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THE TRANSITION PATH IN PRIVATIZING SOCIAL SECURITY

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ABSTRACT

This paper analyzes the transition from the existing pay-as-you-go Social Security program to a system of funded Mandatory Individual Retirement Accounts (MIRAs). Because of the high return on real capital relative to the very low return in a mature pay-as-you-go program, the benefits that can be financed with the existing 12.4 percent payroll tax could eventually be funded with mandatory contributions of only 2.1 percent of payroll. A transition to that fully funded program could be done with a surcharge of less than 1.5 percent of payroll during the early part of the transition. After 25 years, the combination of financing the pay-as-you-go benefits and accumulating the funded accounts would require less than the current 12.4 percent of payroll. The paper also discusses how a MIRA system could deal with the benefits of low income employees and with the risks associated with uncertain longevity and fluctuating market returns.

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The Transition Path in Privatizing Social Security

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1. Background and Overview

There is now substantial experience around the world with partial or complete shifts from government pension systems to private funded plans. Although there are important common features of all such transitions, each country that makes such a transition faces a unique problem, reflecting the demographic and economic situation of that country and the promises and expectations embedded in existing law.[1]

In the United States, the actuarial projection that the Social Security trust fund will be depleted by the year 2030 has fostered interest in options to shift from the pay-as-you-go system to a funded or privatized system.[2] The very low implicit rate of return earned on contributions in the existing pay-as-you-go system and the adverse effect of the unfunded program on national saving have also encouraged consideration of the possibility of shifting to a partially or fully funded system

[1]See for example World Bank (1994) and the papers in this NBER volume describing the experience in Argentina, Australia, Chile, Great Britain and Mexico.

[2]See the alternative proposals in the Report of the Quadrennial Social Security Advisory Council, (forthcoming 1996).

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and, in particular, to a system with individual funded accounts.[3]

The current paper shows that shifting to a funded system would permit the existing 12.4 percent payroll tax to be replaced in the long run by a payroll tax of about two percent because a funded system has so much higher a rate of return than the implicit rate of return in a pay-as-you-go unfunded Social Security program. This reduction in the payroll tax results in a reduction in the deadweight loss that is itself equal to about two percent of payroll. Thus the long-run gain from shifting to a funded system is almost as large as the entire twelve percent payroll tax. This is equivalent to a permanent increase in real income of about five percent of GDP.

A major concern in all discussions of privatizing Social Security is the transition path. Critics of privatization argue that the current and projected conditions in the United States -- a population that is growing slowly and aging rapidly, a low rate of economic growth, and a very generous level of promised benefits -- make the transition from the existing unfunded system to individual funded accounts too costly to be politically acceptable. Current employees now pay a twelve percent payroll tax to finance the benefits of current retirees. In the transition to a funded system these employees would have to pay this plus the contributions to fund their own future benefits. Critics argue that this combination would be too onerous to be acceptable and even those who favor a funded system in principle may fear that they are correct.

The purpose of the current paper is to examine the basic issues involved in a transition and to explore alternative feasible transition paths from the existing U.S. pay-as-you-go Social Security system to a program of funded Mandatory Individual Retirement Accounts (MIRAs). The transition plans that we study are constrained to provide the same level of benefits in each future year as retirees

[3]See for example Feldstein (1996) and Kotlikoff (1996).

would receive from the existing Social Security system. In addition, the financing leaves the projected path of the Social Security trust fund unchanged, thus guaranteeing that any additional private saving that results from the Mandatory Individual Retirement Accounts is a net addition to the nation's capital stock.

An important finding in our analysis is that the additional payments that are required in the early years of the transition are small relative to the existing payroll tax and to the long-run gains from privatization. These additional payments during the early part of the transition can be anywhere from one percent of payroll to three percent of payroll. Younger workers at the time of the transition are net beneficiaries over their own lifetimes. Although the gains of the older workers are not large enough to compensate them for the higher costs in the early years of the transition, when we look at nuclear families of parents and their children we see that a substantial majority of two generation pairs are likely to be net gainers. More generally, the gains occur quickly enough and are large enough that the present value of the annual net changes over the first fifty years are positive for any reasonable discount rate.

A basic problem in analyzing alternatives to the current system is that the benefits "promised" in current law are inconsistent with the current level of taxes. The Social Security actuaries predict that the existing trust fund will be exhausted by about the year 2030, a date that has been advanced repeatedly during the past decade. We therefore cannot sensibly compare alternative transition paths to the tax and benefit schedules in current law but must make some assumption about how the system would be kept solvent if it were not privatized. Most of our simulations make the simple assumption that the current system would keep the existing 12.4 percent tax rate for the Old Age, Survivors and Disability Insurance program but would cut benefits when the trust fund is exhausted.

We refer to all of these feasible benefit paths as the baseline benefit paths to distinguish them from the current law benefit path. We also simulate a proposal to maintain the benefit rules embodied in current law by raising the tax rate after 2030 to the level required to meet the resulting benefit obligations.

One final comment of introduction is needed about our use of the term "privatize." We are analyzing the transition to a system of Mandatory Individual Retirement Accounts, similar to current IRAs and 401k's, to which employers and/or employees would be required to make contributions that would then be invested in stocks and bonds. There are two aspects of this that should be emphasized. First, participation is not voluntary. Everyone must participate and thus provide for his or her retirement.[4] Second, while the funds could in principle be collected and invested by the government, we believe that there are many reasons for preferring a decentralized system in which individuals and/or employers choose private fund managers. For this reason, we refer to the proposed alternatives as "privatizing" Social Security.

To motivate interest in the problem of transition, this paper begins (section 2) by indicating in more detail the potential steady state benefit of substituting a funded Mandatory Individual

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[4]The individual's decision to shift from the existing pay-as-you-go Social Security system to the system of individual investment accounts could be made voluntary. Since our analysis assumes that individuals receive a full credit against their payroll tax liability for contributions to the funded retirement accounts, the incentive for individuals to voluntarily shift would be extremely strong. But although the choice between the current system and the funded alternative could be made voluntary, individuals are required to participate in one of the two.

There are two obvious alternatives to a mandatory system: a voluntary system coupled with either a means tested benefit or with a uniform flat rate benefit. A means tested system runs the risks of discouraging savings if the level of benefits is set high enough or of leaving undesirable poverty if it is set too low; see Feldstein (1987). A flat rate benefit may also discourage private saving and may require a high tax rate with a correspondingly high deadweight loss.

Retirement Account program for the existing U.S. pay-as-you-go Social Security system. The remaining sections of the paper present our simulations and analyses of a variety of feasible transition paths for the U.S. Social Security system.

Section 3 provides some simple calculations to show the order of magnitude of the extra taxes required during the transition to a funded system that maintains a feasible baseline benefit path. Section 4 then describes our Social Security Simulation Model (SS-SIM) and discusses the parameter values that we have used. Section 5 presents results for the simulation of a gradual transition to a privatized system for all employees. Section 6 deals with the distributional issue of the benefits for lower income individuals in a privatized system. Section 7 discusses the problem that the returns on privately invested funds are uncertain and that actuarially fair annuities based on debt and equity returns are not available.

In section 8 we analyze an alternative baseline in which the annual inflation-adjustment to Social Security benefits would be reduced by one percentage point. In section 9 we turn in the opposite direction and consider a transition to a privatized system that maintains the current law benefit path. Instead of requiring a rise in the payroll tax from 12.4 percent to more than 19 percent, the fully funded system can maintain benefits with a long-run contribution rate of only slightly more than 3 percent. We present the corresponding transition path.

A final section summarizes our findings and comments on some issues that remain to be analyzed.

2. The Steady State Advantage of a Funded Retirement Program[5]

In a growing economy with an unchanging age structure, an unfunded pay-as-you-go (PAYGO) Social Security retirement system that is financed by a constant payroll tax rate provides each cohort of participants with an implicit real rate of return on their tax contributions equal to the aggregate rate of growth of the economy (Samuelson, 1958). For the current illustrative calculation, we take this rate of return to be 2.5 percent, the rate of growth of real wage and salary payments between 1960 and 1995 (Economic Report of the President, 1996).[6]

In contrast, funds that are saved and invested in the nation's capital stock earn a real rate of return for the nation that is equal to the pretax marginal product of capital. For the past 35 years, this has averaged slightly more than 9.0 percent.[7] We now assume that the individual can in principle receive the entire 9 percent in a funded account; we return below to defend the reasonableness of this assumption.

To see the importance of the difference between the 2.5 percent and 9 percent rates of return for the required amount of retirement saving, consider the very simple example of an individual who saves at one point during the middle of his working life for consumption during the middle of his

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[5]The steady state gain of a funded program must be balanced against the costs of transition. Realistic estimates of these costs are the primary focus of this paper. We present calculations that show that the present value of the gains exceed these costs for any reasonable discount rate, even when the horizon is limited to forty years. For a theoretical discussion of the conditions under which shifting from an unfunded to a funded program has a positive present value, see Feldstein (1995c).

[6]Because of the reduced rate of growth during the past two decades, the Social Security Trustees (1995) assume that the rate of growth in the future will be only two percent.

[7]Rippe (1995), following the method described in Feldstein, Dicks-Mireaux and Poterba (1983), found that the real pretax marginal rate of return on capital in the nonfinancial corporate sector averaged 9.3 percent between 1960 and 1994.

retirement years. More specifically, consider an individual who is age 45 and who "saves" $2,600 (approximately the current average payroll tax payment) to finance retirement consumption at age 75. With the PAYGO real return of 2.5 percent, this $2,600 increases over the 30 year period to $5454. If the individual had instead earned a real 9 percent return on his retirement saving, this $5454 retirement amount could have been "purchased" at age 45 for only $411 instead of $2,600.

If the $2,600 PAYGO contribution is obtained by a 12.4 percent payroll tax, this implies that the tax could be reduced to (411/2600) x 12.4 percent = 1.96 percent.

The individual benefits in two quite distinct ways from being in the high-yield funded program rather than the low-yield PAYGO program. First, the individual saves $2190 in taxes at age 45 while maintaining the original benefits in retirement. Second, the distortionary payroll tax is reduced from 12.4 percent to 1.96 percent. Each of these deserves more comment, as does the assumption that the entire 9 percent pretax return is available to the mandatory individual retirement account.

First, the individual's gain at age 45 is not a "future" gain in the form of higher benefits (that might be discounted by the individual at a high personal discount rate) but a tax reduction available immediately for additional consumption. Moreover, valuing this as $2190 of additional consumption at age 45 may understate its value to the individual who may be able to obtain a higher level of utility by saving some of that additional disposable income.

Second, the existing 12.4 percent payroll tax distorts employment and compensation decisions. While 1.96 percentage points can be thought of as the amount needed to purchase a retirement benefit, the remaining 10.44 percentage points represent a pure tax. A deadweight loss results from this tax because of the compensated change in individual labor supply broadly defined (to include not only participation and hours but the choice of job, degree of effort, location, etc.) and

in the consumption of such things as fringe benefits and better working conditions that are not part of taxable payroll income. The magnitude of the deadweight loss depends on the combined marginal tax rate that results from the income and payroll taxes. Taking the combined federal and state marginal income and sales tax rates to be 25 percent implies that the net payroll tax of 10.44 percent raises the marginal tax rate from approximately 25 percent to approximately 35.5 percent. The deadweight loss rises from being proportional to the square of 0.25 (i.e., to 0.0625) to being proportional to the square of 0.355 (i.e., 0.126, about twice as large.)

Since the deadweight loss reflects changes in both labor supply and in the form of compensation, the relevant elasticity is the compensated elasticity of the taxable income with respect to the net-of-tax share of income (Feldstein, 1995a). If we write that elasticity as ε, the increased deadweight loss due to the 10.4 percent net payroll tax can be written (following Harberger (1964) and Browning (1987)) as $0.5\ \varepsilon\ (0.126 - 0.0625)\ (wL) / (1 - 0.355)$ where wL is the taxable payroll and the division by 1 - 0.355 reflects the fact that the elasticity is evaluated empirically at the net-of-tax wage rate (Browning, 1987). In the current example, since the 12.4 percent payroll tax produced revenue of $2600, the value of wL is $20,967. The increased deadweight loss is therefore $1032 ε. Although estimates of ε for changes in the income tax for high income individuals suggested values of ε between 1.0 and 1.5 (Feldstein, 1995b; Auten and Carroll, 1994), we will be conservative and assume $\varepsilon = 0.5$. With this value, the increased deadweight loss associated with a PAYGO tax of 12.4 percent is $516 or 2.5 percent of payroll earnings.

Note that this point is fundamentally different from the reduced payroll tax distortion

discussed in Kotlikoff (1996) and in Auerbach and Kotlikoff (1987). Their analysis emphasized the fact that in the current Social Security system some individuals receive substantially higher implicit rates of return on their contributions than others. They note that because of these differences and the great complexity of the benefit rules, individuals may disregard the link between contributions and benefits completely, treating the entire payroll tax as a pure tax for which nothing is received in return. They then assume that shifting to individualized accounts in which all individuals are treated equally can be used to eliminate the deadweight loss that results from the payroll tax distortions even if the individual accounts remain on a pay-as-you-go basis. They arrive at this conclusion by assuming that the benefits could be paid in a way that eliminates the net tax at the margin even though the average benefit represents a very low rate of return on the taxes paid. This is possible in their simulation model because all individuals have the same income. In effect, Auerbach and Kotlikoff require each individual to pay both a proportional payroll tax at a relatively low rate and a large lump sum tax. The revenue from the lump sum tax is used to subsidize the benefits so that the implied return on the payroll tax is equal to a market rate of return, eliminating the distorting effect of the payroll tax. As a practical matter, however, a lump sum tax equal to at least two thirds of the average Social Security payroll tax would not be feasible. Although some reductions in deadweight loss could no doubt be achieved within the pay-as-you-go unfunded system by reducing the anomalies in the links between taxes and benefits[8], those gains would be small in comparison to the gains that would be achieved by shifting from a pay-as-you-go system to a funded system. All of the welfare gain from reduced distortion in our current analysis comes about because individuals are investing in higher

[8]On the extent of these differences in effective tax rates, see Feldstein and Samwick (1992).

yielding assets.

In summary, by being in a funded program rather than the PAYGO system, our 45 year old individual saves 10.4 percent of payroll in contribution and an additional 2.5 percent of payroll in reduced deadweight loss. For the individual, the gain is equivalent to 12.9 percent of payroll. Note that this gain is more than the entire initial level of the payroll tax.

The relative size of the gain depends of course on the age of the individual. For someone at age 30 the gain is substantially larger while for someone on the verge of retirement it is significantly smaller. A 30 year old who now pays a tax of $2600 to buy benefits at age 75 could buy those benefits in a funded program (with a 9 percent return) with a payment of only $55. A 65 year old who is buying benefits at age 75 can only reduce his cost from $2600 to $1406.

To get a very rough sense of the overall aggregate effect, consider a workforce of individuals between ages 30 and 65 with each year's cohort 1 percent larger than the cohort born a year earlier. If all individuals earn the same average income and save to receive benefits at age 75, a PAYGO system with a 12.4 percent tax would provide the same benefit as a funded system with a 9 percent rate of return and a contribution rate of 2.2 percent. This is surprisingly close to the example of the 45 year old examined above. The combination of the reduced contribution and the reduced deadweight loss due to the distorting payroll tax is equivalent to about 12.5 percent of payroll up to the Social Security maximum. Since the payroll covered by Social Security is about 40 percent of GDP (Trustee's Report, page 190) the gain from having a funded system rather than a PAYGO system is equal to about 5 percent of GDP.

This calculation assumes that it is appropriate to attribute the entire real pretax return of 9 percent to the Mandatory Individual Retirement Accounts. About 40 percent of the 9 percent pretax

return on capital (i.e., an amount equal to a 3.6 percent return on the private capital investment) is now collected by the government in corporate taxes and property taxes. It would be reasonable and fair for this return to be given back to the capital that earned it by crediting the Mandatory Individual Retirement Accounts with a government matching contribution that supplements the income earned in the account (just as the Treasury now rebates the tax collected on Social Security benefits to the Social Security trust fund.) This "government contribution" would not represent a net cost to the government since it would simply be the extra corporate tax collected because of the new funded retirement accounts.[9]

3. The Strategy of Privatization

The strategy of privatization that we pursue in this study does not deal with the normative issue of the proper level of Social Security benefits. Instead, we assume that benefits in each future year will be maintained at the same levels that would prevail in the absence of privatization. We also assume that, by investing the MIRA accounts in the market mixture of debt and equity and receiving rebates of the tax revenues collected from the corporations on the incremental MIRA capital, the MIRA funds can earn the real pretax return of 9 percent. If these funds are used to purchase annuities (so that there are no bequests to children from MIRA accounts), the full 9 percent can be used to

[9] It would clearly be wrong to ignore the approximately 3.6 percent return captured in taxes and credit the mandatory retirement accounts with just the net 5.4 percent. It could however be assumed as a matter of political economy that the government would not credit this 3.6 percent of MIRA assets back to the MIRAs but would spend it on current consumption or tax cuts. If so, it would be necessary to recalculate the mandatory retirement contributions on the basis of the lower return and to consider a way to treat the corporate tax collections as an offset to the resulting higher payroll taxes. We present such a calculation based on a 5.4 percent return on MIRA assets in section 5.5 below.

fund retirement and survivor benefits.[10]

As noted above, the future benefits in our baseline case are not the level of benefits implied by the formula in current law since that is not feasible without substantially raising the existing 12.4 percent payroll tax rate. The Social Security actuaries now project that under current law the real value of the trust fund begins declining in 2015 and reaches zero in 2030. Our simulations essentially reproduce this projection. To assume a feasible baseline benefit path, we assume that benefits in each year after 2030 are adjusted to the level that can be financed in that year with a 12.4 percent payroll tax. Thus, the trust fund is zero in each year after 2030.[11]

After the privatization begins, individuals (or their employers or both) are required to contribute to a Mandatory Individual Retirement Account (MIRA). The amount that is contributed for each individual depends on that individual's age and is calculated to be such that, when the privatization process is fully phased in[12], the contribution would grow at 9 percent to equal the same benefit stream in retirement that the individual would have obtained under the existing unfunded system (as modified to maintain solvency) by contributing 12.4 percent of his/her covered earnings.[13]

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[10]We are not explicit in the current analysis about survivors or the treatment of spouses. Similarly, the 12.4 percent tax rate includes Social Security disability benefits and these are implicitly incorporated into our system.

[11]Section 9 presents an alternative analysis in which taxes are raised after 2029 to maintain the level of benefits implied by current law.

[12]We discuss a phase-in method of gradually shifting from the current system to the MIRA system in section 5.

[13]If all individuals make MIRA contributions in this way, the transition is similar in spirit to the system of recognition bonds used for Social Security privatization by Chile and other countries. It differs in defining the value of the individual's claim to be based on the benefits to which he is entitled rather than the taxes that he paid. The current strategy also has the feature that the existing payroll tax is used to pay principal and interest on the implicit "recognition

Each individual's MIRA contribution is credited against that individual's payroll tax obligation. A temporary uniform payroll tax surcharge must therefore be levied on all employees and employers to maintain the Social Security trust fund on its currently projected path.[14]

In the first year of privatization, individuals and their employers in the aggregate thus pay an amount equal to the full 12.4 percent Social Security payroll tax plus a surcharge that in the aggregate has the value of the specified MIRA contributions.

It is tempting to say that that the MIRA surcharge is unnecessary since the credit given for the MIRA contributions could instead be offset by reducing the existing Social Security trust fund. But reducing the trust fund in this way would defeat the purpose of the MIRA contributions. The reduction in the trust fund would exactly offset the increase in capital formation in the MIRAs that provides the higher return than the current unfunded system.

To assure that the nation's aggregate capital stock increases by the amount of the MIRA contributions, we assume that the payroll tax plus the surcharge is set in each year to maintain the trust fund at the level that would have prevailed in the absence of privatization. (This is not necessary, but any decision to reduce the trust fund must be reflected in a lower capital stock and a reduction in national income calculated as the product of the reduced capital stock and the marginal

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bonds" and that those "bonds" are completely paid off at the death of the youngest covered worker at the time of privatization.

[14]There are of course many alternative transition paths with different distributional consequences for employees of different ages. For example, if MIRA contributions are not credited against payroll tax obligations, the transition is much more favorable to younger employees and less favorable to those nearer to retirement. In principle, payroll tax rates could vary by age.

product of capital, not the government bond rate.)

The pure pay-as-you-go payroll tax that is required to keep the current trust fund path unchanged declines gradually as more and more of the retirement benefits come to be funded out of the MIRAs . Eventually, the traditional payroll tax is unnecessary and the only contribution that individuals are required to make is to the Mandatory Individual Retirement Account.[15]

Under the current law, Social Security benefits are based only on the taxes that individuals pay when they are 30 years old or older (technically, on the 35 years of highest income). If full privatization began now for all employees between the ages of 30 and 65 (we assume that everyone retires at age 65[16]), when the current 30 year olds retire they would not receive any PAYGO benefits but would receive benefits wholly on the basis of their MIRA contributions. Those who are now over the age of 30 would continue to have some vestige of PAYGO benefits as long as they live. The payroll tax could therefore continue for as long as 70 years but at a very much reduced rate. At some point in the future, long before 70 years from now, the reduction in the PAYGO benefits to retirees would exceed the MIRA contributions. At that point and ever after that, the combination of the payroll tax and the MIRA contribution would be less than the 12.4 percent payroll tax.

The specific timing of this cross-over from mandatory contributions (the payroll tax plus the MIRA contributions) that are greater than 12.4 percent to mandatory contributions that are lower than 12.4 percent will depend on such things as (1) whether participation is initially universal or is

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[15]At some point, when the traditional payroll tax is small enough, the system of crediting MIRA contributions would be eliminated. By then, all individuals would be paying a combined MIRA contribution plus payroll tax that is substantially less than the current 12.4 percent.

[16] To the extent that those who retire before (after) age 65 have an actuarially fair reduction (increase) in their benefits, the age of retirement does not matter for our calculations.

phased in over time and (2) whether the MIRA contributions are immediately set to substitute completely for the 12.4 percent funding of future benefits or for just a fraction of those benefits. We focus on the case in which everyone over age 29 is covered immediately but in which the MIRA contributions begin at a level equal to just one-fourth of the full amount required to fund future benefits and rise gradually until they reach the full amount after 25 years.

Before turning to our detailed analysis of the transition options for the U.S. economy, it may be helpful to consider briefly the way that our basic transition would operate in a simple stylized economy. For this purpose, we assume that the economy experiences steady state growth at 2.5 percent and currently has an unfunded Social Security program in which benefits rise at 2.5 percent a year at a level that is compatible with a constant 12.4 percent payroll tax rate. We assume also that additions to the capital stock earn a real return of 9 percent. (The key differences from the actual situation in the United States is that the U.S. combination of benefit promises, changing demography, and initial trust fund are not consistent with a 2.5 percent implicit return and are not financially viable.)

The required MIRA contributions in this steady state economy have already been derived in section 2 above. We saw there that a 45 year old who earned 9 percent instead of 2.5 percent could replace a 12.4 percent tax with a 1.96 percent MIRA contribution. More generally, we saw that if the labor force is growing at one percent a year, the real wage rate is rising at 1.5 percent a year, and all workers earn the same wage, the 12.4 percent tax could be replaced by a 2.2 percent MIRA contribution.

The 2.2 percent is therefore an estimate of the level of MIRA contributions that would be possible in steady state after the last PAYGO retiree had died. It is also a rough estimate of the

payment that workers (and/or their employers) would have to make in the first year of the transition (before there is any benefit replacement) in addition to the 12.4 percent PAYGO tax if there is an immediate shift to full MIRA contributions.[17] Thus the tax rises in the first year to 14.6 percent. In the second year, however, the new retirees receive some of their retirement income from the MIRA saving that they did in the previous year and therefore receive less in PAYGO benefits. Thus 14.6 percent would be the maximum tax during the privatization period and would fall rapidly over the transition period as the amount of the future PAYGO retiree benefits is replaced by MIRA benefits.

Rather than explore the time path for this hypothetical economy, we return to the simulation analysis of the actual US economy and its current and future demographic structure.

4. The SS-SIM Model

This section describes the micro simulation model that we use to analyze alternative privatization paths. The model has four basic components: (1) demographic projections; (2) basic economic assumptions; (3) Social Security rules; and (4) the response of taxpayers to changes in tax rates and the associated changes in deadweight losses. The model is calibrated so that with the current Social Security rules it reproduces the basic time series of benefits, revenues, and trust fund assets predicted in the 1995 Social Security Trustees Report.

4.1 Demographics

The unit of analysis in the simulation is the individual. We simplify the Social Security rules

[17]With a 25 percent phase-in in the first year, the corresponding incremental payment would be one-fourth of the 2.2 percent or 0.55 percent.

by making no specific adjustments for married couples or survivor benefits. The values of these benefits as well as of the disability benefits are all subsumed in the projected individual retirement benefits.

Our analysis incorporates the actual current age structure of the population and the Census Bureau projections of future births through 2050 and the cohort specific life tables for individuals born through 2050.[18] To reflect the net inflow of immigrants, we scale up the projected population at every age to coincide with the aggregate projections of the Social Security Administration.

4.2 Economic Assumptions

The simulations assume that individuals enter the labor force at age 21 and work until age 65 (or death if that occurs sooner). Since not everyone in the population actually works during these years and since there are workers in covered employment at younger and older ages, we select a labor force participation rate among 21 to 64 year olds that gives the correct number of covered workers in 1995 (Trustees Report page 122.). This is a 94 percent participation rate among individuals aged 21 through 64. The number of workers in future years is also calibrated to the Social Security projections, implying small fluctuations in future labor force participation rates.

The assumed wage in 1995 is the average earnings in covered employment ($24,825). This reflects the ceiling on taxable wages ($ 61,200 in 1995) but overstates the taxable payroll because some employees with multiple jobs exceed the maximum taxable wage. Taxable payroll per employee

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[18]Our source for the initial population numbers is US Population Estimates by Age, Sex , Race and Hispanic Origin 1990-1995 (Bureau of the Census, 1996a). The Census source of both births and mortality projections is Population Projections of the United States (Bureau of the Census, 1996b).

has averaged about 83.5 percent of the average wage in covered employment, a ratio that we assume holds in the future as well.

We use the historic data for average earnings in covered employment in previous years and follow the intermediate assumption in the 1995 Trustees' Report that, after 1995, the average real wage rises at 1.0 percent per year. The movements in the average real wage are assumed to reflect changes in the age structure of the labor force and differences among age groups in the rate of increase of wages. More specifically, based on the pattern of covered earnings by age as reported in the 1995 Social Security Statistical Supplement, we assume that annual earnings rise at g + 3 percent for individuals under age 35, at g + 1 percent for individuals between 35 and 45, and at g minus 1.5 percent for those above 45 years old where the value of g for each year is chosen to make the overall rise in wages equal to the historic record before 1995 and to the projected 1 percent rise after 1995.

The Social Security Trustees assume that the assets in the trust fund will earn a 2.3 percent real interest rate in the future. Since the basic policies that we study leave the path of benefits and taxes (and therefore of the trust fund) unchanged, this rate of interest is not relevant for the analysis of these options.

The real marginal product of capital is assumed to be 9 percent. As noted above, the average pretax rate of return on capital in the nonfinancial corporate sector from 1960 through 1994 has been slightly above 9 percent (Rippe, 1995). This figure is derived, following Feldstein, Dicks-Mireaux and Poterba (1983) by adding corporate profits, net interest payments, and all taxes paid to measure the pretax product of capital and then dividing that by the estimate of the capital stock at replacement

cost.[19] Our estimate makes no allowance for the lower return that is earned on capital outside the corporate sector or on the net effect of increased capital accumulation on the marginal product of capital and on the net international capital flow.

4.3 Social Security Rules

Each individual is subject to an initial Social Security payroll tax of 12.4 percent. Since average real wages are projected to rise at 1.0 percent a year, we increase taxable wages at that same rate.

Because we use the individual as the unit of analysis, we do not have separate survivors' benefits. The "return" on contributions to Social Security (and to the MIRAs) is calculated as if it is all paid in the form of annuities to the retired individuals. We also do not make separate provision for disability benefits. We include the disability tax by using the 12.4 percent tax rate but include the disability benefits with the retirement annuity.

Individuals become eligible for benefits at age 65 in the simulation and receive benefits until they die. In actual practice, some individuals retire earlier than 65 and some wait until later to retire. To the extent that Social Security benefits are adjusted for the retirement age in an actuarially fair way, these differences in retirement age do not change the costs of providing benefits.

Because we do not distinguish income levels or family structures, we cannot apply the actual Social Security benefit rules. We therefore calculate benefits by attributing a rate of return on the taxes that each individual has paid. We follow current Social Security rules and assume that only those taxes paid between age 30 and 65 -- the highest 35 years of earnings -- are used in calculating

[19]These figures relate profits and interest earned in the United States to the value of the domestic capital stock.

benefits. The cohort specific real rates of return that we use are modifications of earlier estimates by Boskin et al (1987); their estimates, which were for single earner couples, have been adjusted to produce aggregate benefit amounts that coincide with the Trustees' projections of the benefits implied by the current law for future years:

Year of birth	Pre-1915	1915	1930	1945	1960	1975	1990+
Real Rate of Return	7.0 %	4.21%	2.52%	1.67%	1.39%	1.39%	1.43%

Even with the lower rates of return for younger workers implied by this procedure, the projected benefits cannot be financed by the existing 12.4 percent OASDI tax rate because of the changing age structure of the population. The changing demographics cause the trust fund to be exhausted in the year 2030. Our basic simulations assume that at that point benefits under the existing system would be reduced to the level that can be financed on a current basis by the taxes collected with a 12.4 percent payroll tax. The calculations presented in the next section show that this requires a benefit reduction that begins at 18 percent and rises to 35 percent. Two alternatives are also examined: the analysis in section 8 modifies the existing inflation indexing rule while the analysis of section 9 maintains the current law benefits by increasing the tax or MIRA contributions..

4.4 Taxpayers responses, tax rates and deadweight losses.

The projections of taxable earnings described in section 4.2 have to be modified to incorporate the changes in taxpayer behavior that would result from changes in the payroll tax rates. This is important both to estimate the required payroll tax rates and the associated changes in deadweight losses. Traditional estimates of the effects of tax rates on labor supply indicate that participation rates

and average hours are quite insensitive to net-of-tax wages among prime age males and single women but much more sensitive among married women. However, this is too narrow a measure of taxpayers' responses for the current purpose. The change in revenue and therefore the required revenue-neutral change in tax rates reflects not only changes in working hours but in a broader definition of labor supply (that includes the choice of job, the degree of effort, location, etc.) as well any shift between cash compensation and fringe benefits, improved working conditions, and other things that are not subject to the payroll tax. Feldstein (1995a) showed that the deadweight loss associated with the tax rate depends on the compensated elasticity of taxable income with respect to the net of tax share.

There is, unfortunately, no good evidence on this elasticity for changes in the payroll tax rate. The estimated elasticities of between 1.0 and 1.5 for the income tax (Feldstein 1995b and Auten and Carroll, 1994) are not directly relevant because they include changes in deductibles and are for higher income individuals. We assume in what follows that the uncompensated elasticity of labor earnings with respect to the relevant net of tax rate is only 0.5. Although the compensated elasticity would be larger, we also use an elasticity of 0.5 for the deadweight loss calculations. The calculation of the earnings response and the associated adjustment in the tax rate, as well as the implications for the deadweight losses, are developed in section 5.3.

Our analysis does not take into account the broader general equilibrium effects of the shift to a funded system. The primary general equilibrium effect is the impact of the increased national capital stock on the rate of return and on real wages. Although the higher real wages reinforce the effect of lower tax rates to increase labor supply, the effect is smaller than the tax effect because the higher marginal product of labor does not affect the choice between taxable wages and other forms of

compensation.[20]

5. Simulation Results for Gradual Privatization

This section begins by presenting the values of key variables under current law and then shows the "solvency adjustment" to benefits needed to avoid a tax increase when the trust fund is exhausted. The section then goes on to consider the effect of a gradual privatization on tax rates and on the deadweight loss of the tax system.

5.1 Current Law and Baseline Simulations

Table 1 shows the projected values of the numbers of covered workers and of beneficiaries in each year from 1995 through 2071. (The number of beneficiaries is the number of persons who are supported by Social Security. In a married couple, this is two persons regardless of whether each would claim benefits as a retired worker or one would claim as a dependent spouse.)

The ratio of covered workers per beneficiary declines from the current value of 3.27 to 2.03 in the year 2031 and then continues to decline to 1.80 at the end of the period.

Table 2 shows our simulation of the projected values of payroll tax receipts and of retirement benefits under current law. The payroll tax revenue is the result of a constant 12.4 percent rate applied to the projected labor force with real wages per employee growing at 1.0 percent per year. The initial payroll tax per worker is $2,570. All dollar amounts are reported in constant 1995 dollars.

The retirement benefits reflect the projected numbers of retirees and the assumption that

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[20]For examples of the general equilibrium analysis of the effects of social security reforms, see Auerbach and Kotlikoff (1987) and Kotlikoff (1996 and in this volume).

Table 1 DEMOGRAPHIC PROJECTIONS

A) Covered Workers (millions)

1995	141.21	142.49	143.77	145.04	146.32	147.60	148.77
2002	149.95	151.12	152.29	153.47	154.47	155.47	156.48
2009	157.48	158.49	159.06	159.63	160.20	160.78	161.35
2016	161.60	161.84	162.09	162.34	162.59	162.79	162.99
2023	163.19	163.39	163.59	163.87	164.15	164.43	164.71
2030	164.99	165.38	165.77	166.16	166.55	166.94	167.32
2037	167.70	168.09	168.47	168.85	169.11	169.38	169.65
2044	169.91	170.18	170.37	170.55	170.74	170.92	171.11
2051	171.25	171.39	171.53	171.67	171.81	171.95	172.09
2058	172.23	172.37	172.52	172.67	172.83	172.98	173.14
2065	173.30	173.44	173.58	173.72	173.87	174.01	174.15

B) Beneficiaries (millions)

1995	43.22	43.86	44.50	45.15	45.79	46.43	47.11
2002	47.79	48.47	49.15	49.83	50.73	51.64	52.55
2009	53.46	54.37	55.62	56.88	58.14	59.40	60.65
2016	62.15	63.65	65.14	66.64	68.14	69.59	71.04
2023	72.50	73.95	75.41	76.49	77.58	78.67	79.76
2030	80.85	81.50	82.15	82.80	83.44	84.09	84.32
2037	84.56	84.79	85.02	85.25	85.48	85.70	85.93
2044	86.16	86.38	86.70	87.01	87.32	87.63	87.94
2051	88.42	88.90	89.38	89.86	90.34	90.82	91.30
2058	91.78	92.26	92.73	93.13	93.52	93.92	94.31
2065	94.70	95.05	95.39	95.73	96.08	96.42	96.76

C) Support Ratio

1995	3.27	3.25	3.23	3.21	3.20	3.18	3.16
2002	3.14	3.12	3.10	3.08	3.04	3.01	2.98
2009	2.95	2.92	2.86	2.81	2.76	2.71	2.66
2016	2.60	2.54	2.49	2.44	2.39	2.34	2.29
2023	2.25	2.21	2.17	2.14	2.12	2.09	2.06
2030	2.04	2.03	2.02	2.01	2.00	1.99	1.98
2037	1.98	1.98	1.98	1.98	1.98	1.98	1.97
2044	1.97	1.97	1.97	1.96	1.96	1.95	1.95
2051	1.94	1.93	1.92	1.91	1.90	1.89	1.88
2058	1.88	1.87	1.86	1.85	1.85	1.84	1.84
2065	1.83	1.82	1.82	1.81	1.81	1.80	1.80

Table 2 CURRENT LAW: TAXES AND BENEFITS

A) Payroll Taxes ($ billions)

1995	362.96	369.91	376.96	384.12	391.38	398.75	405.93
2002	413.23	420.63	428.13	435.75	442.98	450.32	457.76
2009	465.30	472.95	479.40	485.94	492.56	499.26	506.05
2016	511.90	517.81	523.79	529.84	535.95	541.98	548.07
2023	554.23	560.47	566.76	573.41	580.13	586.93	593.81
2030	600.76	608.21	615.74	623.37	631.08	638.89	646.75
2037	654.70	662.75	670.89	679.13	687.01	694.97	703.03
2044	711.17	719.41	727.40	735.48	743.64	751.90	760.24
2051	768.47	776.79	785.19	793.69	802.27	810.97	819.75
2058	828.63	837.61	846.68	855.92	865.26	874.70	884.25
2065	893.90	903.58	913.37	923.26	933.26	943.37	953.59

B) Payroll Taxes per Worker ($ thousands)

1995	2.57	2.60	2.62	2.65	2.67	2.70	2.73
2002	2.76	2.78	2.81	2.84	2.87	2.90	2.93
2009	2.95	2.98	3.01	3.04	3.07	3.11	3.14
2016	3.17	3.20	3.23	3.26	3.30	3.33	3.36
2023	3.40	3.43	3.46	3.50	3.53	3.57	3.61
2030	3.64	3.68	3.71	3.75	3.79	3.83	3.87
2037	3.90	3.94	3.98	4.02	4.06	4.10	4.14
2044	4.19	4.23	4.27	4.31	4.36	4.40	4.44
2051	4.49	4.53	4.58	4.62	4.67	4.72	4.76
2058	4.81	4.86	4.91	4.96	5.01	5.06	5.11
2065	5.16	5.21	5.26	5.31	5.37	5.42	5.48

C) Retirement Benefits ($ billions)

1995	324.72	331.44	338.02	344.77	351.65	358.83	366.48
2002	374.17	382.29	390.56	398.92	409.38	420.00	430.97
2009	441.79	452.67	466.87	482.00	497.25	512.61	528.26
2016	546.18	564.51	582.85	601.17	619.56	637.58	655.33
2023	673.18	690.91	708.69	723.30	738.02	752.92	767.96
2030	783.16	794.17	804.99	816.10	827.44	839.10	846.86
2037	854.47	862.13	870.04	878.36	887.20	896.59	906.75
2044	917.61	929.38	942.67	956.75	971.47	986.70	1002.99
2051	1021.89	1040.90	1061.14	1082.29	1104.54	1127.39	1150.55
2058	1174.02	1197.94	1222.39	1245.46	1268.22	1290.68	1312.88
2065	1334.81	1355.78	1376.50	1396.95	1417.22	1437.30	1457.25

D) Benefits per Retiree ($ thousands)

1995	7.51	7.56	7.60	7.64	7.68	7.73	7.78
2002	7.83	7.89	7.95	8.01	8.07	8.13	8.20
2009	8.26	8.33	8.39	8.47	8.55	8.63	8.71
2016	8.79	8.87	8.95	9.02	9.09	9.16	9.22
2023	9.29	9.34	9.40	9.46	9.51	9.57	9.63
2030	9.69	9.74	9.80	9.86	9.92	9.98	10.04
2037	10.11	10.17	10.23	10.30	10.38	10.46	10.55
2044	10.65	10.76	10.87	11.00	11.13	11.26	11.41
2051	11.56	11.71	11.87	12.04	12.23	12.41	12.60
2058	12.79	12.99	13.18	13.37	13.56	13.74	13.92
2065	14.09	14.26	14.43	14.59	14.75	14.91	15.06

benefits are calculated by giving a return to each cohort as described above.

Table 3 shows how the trust fund evolves under current law. The fund is increased by the payroll taxes received, receipts from the Treasury, and interest on the fund balance, and is reduced by the benefits paid and administrative expenses.[21] In addition, the trust fund is assumed to spend 0.8 percent of benefits on administrative costs.[22]

The simulations show that the net additions to the trust fund continue to be positive until 2012 and then turn negative. Even after net additions to the trust fund (from taxes and Treasury transfers minus benefits and administrative costs) become negative, the trust fund continues to grow because of the interest earned on the government bonds in which the funds are invested and the Treasury tax collections on benefits that are transferred to the trust fund. At its peak in the year 2015, the trust fund has $1482 billion (at the 1995 price level). The decline in the trust fund after that date causes the fund to be exhausted in the year 2030, a date that also coincides with the Social Security actuaries' projection.

Since a negative trust fund is not feasible, we assume for the rest of our calculations in this section that the current system shifts to a pay-as-you-go basis after 2030 with benefits reduced to keep outlays equal to the funds raised by a combination of the 12.4 percent payroll tax and the Treasury tax collections on existing benefits, all net of the small administrative charge. Table 4 shows

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[21] Under current law, the Treasury adds to the Social Security trust fund the income tax that it collects on benefits. This starts with a very small amount ($5.13 billion in 1995) but grows rapidly because the income tax is applied to 85 percent of benefits above an unindexed amount of $32,000 per couple and $25,000 per single individual. The calculations of the cohort specific rates of return are based on benefits net of the income tax so that this is already taken into account.

[22] The administrative cost of the funded program is assumed to come from the difference between the assumed 9 percent rate of return and the total return of 9.30 percent that Rippe (1995) actually reported.

Table 3 CURRENT LAW: TRUST FUND

A) Net Addition to Trust Fund ($ billions)

1995	35.65	35.82	36.24	36.59	36.92	37.05	36.53
2002	36.06	35.28	34.45	33.63	30.33	26.95	23.34
2009	19.97	16.65	8.79	0.08	-8.67	-17.44	-26.43
2016	-38.65	-51.22	-63.72	-76.14	-88.57	-100.71	-112.50
2023	-124.33	-135.97	-147.60	-155.68	-163.79	-172.01	-180.29
2030	-188.66	-192.32	-195.69	-199.26	-202.97	-206.92	-206.88
2037	-206.60	-206.27	-206.11	-206.26	-207.29	-208.79	-210.98
2044	-213.77	-217.41	-222.81	-228.92	-235.60	-242.70	-250.77
2051	-261.60	-272.44	-284.43	-297.26	-311.10	-325.44	-340.00
2058	-354.78	-369.92	-385.49	-399.50	-413.10	-426.30	-439.13
2065	-451.60	-463.05	-474.15	-484.86	-495.29	-505.43	-515.32

B) Total Amount in Trust Fund ($ billions)

1995	501.70	559.60	619.90	681.29	743.41	805.73	867.24
2002	928.45	988.80	1047.97	1105.71	1161.47	1215.13	1266.42
2009	1315.52	1362.43	1402.56	1434.90	1459.23	1475.34	1482.84
2016	1478.30	1461.08	1430.97	1387.74	1331.09	1261.00	1177.50
2023	1080.26	969.14	843.83	707.56	560.05	400.91	229.84
2030	46.46	-144.79	-343.81	-550.98	-766.62	-991.17	-1220.85
2037	-1455.54	-1695.29	-1940.39	-2191.27	-2448.96	-2714.08	-2987.48
2044	-3269.97	-3562.58	-3867.33	-4185.20	-4517.06	-4863.65	-5226.28
2051	-5608.09	-6009.51	-6432.17	-6877.36	-7346.64	-7841.05	-8361.40
2058	-8908.49	-9483.30	-10086.91	-10718.41	-11378.03	-12066.03	-12782.68
2065	-13528.28	-14302.48	-15105.58	-15937.88	-16799.74	-17691.56	-18613.79

Table 4 CURRENT LAW: SOLVENCY ADJUSTMENT

A) Fraction by Which Benefits Must Be Reduced (Percent)

1995	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2002	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2009	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2023	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2030	0.00	18.09	24.12	24.22	24.34	24.46	24.24
2037	23.99	23.74	23.50	23.30	23.18	23.10	23.08
2044	23.11	23.21	23.45	23.74	24.06	24.40	24.80
2051	25.40	25.97	26.59	27.25	27.94	28.64	29.32
2058	29.98	30.63	31.29	31.82	32.32	32.77	33.18
2065	33.56	33.88	34.17	34.43	34.67	34.89	35.08

B) New Path of Retirement Benefits ($ billions)

1995	324.72	331.44	338.02	344.77	351.65	358.83	366.48
2002	374.17	382.29	390.56	398.92	409.38	420.00	430.97
2009	441.79	452.67	466.87	482.00	497.25	512.61	528.26
2016	546.18	564.51	582.85	601.17	619.56	637.58	655.33
2023	673.18	690.91	708.69	723.30	738.02	752.92	767.96
2030	783.16	650.54	610.86	618.42	626.08	633.82	641.62
2037	649.51	657.49	665.57	673.74	681.55	689.46	697.45
2044	705.53	713.70	721.63	729.64	737.74	745.93	754.21
2051	762.37	770.62	778.96	787.39	795.91	804.53	813.25
2058	822.06	830.96	839.96	849.13	858.40	867.76	877.23
2065	886.80	896.41	906.12	915.93	925.85	935.88	946.02

Table 5 PHASE-IN FROM PARTIAL TO TOTAL PRIVATIZATION

A) Mandatory Individual Contributions ($ billions)

1995	20.25	23.12	26.18	29.44	32.88	36.43	40.11
2002	44.07	48.04	52.22	56.67	61.11	65.70	70.25
2009	75.07	79.99	84.82	88.94	93.25	97.70	102.05
2016	106.10	110.13	114.06	117.82	121.27	120.74	120.64
2023	120.09	119.59	118.81	118.04	117.53	117.14	116.90
2030	116.82	117.11	118.10	118.88	119.58	120.03	120.34
2037	121.17	122.29	123.42	124.33	125.21	126.20	127.08
2044	127.96	128.60	129.28	129.89	130.58	131.44	132.06
2051	132.69	133.78	134.61	135.35	135.87	136.38	137.07
2058	137.91	138.89	139.94	141.10	142.35	143.70	145.14
2065	146.67	148.27	149.94	151.68	153.49	155.35	157.25

B) Mandatory Individual Contributions (Percent of Payroll)

1995	0.69	0.78	0.86	0.95	1.04	1.13	1.23
2002	1.32	1.42	1.51	1.61	1.71	1.81	1.90
2009	2.00	2.10	2.19	2.27	2.35	2.43	2.50
2016	2.57	2.64	2.70	2.76	2.81	2.76	2.73
2023	2.69	2.65	2.60	2.55	2.51	2.47	2.44
2030	2.41	2.39	2.38	2.36	2.35	2.33	2.31
2037	2.29	2.29	2.28	2.27	2.26	2.25	2.24
2044	2.23	2.22	2.20	2.19	2.18	2.17	2.15
2051	2.14	2.14	2.13	2.11	2.10	2.09	2.07
2058	2.06	2.06	2.05	2.04	2.04	2.04	2.04
2065	2.03	2.03	2.04	2.04	2.04	2.04	2.04

C) Benefits Replaced Due to Privatization ($ billions)

1995	0.00	0.13	0.38	0.78	1.35	2.18	3.25
2002	4.52	6.22	8.25	10.62	13.57	17.03	21.32
2009	25.93	31.17	37.29	45.26	53.82	63.07	73.44
2016	85.18	97.86	111.70	126.74	143.23	160.99	178.93
2023	198.55	218.93	240.74	262.44	284.59	307.56	331.29
2030	355.89	310.24	303.98	320.95	338.42	356.61	375.26
2037	393.42	411.53	430.08	449.32	468.52	487.90	507.68
2044	527.69	548.06	568.03	587.98	607.72	627.03	646.30
2051	664.97	682.81	700.46	717.66	734.44	750.59	766.05
2058	780.86	795.15	808.95	822.37	835.40	848.07	860.44
2065	872.55	884.37	896.00	907.47	918.83	930.10	941.30

D) Payroll Tax Needed to Maintain Trust Fund Trajectory (Percent of Payroll)

1995	12.40	12.40	12.39	12.37	12.36	12.33	12.30
2002	12.26	12.22	12.16	12.10	12.02	11.93	11.82
2009	11.70	11.58	11.43	11.24	11.03	10.82	10.59
2016	10.32	10.04	9.73	9.41	9.06	8.69	8.32
2023	7.92	7.52	7.09	6.68	6.27	5.85	5.43
2030	5.00	6.02	6.23	5.96	5.70	5.42	5.15
2037	4.89	4.64	4.39	4.13	3.88	3.63	3.37
2044	3.13	2.88	2.64	2.41	2.19	1.98	1.77
2051	1.58	1.41	1.25	1.10	0.96	0.83	0.72
2058	0.62	0.53	0.46	0.39	0.33	0.28	0.24
2065	0.20	0.17	0.14	0.11	0.09	0.08	0.06

E) Total Payroll Tax plus Mandatory Contribution (Percent of Payroll)

1995	13.09	13.17	13.25	13.32	13.40	13.46	13.53
2002	13.59	13.63	13.67	13.71	13.73	13.74	13.72
2009	13.70	13.67	13.62	13.51	13.38	13.25	13.09
2016	12.89	12.68	12.43	12.17	11.87	11.45	11.05
2023	10.61	10.16	9.69	9.23	8.78	8.32	7.87
2030	7.41	8.41	8.61	8.33	8.05	7.75	7.45
2037	7.18	6.93	6.67	6.40	6.14	5.88	5.62
2044	5.36	5.09	4.84	4.60	4.36	4.14	3.93
2051	3.73	3.55	3.38	3.21	3.06	2.92	2.79
2058	2.69	2.59	2.51	2.43	2.37	2.32	2.27
2065	2.23	2.20	2.17	2.15	2.13	2.12	2.11

the percentage by which benefits must be reduced beginning in 2031. The reduction goes from about 18 percent in that year to 24 in the next and then rises steadily. These simulation results provide the basis for the alternative privatization paths that we now consider.

5.2 Phase-in from Partial to Total Privatization

Table 5 shows the effect of starting with a partial privatization for everyone and then expanding the privatized share until it completely substitutes for the unfunded program. More specifically, in the first year individuals are required to contribute to the MIRA an amount which at a 9 percent rate of return will accumulate enough by age 65 to replace one-fourth of the corresponding unfunded Social Security benefits. In the second year, the share of retirement benefits that is to be prefunded (by that year's contributions) rises from 25 percent to 28 percent. The privatized share increases in this way by three percentage points a year for 25 years until MIRA contributions are enough to pre-fund 100 percent of the benefits associated with that year's contributions. (These figures ignore the effect of changes in tax rates on pretax earnings, a restriction that we correct in section 5.3.)

The contribution to the Mandatory Individual Retirement Account is $20.3 billion in 1995. This implies that the MIRA contributions are equivalent to 0.69 percent of taxable payroll, an amount shown in the second group of numbers, designated Table 5B within Table 5. This measures the extent to which the existing generation of employees is required in the first year of the transition to "pay for their own retirement as well as for the existing retiree benefits." It is clearly very much less than having to pay twice the existing payroll tax (i.e., an additional 12.4 percent) that some critics of privatization imply.

Since there are no MIRA benefits paid in 1995, part 5C of table 5 shows no "Benefits Replaced Due to Privatization" for 1995. The basic payroll tax needed to meet the existing benefit requirements and to keep the trust fund on its original trajectory therefore remains 12.40 percent of payroll, the amount shown for 1995 in part 5D of the table.

Combining the 0.69 percent of payroll MIRA contribution with the 12.4 percent Payroll Tax Needed to Maintain the Trust Fund Trajectory implies total contributions of 13.09 percent of payroll, the amount shown in part 5E of the table.[23]

As the privatization program moves forward through time, two major changes occur. First, the amount of MIRA contributions rises as (1) the privatization share rises from 25 percent to 100 percent over a 25 year phase-in period and (2) as the labor force grows and wages increase. This increase in MIRA contributions is shown in Table 5A. The changing age structure of the workforce and the changes in relative benefit levels projected for the future also cause the mandatory individual contributions as a percentage of payroll to vary in a moderate way; Table 5B shows that the contribution per dollar of payroll reaches a high of 2.81 percent of payroll in 2011 and then declines to a long-run level of 2.04 percent of payroll.

The second major change is the gradual replacement of the unfunded Social Security benefits with the MIRA benefits. In 1996, those who were 64 years old in 1995 retire and receive some

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[23]It would of course be possible to keep the combined MIRA contributions and payroll tax unchanged while meeting existing benefit obligations by reducing the trust fund or by explicit borrowing from the public by the social security program. Either of these would increase the unified budget deficit and reduce national saving by an amount that offsets the increased national saving in the MIRAs. Of course, if additional actions were taken to keep the budget deficit unchanged, the national saving rate would still increase by the amount of the MIRA accumulations. The possibility of these additional changes in government spending or taxes lies beyond the scope of the current paper.

benefits based on their MIRA contributions in the previous year. These benefits are just $0.13 billion (as shown in Table 5C). By the year 2000, these benefits are $1.35 billion; this reduces the pay-as-you-go tax rate required to maintain the trust fund trajectory from 12.40 percent to 12.36 percent.

Over time, this benefit replacement becomes much more important. After 20 years (in 2014), MIRA benefits reach $63.07 billion and therefore permit the payroll tax needed to maintain the trust fund trajectory to decline from the initial 12.40 percent to 10.82 percent, as shown in table 5D. Seven years later, in 2021, the required pay-as-you-go tax is down to 8.69 percent.

Those individuals who are 30 years old or younger in 2020 (when the MIRA system is fully phased in) eventually finance their retirement solely with MIRA withdrawals. Unlike earlier cohorts, they receive no PAYGO benefits. Since we assume that no one lives beyond age 100, this means that the PAYGO system is completely finished by the seventieth year after privatization begins (i.e., in 2090). The results in table 5D show that, as a practical matter, the required pay-as-you-go payroll tax is essentially zero (i.e., less than 0.5 percent) in 2059 and beyond.

Combining the MIRA contribution (part 5B) and the required payroll tax (table 5D) produces the combined payroll tax and MIRA contribution shown in Table 5E. This combination remains higher than the existing 12.4 percent payroll tax for 24 years. After that, the combined cost falls rapidly. In the thirtieth year, the combined ratio is down to 10.16 percent and by the fortieth year it is down to only 8.02 percent, less than two-thirds of the original 12.4 percent payroll tax that would otherwise be required to finance the same benefits. These figures imply that an individual who is a young employee at the start of privatization pays slightly higher taxes plus contributions in the early years but then sharply lower total taxes and contributions during later years. Before looking at the implication of such individual time paths for the present value of such payments, we consider the

effect of the plan on taxpayers' behavior and the implications of that response for tax rates and deadweight losses.

5.3 Behavioral Response, Required Tax Rates and Deadweight Losses

The existing payroll tax causes employees to reduce their labor supply (broadly defined to include effort, occupational choice, and location as well as the number of hours worked) and to substitute untaxed fringe benefits and nicer working conditions for taxable cash compensation. We model the reduction in taxable payroll earnings as the product of an elasticity and the change in the marginal net-of-tax share of wages, i.e., as the product of an elasticity and "one minus the effective marginal tax rate". The effective marginal tax rate includes the federal and state personal income tax rate, the effective state and local sales tax rates, and the net payroll tax rate. We assume (quite conservatively) a rate of 20 percent for the taxes other than the payroll tax. The net payroll tax rate is the difference between the payroll tax payment (12.4 percent of payroll) and the amount that the individual would have to pay to purchase the same benefit at the higher rate of return available in the market.

The cost of purchasing that benefit is calculated in the following way. If the implicit rate of return that the individual earns on Social Security payroll taxes[24] is denoted γ, a dollar of payroll tax paid at age a could provide a cash benefit of $(1+\gamma)^{65-a}$ at age 65. If $ann65(\gamma)$is the actuarial present value of a dollar a year from age 65 to death based on a return of γ, the dollar of payroll tax paid at age a earns an annuity starting at age 65 of $(1+\gamma)^{65-a}/ann65(\gamma)$. To purchase that same annuity in

[24]Recall that this implicit return has declined from 7.0 percent among individuals born before 1915 to less than 1.5 percent among individuals born after 1960.

a private pension plan, an employer would have to spend only $[(1 + \mu)^{65-a} / ann65(\mu)]^{-1}$ where μ is the rate of return earned in the private pension alternative. Because pension funds do not pay tax on their income, a plausible value for μ is the return on capital net of corporate and property taxes but before all personal income taxes. A pretax real return of 9 percent and a corporate tax rate (including state taxes and property taxes) of 40 percent imply $\mu = 5.4$ percent. Since μ is substantially greater than γ, there is a substantial effective tax implied by the payroll tax. For example, since someone born in 1960 would receive a return on Social Security taxes of only $\gamma = 1.39$ percent, each dollar of payroll tax could be replaced by only 9.7 cents of contribution to a private pension fund. This implies that 90.3 percent of the 12.4 percent payroll tax is a pure tax since the same benefits could be bought for a private pension contribution of only 1.2 percent of the individual's payroll. More generally, we define the effective payroll tax rate as $\{ 1 - [(1+\gamma)/(1+\mu)]^{65-a} [ann65(\mu)/ann65(\gamma)]\} \tau_p$ where τ_p is the payroll tax rate (currently 0.124). Alternatively, we can write the individual's effective payroll tax rate as $\tau_p - \beta$ where $\beta = [(1+\gamma)/(1+\mu)]^{65-a} [ann65(\mu)/ann65(\gamma)] \tau_p$ is the value of the benefit that the individual receives per dollar of incremental earnings.[25]

Combining this with the marginal personal income tax rate (θ) implies a net of tax share under existing Social Security rules of $1 - \theta - \tau_p + \beta$. We shall denote this net of tax share by N_0 . For example, with $\theta = 0.20$, $\gamma = 0.0139$ and $\mu = 0.054$, the net of tax share for a current 35 year old is $N_0 = 0.688$.

In the MIRA system, the individual would continue to pay a payroll tax to meet the remaining pay-as-you-go benefit obligations plus a surcharge to offset the revenue lost because individuals

[25]Our analysis does not classify individuals by income level and therefore does not distinguish between the average and marginal benefits per dollar of earnings.

reduce their regular payroll tax obligations by the amount of their MIRA contributions. If we denote this combined tax plus surcharge, shown in Table 5E as "Total Payroll Tax plus Mandatory Contribution," by τ^*_p we can write the individual's net-of-tax share under the MIRA system as $N_1 = 1 - \theta - \tau^*_p + \beta$ (where β is the same as in the current system since the value of the benefits are unchanged by switching to the MIRA system.)

At first, the net of tax share declines because τ^*_p is greater than the τ_p under the existing system. After a while, however, the net of tax rate rises and the corresponding effective marginal tax rate falls.

Our assumed elasticity of 0.5 implies that taxable income rises by a factor of $[N_1 / N_0]^{0.5}$. This in turn means that the payroll tax revenue collected by tax rate τ_p with the initial labor supply can be collected at a lower tax rate $\tau'_p = \tau_p [N_1 / N_0]^{-0.5}$. Similarly the personal income tax rate that collects the same revenue falls to $\theta' = \theta [N_1 / N_0]^{-0.5}$.

The path of the adjusted tax rates is shown in panels 6B and 6C of Table 6. In the first year, the combination of the MIRA surcharge and the unchanged payroll tax causes the net-of-tax-share to fall and therefore the aggregate labor supply to decline. The effect is small and is offset by raising the payroll tax rate from 12.40 percent to 12.46 percent. Similarly, the personal income tax rate only has to be raised from 20 percent to 20.10 percent. But by the eighth year the payroll tax rate is lower than the initial 12.4 percent and by year 25 the increased taxable labor income causes the payroll tax rate to be lower than it would be with no allowance for the change in labor income (i.e., by year 25 the payroll tax rate in table 6B is less than the payroll tax rate in table 5D.) The personal income tax rate in that year is also lower than its no-behavioral-response value.

By year 52, the personal income tax rate is reduced from 20 percent to 19 percent. The

Table 6 EFFECT OF PHASE-IN PARTIAL PRIVATIZATION ON TAX BASE AND DWL

A) Payroll Tax Needed to Maintain Trust Fund With No Behavioral Response (5D)

1995	12.40	12.40	12.39	12.37	12.36	12.33	12.30
2002	12.26	12.22	12.16	12.10	12.02	11.93	11.82
2009	11.70	11.58	11.43	11.24	11.03	10.82	10.59
2016	10.32	10.04	9.73	9.41	9.06	8.69	8.32
2023	7.92	7.52	7.09	6.68	6.27	5.85	5.43
2030	5.00	6.02	6.23	5.96	5.70	5.42	5.15
2037	4.89	4.64	4.39	4.13	3.88	3.63	3.37
2044	3.13	2.88	2.64	2.41	2.19	1.98	1.77
2051	1.58	1.41	1.25	1.10	0.96	0.83	0.72
2058	0.62	0.53	0.46	0.39	0.33	0.28	0.24
2065	0.20	0.17	0.14	0.11	0.09	0.08	0.06

B) New Payroll Tax Rate Allowing for Labor Supply Response

1995	12.46	12.46	12.46	12.46	12.44	12.43	12.40
2002	12.37	12.32	12.27	12.21	12.13	12.04	11.93
2009	11.81	11.68	11.53	11.32	11.11	10.89	10.64
2016	10.36	10.06	9.74	9.39	9.03	8.63	8.24
2023	7.82	7.40	6.96	6.53	6.11	5.69	5.26
2030	4.83	5.86	6.07	5.80	5.53	5.25	4.98
2037	4.72	4.47	4.22	3.96	3.71	3.47	3.22
2044	2.98	2.74	2.51	2.28	2.07	1.87	1.67
2051	1.49	1.33	1.17	1.03	0.90	0.78	0.67
2058	0.58	0.50	0.43	0.36	0.31	0.26	0.22
2065	0.18	0.15	0.13	0.10	0.08	0.07	0.05

C) New Personal Income Tax Allowing for Labor Supply Response

1995	20.10	20.11	20.12	20.13	20.14	20.15	20.16
2002	20.17	20.18	20.18	20.19	20.19	20.19	20.19
2009	20.19	20.18	20.17	20.16	20.14	20.12	20.10
2016	20.07	20.04	20.00	19.97	19.93	19.87	19.81
2023	19.75	19.69	19.63	19.57	19.51	19.45	19.39
2030	19.33	19.46	19.49	19.45	19.42	19.38	19.34
2037	19.31	19.27	19.24	19.21	19.17	19.14	19.11
2044	19.08	19.05	19.02	18.99	18.96	18.93	18.91
2051	18.88	18.86	18.84	18.82	18.80	18.79	18.77
2058	18.76	18.75	18.74	18.73	18.72	18.72	18.71
2065	18.71	18.70	18.70	18.70	18.70	18.69	18.69

D) Change in Deadweight Loss Due to Privatization ($ billions)

1995	3.78	4.49	5.22	6.00	6.77	7.50	8.18
2002	8.87	9.39	9.87	10.36	10.64	10.80	10.72
2009	10.60	10.32	9.75	8.37	6.90	5.29	3.36
2016	1.00	-1.63	-4.56	-7.81	-11.46	-16.30	-20.96
2023	-26.07	-31.24	-36.69	-42.04	-47.31	-52.60	-57.90
2030	-63.22	-56.17	-55.84	-59.86	-63.99	-68.30	-71.35
2037	-74.04	-76.53	-79.01	-81.58	-84.04	-86.41	-88.79
2044	-91.12	-93.53	-95.78	-97.96	-100.01	-101.88	-103.77
2051	-105.52	-107.00	-108.49	-109.92	-111.31	-112.59	-113.69
2058	-114.63	-115.43	-116.16	-116.82	-117.40	-117.91	-118.37
2065	-118.77	-119.12	-119.42	-119.68	-119.92	-120.13	-120.32

E) Change in Deadweight Loss As a Percent of Covered Wages

1995	0.13	0.15	0.17	0.19	0.21	0.23	0.25
2002	0.27	0.28	0.29	0.29	0.30	0.30	0.29
2009	0.28	0.27	0.25	0.21	0.17	0.13	0.08
2016	0.02	-0.04	-0.11	-0.18	-0.27	-0.37	-0.47
2023	-0.58	-0.69	-0.80	-0.91	-1.01	-1.11	-1.21
2030	-1.30	-1.15	-1.12	-1.19	-1.26	-1.33	-1.37
2037	-1.40	-1.43	-1.46	-1.49	-1.52	-1.54	-1.57
2044	-1.59	-1.61	-1.63	-1.65	-1.67	-1.68	-1.69
2051	-1.70	-1.71	-1.71	-1.72	-1.72	-1.72	-1.72
2058	-1.72	-1.71	-1.70	-1.69	-1.68	-1.67	-1.66
2065	-1.65	-1.63	-1.62	-1.61	-1.59	-1.58	-1.56

payroll tax rate is also reduced by one-twentieth, from 2.61 percent to 2.48 percent.

The changes in the rates of payroll tax and income tax cause corresponding changes in the deadweight loss of the tax system. Using the traditional Harberger-Browning approximation for the deadweight loss, the change in the deadweight loss can be written: Δ DWL = $0.5\ \varepsilon\ [\ t^2_1 - t^2_0\ ]\ (\ 1 - \ t_0\ )^{-1}$ wL where wL is the current payroll tax base, $t_0 = 1 - N_0$ and $t_1 = 1 - N_1$.

Table 6D shows the annual changes in the deadweight loss that result from the changes in net of tax shares. The annual deadweight loss of the tax system initially rises by about $3.8 billion, an amount equivalent to 0.13 percent of covered wages (as shown in Table 6E). At its maximum, the increased deadweight loss is 0.30 percent of payroll (in years 11 and 12). By year 23 (2017), the shift to a MIRA system is reducing the deadweight. The decline in the overall deadweight loss of the tax system rises rapidly to$50 billion in 2028, $100 billion in 2048, etc. In the final year of the simulations, the reduced deadweight loss is 1.57 percent of covered wages.

Putting the pieces together, the analysis in Tables 5 and 6 shows that in the long run privatization reduces the burden on employees from a 12.4 percent payroll tax in the current pay-as-you-go system to a mandatory MIRA contribution of 2.04 percent of payroll (Table 5B)[26] and reduces the deadweight loss of the income and payroll taxes by 1.57 percent of payroll (Table 6E). The combined gain to individuals is the sum of the reduction in the cash contributions (12.4 percent – 2.05 percent = 10.35 percent of payroll) and the reduction in the deadweight loss of the tax system

[26]The actual long-run MIRA contribution is reduced from 2.04 percent of payroll to 1.94 percent of payroll because the lower marginal tax rates cause an increase in payroll income. The correct way to compare the reduced cash tax burden (i.e., the effect on net income) is however to use the payroll tax rate on the initial base.

(1.57 percent of payroll) for a combined gain of 11.92 percent of payroll. The long run gain is thus equal to almost the entire current tax paid by employers and employees and is achieved without any reduction in the retirement benefits below what could be purchased with the current 12.4 percent payroll tax.

In the earlier years of the transition, the net effect on real disposable income (adjusted for the change in the deadweight loss) is at first negative and then becomes a positive gain. Thus, in the first year there is (1) no effect on the payroll tax rate,[27] (2) a MIRA surcharge of 0.69 percent and (3) an increased deadweight loss of 0.13 percent of payroll. The total burden rises by 0.82 percent of payroll to 13.22 percent. By year 15, (1) the payroll tax rate is down to 11.7 percent, a decline of 0.7 percent of payroll, (2) the MIRA surcharge is 2.00 percent of payroll and (3) the deadweight loss of the tax system is increased by 0.28 percent of payroll. The total burden rises by only 1.58 percent of payroll. But by year 25 the real disposable income is higher under the MIRA system: the payroll tax is only 9.41 percent, the MIRA surcharge is 2.76 percent; the combined 12.17 percent rate implies that the deadweight loss is reduced (a reduction of 0.18 percent of payroll), implying a net burden of 11.99 percent of payroll. After that the net burden falls rapidly. By year 35, the combination of the payroll tax and the MIRA surcharge is only 7.87 percent of payroll and the deadweight loss reduction is 1.21 percent of payroll, implying a net burden of 6.66 percent of payroll and therefore a net gain of 5.74 percent of payroll.

Looking at the aggregate gains and losses (i.e, multiplying these percentage of payroll changes

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[27]To calculate the change in real disposable income it is appropriate to use the tax rate that would be applied to the original tax base (12.40 percent) rather than the tax rate that would be applied to the slightly reduced tax base (12.46 percent). Of course, the deadweight loss calculation does use the higher tax rate.

by the aggregate payroll) shows that the present value of the changes during the first 41 years is positive at any real discount rate of 5 percent or less. As the horizon extends beyond 41 years, the present value of the changes becomes increasingly positive. Even with a very high real discount rate of 7 percent, the present value of the changes is positive for any horizon of 51 years or more. The shift to a privatized plan with MIRA accounts using the transition path analyzed in this section thus has a positive aggregate present value for all plausible discount rates and does so even if the horizon is limited to only 51 years.

The next section discusses what happens to the individual initial age cohorts during this transition.

5.4 The Effects of the Transition on Different Age Cohorts

The transition option that we have been analyzing is more favorable to younger employees (and, of course, to future generations) than to those who are currently in middle age or near retirement. An analysis of the distribution of gains by the current age cohorts is interesting in itself and shows that the gains and losses cannot be redistributed among the initial generation of employees in a way that makes everyone better off. It also shows that the present value of the losses to those in the initial generation of employees who do lose are relatively very small.

To study this, we calculate the lifetime path of the payroll taxes, MIRA surcharges and deadweight loss changes for a representative individual in each age cohort from age 5 to age 60.[28]

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[28]The representative individual is someone with mean earnings for that age cohort. The issues associated with income distribution and the redistribution of the current Social Security program to individuals with low lifetime covered earnings are discussed in section 6 of this paper.

The changes in the deadweight losses involve the approximating assumption that all of the change in the deadweight loss that results from the changes in the marginal tax rates faced by the

For each individual, the net gain in each year is the difference between the payroll tax (in constant 1995 dollars) that the individual would pay at the 12.4 percent rate in the current pay-as-you-go system and the sum of the payroll tax, the MIRA surcharge and the deadweight loss change under the MIRA system.

Table 7 shows the resulting paths of net gains for individuals who are 25, 40 and 55 years old in 1995, the assumed first year of the program. Note that the 25 year olds are affected for forty years while the 40 year olds and 55 year olds are affected for shorter periods until they retire at age 65. During the first two decades, each of these representative individuals incurs a small loss, exceeding two percent of payroll only for the oldest age group. When the current 25 year olds reach age 50, they begin to have positive annual benefits.

Table 8 summarizes the actuarial present values of these annual effects of privatization on representative individuals in each initial age cohort from 5 through 60 years old. Estimates are presented for three different real discount rates. The common feature about all of these figures is that they are quite small for existing employees (aged 20 through 60), indicating that the transition generations do not pay a large price for the benefits that will accrue to future generations.

With a real discount rate of 3 percent, the initial cohort of 50 years olds incur lifetime losses with an actuarial present value of $4,680. The lifetime gains to those who are 20 years old when privatization begins are worth $4,420 in present value. But those who have not yet joined the labor force can look forward to substantially larger gains: $9380 for 15 year ols and $14440 for 10 year olds.

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individual accrue to that individual. While this is true when there is no preexisting tax rate, part of the gain that results from a change in an existing tax rate accrues to the government in the form of additional revenue. Our calculation implicitly assumes that this is returned to the individual.

Table 7 NET GAINS FROM PHASE-IN PARTIAL PRIVATIZATION (BY COHORT)

Percent of Payroll

Age in 1995 = 25

1995	-0.08	-0.18	-0.28	-0.37	-0.47	-1.06	-1.15
2002	-1.25	-1.33	-1.40	-1.47	-1.51	-1.55	-1.55
2009	-1.55	-1.54	-1.50	-1.38	-1.25	-1.11	-0.94
2016	-0.72	-0.48	-0.21	0.08	0.42	0.90	1.35
2023	1.85	2.34	2.87	3.38	3.87	4.36	4.86
2030	5.35	4.12	3.83	4.11	4.39	0.00	0.00

Age in 1995 = 40

1995	-0.82	-0.94	-1.07	-1.19	-1.31	-1.42	-1.53
2002	-1.64	-1.73	-1.81	-1.89	-1.95	-1.99	-2.01
2009	-2.02	-2.02	-1.99	-1.89	-1.77	-1.65	-1.49
2016	-1.29	-1.07	-0.82	-0.54	0.00	0.00	0.00

Age in 1995 = 55

1995	-1.39	-1.53	-1.66	-1.79	-1.92	-2.04	-2.16
2002	-2.27	-2.36	-2.45	-0.00	-0.00	-0.00	-0.00

Table 8 ACTUARIAL PV OF NET GAINS FROM PHASE-IN PARTIAL PRIVATIZATION

	Thousands of Dollars Per Worker			Percent of Future Wages		
Age (1995)	r = 3%	r = 5%	r = 8%	r = 3%	r = 5%	r = 8%
5	19.24	8.61	2.81	4.52	3.84	2.96
10	14.39	6.55	2.10	3.06	2.41	1.58
15	9.34	4.11	1.08	1.81	1.25	0.58
20	4.39	1.44	-0.20	0.77	0.36	-0.08
25	0.20	-0.99	-1.48	0.04	-0.24	-0.51
30	-3.14	-3.11	-2.74	-0.59	-0.75	-0.92
35	-5.40	-4.50	-3.50	-1.12	-1.17	-1.20
40	-6.24	-5.12	-3.93	-1.50	-1.49	-1.45
45	-5.84	-4.91	-3.88	-1.74	-1.70	-1.64
50	-4.68	-4.09	-3.40	-1.86	-1.83	-1.78
55	-3.24	-2.96	-2.62	-1.91	-1.90	-1.87
60	-1.63	-1.57	-1.48	-1.89	-1.88	-1.87

Although different phase in schedules or age related payroll taxes could change this pattern, there is no way in which all age cohorts in the labor force at the time of privatization can be made better off. The cumulative present value for all those age 20 to 65 at the time of privatization is clearly negative.[29]

The result would however look quite different if we took the nuclear family as the unit of observation for our analysis. Consider a couple in which the husband and wife are both aged 45 with two children aged 10 and 15. Although the 45 year olds have a combined net present value loss of $11,680 (at a 3 percent discount rate), this is outweighed by the children's gains of more than $23,000. Younger families would tend to be even bigger gainers.

5.5 Effect of a Lower Return on MIRA Contributions

Throught this section, the analysis has assumed that MIRA contributions earn a real return equal to the full 9 percent pre-tax marginal product of capital. To achieve this, the federal and state governments would have to contribute to each MIRA account an amount estimated to be the corporate taxes collected on the incremental capital represented by that account. In the current analysis, which has ignored fluctuations in stock and bond prices, this would be about 3.6 percent of the assets in each account.

Although a proper accounting of the effects of the MIRA contributions does require

[29] It would of course be possible to create what appears to be a Pareto improving privatization by combining the social security privatization with another fundamental reform (e.g., the shift from an income tax to a consumption tax) and distributing the gains from that reform in a way that causes the combination of the two reforms to make everyone better off. Since the tax reform could be done separately, the Pareto improvement cannot properly be attributed to the privatization of social security.

attributing the additional corporate tax collections to the MIRA accounts, in practice the government may not be willing to make such a transfer and may use the increased corporate tax revenue to fund other government spending or tax reductions. It is worthwhile therefore to ask what the MIRA contributions would have to be if the real return earned by the MIRA accounts is limited to the 5.4 percent that is net of corporate tax payments (and therefore that could be earned directly by investing in the market mixture of equity and debt.)

The long-run effect is to raise the required MIRA contribution from 2.04 percent of payroll to 3.31 percent of payroll, i.e., slightly less than in inverse proportion to the decline in the rate of return. Panel 9B shows that this same almost exact inverse proportion relation holds for each year in the transition.

Thus, even with this much reduced return, the long-run mandatory contribution is reduced by almost three-fourths of the current 12.4 percent tax rate.

Moreover, during the transition, the combination of the payroll tax plus mandatory contribution only rises from the current 12.4 percent to a maximum of 14.8 percent after 14 years (Panel 9E) and is permanently down below 12.4 percent after 28 years.

We reiterate, however, that this is looking at the pension contributions in isolation and ignores the favorable effect on revenue elsewhere in the system. A complete accounting requires crediting the additional corporate tax revenue.

6. Distributional Considerations: Protecting the Poor

The method of calculating Social Security benefits in the current unfunded system is designed to provide some redistribution from individuals with high lifetime earnings to those with low lifetime

Table 9 PHASE-IN FROM PARTIAL TO TOTAL PRIVATIZATION AT ρ = 5.4%

A) Mandatory Individual Contributions ($ billions)

1995	34.10	38.88	43.85	49.05	54.47	60.05	65.76
2002	71.71	77.67	83.84	90.30	96.70	103.21	109.78
2009	116.57	123.46	130.07	136.09	142.28	148.59	154.89
2016	160.81	166.64	172.45	178.19	183.76	183.56	183.72
2023	183.52	183.38	183.06	182.83	182.85	183.00	183.33
2030	183.80	184.68	186.13	187.38	188.55	189.52	190.38
2037	191.67	193.21	194.76	196.16	197.49	198.93	200.31
2044	201.72	202.97	204.24	205.49	206.86	208.39	209.76
2051	211.15	212.94	214.55	216.11	217.52	218.97	220.59
2058	222.37	224.28	226.28	228.39	230.61	232.93	235.34
2065	237.84	240.41	243.06	245.78	248.58	251.44	254.34

B) Mandatory Individual Contributions (Percent of Payroll)

1995	1.17	1.30	1.44	1.58	1.73	1.87	2.01
2002	2.15	2.29	2.43	2.57	2.71	2.84	2.97
2009	3.11	3.24	3.36	3.47	3.58	3.69	3.80
2016	3.90	3.99	4.08	4.17	4.25	4.20	4.16
2023	4.11	4.06	4.01	3.95	3.91	3.87	3.83
2030	3.79	3.77	3.75	3.73	3.70	3.68	3.65
2037	3.63	3.61	3.60	3.58	3.56	3.55	3.53
2044	3.52	3.50	3.48	3.46	3.45	3.44	3.42
2051	3.41	3.40	3.39	3.38	3.36	3.35	3.34
2058	3.33	3.32	3.31	3.31	3.30	3.30	3.30
2065	3.30	3.30	3.30	3.30	3.30	3.30	3.31

C) Benefits Replaced Due to Privatization ($ billions)

1995	0.00	0.13	0.38	0.78	1.35	2.18	3.25
2002	4.52	6.22	8.25	10.62	13.57	17.03	21.32
2009	25.93	31.17	37.29	45.26	53.82	63.07	73.44
2016	85.18	97.86	111.70	126.74	143.23	160.99	178.93
2023	198.55	218.93	240.74	262.44	284.59	307.56	331.29
2030	355.89	310.24	303.98	320.95	338.42	356.61	375.26
2037	393.42	411.53	430.08	449.32	468.52	487.90	507.68
2044	527.69	548.06	568.03	587.98	607.72	627.03	646.30
2051	664.97	682.81	700.46	717.66	734.44	750.59	766.05
2058	780.86	795.15	808.95	822.37	835.40	848.07	860.44
2065	872.55	884.37	896.00	907.47	918.83	930.10	941.30

D) Payroll Tax Needed to Maintain Trust Fund Trajectory (Percent of Payroll)

1995	12.40	12.40	12.39	12.37	12.36	12.33	12.30
2002	12.26	12.22	12.16	12.10	12.02	11.93	11.82
2009	11.70	11.58	11.43	11.24	11.03	10.82	10.59
2016	10.32	10.04	9.73	9.41	9.06	8.69	8.32
2023	7.92	7.52	7.09	6.68	6.27	5.85	5.43
2030	5.00	6.02	6.23	5.96	5.70	5.42	5.15
2037	4.89	4.64	4.39	4.13	3.88	3.63	3.37
2044	3.13	2.88	2.64	2.41	2.19	1.98	1.77
2051	1.58	1.41	1.25	1.10	0.96	0.83	0.72
2058	0.62	0.53	0.46	0.39	0.33	0.28	0.24
2065	0.20	0.17	0.14	0.11	0.09	0.08	0.06

E) Total Payroll Tax plus Mandatory Contribution (Percent of Payroll)

1995	13.57	13.70	13.83	13.96	14.08	14.20	14.31
2002	14.42	14.50	14.59	14.67	14.72	14.77	14.79
2009	14.81	14.81	14.79	14.71	14.62	14.51	14.38
2016	14.22	14.03	13.82	13.58	13.31	12.89	12.48
2023	12.03	11.57	11.10	10.63	10.18	9.72	9.25
2030	8.79	9.79	9.98	9.69	9.40	9.10	8.80
2037	8.52	8.25	7.99	7.71	7.44	7.17	6.91
2044	6.64	6.38	6.12	5.87	5.63	5.41	5.20
2051	4.99	4.81	4.64	4.47	4.32	4.18	4.06
2058	3.95	3.85	3.77	3.70	3.64	3.58	3.54
2065	3.50	3.47	3.44	3.42	3.40	3.38	3.37

earnings. In practice, this redistribution is attenuated and in some cases reversed because of a variety of ways in which low income and high income individuals differ. Low wage workers generally enter the full time labor force at an earlier age, have higher mortality rates, and are more likely to be in two-earner families. Each of these characteristics reduces the implicit rate of return on the household's Social Security taxes.[30] In order to prevent poverty in old age the regular Social Security program is currently augmented by the means tested Supplemental Security Income (SSI) program. The SSI program could of course be continued in parallel to a privatized Social Security system, a subject that we will not pursue further here.[31]

A privatized system of individual funded accounts is explicitly nonredistributive. Each individual receives income after age 65 based on that individual's MIRA contributions. It is worth stressing however that the MIRA system would make low income workers after the transition much better off than they would be with the current unfunded system. The reason for this is that instead of a payroll tax of 12.4 percent they would pay a MIRA contribution of only about two percent of payroll. They would receive the benefit of a tax cut equal to 10 percent of income.

A modification of the basic MIRA system might permit individuals with below average earnings to make voluntary contributions, perhaps limited by the level that would provide the same

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[30]On the relation between Social Security net transfers and income distribution, see Hurd and Shoven (1985).

[31] The combination in the SSI program of an age test in addition to a means test reduces the problem of the work disincentive associated with means tested welfare programs for younger workers. The SSI means test still creates incentives to reduce saving during working years. It also encourages low wage workers to work in the underground economy to avoid social security payroll taxes since any resulting increase in social security benefits would be fully offset by lower SSI payments.

benefits that they would have gotten under the existing Social Security system. A lower income individual who earns the equivalent of a 4 percent rate of return under the unfunded system (because of its redistributive features) could make MIRA contributions that achieved that level of benefits and still enjoy a substantial net tax reduction.[32]

Although we shall not pursue this possibility, we do want to address the question of how the system of individual accounts could be modified in a simple way so that no individual is left with an unacceptably low annuity. For this purpose, we define "unacceptably low" to mean less than half of the average annuity. The calculations that we report in this section show that a very small tax-transfer at retirement would be sufficient to provide all retirees with at least this level of retirement annuity.[33]

Since the size of each individual's accumulated MIRA funds at age 65 depends on the entire annual pattern of earnings from age 30 to age 65, the frequency and extent to which the MIRA accounts at age 65 fall below half of the mean account cannot be inferred from single cross sections of earnings. We therefore use the Social Security New Beneficiaries Survey, a unique data set that provides the necessary lifetime earnings histories. More specifically, the data are a sample of all persons who began receiving Social Security retirement benefits between June 1980 and May 1981. For each person in the sample, Social Security earnings histories are available beginning with 1951.

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[32] A worker born in 1945 who has a dependent spouse and who earns half the median income would receive an actuarial return of about 3.5 percent on the taxes that he and his employer pay.

[33]We are grateful to Jeffrey Liebman for making the calculations that we report in this section. The current analysis does not deal with differences in rates of return that different individuals in the same age cohort would earn on their savings. To the extent that this reflects voluntary decisions to hold different types of portfolios because of differences in risk preferences, it may not be appropriate to compensate individuals with low outcomes (other than through the means tested SSI program). We return to the subject of return uncertainty in the next section of this paper.

Since most people in the sample were between 32 and 36 in 1951 (88 percent of the sample were born between 1915 and 1919), we assumed that the real earnings between age 30 and the age in 1951 were the same as the actual earnings in 1951. All nominal dollar amounts are restated to 1996 dollars by using the CPI. Since the rate of MIRA contributions varies over time during the transition, we do our calculation for the long-run value of the annual MIRA contributions as shown in Table 5D, i.e., 2.04 percent of the amount of earnings up to the annual Social Security maximum covered earnings.

Among men who retired in 1980-81, MIRA contributions of 2.04 percent of their earnings from age 30 would have accumulated (at a 9 percent real rate of return) to a mean value of $82,985 in 1981 at the 1996 price level.[34] Approximately 19 percent of such accumulated MIRA accounts had less than half of this amount. The average short-fall among these accounts, i.e., the amount that must be added to these accounts to bring them up to half of the mean account, was $3,889.[35] The aggregate amount of this shortfall is thus equivalent to only 4.7 percent of the total of all MIRA accounts at age 65. This implies that increasing each MIRA contribution by 4.7 percent, i.e., from the 2.04 percent of covered earnings reported as the long-run value in Table 5E to 2.14 percent of covered earnings and then levying a "tax" of 4.7 percent on all accounts at age 65 would provide the funds to preclude any account from having less than half of the mean account while keeping the mean

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[34]To put this number in perspective, note that with a 9 percent real return such an accumulated amount would produce an annuity of about $9,950 a year. For comparison, the average annual Social Security benefit in 1980 (in 1996 dollars) of a retired worker was $7795 and of a retired worker and wife was $12928.

[35]There are two reasons why this overstates the cost of assuring that everyone has a fund equal to at least half of the mean fund. First, many of the low Social Security individuals would now be eligible for Supplemental Security Income benefits which would help to defray the cost of increasing the fund. Second, many of those with low social security earnings are individuals who had spent most of their careers in the Federal government or in state governments that provide pensions and remain outside the Social Security system.

net-of-tax annuity equal to the level of Social Security benefits projected in current law (with the solvency correction described above.)[36]

This calculation of an additional 0.10 percent of payroll MIRA contribution and the associated tax on the accumulated accounts assumes that levying the tax and providing the transfer would not alter individuals' incentives to earn. Even if this had to be adjusted because of incentive effects, the implication is clear that "unacceptably low" accumulations can be avoided with a relatively small tax and transfer. The distributional issue, judged in this way, need not be an impediment to privatized individual MIRA accounts.

7. Risks: Uncertain Returns and Imperfect Annuity Markets

Until now we have ignored the problem that funded MIRA accounts involve risky investments. Of course, the current unfunded pay-as-you-go system is also risky, although in a very different way. Despite the reforms of 1983, it is clear that the existing system cannot pay the "promised" benefits. Many younger persons say that they believe that Social Security benefits will not be there when they retire. Legislative proposals involve reducing all benefits, taxing benefits of higher income recipients, and other changes that would reduce the real value of the benefits for some individuals very substantially. This section focuses on the risks of the funded MIRA accounts and asks how (and at what costs) individuals could be protected from such risks.

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[36]This calculation is based on the earnings of men only, even in two earner couples. Applying the same method of accumulation to the earnings of husbands and wives in a pooled account leads to similar conclusions. The mean accumulated MIRA account based on 2.04 percent of husbands and wives earnings was $104,511 in 1986 dollars. Only 19.2 percent of MIRA accounts had less than half of this total with a mean shortfall of $4204, corresponding to a 4.2 percent tax on accumulated accounts. .

Although the real pretax return on the nonfinancial corporate capital stock has averaged somewhat more than nine percent since 1960, there are substantial year-to-year fluctuations in the return earned by portfolio investors. If MIRA contributions are based on the expected 9 percent return (as in the calculations of section 5 above), an individual who is fortunate to save and contribute to a MIRA account during years when the stock and bond markets are relatively low and to retire and dissave when those markets are relatively high will enjoy a level of benefits greater than those provided by the pay-as-you-go Social Security system (as well as having paid a much lower cost of financing that benefit.) Conversely, an individual who retires when the level of stock prices is relatively low will receive annuity payments that are less than those provided by the pay-as-you-go system if the MIRA contributions are based on an assumed 9 percent return.

The lifetime return in a MIRA account that is invested in the market's debt-equity mixture is almost certain to exceed the return in the pay-as-you-go unfunded Social Security system.[37] Nevertheless, the existing variability of returns does mean that an individual who contributes on the basis of an expected 9 percent return could have very much lower retirement income if the ex post return is substantially lower.

This market fluctuation risk is compounded by the inability to purchase actuarially fair variable annuities based on the return earned by the market's debt-equity mixture. Without such an annuity, an individual must save enough to finance more than the total benefits that he expects to

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[37]This is similar to the conclusion of MacCurdy and Shoven (1992) that individuals who invested in equities are almost certain to receive a higher rate of return than those who invested in bonds or money market instruments. They show that lifetime equity returns have been better than debt return for individuals who began their life cycle saving in every year for more than three quarters of a century. The MacCurdy and Shoven analysis takes the amount of saving as given and shows that the equity returns have dominated in the past. That is, of course, separate from the question of how much an individual should save.

receive or must accept the risk of a much reduced level of consumption if he lives more than the normal life expectancy. Although the life expectancy for men at age 65 is now nearly 16 years, 33 percent of 65 year old men live more than an additional 20 years and 5 percent live more than 30 years.

Although the introduction of a universal system of MIRA accounts might lead to market innovations that ameliorate the market risk (e.g., the availability of long-term put options) and the annuity risk (e.g., the availability of actuarially fair variable annuities) , we have explored how the MIRA program might be adjusted in the current institutional context in which such products are not available. Our approach does not seek an optimal adjustment of the MIRA program to the risks that we have identified. Instead, we have imposed a very demanding requirement on the MIRA accounts by asking the following question:

> In the absence of any annuity and given the historic market uncertainty of returns on debt and equity, how much would individuals have to contribute to MIRA accounts to be able to receive the baseline level of Social Security benefits with probability 0.95 even if they might live to age 100?

Individuals who will receive some pay-as-you-go Social Security benefits during the transition are partially protected from these risks. To focus on the maximum risk that will eventually be faced by those who are wholly dependent on MIRA accounts for their retirement income,[38] we examine the problem for individuals who reach age 30 after the phase-in is completed and who therefore will receive no pay-as-you-go benefits when they have retired. We show in this section that

[38]Individuals could of course continue to have private pensions, voluntary IRAs and voluntary 401k accounts. By being "wholly dependent" on the MIRA account we mean only that they will not receive any unfunded Social Security benefits.

such individuals can achieve, with 95 percent probability, benefits equal to baseline Social Security benefits even if they may live to 100 by contributing as if they expect a rate of return that is 6.7 percent instead of 9.0 percent. This in turn implies that in the long-run the average MIRA contributions are approximately 2.74 percent of payroll instead of the 2.04 percent of payroll implied by the 9 percent expected rate of return (as shown in Table 5D).

Raising the average MIRA contributions in this way implies that individuals will generally die with substantial balances in their MIRA accounts. Since the extra MIRA contributions are returned to the next generation as either private bequests or as tax revenues (if bequests from the MIRA accounts are not permitted and are taxed at death), the extra MIRA contributions are not really an increased cost of privatization. In exchange for the resulting bequests, the subsequent generation might agree to reinsure the individuals against the "5 percent" risk that the combination of poor average stock and bond market performance for their age cohort and above average longevity of the individual causes funds to be exhausted. This might be formalized by a government reinsurance arrangement. Such possibilities will not be explored further in this paper. Instead, we now describe the calculations that show that raising the average MIRA contributions from2.04 percent of payroll to 2.74 percent is sufficient to fund the baseline level of Social Security benefits with 95 percent probabilty.

To describe the evolution of an individual's MIRA account, we use the following notation: M(t) is the market value of the individual's MIRA account in year t; Q(t) is the ratio of the market value of a market-weighted mixture of debt and equity to the real value of the underlying capital stock; S(t) is the individual's MIRA contribution in year t; and K(t) is the real value of the assets in the MIRA account, i.e., $M(t) = Q(t) \times K(t)$.

We assume the following simplified picture of the real return on these assets. Each dollar of real capital yields a real return of 9 percent.[39] The government takes 3.5 percent of this in corporate taxes. Real dividends and interest are 3.0 percent, leaving retained earnings of 2.5 percent of capital. The real capital stock in the individual's MIRA account grows because of the retained earnings and because of the investment of dividends, interest, corporate tax rebates and new MIRA contributions. Although the retained earnings add dollar for dollar to the real capital stock, the amount of real capital purchased by the other external investments depends on the level of Q(t). Thus the real capital stock in the MIRA evolves during the preretirement years according to:

$$(1) \qquad K(t+1) = 1.025\ K(t) + 0.065\ K(t)/Q(t) + S(t+1)/Q(t+1)$$

and the corresponding market value of the capital stock is

$$(2) \qquad M(t+1) = Q(t+1)\ [1.025\ K(t)\ ] + 0.065\ Q(t+1)\ K(t) / Q(t) + S(t+1)$$

After retirement, the annual contributions cease and the market value of the capital stock is reduced by withdrawing the baseline benefits [B(t)] according to

$$(3) \qquad M(t+1) = Q(t+1)\ [1.025\ K(t)\ ] + 0.065\ Q(t+1)\ K(t) / Q(t) - B(t+1)$$

This is a stochastic relationship because Q(t) varies randomly from year to year. We have estimated the following autoregressive equation with data on Q(t) for 1947 to 1994.[40]

$$(4) \qquad \ln Q(t) = \underset{(0.041)}{-0.015} + \underset{(0.067)}{0.920} \ln Q(t-1) + u(t)$$

with $\sigma_u = 0.18$. Although this specification implies regression to the mean, the coefficients are not significantly different from those of a random walk. Moreover, at the mean value of Q(t) = 0.69 for

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[39]We ignore the fluctuations -in is the real return on capital and focus on the much larger fluctuations -in is the market value of the assets.

[40] The data for this equation are presented -in is Poterba and Samwick (1995).

the sample period, the equation approximates the random walk: ln Q(t) – ln Q(t-1) = u(t).[41]

Combining equations (2), (3) and (4), we simulate the time path of M(t) for someone who starts contributing to the MIRA at age 30, works until age 65 and then dissaves the Social Security baseline benefits from age 65 until death. We repeat the simulation 1000 times and note the fraction of times that the individual still has positive MIRA assets at death. Using the saving rates implied by the 9 percent rate of return implies that individuals die with positive assets in 80 percent of the simulations but exhaust their assets in the other 20 percent. Reducing the assumed rate of return used to calculate each year's required MIRA contribution from 9 percent to 6.7 percent raises the fraction of the time that individuals die with assets to 95 percent.[42] Repeating the calculations of Table 5 shows that a 6.7 percent assumed rate of return on MIRA contributions raises the required contributions from 2.04 percent of payroll to 2.74 percent of payroll. As already noted, the extra 70 basis points of tax are not really an extra burden since these additional MIRA savings are returned to the next generation as bequests or in the form of lower taxes.

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[41]Using this random walk formulation and recognizing that the u(t)'s are serially independent implies that the variance of ln Q(t) – ln Q(t-s) is $s \times \sigma^2_u$ where σ^2_u is the variance of the disturbance u. If individuals did all of their saving at age 45 and then dissaved it at age 75, the variance of the relative level of Q(t) at age 75 relative to its level at age 45 would be $30\sigma^2_u$. With $\sigma^2_u = 0.0324$ (as observed -in is the data for 1947 through 1994), this implies that the variance of the logarithm of the level of Q(t) at age 75 relative to this value at age 45 would be about 1 and therefore that its standard deviation would also be about 1. If the expected rise -in is the value of the saving from age 45 to age 75 is $(1.09)^{30} = 13.3$, the one standard deviation range is from $13.3\ e^{-1} = 13.3/2.72 = 4.89$ to $13.3\ e = 36.18$. Ninety-five percent of the probability distribution lies above the mean minus 1.64 standard errors or $13.3\ e^{-1.64} = 2.58$. Note that this substantially exceeds the value implied by the PAYGO return of 2 percent per year or $(1.02)^{30} = 1.81$. The actual risk characteristic is more complex and less extreme because saving and dissaving are done over many years and not at just two points -in is time.

[42]Reducing the assumed rate of return to 5.2 percent rates the fraction who die with assets 99 percent.

In concluding this discussion of risk, we reiterate that this calculation is not presented as an optimal response to the market risk and annuity risk but is intended to show that even maintaining the full baseline benefits can be achieved with a relatively small increase in the MIRA contributions that still leaves the MIRA contributions less than one fourth of the existing 12.4 percent payroll tax.[43]

8. An Alternative Baseline for Social Security : Modifying the Inflation Indexing

For the simulation in sections 5 through 7, the benefits correspond to the formula in the existing Social Security law until the trust fund is exhausted in is 2030 and then drop sharply to the level of benefits that can be financed with the 12.4 percent payroll tax. This sharp drop in benefits in the year 2030 is the simplest case to analyze but it is not the most realistic. A more plausible assumption is that, whether or not Social Security is privatized, the growth of benefits will be reduced gradually by reducing the annual inflation indexing of benefits.[44]

Reducing the annual indexing of benefits by one percentage point causes the aggregate level of Social Security benefits to decline eventually by about 9 percent. The decline does not continue beyond this level because the modification of indexing only affects post-retirement benefits and not the level of benefits of new retirees.

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[43]One plausible modification would reduce benefits -in is year t to Q(t) times the basic benefit if $0.7 < Q(T) < 1.0$ and to 0.7 times the basic benefit if $Q(t) < 0.7$. -in is this case, MIRA contributions calculated by assuming a 7.3 percent rate of return will generate enough contributions to cause 95 percent of the simulations to end with positive assets. This implies an average MIRA contribution of 2.53 percent of payroll (instead of the 2.04 percent of payroll with no uncertainty and 2.74 percent with the uncertain but inflexible benefits).

[44]The Senate Finance Committee has appointed an Expert Committee to consider how the indexing of Social Security benefits should be modified to be consistent with the true increase -in is the cost of living. See Boskin et. al. (1996). For an earlier advocacy of such an inflation adjustment, see Feldstein and Feldstein (1984).

The effect of this temporarily lower rate of growth of Social Security benefits depends on how the resulting funds are used. We assume that the path of the trust fund is kept unchanged and therefore that the payroll tax is reduced. This makes the transition to the MIRA system more attractive to the initial generation of employees as well as reducing the relative magnitude of the benefit reduction in 2030 when the trust fund is exhausted.

Table 10A shows the percentage reduction in benefits that results from the one percentage point adjustment to the indexing. At the end of seven years, aggregate benefits are 4.64 percent lower and at the end of 21 years they are 7.97 percent lower. After 2030 the benefit reduction is the same relative to existing law as we showed in Table 4.[45]

Table 11 presents our standard analysis of the time path of payroll taxes and MIRA surcharges for the policy of adjusting retiree benefits by one percent less than the increase in the consumer price index. Since future benefits (before 2030) will be lower than they would be with full CPI indexing, the required MIRA contributions and required payroll tax are smaller than they would otherwise be. Since this affects only the transition before 2030, in the very long run the tax and MIRA contributions are essentially unchanged from the case of full indexing. Table 12 shows the analogous calculations of the resulting shift in labor supply and the change in the deadweight loss of the payroll tax.

Perhaps most interesting are the disaggregated analyses for representative individuals that are presented in tables 13 and 14. With this CPI-minus-one adjustment of benefits, the actuarial present value of the change in real disposable income is positive for all current individuals who are below the age of 30. The present value losses for those who are older are substantially less than they are with

[45]We discontinue the indexing adjustment after the benefit reduction in 2030.

Table 10 PARTIAL INDEXATION: TRUST FUND AND SOLVENCY ADJUSTMENT

A) Reduction in Benefits Due to Partial Indexation and Solvency Adj. (Percent)

1995	0.00	0.93	1.79	2.60	3.35	4.02	4.64
2002	5.23	5.72	6.17	6.57	6.91	7.20	7.40
2009	7.61	7.78	7.93	7.92	7.94	7.97	7.97
2016	7.97	7.99	8.00	8.01	8.01	8.00	8.05
2023	8.08	8.13	8.18	8.23	8.31	8.41	8.51
2030	8.62	18.09	24.12	24.22	24.34	24.46	24.24
2037	23.99	23.74	23.50	23.30	23.18	23.10	23.08
2044	23.11	23.21	23.45	23.74	24.06	24.40	24.80
2051	25.40	25.97	26.59	27.25	27.94	28.64	29.32
2058	29.98	30.63	31.29	31.82	32.32	32.77	33.18
2065	33.56	33.88	34.17	34.43	34.67	34.89	35.08

B) Retirement Benefits Under Partial Indexation and Solvency Adj. ($ billions)

1995	324.72	328.37	331.96	335.80	339.86	344.38	349.46
2002	354.62	360.42	366.48	372.70	381.08	389.75	399.07
2009	408.17	417.45	429.85	443.82	457.78	471.76	486.14
2016	502.64	519.41	536.21	553.01	569.96	586.60	602.57
2023	618.79	634.72	650.75	663.78	676.68	689.63	702.59
2030	715.62	650.54	610.86	618.42	626.08	633.82	641.62
2037	649.51	657.49	665.57	673.74	681.55	689.46	697.45
2044	705.53	713.70	721.63	729.64	737.74	745.93	754.21
2051	762.37	770.62	778.96	787.39	795.91	804.53	813.25
2058	822.06	830.96	839.96	849.13	858.40	867.76	877.23
2065	886.80	896.41	906.12	915.93	925.85	935.88	946.02

Table 11 PHASE-IN PARTIAL PRIVATIZATION (PARTIAL INDEXATION)

A) Mandatory Individual Contributions ($ billions)

1995	19.01	21.76	24.69	27.82	31.14	34.58	38.16
2002	42.02	45.92	50.03	54.41	58.81	63.37	67.93
2009	72.76	77.72	82.59	86.83	91.26	95.84	100.34
2016	104.57	108.77	112.87	116.81	120.44	120.11	120.17
2023	119.75	119.37	118.68	117.98	117.50	117.13	116.90
2030	116.82	117.11	118.10	118.88	119.58	120.03	120.34
2037	121.17	122.29	123.42	124.33	125.21	126.20	127.08
2044	127.96	128.60	129.28	129.89	130.58	131.44	132.06
2051	132.69	133.78	134.61	135.35	135.87	136.38	137.07
2058	137.91	138.89	139.94	141.10	142.35	143.70	145.14
2065	146.67	148.27	149.94	151.68	153.49	155.35	157.25

B) Mandatory Individual Contributions (Percent of Payroll)

1995	0.65	0.73	0.81	0.90	0.99	1.08	1.17
2002	1.26	1.35	1.45	1.55	1.65	1.74	1.84
2009	1.94	2.04	2.14	2.22	2.30	2.38	2.46
2016	2.53	2.60	2.67	2.73	2.79	2.75	2.72
2023	2.68	2.64	2.60	2.55	2.51	2.47	2.44
2030	2.41	2.39	2.38	2.36	2.35	2.33	2.31
2037	2.29	2.29	2.28	2.27	2.26	2.25	2.24
2044	2.23	2.22	2.20	2.19	2.18	2.17	2.15
2051	2.14	2.14	2.13	2.11	2.10	2.09	2.07
2058	2.06	2.06	2.05	2.04	2.04	2.04	2.04
2065	2.03	2.03	2.04	2.04	2.04	2.04	2.04

C) Benefits Replaced Due to Privatization ($ billions)

1995	0.00	0.13	0.38	0.78	1.34	2.16	3.20
2002	4.44	6.10	8.08	10.37	13.21	16.55	20.70
2009	25.12	30.15	35.99	43.66	51.86	60.68	70.56
2016	81.72	93.74	106.84	121.06	136.64	153.40	170.19
2023	188.59	207.61	227.96	248.15	268.62	289.78	311.54
2030	334.04	310.24	303.98	320.95	338.42	356.61	375.26
2037	393.42	411.53	430.08	449.32	468.52	487.90	507.68
2044	527.69	548.06	568.03	587.98	607.72	627.03	646.30
2051	664.97	682.81	700.46	717.66	734.44	750.59	766.05
2058	780.86	795.15	808.95	822.37	835.40	848.07	860.44
2065	872.55	884.37	896.00	907.47	918.83	930.10	941.30

D) Payroll Tax Needed to Maintain Trust Fund Trajectory (Percent of Payroll)

1995	12.40	12.29	12.19	12.09	11.98	11.88	11.78
2002	11.68	11.57	11.47	11.36	11.24	11.11	10.97
2009	10.83	10.68	10.50	10.30	10.09	9.87	9.63
2016	9.35	9.06	8.75	8.42	8.07	7.70	7.32
2023	6.93	6.53	6.10	5.70	5.30	4.89	4.48
2030	4.06	6.02	6.23	5.96	5.70	5.42	5.15
2037	4.89	4.64	4.39	4.13	3.88	3.63	3.37
2044	3.13	2.88	2.64	2.41	2.19	1.98	1.77
2051	1.58	1.41	1.25	1.10	0.96	0.83	0.72
2058	0.62	0.53	0.46	0.39	0.33	0.28	0.24
2065	0.20	0.17	0.14	0.11	0.09	0.08	0.06

E) Total Payroll Tax plus Mandatory Contribution (Percent of Payroll)

1995	13.05	13.02	13.00	12.98	12.97	12.96	12.95
2002	12.94	12.93	12.92	12.90	12.88	12.85	12.81
2009	12.77	12.72	12.64	12.52	12.39	12.25	12.08
2016	11.88	11.66	11.42	11.15	10.85	10.44	10.04
2023	9.61	9.17	8.70	8.26	7.81	7.37	6.92
2030	6.47	8.41	8.61	8.33	8.05	7.75	7.45
2037	7.18	6.93	6.67	6.40	6.14	5.88	5.62
2044	5.36	5.09	4.84	4.60	4.36	4.14	3.93
2051	3.73	3.55	3.38	3.21	3.06	2.92	2.79
2058	2.69	2.59	2.51	2.43	2.37	2.32	2.27
2065	2.23	2.20	2.17	2.15	2.13	2.12	2.11

Table 12 EFFECT OF PHASE-IN PARTIAL PRIVATIZATION ON TAX BASE AND DWL
PARTIAL INDEXATION AND SOLVENCY ADJUSTMENT

A) Payroll Tax Needed to Maintain Trust Fund With No Behavioral Response (11D)

1995	12.40	12.29	12.19	12.09	11.98	11.88	11.78
2002	11.68	11.57	11.47	11.36	11.24	11.11	10.97
2009	10.83	10.68	10.50	10.30	10.09	9.87	9.63
2016	9.35	9.06	8.75	8.42	8.07	7.70	7.32
2023	6.93	6.53	6.10	5.70	5.30	4.89	4.48
2030	4.06	6.02	6.23	5.96	5.70	5.42	5.15
2037	4.89	4.64	4.39	4.13	3.88	3.63	3.37
2044	3.13	2.88	2.64	2.41	2.19	1.98	1.77
2051	1.58	1.41	1.25	1.10	0.96	0.83	0.72
2058	0.62	0.53	0.46	0.39	0.33	0.28	0.24
2065	0.20	0.17	0.14	0.11	0.09	0.08	0.06

B) New Payroll Tax Rate Allowing for Labor Supply Response

1995	12.46	12.35	12.24	12.14	12.03	11.93	11.83
2002	11.72	11.62	11.51	11.40	11.27	11.14	11.00
2009	10.86	10.70	10.52	10.31	10.09	9.86	9.60
2016	9.32	9.01	8.69	8.34	7.98	7.59	7.21
2023	6.80	6.38	5.95	5.54	5.14	4.73	4.31
2030	3.89	5.86	6.07	5.80	5.53	5.25	4.98
2037	4.72	4.47	4.22	3.96	3.71	3.47	3.22
2044	2.98	2.74	2.51	2.28	2.07	1.87	1.67
2051	1.49	1.33	1.17	1.03	0.90	0.78	0.67
2058	0.58	0.50	0.43	0.36	0.31	0.26	0.22
2065	0.18	0.15	0.13	0.10	0.08	0.07	0.05

C) New Personal Income Tax Allowing for Labor Supply Response

1995	20.09	20.09	20.08	20.08	20.08	20.08	20.08
2002	20.08	20.07	20.07	20.07	20.07	20.06	20.06
2009	20.05	20.04	20.03	20.02	20.00	19.98	19.96
2016	19.93	19.90	19.86	19.83	19.79	19.73	19.68
2023	19.62	19.56	19.50	19.44	19.39	19.33	19.27
2030	19.22	19.46	19.49	19.45	19.42	19.38	19.34
2037	19.31	19.27	19.24	19.21	19.17	19.14	19.11
2044	19.08	19.05	19.02	18.99	18.96	18.93	18.91
2051	18.88	18.86	18.84	18.82	18.80	18.79	18.77
2058	18.76	18.75	18.74	18.73	18.72	18.72	18.71
2065	18.71	18.70	18.70	18.70	18.70	18.69	18.69

D) Change in Deadweight Loss Due to Privatization ($ billions)

1995	3.46	3.35	3.28	3.27	3.29	3.30	3.29
2002	3.31	3.22	3.13	3.08	2.86	2.55	2.11
2009	1.64	1.05	0.15	-1.33	-2.91	-4.62	-6.60
2016	-8.99	-11.64	-14.55	-17.73	-21.27	-25.89	-30.39
2023	-35.29	-40.25	-45.46	-50.53	-55.55	-60.59	-65.64
2030	-70.71	-56.17	-55.84	-59.86	-63.99	-68.30	-71.35
2037	-74.04	-76.53	-79.01	-81.58	-84.04	-86.41	-88.79
2044	-91.12	-93.53	-95.78	-97.96	-100.01	-101.88	-103.77
2051	-105.52	-107.00	-108.49	-109.92	-111.31	-112.59	-113.69
2058	-114.63	-115.43	-116.16	-116.82	-117.40	-117.91	-118.37
2065	-118.77	-119.12	-119.42	-119.68	-119.92	-120.13	-120.32

E) Change in Deadweight Loss As a Percent of Covered Wages

1995	0.12	0.11	0.11	0.11	0.10	0.10	0.10
2002	0.10	0.09	0.09	0.09	0.08	0.07	0.06
2009	0.04	0.03	0.00	-0.03	-0.07	-0.11	-0.16
2016	-0.22	-0.28	-0.34	-0.42	-0.49	-0.59	-0.69
2023	-0.79	-0.89	-0.99	-1.09	-1.19	-1.28	-1.37
2030	-1.46	-1.15	-1.12	-1.19	-1.26	-1.33	-1.37
2037	-1.40	-1.43	-1.46	-1.49	-1.52	-1.54	-1.57
2044	-1.59	-1.61	-1.63	-1.65	-1.67	-1.68	-1.69
2051	-1.70	-1.71	-1.71	-1.72	-1.72	-1.72	-1.72
2058	-1.72	-1.71	-1.70	-1.69	-1.68	-1.67	-1.66
2065	-1.65	-1.63	-1.62	-1.61	-1.59	-1.58	-1.56

Table 13 NET GAINS FROM PHASE-IN PARTIAL PRIVATIZATION (BY COHORT)
PARTIAL INDEXATION AND SOLVENCY ADJUSTMENT

Percent of Payroll

Age in 1995 =	25						
1995	-0.02	0.01	0.04	0.06	0.08	-0.42	-0.42
2002	-0.43	-0.44	-0.44	-0.45	-0.44	-0.43	-0.40
2009	-0.37	-0.33	-0.26	-0.14	-0.00	0.14	0.32
2016	0.53	0.77	1.04	1.33	1.66	2.12	2.57
2023	3.05	3.54	4.05	4.54	5.02	5.49	5.97
2030	6.44	4.12	3.83	4.11	4.39	0.00	0.00
Age in 1995 =	40						
1995	-0.76	-0.76	-0.76	-0.76	-0.77	-0.79	-0.81
2002	-0.83	-0.84	-0.86	-0.88	-0.89	-0.89	-0.87
2009	-0.86	-0.83	-0.77	-0.66	-0.54	-0.41	-0.26
2016	-0.06	0.16	0.41	0.69	0.00	0.00	0.00
Age in 1995 =	55						
1995	-1.34	-1.34	-1.35	-1.37	-1.39	-1.42	-1.44
2002	-1.47	-1.50	-1.52	-0.00	-0.00	-0.00	-0.00

Table 14 ACTUARIAL PV OF NET GAINS FROM PHASE-IN PARTIAL PRIVATIZATION
PARTIAL INDEXATION AND SOLVENCY ADJUSTMENT

	Thousands of Dollars Per Worker			Percent of Future Wages		
Age (1995)	r = 3%	r = 5%	r = 8%	r = 3%	r = 5%	r = 8%
5	22.06	10.36	3.69	5.18	4.62	3.89
10	18.20	9.03	3.46	3.88	3.32	2.61
15	14.02	7.30	2.97	2.71	2.21	1.60
20	9.61	5.12	2.11	1.68	1.28	0.81
25	5.50	2.80	0.95	0.97	0.67	0.33
30	1.95	0.60	-0.30	0.37	0.15	-0.10
35	-1.04	-1.21	-1.24	-0.22	-0.31	-0.43
40	-2.75	-2.38	-1.96	-0.66	-0.69	-0.72
45	-3.28	-2.81	-2.30	-0.98	-0.98	-0.97
50	-3.02	-2.67	-2.26	-1.20	-1.19	-1.18
55	-2.38	-2.20	-1.96	-1.41	-1.40	-1.40
60	-1.38	-1.33	-1.27	-1.60	-1.60	-1.60

no benefit adjustment before 2030.[46] The maximum loss occurs for 45 year olds and, at a 3 percent real discount rate, the loss for a couple is $6560. If they have two children aged 10 and 15, the net gain for the nuclear family would be more than $25,000.

9. Maintaining Current Law Benefits

Our final analysis deals with the possibility of maintaining the level of benefits specified by current law. The future insolvency of the existing Social Security system will force a reduction in benefits unless taxes are raised dramatically or a much higher return is earned on individual contributions. Unlike the previous sections of this paper, we now explore the role of the MIRA system if the level of benefits implied by current law is to be maintained.

Tables 3 and 4 showed that, with the current pay-as-you-go system, the Trust Fund is projected to be exhausted in 2030 (Table 3B) and that benefits must be reduced by 24 percent in 2032 if they are to be financed by the revenue prodcued by a 12.4 percent tax. The benefit reduction consistent with a 12.4 percent tax rises to 35 percent by the last year of the projections (2071). These numbers imply that maintaining the level of benefits implied by current law would require raising the tax by 31 percent in 2032 (from 12.4 percent to 16.3 percent) and then continuing to raise the tax rate, reaching 19.1 percent in 2071.[47]

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[46]Of course, these individuals will receive lower benefits at retirement than under current law. But that is common to the pay-as-you-go and privatized systems if the CPI adjustment will be adopted in either case.

[47]This calculation ignores the effect of the higher tax rate on labor supply and taxable income. Because the shift from a 12.4 percent tax rate to a 19.1 percent tax rate would reduce taxable income, a higher rate would be necessary to offset the resulting reduction in payroll and income tax revenue.

The MIRA system would permit benefits to be maintained at the level provided by current law with a long-run MIRA contribution rate of only 3.15 percent (instead of the 2.04 percent required to finance the level of benefits that would result from maintaining the 12.4 percent payroll tax). Thus the MIRA contributions rise in approximately the same proportion as the payroll tax would have to rise (from 12.4 percent to 19.1 percent) but the level is dramatically lower.

Table 15 presents our usual analysis of the transition path. It is particularly noteworthy that the MIRA contributions (and the combined payroll tax plus MIRA contributions) during the first two decades differ little from the baseline case (presented in Table 5) that corresponds to the eventual sharp benefit reductions. In is the tenth year, for example, the combined payroll tax plus MIRA contribution is 13.87 percent versus the 13.71 percent in the baseline case. This is not surprising since in these early years most employees need make little provision for the benefits to be received after 2030.

10. Summary and Questions for Future Research

The analysis in this paper has convinced the authors that the transition to a fully privatized system of individual retirement accounts can be done in a way that conveys a very substantial long-run benefit and that has relatively modest transition costs. The longer-term benefits would exceed 5 percent of GDP every year. Younger employees at the time of the transition would be net gainers in their own working lives. The net extra costs incurred by older employees during the transition would be very small and would generally be more than offset by the positive net benefits that their own children would receive. For the first fifty years of the transition taken as a whole, the present value of net gains would be positive for any reasonable rate of interest.

Table 15 PHASE-IN FROM PARTIAL TO TOTAL PRIVATIZATION WITH CURRENT LAW BENEFITS

A) Mandatory Individual Contributions ($ billions)

1995	21.09	24.19	27.52	31.09	34.91	38.88	43.05
2002	47.55	52.14	57.01	62.24	67.55	73.09	78.73
2009	84.74	90.97	97.18	102.82	108.77	115.00	121.26
2016	127.32	133.46	139.63	145.75	151.66	152.71	154.18
2023	155.13	156.10	156.69	157.20	157.91	158.63	159.41
2030	160.20	161.29	163.28	165.02	166.68	168.06	169.30
2037	171.25	173.61	176.00	178.13	180.24	182.49	184.61
2044	186.72	188.51	190.33	192.04	193.85	195.87	197.53
2051	199.16	201.40	203.24	204.91	206.23	207.48	208.95
2058	210.62	212.44	214.34	216.37	218.52	220.78	223.15
2065	225.63	228.19	230.85	233.59	236.41	239.30	242.23

B) Mandatory Individual Contributions (Percent of Payroll)

1995	0.72	0.81	0.91	1.00	1.11	1.21	1.32
2002	1.43	1.54	1.65	1.77	1.89	2.01	2.13
2009	2.26	2.39	2.51	2.62	2.74	2.86	2.97
2016	3.08	3.20	3.31	3.41	3.51	3.49	3.49
2023	3.47	3.45	3.43	3.40	3.38	3.35	3.33
2030	3.31	3.29	3.29	3.28	3.28	3.26	3.25
2037	3.24	3.25	3.25	3.25	3.25	3.26	3.26
2044	3.26	3.25	3.24	3.24	3.23	3.23	3.22
2051	3.21	3.22	3.21	3.20	3.19	3.17	3.16
2058	3.15	3.14	3.14	3.13	3.13	3.13	3.13
2065	3.13	3.13	3.13	3.14	3.14	3.15	3.15

C) Benefits Replaced Due to Privatization ($ billions)

1995	0.00	0.13	0.38	0.78	1.35	2.18	3.25
2002	4.52	6.22	8.25	10.62	13.57	17.03	21.32
2009	25.93	31.17	37.29	45.26	53.82	63.07	73.44
2016	85.18	97.86	111.70	126.74	143.23	160.99	178.93
2023	198.55	218.93	240.74	262.44	284.59	307.56	331.29
2030	355.89	378.74	400.58	423.54	447.27	472.11	495.30
2037	517.57	539.62	562.21	585.79	609.89	634.48	660.04
2044	686.31	713.69	742.02	770.99	800.25	829.43	859.48
2051	891.33	922.29	954.19	986.44	1019.23	1051.81	1083.78
2058	1115.19	1146.31	1177.25	1206.22	1234.25	1261.40	1287.75
2065	1313.36	1337.57	1361.13	1384.04	1406.46	1428.41	1449.99

D) Payroll Tax Needed to Maintain Trust Fund Trajectory (Percent of Payroll)

1995	12.40	12.40	12.39	12.37	12.36	12.33	12.30
2002	12.26	12.22	12.16	12.10	12.02	11.93	11.82
2009	11.70	11.58	11.43	11.24	11.03	10.82	10.59
2016	10.32	10.04	9.73	9.41	9.06	8.69	8.32
2023	7.92	7.52	7.09	6.68	6.27	5.85	5.43
2030	5.00	4.62	4.27	3.91	3.54	3.16	2.83
2037	2.52	2.22	1.93	1.62	1.30	0.99	0.67
2044	0.34	0.00	-0.35	-0.70	-1.05	-1.39	-1.73
2051	-2.10	-2.44	-2.79	-3.13	-3.48	-3.81	-4.12
2058	-4.42	-4.71	-4.98	-5.21	-5.43	-5.62	-5.80
2065	-5.96	-6.10	-6.23	-6.34	-6.44	-6.53	-6.61

E) Total Payroll Tax plus Mandatory Contribution (Percent of Payroll)

1995	13.12	13.21	13.29	13.38	13.46	13.54	13.61
2002	13.69	13.75	13.81	13.87	13.91	13.94	13.95
2009	13.96	13.96	13.94	13.86	13.77	13.68	13.56
2016	13.40	13.23	13.04	12.82	12.57	12.18	11.81
2023	11.39	10.97	10.52	10.08	9.64	9.20	8.76
2030	8.30	7.90	7.56	7.19	6.82	6.43	6.07
2037	5.76	5.47	5.18	4.87	4.56	4.24	3.92
2044	3.59	3.25	2.89	2.54	2.18	1.84	1.49
2051	1.12	0.77	0.42	0.07	-0.29	-0.64	-0.96
2058	-1.27	-1.56	-1.84	-2.08	-2.30	-2.50	-2.67
2065	-2.83	-2.97	-3.09	-3.20	-3.30	-3.38	-3.46

Our research has suggested a variety of issues that deserve further attention. One important issue is the treatment of couples, including the special problems caused by divorce and remarriage. In principle this should be easier to deal with in a system of individual accounts but this deserves detailed analysis.

The role of survivor benefits and disability benefits should also be considered more explicitly. How can these be provided in a way that captures the potential real return on the market mix of equity and debt? How would permitting bequests affect the economics of the program?

Although our calculations indicate that a small tax-based redistribution of MIRA assets at age 65 can prevent poverty in old age, it would be good to examine this and other distributional issues in more detail.

The potential long-run gain from privatizing Social Security implies that further research on these issues deserves a very high priority.

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