efficient than income or wage taxation because it incorporates a lump sum tax on existing wealth.

How much of this efficiency gain could be achieved by just financing existing social security benefits through a consumption tax? A run that substitutes for the payroll tax a consumption tax and keeps benefits in place while compensating living generations gives the answer: the efficiency gain is 3.44 per-

cent compared to 4.33 percent if benefits are phased out over time. Note, however, that, in the absence of compensation, the long-run gains from simply switching to consumption tax financing of social security are much smaller than those arising when one also phases out social security benefits over time. For example, the capital stock increases by only 17.5 percent, compared to 56.7 percent when benefits are phased out. And the long-run welfare gain is only 4.05 percent, compared to 10.79 percent.

7.3.4 Sensitivity Analysis

To what extend does the choice of parameter values influence the findings outlined above? Table 7.9 addresses this question. It shows efficiency gains from privatizing social security with income or consumption tax financing for combinations of intratemporal substitution elasticities ranging from 0.50 to 1.20 and intertemporal elasticities of substitution ranging from 0.15 to 0.50. The qualitative results are the same for all the combinations indicted. Future generations' welfare increases between 0.7 and 2.7 percent with income tax financing and between 3.5 and 5.1 percent with consumption tax financing. Since—as discussed before—efficiency gains largely arise from eliminating the payroll tax's distortion of labor supply decisions, the intratemporal elasticity of substitution between leisure and consumption has a larger influence on the magnitude of efficiency gains than does the intertemporal elasticity of substitution.

7.3.5 The Importance of the Initial Debt Position

Thus far, I have assumed no government debt in the initial steady state. To check whether this matters, I repeated runs 9 and 10 as well as 13 and 14 with

Table 7.9 **Sensitivity Analysis**

Intratemporal Elasticity of Substitution	Intertemporal Elasticity of Substitution		
	.15	.25	.50
	Efficiency Gains with Income-Tax Finance (%)		
.50	Not converged	.65	1.08
.80	1.65	1.67	1.96
1.20	2.46	2.44	2.70
	Efficiency Gains with Consumption-Tax Finance (%)		
.50	Not converged	3.67	3.53
.80	4.78	4.33	4.22
1.20	5.05	4.75	4.72

an initial 50 percent debt-to-GDP ratio. Recall that runs 9 and 10 incorporate progressive income tax financing of social security benefits, whereas runs 13 and 14 incorporate consumption tax financing. Runs 9 and 13 are non-LSRA, and runs 10 and 14 are LSRA. In all cases, the welfare gains are larger with initial debt than without. Welfare increases by 11.5 percent compared to 10.8 percent in runs 9 and 13. Efficiency gains from privatization are 1.91 percent in the income tax financing case and 4.72 in the consumption tax financing case, an increase of .15 and .29 percentage points, respectively.

The reason for these differences in straightforward. During the transition, capital accumulation reduces interest rates, which also reduces the fiscal burden of debt service. This permits a reduction in tax rates. This, again, induces more capital accumulation and labor supply. In fact, repeating run 9 with initial debt leads to a 61.7 percent higher long-run capital stock and a 7.21 percent higher long-run labor supply. The concomitant numbers without debt are 56.7 and 6.28 percent, respectively. Similar results apply to the other runs. Thus, the calculations presented so far can be understood as lower bounds for an economy with initial debt.

7.3.6 Using Debt Financing in the Short Run

An alternative to immediately raising either income or consumption tax rates to pay for transition benefits is to borrow for a while. The next set of simulations considers a postreform period of borrowing that lasts for five years. Figures 7.12 and 7.13 and runs 15 and 16 consider raising progressive income tax rates after the five-year issuance of debt to pay both interest on the accumulated debt and social security benefits during the remainder of the transition. Figures 7.14 and 7.15 and runs 17 and 18 repeat this analysis but use a proportional consumption tax to pay for social security benefits after the five-year period of deficit financing is completed.

Consider first the uncompensated runs. With income tax financing, capital is first crowded in, then crowded out, then crowded in. As discussed in Auerbach and Kotlikoff (1987), short-run crowding in can arise in the presence of deficit financing as workers take advantage of temporarily low marginal tax rates to increase their labor supply. This leads them to both earn and save more. Once income taxes are raised (indeed, raised above their initial values) to pay interest on past accumulated debt as well as to pay for ongoing spending, workers reduce their labor supply below their initial values. In run 17, the crowding-in/crowding-out/crowding-in effects of deficit financing alter the basic short-run pattern of capital accumulation observed in no-deficit, income tax financing (run 9). The deficit financing also reduces the amount of long-run crowding in of capital, with the long-run capital stock now only 40 percent, rather than 57 percent, larger than in the initial steady state.

In contrast to the income tax cum temporary deficit results, the consumption tax cum temporary deficit displays smaller crowding in in the very short run. The principal reason is that the prospect of a near-term (after year 5) increase

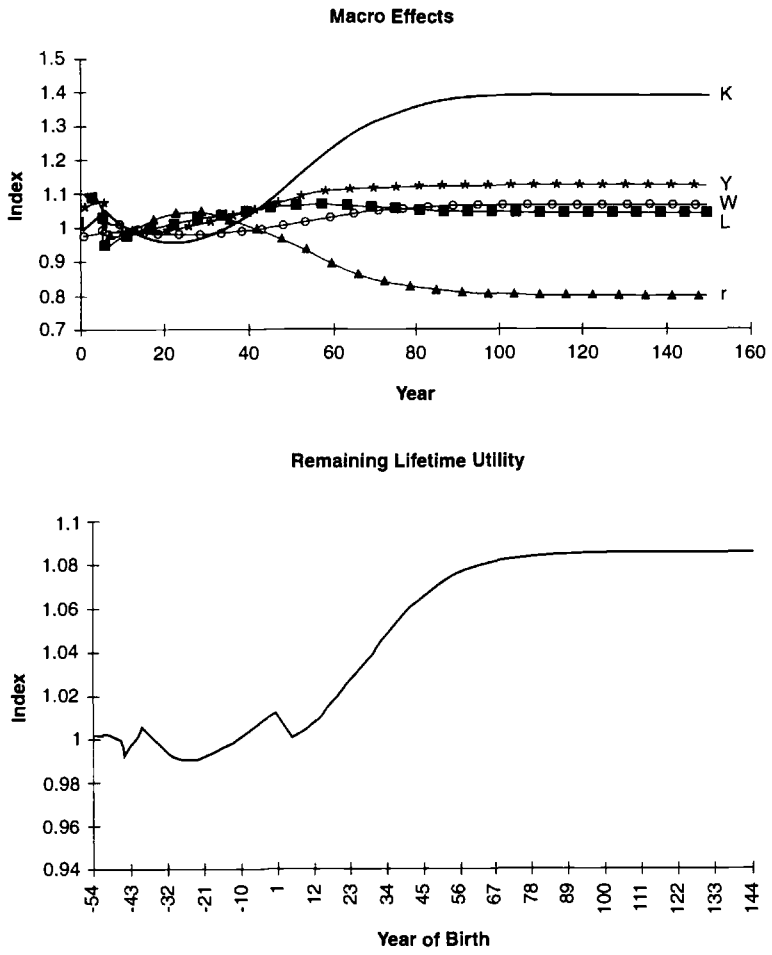

Fig. 7.12 Progressive income tax financing of benefits, 5 year debt finance
Note: K = capital stock; Y = output; W = the real wage; L = the labor supply; and r = the real interest rate.

in consumption tax rates acts just like a temporarily high rate of capital income taxation, leading households to substitute current for future consumption. The smaller short-run crowding in under consumption tax financing necessitates more debt accumulation in the consumption tax run than in the income tax run. This higher debt-to-output ratio explains why long-run capital formation is slightly smaller under consumption tax financing than income tax financing.

The use of short-term deficit financing during the transition leaves the economy with permanently higher marginal tax rates. It also particularly distorts the choices of how much to work and how much to save right before and right after the period of deficit financing. Hence, it is not surprising that the LSRA

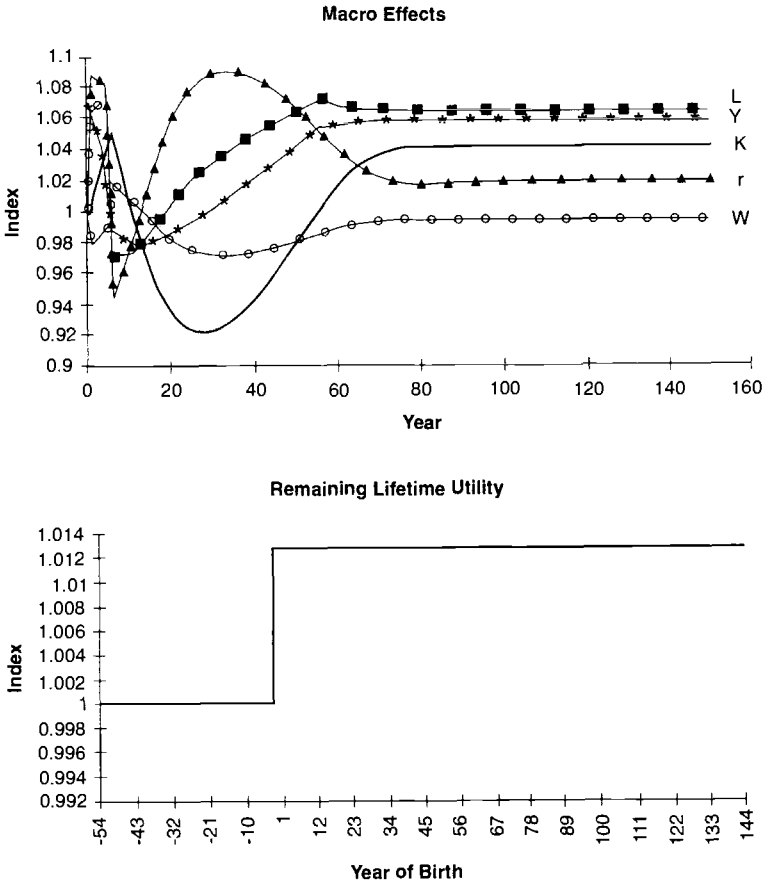

Fig. 7.13 Progressive income tax financing of benefits, 5 year debt finance welfare of living generations constant
Note: K = capital stock; Y = output; W = the real wage; L = the labor supply; and r = the real interest rate.

runs produce smaller efficiency gains from privatization with deficit financing than without it. In the income tax runs, the efficiency gain is 1.27 percent with deficit financing, compared to 1.65 percent without. In the consumption tax runs, the efficiency gain is 2.98 percent with deficit financing, compared to 4.33 percent without it.

7.3.7 Privatizing from a Position of Partial Benefit-Tax Linkage

The remaining eight sets of simulations, runs 19–26, also phase out social security benefits over a fifty-five-year period but do so assuming either 10 or

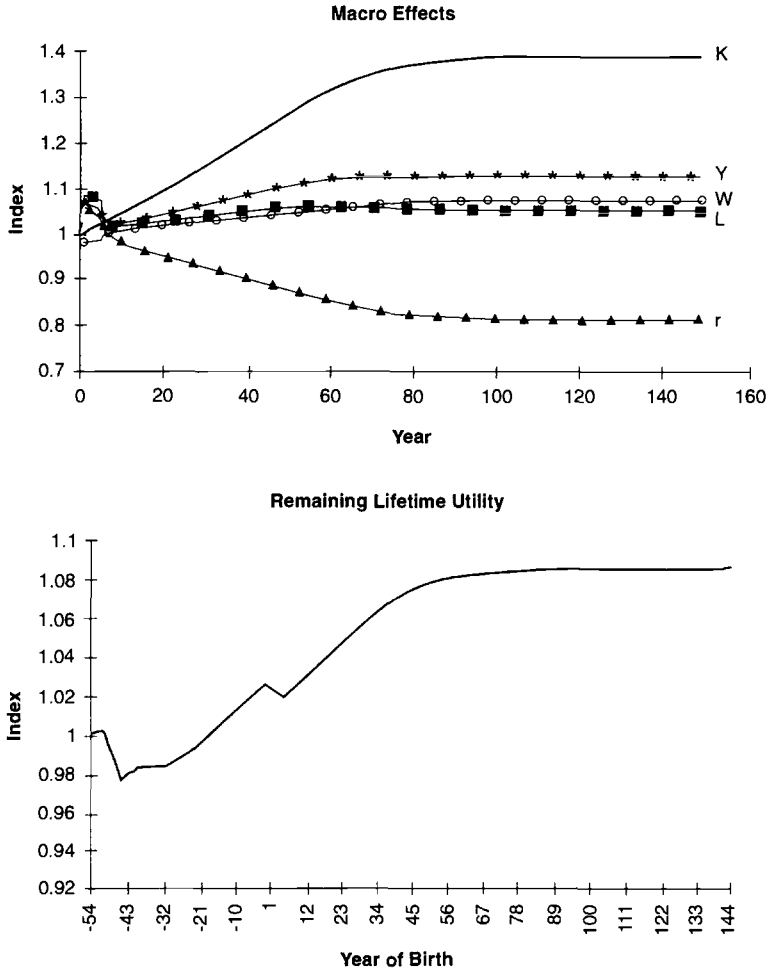

Fig. 7.14 Proportional consumption tax financing of benefits, progressive income tax finance of general revenues, 5 year debt finance
Note: K = capital stock; Y = output; W = the real wage; L = the labor supply; and r = the real interest rate.

30 percent marginal benefit-tax linkage. As tables 7.3–7.8 indicate, the crowding in associated with privatization is smaller the higher the degree of benefit-tax linkage. For example, with 30 percent linkage, the long-run increase in capital in the no-LSRA income and consumption tax runs is 52 percent, compared with 57 percent with no linkage. These differences and those of other macro variables are not large. But the differences in efficiency gains with and

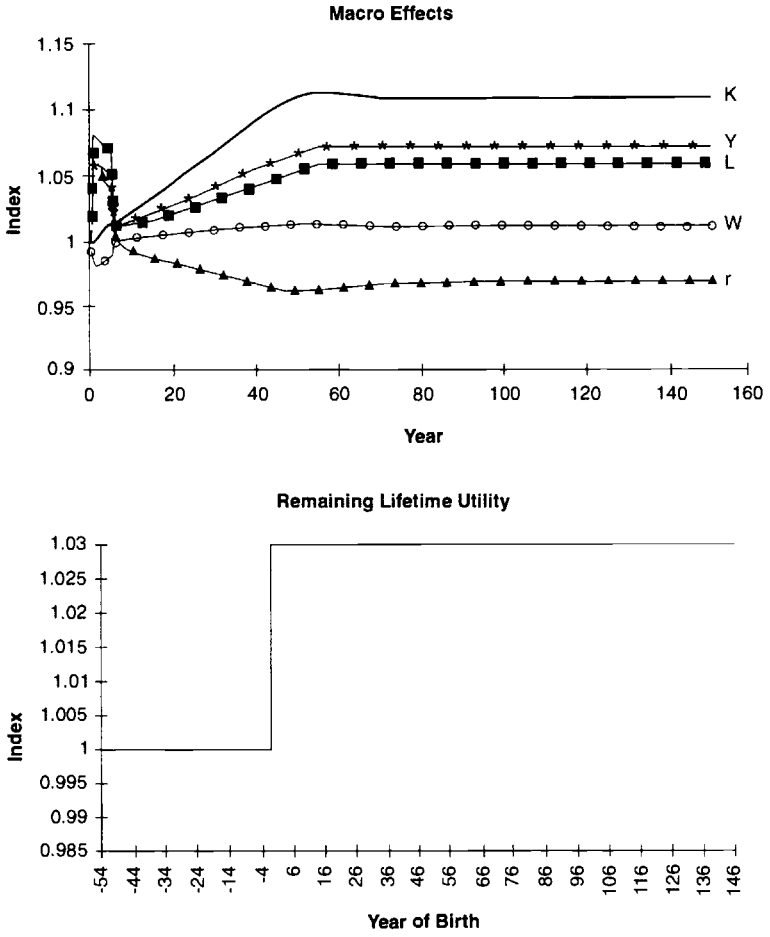

Fig. 7.15 Proportional consumption tax financing of benefits, progressive income tax finance of general revenues, 5 year debt finance, welfare of living generations constant

Note: K = capital stock; Y = output; W = the real wage; L = the labor supply; and r = the real interest rate.

without partial linkage are substantial. Run 20 in table 7.8 indicates only a 0.66 percent gain under income tax financing when linkage is 10 percent compared to a 1.65 percent gain with zero linkage. And run 22, which features income tax financing with 30 percent linkage, actually shows a 1.22 percent efficiency loss. In the case of consumption tax financing, the efficiency gain is 4.33 percent with zero linkage, 3.4 percent with 10 percent linkage, and 1.64 percent with 30 percent linkage. These efficiency gains are 61, 55, and 37 percent, respectively, of the corresponding maximum efficiency gains reported

in runs 2, 6, and 8 of table 7.6 from replacing social security with lump sum net taxes.

7.4 Incorporating Intracohort Heterogeneity

The multi-income version of the AK model developed by Kent Smetters, Jan Walliser, and me follows Fullerton and Rogers (1993) in positing twelve earnings classes within each cohort. Each of these earnings classes experiences the same longitudinal age-earnings profile as described in Auerbach and Kotlikoff (1987), but each has its own wage level. Thus, the classes can be thought of as differing in their endowments of human capital. Following Fullerton and Rogers (1993), the bottom decile of wage earners is divided into classes 1 and 2. Class 1 contains 2 percent of the distribution, and class 2 contains 8 percent of the distribution. Classes 3–10 contain 10 percent each of the distribution, and classes 11 and 12 contain the highest decile, with class 12 containing 2 percent of the distribution and class 11 containing 8 percent. The initial steady-state wage rates for the twelve classes are also taken from Fullerton and Rogers (1993) and are 1, 1.7, 2.2, 2.7, 3.1, 3.5, 3.8, 4.2, 4.7, 5.5, 7.2, and 10.2, respectively.

Tables 7.10–7.15 use the multi-income model to consider two alternative privatization policies. One uses a consumption tax to finance transition benefits, the other a progressive income tax. Both simulations are uncompensated.

Table 7.10 **Percentage Change in Capital Stock Relative to Steady State with Multiple Income Classes**

Run	Tax Financing Soc. Sec. Benefits	Years Benefits Phased Out	LSRA	BTL	Years of Deficit Financing	Year of Transition 5	10	25	150
27	C	55	No	0	0	5.75	11.85	26.06	55.64
28	Yprog	55	No	0	0	−.50	−.56	5.09	55.64

Note: For abbreviations, see table 7.3.

Table 7.11 **Percentage Change in Labor Supply Relative to Steady State with Multiple Income Classes**

Run	Tax Financing Soc. Sec. Benefits	Years Benefits Phased Out	LSRA	BTL	Years of Deficit Financing	Year of Transition 5	10	25	150
27	C	55	No	0	0	5.64	4.86	5.34	6.55
28	Yprog	55	No	0	0	1.82	1.84	5.49	6.55

Note: For abbreviations, see table 7.3.

Table 7.12 **Percentage Change in Output Relative to Steady State with Multiple Income Classes**

Run	Tax Financing Soc. Sec. Benefits	Years Benefits Phased Out	LSRA	BTL	Years of Deficit Financing	Year of Transition 5	10	25	150
27	C	55	No	0	0	5.67	6.57	10.17	17.14
28	Yprog	55	No	0	0	1.23	1.24	5.39	17.14

Note: For abbreviations, see table 7.3.

Table 7.13 **Percentage Change in Wages Relative to Steady State with Multiple Income Classes**

Run	Tax Financing Soc. Sec. Benefits	Years Benefits Phased Out	LSRA	BTL	Years of Deficit Financing	Year of Transition 5	10	25	150
27	C	0	No	0	0	.03	1.63	4.59	9.93
28	Yprog	55	No	0	0	−.57	−.60	−.09	9.93

Note: For abbreviations, see table 7.3.

Table 7.14 **Percentage Change in Interest Rates Relative to Steady State with Multiple Income Classes**

Run	Tax Financing Soc. Sec. Benefits	Years Benefits Phased Out	LSRA	BTL	Years of Deficit Financing	Year of Transition 5	10	25	150
27	C	55	No	0	0	−.08	−4.72	−12.60	−24.73
28	Yprog	55	No	0	0	1.73	1.81	1.00	−24.73

Note: For abbreviations, see table 7.3.

Table 7.15 **Percentage Change in Remaining Lifetime Utilities for Selected Income Classes**

Run and Class	Year of Birth −54	−25	−10	0	10	25	150
27:							
1	−4.58	−1.79	1.17	2.91	4.29	6.78	10.13
3	−4.17	−1.61	1.17	2.81	4.03	6.27	9.22
6	−4.01	−1.39	1.27	2.83	3.97	6.08	8.82
9	−3.89	−1.16	1.38	2.87	3.96	6.00	8.59
12	−3.67	−.23	1.88	3.10	4.03	5.89	8.12
28:							
1	−.14	−1.70	.00	1.32	2.29	5.08	10.13
3	−.11	−1.64	−.10	1.18	2.10	4.70	9.22
6	−.13	−1.52	.00	1.13	2.04	4.57	8.82
9	−.09	−1.50	−.11	1.11	2.02	4.53	8.59
12	−.19	−1.19	.00	1.10	2.04	4.52	8.12

The corresponding one-income-class runs with which to compare these results are listed in tables 7.3–7.8 as runs 13 and 9. (Table 7.16 shows the share of tax revenue paid by the different income classes, and table 7.17 shows the percentage changes in labor supply and consumption.)

Such comparisons indicate that changes in macroeconomic variables in the multi-income-class model are very close to those in the one-income-class model. Take, for example, year 5 and year 150 increases in the capital stock under consumption tax financing. They are 5.75 and 55.64 percent, respectively, in the multi-income-class run and 5.54 and 56.67 percent, respectively, in the one-income-class model. Or consider the year 5 and year 150 increases in output in the progressive tax run. They are 1.23 and 17.14 percent, respectively, in the multi-income-class run and 1.10 and 17.11 percent, respectively, in the one-income-class model. Intracohort earnings heterogeneity does not, then, alter this paper's central finding that privatizing social security can produce very major long-run improvements in the state of the economy.

Table 7.15 indicates that the welfare gains and losses associated with uncompensated transitions to privatized social security can differ significantly across members of a cohort and that these differences can flip signs over time. Take run 27, which incorporates consumption tax financing. In this run, all members of the oldest cohort at the time of the reform, those age fifty-four, end up worse off. But the poorer elderly suffer a relatively larger welfare loss. For example, class 1 fifty-four-year-olds suffer a 4.58 percent reduction in re-

Table 7.16 **Share of Tax Revenues by Class in Steady States (%)**

1	2	3	4	5	6	7	8	9	10	11	12
.48	3.33	5.54	6.77	7.91	8.88	9.65	10.77	12.17	14.33	14.95	5.22
.40	2.94	5.05	6.32	7.52	8.57	9.42	10.67	12.27	14.80	16.08	5.96

Table 7.17 **Percentage Change in Labor Supply and Consumption**

	Class				
Age	1	3	6	9	12
Labor supply:					
15	.46	.97	1.44	1.86	3.60
35	21.70	23.76	22.56	20.39	9.96
45	167.60	168.50	108.49	69.61	11.78
55	.00	.00	.00	.00	7.55
Consumption:					
15	27.50	28.60	29.65	30.59	33.35
35	18.00	18.86	19.47	19.87	19.73
45	12.51	12.44	12.26	11.97	9.58
55	−1.66	−1.76	−1.56	−1.38	2.65

maining lifetime utility, whereas the class 12 fifty-four-year-olds experience only a 3.67 percent utility loss.

These differences reflect two factors. First, the reform induces a significant and immediate increase in labor supply (see table 7.11), which raises the year 1 interest rate from 9.4 to 9.8 percent. This benefits the rich elderly more than the poor elderly because a bigger share of their old age consumption is financed by their assets (as opposed to their social security benefits). Second, the increase in labor supply means more income, which means a larger income tax base. This permits the government to cut its income tax rates, which is relatively more important to the rich elderly, who start out in quite high marginal tax brackets.

Interestingly, the distribution of long-run utility gains in run 27 is quite different from the distribution of the short-run gains. As table 7.15 points out, all income groups benefit in the long run, but the welfare gains to poorer income groups exceed those to richer ones. For example, members of the class 1 cohort alive in the long run enjoy a 10.13 percent increase in lifetime utility, compared to an 8.12 percent increase for members of the class 12 cohort alive in the long run. What explains this? The answer is that, for lower income classes, social security's implicit tax associated with its pay-as-you-go financing represents a larger share of its lifetime resources than it does for the higher income classes. Hence, eliminating pay-as-you-go social security provides lower income classes with a larger percentage welfare gain than it provides higher income classes.

Comparing the top and bottom halves of table 7.15 shows that the short-run distribution of welfare gains from privatizing social security is critically dependent on the method used to finance the transition. The bottom half of the table, run 28, considers progressive income tax financing of transition benefits. Since this is disadvantageous to the richer agents as well as less efficient overall compared to consumption tax financing, it is not surprising that initial elderly and young members of income class 12 are worse off in this run compared to run 27. It is also not surprising that, for example, the richest fifty-four-year-olds suffer a bigger welfare loss than do the poorest fifty-four-year-olds.

7.5 Conclusion

The privatizing of social security is spreading from South America. It could well spread to the United States as politicians grapple with ways of addressing the fiscal/demographic debacle facing the country. This paper's simulations of the AK model show that privatizing social security is likely to generate major long-run increases in output and living standards. But, unless privatization includes compensation to initial generations, these long-run gains will come, in large part, at their expense. This said, the pure efficiency gains from privatization can be substantial. Their precise size depends on the existing tax structure, the linkage between benefits and taxes under the existing social security sys-

tem, and the choice of the tax instrument used to finance benefits during the transition. When the initial tax structure features a progressive income tax, when benefit-tax linkage is low, when consumption taxation is used to finance social security benefits during the transition, and when existing generations are fully compensated for their privatization losses, there is a 4.3 percent welfare gain to future generations. But, if these circumstances do not hold, the efficiency gains from privatization are likely to be smaller, possibly even negative. Indeed, with income tax financing of transitional benefits, 30 percent linkage, and full compensation paid to initial generations, future generations suffer a 1.2 percent welfare decline.

There are two lessons to be drawn from this multi-income-class analysis. First, policies that equalize the intracohort distribution of utility in the long run may fail to do so in the short run. Second, in the long run, since the privatization of social security eliminates an implicit tax that places a relatively high proportional burden on the lifetime poor, it is likely to improve the well-being of the lifetime poor relative to the lifetime rich; that is, as a long-run proposition, privatizing social security is progressive.

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Comment

Thomas J. Sargent

The U.S. social security system was conceived during the 1930s, when many academic economists believed that excessive saving and overaccumulation of capital were fundamental macroeconomic problems. Because it depressed the prospective returns to new physical investments, a large capital stock promoted unemployment. This was the stagnation thesis. An unfunded social retirement system could "cure" the problem of capital overaccumulation by diminishing incentives to save: taxes from young workers were to be transferred to retirees. The promise that they too should expect to receive transfers when they were old would dissuade the young from saving. This cure for too much capital was later formalized by the analysis of Paul Samuelson's (1956) overlapping generations model (see, e.g., Diamond 1996; and Gale 1973). In that model, capital overaccumulation threatens when the rate of return on capital falls short of the rate of growth of the labor force. Low rates of return on bonds prevailed in the United States during the 1930s.

With the passage of years, concerns about capital overaccumulation and stagnation have receded into memory, to be replaced by public concern over a low U.S. saving rate. But we continue to live with a social retirement system that was designed to arrest saving. This dissonance is the origin of calls to reform the social retirement system to make it match what are *now* thought to be the economic rewards to national saving, not those feared in the 1930s.

The political difficulties of reforming social security are inherited from the economic transition dynamics associated first with installing, then with reforming, an unfunded social retirement system. Installing the system *ab novo* is easier because many of those who might be harmed by the proposal cannot vote. A brand new system helps early retirees at the expense of future generations, who cannot vote until much later, after the system is already in place. Reforming an ongoing system is more difficult because the beneficiaries of the old system *do* vote. This makes it necessary somehow not to undo the old

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system too rapidly and to honor the government's promises to retirees who live through the transition. It seems easier to vote an unfunded social retirement system in than to vote one out.

Laurence Kotlikoff is the coauthor of the Auerbach-Kotlikoff (1987) model (the AK model), our most important practical tool for quantitatively studying alternative proposals to reform social retirement arrangements. The present paper by Kotlikoff consists of two broad parts, each of which is informed by Kotlikoff's work with the AK model. The first is a wide-ranging informal discussion of a host of financing and incentive issues. The second part is a battery of numerical simulations of a calibrated version of the AK model. These simulations add weight to the opinions Kotlikoff expresses in the first, less formal section.

The Model

The AK model is the correct tool for this job. It consists of overlapping generations of long-lived people. The equilibrium is competitive, with an exogenous government policy. A government policy is a specification of rules for setting tax rates and transfers and for managing the government's debt. An equilibrium is a price system, a consumption allocation (to each person of each cohort at each age), and a government policy at which households are optimizing and the government is satisfying its sequence of budget constraints. There is no uncertainty in the environment and therefore no demand for insurance. Thus, for Kotlikoff, an equilibrium is a collection of sequences of real numbers. Were there uncertainty facing households, an equilibrium would be a sequence of probability distributions of wealth and consumption.

Kotlikoff at first assumes a single type within each cohort and then, in order to study within-cohort distribution effects, a version in which there are twelve earning classes within each cohort. A good feature of the model is that Kotlikoff's specification of a household's preferences induces endogenous work reductions at the end of life (i.e., retirements).

The AK model is a machine for studying how tax and transfer policies affect distributions of consumption and welfare when households are free to rearrange their own affairs in reaction to government policies. A general equilibrium imposes two kinds of discipline. First, the government must respect its budget constraint—deficit financing limits the government's opportunities in the future. Second, households respond purposefully, not arbitrarily, to government policies.

Issues

Kotlikoff analyses alternative tax and transfer policies that can eventually lead to a fully funded system. Many policies can do the job. Kotlikoff's paper compares a number of them with an eye toward their political sustainability. Attaining political sustainability requires transferring enough of the long-term gains from posterity to those entitled under the initial unfunded systems. When the eventual gains from full funding are large enough—as they are with Kotli-

koff's parameter settings—there is plenty of room to redistribute some of the gains toward these entitled people.

Kotlikoff's paper contains a valuable discussion of benefit-tax linkages. Whether the social security tax acts entirely as a payroll tax or partly as a saving plan depends on workers' perception of how their prospective receipts vary with their contributions. This perception interacts with their labor supply elasticities to influence the distortions associated with the social security payroll tax.

Kotlikoff also compares consequences of alternative means of financing a scheme to compensate those who would be hurt by a sudden transition to a fully funded system. I commend his welfare analysis of the use of a consumption tax to finance the transition. His discussion well balances the efficiency and redistribution consequences of using a consumption tax. This work continues Auerbach and Kotlikoff's focus on the intergenerational redistributional consequences of moving, say, from a tax on capital to a consumption tax.

Extensions

Kotlikoff's formal model excludes aspects that his informal discussion mentions, the social insurance provided by the social security system. How and whether this exclusion affects the case for fully funding social security depends on how one models markets for insurance. Settings with incomplete markets augment forces for capital accumulation and make more room for using a tax-transfer mechanism to correct the problem. In addition, with incomplete markets, uncertainty activates mechanisms that cause aggregate randomness to affect income distributions.

It is possible and natural to extend the basic AK model to uncertain environments with incomplete markets. The cheapest extension covers settings with no aggregate uncertainty but uninsurable uncertainty at the individual level, which averages out in the aggregate. In recent work, two sorts of individual uncertainty have been included: life-span risk and household-specific endowment or labor-income risk (see Imrohoroglu, Imrohoroglu, and Joines 1995). Even with one type of household ex ante, market incompleteness causes the distribution of consumption across individuals within a cohort to spread. Deaton and Paxson (1994) discuss the fanning-out mechanism, an implication of the permanent income theory with incomplete markets. An equilibrium of such a model induces a probability distribution of consumption across households for each cohort for each time period. Figures 7C.1 and 7C.2 display the mean and standard deviation of consumption distributions for such a model, during a funding experiment similar to one of Kotlikoff's (these figures are taken from Huang, Imrohoroglu, and Sargent [1996]). The experiment is a transition from an unfunded to a fully funded retirement system in which the initially entitled people are fully compensated. The compensation to the old—which is over 2.5 times GDP—is financed by issuing bonds, then raising the tax rate on labor income until the extra bonds are retired. Notice how this transition eventually

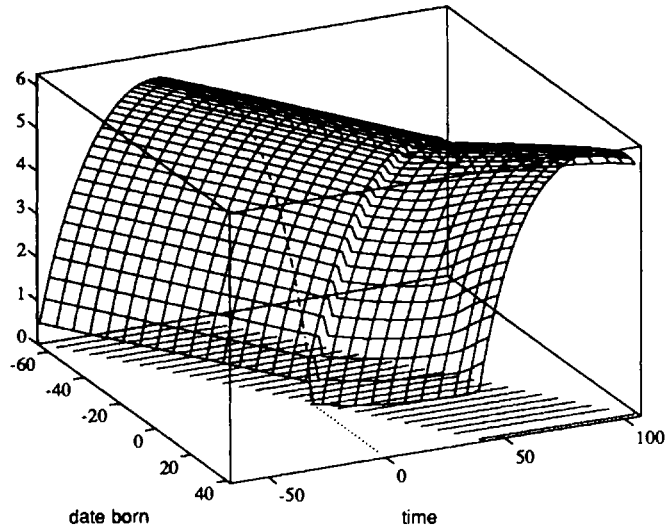

Fig. 7C.1 Mean consumption profiles for all cohorts during a transition for experiment 1 of Huang, Imrohoroglu, and Sargent (1996), a bond-compensated, tax-financed removal of social security. The shadow on the floor depicts when a cohort is alive.

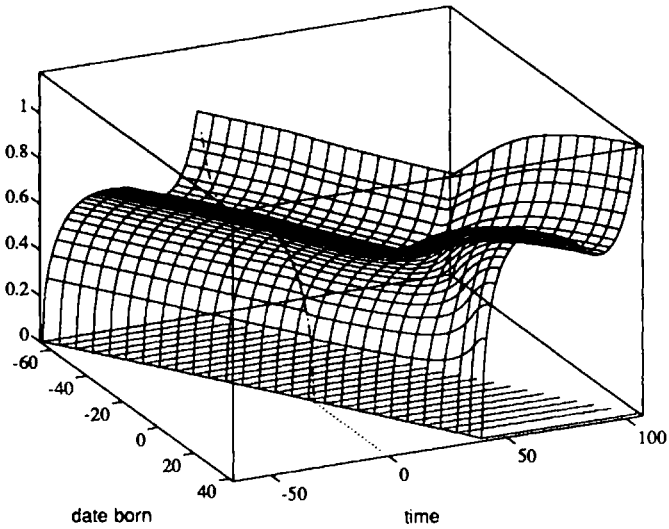

Fig. 7C.2 Standard deviations of consumption for all cohorts during the transition for experiment 1 of Huang, Imrohoroglu, and Sargent (1996).

raises both the mean and the standard deviation of the age-consumption profiles. The point of these pictures is to extend the analysis of Kotlikoff's section 7.4. Government policy affects not only the mean but also the standard deviation of these distributions. The details of the transition financing scheme affect how much the distribution of consumption across households will spread or compress in response to the reform. This point reinforces Auerbach and Kotlikoff's long-standing emphasis on the distributional consequences of alternative fiscal policies. It warns us not to oversell the benefits of a transition: not everyone is likely to be a winner. The current system provides some social insurance that is not likely to be fully replaced.

More challenging aspects of uncertainty to include are aggregate risk about two features of the environment: returns on capital and demography. These are technically difficult to incorporate because they cause the aggregate state for the economy to include distributions of wealth across people, a feature that makes the dimension of the state unmanageably large. Progress is being made with studying such models (see Krusell and Smith 1995), and it is important to bring that progress to bear on AK types of models. Our estimates about the benefits of funded versus unfunded social security and retirement arrangements will hinge on our calibrations of the riskiness of returns to capital and demography.

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Discussion Summary

Jeffrey Liebman and Andrew Samwick

The first comments of the general discussion focused on some of the simplifications used in the model used to simulate privatization. Some caution was

suggested in allowing for the labor supply response to an improved benefit-tax linkage because not all people behave according to the model presented in this paper. In particular, some people might be myopic or simply have high discount rates and face liquidity constraints. The private returns or welfare gains to these people may be very low. Another participant responded that, since the gains came in the form of lower taxes, discounting was not a main concern for evaluating this proposal. The author added that the reduction in payroll taxes might help ease the liquidity constraints on the young workers. Another simplification that was brought to light is that, in a model with income uncertainty, the social security system provides insurance to the extent that it is progressive. Because the author's model eliminates the current system completely, it loses the benefit of this insurance. When evaluating the author's model without uncertainty, the paper's focus on achieving "no distortion" would no longer be appropriate, as the concerns of insurance and redistribution would have to be balanced against efficiency.

The discussion then turned to the role of the consumption tax in the proposed privatization. In particular, given the heavy reliance on the consumption tax for the efficiency gains, the question was raised as to the extent to which this proposal should be considered a privatization rather than simply a change in fiscal policy. In this model, the privatization of social security is simply the elimination of the payroll tax. Because the payroll tax and the consumption tax have identical steady states, the efficiency gains arise from the substitution of the latter for the former in a way that taxes the current elderly disproportionately. One participant noted that the author's claim that implementing a retail sales tax would increase the burden on the elderly owing to higher prices was not necessarily true. If the Fed used monetary policy to keep the price level constant, then more of the burden would be borne by working generations in the form of lower real earnings. The author later responded that the basic proposition here is to make current generations better off by raising the burden on the elderly and that all privatizations are essentially just alternative ways of financing retirement obligations.

The author concluded the discussion by addressing two of the improvements to the overall setup of the simulation model that he has been working on. The first is the more realistic modeling of the demographic changes that will arise as the population ages. These demographics have been included in the original Auerbach-Kotlikoff model and could be incorporated in the privatization model as well. The second is to allow for at least some forms of heterogeneity within each age cohort. In particular, there are preliminary versions of the model that have twelve different income brackets, the results of which are that low-income workers can be taxed less because high-income workers choose to work more and therefore pay more taxes.