

Private Accounts as a Solution to Social Security's Debt

Liqun Liu
Andrew J. Rettenmaier
Thomas R. Saving*

Private Enterprise Research Center
Texas A&M University

Abstract

Social Security reform can be viewed as a method of reducing the system's implicit debt. The program unfunded obligation measures the system's overall financing shortfall, while the current generation unfunded liability measures the debt the next generation owes the current participants of the system. A successful Social Security reform must restore the system to financial solvency, essentially reducing the program unfunded obligation to zero. In so doing, any reform must deal with the debt owed to the current generation. In this paper we examine three reforms and evaluate the extent that each deals with the paying off the current generation debt.

Introduction

Social Security reform will receive serious consideration during the next few years given the current political climate and the increased realization that the funding shortfalls which begin in 2018 are projected to grow throughout the projection horizon. Reforms can take many forms, but those that include prepayment through the vehicle of personal retirement accounts appear to be increasing in popularity. Such reforms have already been enacted in other countries.

Fundamentally, Social Security is financed by intergenerational transfers rather than by resources based on saving and investment. Intergenerational transfer financing, or pay-as-you-go financing, is very sensitive to demographic changes. With the sharp decrease in the worker/retiree ratio caused by increased life expectancy and reduced birth rate, the Social Security status quo (in which the tax rate and benefit schedule remain unchanged) is financially insolvent. As of January 1, 2004, the total financing shortfall, measured by the present value of scheduled benefits in excess of the scheduled tax payments, is \$11.9 trillion.

The financial crisis of the Social Security program can be resolved by transforming this program into a retirement system based on privately owned savings accounts. A fundamental issue of the transition from the existing pay-as-you-go system to a pre-paid system is the distribution of the transition costs between current and future generations. In any pay-as-you-go retirement system the current generation, consisting of those currently working and retired, is owed a debt in the form of accrued retirement benefits. Any move to a prepaid system based on private accounts must find ways to pay off the debt implicit in the old intergenerational transfer financed retirement system. Social Security systems throughout the world have a greater debt to the current generation than that implied by the pure movement through life of each generation.

This greater debt is due to a combination of two events that are occurring worldwide: a population bulge known as “baby boomers,” and increased longevity. These two events have allowed the taxes required to fund the retirement of past retirees to be woefully inadequate to fund the much larger retirement population soon to be in place.

Assessing the cost of transition that must be borne before we reach the point where all post-transition generations are completely relieved of the implicit debts is not as straightforward as it may seem. Any reform must be compared with a benchmark that is itself sustainable. The existing Social Security benefit and tax schedule cannot serve as such a benchmark because the program, without significant benefit cuts or tax hikes, is not financially solvent. The real costs of transition are those that transitional generations must bear that are above and beyond the sacrifice they would have to make to maintain a solvent transfer-based entitlement program. Nevertheless, since both the real costs of transition and the costs that must be incurred to bring about a sustainable generation transfer system have to be paid by the transitional generations, the sum of both is often referred to as the transition cost.

As of January 1, 2004, the existing members of the Social Security system are owed a debt of \$12.7 trillion dollars. This debt consists of the present value of scheduled benefits to current workers and retirees in excess of the scheduled tax payments by the same group of people, and must either be paid or reneged upon if future generations are to be put in a new retirement system based on privately owned accounts. However, even absent any transition to a prepaid retirement system, the \$12.7 trillion Social Security debt exists and must be paid. In a sense, a transition to benefit prepayment does not generate any additional costs, but only brings forward the pain of paying off the existing debt.

In all reform proposals that envision a transition to a retirement system based on privately owned savings accounts, the fundamental issue is how the transition costs should be distributed among transitional generations. In this paper, we study three reforms: one of which shifts to pure pay-as-you-go financing and two of which involve transitions to partial and total prepayment using private accounts. In our analysis, we focus on aggregate quantities and intergenerational equity, therefore implicitly treating individuals of the same generation as identical. A concern expressed by opponents of Social Security privatization has been that general private individual account retirement systems, such as the ones presented in this paper, tend to be less redistributive than the current Social Security system.¹ While intragenerational equity is not a consideration in this paper, the issue of intragenerational redistribution can be handled within a system of individual accounts where the aged poor are treated in a manner similar to the non-aged poor.²

The elimination of the intergenerational contract does not necessarily imply that a generation's paying for its own retirement must be done with individual accounts. One might argue that the benefits of a generation paying for its own retirement can be achieved by government centrally investing funds in the capital market rather than through the establishment of private accounts. This is doubtful, however, since no government has ever been able to do so. Today, in fact, the relatively modest Social Security Trust Fund consists entirely of treasury IOU's. Even if it were possible for the government to commit to investing in real assets, giving

¹ The current system is less progressive than it might seem from its highly redistributive benefit schedule due to a positive correlation between life-time income and longevity. According to Garrett (1995), differences in mortality considerably narrow, and in some cases eliminate, the progressive spread in returns across income classes. Liu and Rettenmaier (2003) also reached a similar conclusion by studying both the rate of return and the present value of the Social Security investment for different racial and education groups.

² For a detailed analysis of how individual accounts and intragenerational redistribution can be mutually compatible with progressive matching of individual accounts, see Kotlikoff, Smetters and Walliser (1998).

the federal government the green light to invest in our nation's equities would raise a number of issues concerning the separation of the government and the private sector with the danger of politicizing firm decisions.

The Economics of Generation Transfer

For purposes of discussion, divide the current and the future population into two groups: all those 15 years and older, which we refer to as the "current generations" (essentially the current adult population), and all pre-adult and yet-to-be-born generations, which we refer to as "future generations." The union of these two groups is sometimes referred to as the "open group."

Denote the present time as time 0. Since the current and future generations do not overlap, program revenue at any time $t \geq 0$, $R(t)$, can be expressed as the sum of revenue from current generations, $CR(t)$ and future generations, $FR(t)$. In the same manner, program expenditures at that same point in time $E(t)$ can be expressed as the sum of the expenditures on the current generations $CE(t)$ and future generations $FE(t)$. Thus,

$$(1) \quad \begin{aligned} R(t) &= CR(t) + FR(t), \\ E(t) &= CE(t) + FE(t). \end{aligned}$$

Based on the above definitions of revenues from and expenditures on various groups, we define three unfunded obligations that describe the financial situation of the system at any point in time. The program unfunded obligation at time 0, $PUO(0)$, is the present value of the difference in program expenditures and revenues from time 0 into the indefinite future less any accumulated assets, which we denote as $TF(0)$; the current generation unfunded obligation at time 0, $CGUO(0)$, is the present value of the difference in program expenditures on and

revenues from the current generation less $TF(0)$; and the future generation unfunded obligation at time 0, $FGUO(0)$, is the present value of the difference in program expenditures on and revenues from future generations. Thus,

$$\begin{aligned}
 (2) \quad & P U O(0) = \int_0^{\infty} e^{-rt} [E(t) - R(t)] dt - TF(0) \\
 & C G U O(0) = \int_0^{100} e^{-rt} [CE(t) - CR(t)] dt - TF(0) \\
 & F G U O(0) = \int_0^{\infty} e^{-rt} [FE(t) - FR(t)] dt
 \end{aligned}$$

where we have replaced the infinite upper bound of the second summation with 100 since current mortality tables imply that essentially all of the existing population of 15-year-olds will be deceased by age 115. Economically, $PUO(0)$ is a measure of the program's financing shortfall, and $CGUO(0)$ is a measure of the debt owed to the system's current participants, referred to by the Social Security Trustees as the 100-year closed group debt.

The accumulated assets of the system, referred to as the Social Security Trust Fund, represents the current value of surpluses that began in 1983 and are forecast by the Trustees to continue until 2018. The Trust Fund is only allowed to hold special, non-negotiable, US government bonds that from the perspective of the Social Security system an asset. However, from the aspect of future taxpayers, the bonds are a liability. In contrast, had the past surpluses been invested in real assets, the Trust Fund would be an asset both from the perspective of the Social Security system and future taxpayers because the sale of the assets would have generated revenue. As the Trust Fund is currently constituted, the redemption of the special bonds will require that future taxpayers pay more in taxes or get fewer government services. For this reason, we and many others, ignore the Trust Fund when calculating the amount future generations will

have to pay to provide the benefits promised current generations. From the perspective of this analysis, whether or not the Trust Fund is a genuine asset does not affect any of the results.

From (1) and (2), we have

$$(3) \quad PUO(0) = CGUO(0) + FGUO(0).$$

This identity says that an intergenerational transfer system's financing shortfall can be decomposed into the net obligation to the current and future generations. Define a sustainable generation transfer system as one with no financing shortfall, i.e., $PUO(0) = 0$. Then, in a sustainable system, the debt owed to current generations, which tends to be positive for generation transfer entitlement programs,³ must be offset by a negative future generation unfunded obligation. In other words, future generations must generate a net surplus to the system. It should not be surprising that the future generation unfunded obligation is likely to be negative, since for many years after time 0 (in the current U.S. system, 47 years assuming retirement occurs at 62 or 52 years if retirement occurs at the full retirement age of 67) future generations contain no recipients, only taxpayers. However, as shown in the following, the contribution by future generations is woefully insufficient to finance the debt in the U.S. Social Security program at the current tax rate and benefit schedule, making the program financially insolvent.

³ When we begin the discounting process, the current generation contains all current transfer recipients and taxpayers. As the system ages, the proportion of the current generation that provides revenue to the system falls as taxpayers become transfer recipients. Thus, if the tax rate was set to just pay the benefits in each year then the unfunded obligation to the current generation is always positive.

In Table 1 we show the three unfunded obligation measures defined above for the present United States Social Security system based on the 2004 Trustees Report.⁴ As the table indicates, the U.S. Social Security system, similar to all other retirement systems in the developed world, has a long run problem indicated by the fact that at current tax rates future generations will provide almost no resources to pay off the debt owed to the current generation. Importantly, whether or not the system is reformed, the debt owed to the current generation must be either paid or cancelled, implying that if the current generation is allowed to receive promised benefits while paying only scheduled taxes, future generations must pay higher taxes.

Table 1
United States Social Security System
Financing Shortfall and Its Decomposition
(Present Values as of 1-1-2004 in trillions of dollars)

Program Unfunded Obligation (Financing shortfall)	\$11.9
Current Generation Unfunded Obligation (100-year closed group debt)	\$12.7
Future Generations Unfunded Obligation	-\$0.8

The fact that future generations will make some small contribution toward the current generation debt, slightly less than \$1 trillion, indicates something else that may not be obvious. At the current tax rate, if the surpluses in the early years of future generations were invested at the assumed discount rate rather than used to pay the current generation debt, the resulting fund would be sufficient to pay the future generation's scheduled benefits. In effect, the current tax rate is more than sufficient to prepay the benefits of future generations but not sufficient to both pay for future generations benefits and the debt owed current generations. Thus, while current

⁴ We have not considered the \$1.5 trillion Trust Fund as an asset. Had we done so, the *CGUO* would be \$11.2 trillion. See "The 2004 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds."

tax rates are not sufficient to fund a generation transfer retirement system, they are sufficient to fund a pre-paid retirement system.

Since Table 1 only gives the unfunded obligation measures for the current, financially insolvent Social Security program, we show below what a program with no financing shortfall would look like and compare it with the current Social Security system. Such a comparison is relevant when we discuss the real transition cost of moving to a pre-paid retirement system. For simplicity, we consider a system with strictly pay-as-you-go financing so that program revenue always equals program expenditure. Thus, the program unfunded obligation is always zero, and the future generation unfunded obligation must be negative and equal in absolute value to the current generation unfunded obligation. The focus here is the *CGUO*, or the debt owed to the current generations. We further assume that both population and wage earnings are constant.

First, divide a representative individual's economic life between working (from 0 to R) and retirement (from R to L). In a strict pay-as-you-go retirement system with constant population, we have

$$(4) \quad tIR = rI(L - R)$$

or

$$(5) \quad t = \frac{r(L - R)}{R}$$

where I is the constant wage earnings per worker, t is the tax rate and r is the work-life income replacement rate.

Denoting the implicit debt the government owes to an individual of age T , ($0 \leq T \leq L$) at the present time as $d(T)$, we have

(i) For $0 \leq T \leq R$

$$\begin{aligned}
 \mathbf{d}(T) &= I \left[\mathbf{r} \int_R^L e^{-r(t-T)} dt - \mathbf{t} \int_T^R e^{-r(t-T)} dt \right] \\
 (6) \quad &= \frac{I}{r} \left[\mathbf{r} \left(e^{-r(R-T)} - e^{-r(L-T)} \right) + \mathbf{t} \left(e^{-r(R-T)} - 1 \right) \right] \\
 &= \frac{\mathbf{r}I}{r} \left[1 + \frac{L}{R} \left(e^{-r(R-T)} - 1 \right) - e^{-r(L-T)} \right] \triangleq \mathbf{d}_R(T)
 \end{aligned}$$

(ii) For $R \leq T \leq L$

$$\begin{aligned}
 \mathbf{d}(T) &= \mathbf{r}I \int_T^L e^{-r(t-T)} dt \\
 (7) \quad &= \frac{\mathbf{r}I}{r} \left(1 - e^{-r(L-T)} \right) \triangleq \mathbf{d}_L(T)
 \end{aligned}$$

Therefore, the current generation unfunded obligation (debt owed to all current workers and retirees) is, denoting S as the constant number of people in each cohort,

$$(8) \quad CGUO = S \int_0^L \mathbf{d}(T) dT = S \left[\int_0^R \mathbf{d}_R(T) dT + \int_R^L \mathbf{d}_L(T) dT \right]$$

which, doing the integration becomes,

$$(9) \quad CGUO = \frac{S\mathbf{r}I}{r^2} \left[\left(e^{-rL} - 1 \right) - \frac{L}{R} \left(e^{-rR} - 1 \right) \right].$$

To use the above formula to estimate the current generation unfunded obligation or debt, we use the values for the current Social Security system in the United States. First, let $r=0.03$, the future real interest rate assumption used by the Trustees, $\mathbf{r} = 0.42$, the average replacement rate for the current Social Security system, and $I = \$28,768$, average annual earnings. Second, let $L=60$ (from age 18 to average age of death, 77) and $R=48$ (from age 18 to age 65). Third, for S , we use the total number of workers and retirees (156,424.00 thousands + 36,420.00 thousands = 192,844,000) divided by the number of cohorts ($L=60$), which is 3,214,067. Substituting these

values into (9), yields an estimate of *CGUO* of \$5.14 trillion, which also implies a *FGUO* of - \$5.14 trillion.

Comparing a solvent program's \$5.14 trillion *CGUO* and a negative \$5.14 trillion *FGUO* with the current insolvent program's \$12.7 trillion *CGUO* and a negative \$0.8 trillion *FGUO*, one can see the magnitude of the burden to restore solvency. Since we have maintained the same replacement rate in the PAYGO system, the system's solvency is restored mainly by increasing the tax rate. As the result, the debt owed to the current generation is reduced from \$12.7 trillion to \$5.14 trillion, and the debt servicing burden on the future generations increases from \$0.8 trillion to \$5.14 trillion. Another interesting point from this comparison is that much of the transition cost to reform the current system, \$12.7 trillion, comes from the fact that the current system is insolvent under promised tax and benefit schedules. If taxes are raised to restore the system's solvency, the transition cost falls to \$5.14 trillion.

Some Aspects of Social Security Reform: Capital Stock, Intergenerational Equity and Timing

Without a contract between current and future generations, each generation must provide for its own retirement by storing output, essentially acquiring capital, during its productive years. However, with a pay-as-you-go social security system in place, the debt owed to the current generation replaces the current generation's need to acquire capital. As a result, generations after the institution of a pay-as-you-go social security system inherit a smaller capital stock and have lower income than pre-social security generations, other things equal. A reform that eliminates the implicit contract between current and future generations has as a benefit an increased capital

stock as generations now provide for their retirement consumption. Once the reform is in place, all post-reform generations inherit a larger capital stock and enjoy higher income.

From the comparison in the last section of the *CGUOs* of the current insolvent system and a solvent one, one can see that a Social Security reform would also have implications for intergenerational equity. A reform featuring private accounts would force policy makers to deal with the financing shortfall directly. If we do nothing, current generations will pay taxes and receive benefits according to the current overly generous tax rate and benefit schedule. As a result, future generations will have to pick up the \$12.7 trillion left by current generations. On the other hand, if the financing shortfall is eliminated by a reform, essentially through tax increases, current generations will contribute to the servicing of the \$12.7 trillion debt. Indeed, from the previous example, what is left for future generations to pick up is reduced to \$5.14 trillion. In general, any transition to a prepaid private account retirement system would have intergenerational redistribution in favor of future generations. Whether generational equity should be a goal of policy is an open question, although one that the proponents of reform have answered in the positive.

Capital stock effects and generational equity consequences feature importantly in our discussion later on alternative transition paths. In the rest of this section, we focus on another issue concerning Social Security reform, i.e., whether or not waiting to reform increases the ultimate cost of the reform. Specifically, we want to see how the program unfunded obligation and the tax rate increase required to eliminate the *PUDO* evolve over time if nothing is done.

First, let us demonstrate that the unfunded liability increases by the interest rate as time passes. When the starting Social Security trust fund debt (positive balance, or trust fund asset, is

treated as a negative debt), denoted as $D(0)$, is included, the program unfunded obligation at time 0 is

$$(10) \quad PUO(0) = D(0) + \int_0^{\infty} e^{-rt} [E(t) - R(t)] dt$$

At any future time $k > 0$, the program unfunded obligation is

$$(11) \quad \begin{aligned} PUO(k) &= D(k) + \int_k^{\infty} e^{-r(t-k)} [E(t) - R(t)] dt \\ &= e^{rk} D(0) + \int_0^k e^{r(k-t)} [E(t) - R(t)] dt + \int_k^{\infty} e^{-r(t-k)} [E(t) - R(t)] dt \\ &= e^{rk} \left\{ D(0) + \int_0^{\infty} e^{-rt} [E(t) - R(t)] dt \right\} = e^{rk} PUO(0) \end{aligned}$$

Thus, the program unfunded obligation grows at the rate of interest as we move forward in time.

Now let us show how the tax increase that would be necessary to bring the system into long run sustainability, i.e., make the program unfunded obligation zero is affected by waiting. Define $\mathbf{a}(0)$ as the permanent percentage increase in the current payroll tax rate, if imposed at time 0, would restore program sustainability. That is, $\mathbf{a}(0)$ solves

$$(12) \quad D(0) + \int_0^{\infty} e^{-rt} \{E(t) - [1 + \mathbf{a}(0)]R(t)\} dt = 0$$

or, using PUO definition (10),

$$(13) \quad \mathbf{a}(0) = \frac{PUO(0)}{\int_0^{\infty} e^{-rt} R(t) dt}$$

Denote the actuarial deficit at time 0, defined by the Trustees as the percentage point increase in the tax rate that would assure long-term solvency, as $A(0)$, which can be expressed as

$$(14) \quad A(0) = [1 + \mathbf{a}(0)]t - t = \mathbf{a}(0)t$$

where t is the current payroll tax rate. From (13) and (14), the actuarial deficit at time 0 is

$$(15) \quad A(0) = \frac{PUO(0)t}{\int_0^{\infty} e^{-rt} R(t) dt}$$

In a similar manner, the actuarial deficit at some future time $k > 0$ is

$$(16) \quad A(k) = \frac{PUO(k)t}{\int_k^{\infty} e^{-r(t-k)} R(t) dt}$$

Using relation (11), (16) becomes

$$(17) \quad A(k) = \frac{e^{rk} PUO(0)t}{e^{rk} \left[\int_0^{\infty} e^{-rt} R(t) dt - \int_0^k e^{-rt} R(t) dt \right]} = \frac{PUO(0)t}{\int_0^{\infty} e^{-rt} R(t) dt - \int_0^k e^{-rt} R(t) dt}$$

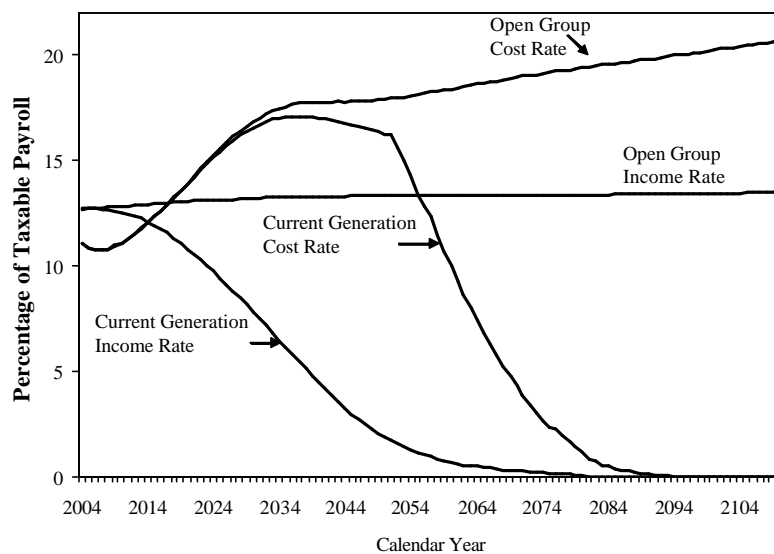
Comparing (17) with (15), we have $A(k) > A(0)$, $\forall k > 0$, so that the tax rate hike required to restore program sustainability increases as time passes. Further, it is obvious from (17) that $\lim_{k \rightarrow \infty} A(k) = \infty$. Thus, there will be a point after which no feasible tax increase would solve the system's financial solvency problem. Essentially we have the so-called "most powerful force in the universe", compound interest, working against us.

Comparing Alternative Reforms

As is clear from the previous discussion, a Social Security program that relies on pay-as-you-go financing has a closed-group debt at any point in time. Figure 1 presents the open and closed group revenue and expenditure rates for the next 100 years, presented as a percentage of taxable payroll. The series titled open group income and cost rate reflect the system's income and costs as it is now financed. Between 2004 and 2017 the system will run surpluses at the current tax rate, but beginning in 2018 the system will run deficits that are projected to grow as a

share of taxable payroll in each subsequent year. The tax income paid and the benefits received by individuals who are 15 years of age and older in 2004 (those born in 1989 and earlier) are identified by the series titled current generation income rate and closed group cost rate. For the next few years most of the income to the system will come from the closed group, or current generation, but as increasing members of this generation reduce their hours of work and begin their retirement, their share of the system's total revenue will decline. The figure also indicates that for the next two decade most of the system's costs are the costs associated with the current generation. The closed group accounts for all new waves of new retirees until 2051 when today's 15 year old workers are 62 years of age. However, as more members of the open group receive disability and survivors benefits and also account for an increasing share of retirees, the current generations' share of total costs decline. By 2089, the youngest members of the current generation are 100 years of age and by then most of the closed group costs are essentially zero.

Figure 1
Social Security Income and Cost Rates for the Open Group
and for the Current Generation



Source: 2004 Social Security Trustees Reports and authors' estimates

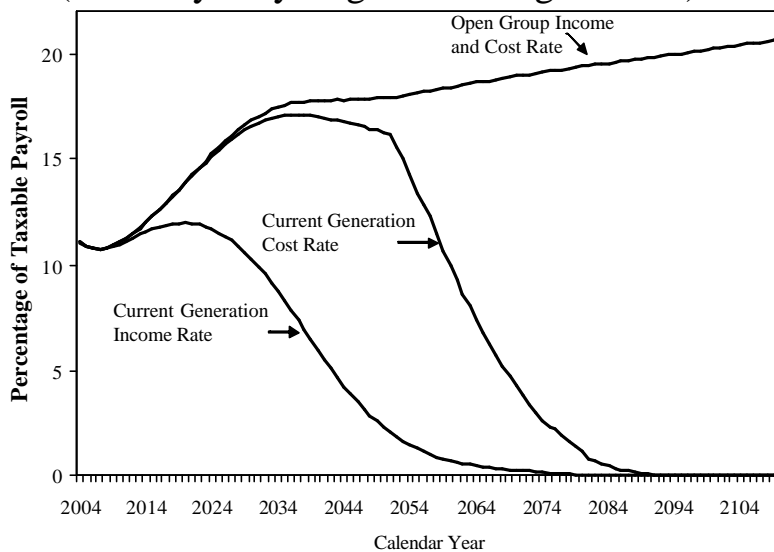
The previously mentioned current generation or close group debt of \$12.7 trillion is simply the difference between the present values of the current generations' costs and revenues assuming the current tax structure. Similarly, the present value of the open group's costs and revenues in perpetuity, assuming the current tax structure, is \$11.9. Recall that both of these numbers do not include the \$1.5 trillion Trust Fund. With the Trust Fund counted as dedicated revenues the closed and open group unfunded obligations are \$11.2 and \$10.4 trillion respectively.

The 2004 Trustees Report identifies that tax rate increase that if enacted today would make the system solvent indefinitely. Assuming a long run 3% real discount rate, the Social Security Actuaries calculate that a tax increase of 3.5% of payroll would make the system solvent indefinitely. This calculation conceptually identifies a type of prepayment, assuming that additions to the Trust Fund are national savings. With such an increase, to a tax rate of 15.9% of payroll, the system would run surpluses until 2030 and would be added to the current Trust Fund along with interest on the Trust Fund's assets. The new revenue series would be reflected in the graph by an upward shift of 3.5% of payroll to the open group income rate. Beginning in 2030 draws from the Trust Fund along with the payroll tax revenues would be sufficient to pay scheduled benefits forever. However, such an approach does not imply investment in the real economy nor does it assign ownership to workers and retirees. Essentially, the surplus revenues would be additional revenues to the Treasury that could be spent on other programs or used to reduce other taxes. Assigning ownership and guaranteeing that any added revenues are directed to truly prepaying requires that individuals are granted ownership and that the system's debts are reduced.

Reform 1: Shift to Pure Pay-as-you-go Financing and Maintain Scheduled Benefits

Next, we will compare several alternative reforms on the basis of how well they reduce the close-group debt. This is useful in that the close-group debt is the debt that all new labor force entrants inherit once they start working. Figure 2 illustrates the closed group debt in a system that relies on pure pay-as-you go financing. It will also serve to illustrate the first reform. In this graph taxpayers pay the cost rate of the program. Setting income to costs with pure pay-as-you go financing result in the open group's income and cost rates being identical as indicated by the upper line in the figure. The initial surpluses that existed under the 12.4% payroll tax have been eliminated by lowering the income rate to the cost rate between 2004 and 2018 and subsequent deficits are eliminated by raising the income rate to follow the program's scheduled costs. Setting the income rate to the cost rate would eliminate the perpetuity open group debt. Further, the new group's surplus would exactly match the current generations' debt.

Figure 2
Social Security Income and Cost Rates for the
Open Group and for the Current Generation
(Pure Pay-as-you-go Financing Reform)



Source: 2004 Social Security Trustees Reports and authors' estimates

The current generations' debt is also affected by the change due to the new income rate that exists while members of the generation are in the labor force. The generations' income rate is indicated by the lower line in the figure. Relative to the cost rate schedule presented in Figure 1, this cost rate is initially lower until 2015, but is thereafter higher. The effects of switching to pay-as-you-go financing on the current generation's debt are presented in the last column of Table 2. However, before discussing the last column we have also added an alternative measure of the current generation debt. The "Status Quo" column reports the current generation debt when the surpluses between 2004 and 2018 are not included. When the surpluses are included in the calculation, implicitly they are treated as if they are investments which earn the Trust Fund rate of return. Eliminating the surpluses from the calculation also makes for a more straightforward comparison with the present exercise. With the surpluses eliminated, the current generation debt rises to \$13.8 trillion as compared to the \$12.7 trillion reported in the 2004 Trustees Report. By moving to pure pay-as-you go financing the current generation pays an additional \$1.8 trillion in taxes and the debt is reduced 13% to \$12.0 trillion. This example shows that with pure pay-as-you-go financing, entering cohorts are confronted with the current generations' debt.

Table 2
Current Generation Unfunded Obligation
(Pure Pay-as-you-go Financing)

Category	Status Quo (Surpluses Not Included)	Pay-as-you- go Financing
Present Value of Revenues	14.1	15.9
Present Value of Expenditures	27.9	27.9
Current Generation Unfunded Obligation	-13.8	-12.0

Sources: Social Security Administration 2004 Trustees Report and authors' estimates.
None of the estimates include the Trust Fund offset as a revenue source.

Reform 2: Partial Prepayment, “The President’s Commission to Strengthen Social Security”

The 2001 *President’s Commission to Strengthen Social Security* suggested that private accounts offset some of the accumulated debt. More importantly, however, the Commission also suggested that rather than replace a constant share of wage indexed earnings, the defined benefit part of Social Security provide a fixed level of purchasing power. This change alone reduces the outstanding debt to existing generations, the 100-year closed group liability, and significantly reduces funding requirements for both new and current generations. Such a change is one way of recognizing the fact that the existing system is not sustainable and therefore, is not the appropriate target when deciding whether a transition is Pareto.

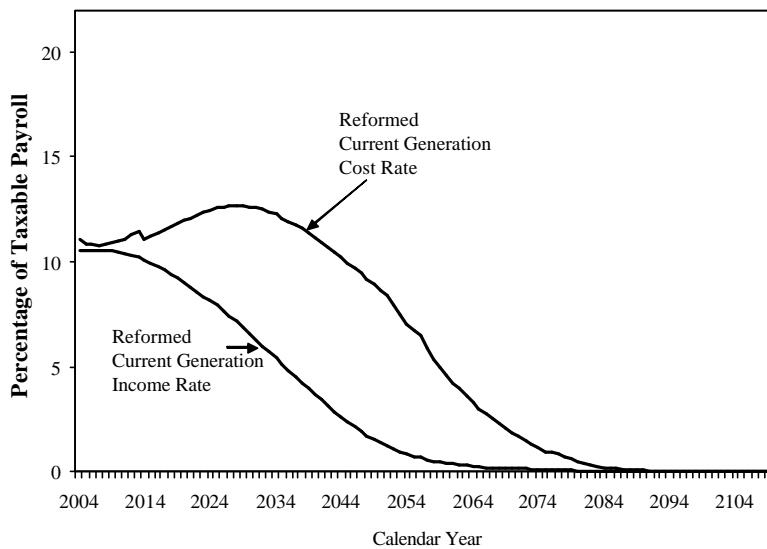
The private account portion of the President’s Commission would allow workers who are 55 years of age and above to contribute roughly 31.7% of their payroll taxes, 4 percentage points of the total 12.4% payroll tax, up to \$1,000 per year, to a private account. With the restriction of \$1,000, the total contributions to private accounts ultimately reach 2.39% of taxable payroll. This reform also replaces the wage indexed benefits formula with a price indexed formula beginning in 2009. Price indexing effectively sets the defined benefit after 2008 to the real purchasing power of the 2009 benefit.⁵ In exchange for the opportunity to divert one’s payroll taxes to a private account, the price indexed benefit is offset by the annuity resulting from one’s private account, assuming the private account earns 2%. Future benefits are first reduced by the new benefit formula and are then further reduced by the benefit offset, assuming the 2% rate of return. Any accumulations earned in excess of the 2% are added to the reformed benefits to arrive at a retirees’ total benefit. Assuming that the private accounts are invested in a portfolio

⁵ Given positive income growth, fixing the real defined benefit makes this reform a total prepayment reform in the limit as the ratio of prepaid benefit to defined benefit goes to zero.

that yields a rate of return of 4.6% during the accumulation phase, and a 3% return during the decumulation phase, the Commission estimated that the ultimate benefits from this reform would be roughly comparable to those that are currently scheduled.

In the calculations reported below, we assume 100% participation and participant's contributions to their accounts are deducted from their payroll tax payments. Figure 3 shows the path of the current generations' income and cost rates. As the figure indicates, the current generation cost rate is significantly reduced relative to the associated cost rates in Figure 2. Both setting the benefit at the 2009 real benefit level and the benefit offset reduce the costs necessary to support the current generation. The income rate is reduced relative to the rate shown in the first Figure by the amount of contributions made by workers who are 55 years of age and younger in 2004.

Figure 3
Social Security Income and Cost Rates for the Current Generation
(President's Commission Reform)



Source: 2004 Social Security Trustees Reports and authors' estimates

Table 3 presents the present value of the two series and the resulting reformed debt. The reform produces a current generation debt of \$8.7 trillion which is 27.5% lower than the debt with pure pay-as-you go financing and 31.5% percent lower than the current generation debt reported by the Trustees. The reduction is largely due to the elimination of benefits that are replaced by the private accumulations in the personal retirement accounts. The Commission reform is partial in the sense that after the reform a part of Social Security remains a pay-as-you-go defined benefit. However, the debt of the system is reduced because the form of promised benefits is changed from fixed income replacement rate to fixed purchasing power.

Table 3
 Current Generation Obligation
 (President's Commission Reform)

Category	President's Commission
Present Value of Revenues	12.0
Present Value of Expenditures	20.7
Current Generation Unfunded Obligation	-8.7

Sources: Social Security Administration 2004 Trustees Report and authors' estimates. None of the estimates include the Trust Fund offset as a revenue source.

Reform 3: Full Privatization, Both Current and Future Generations Included

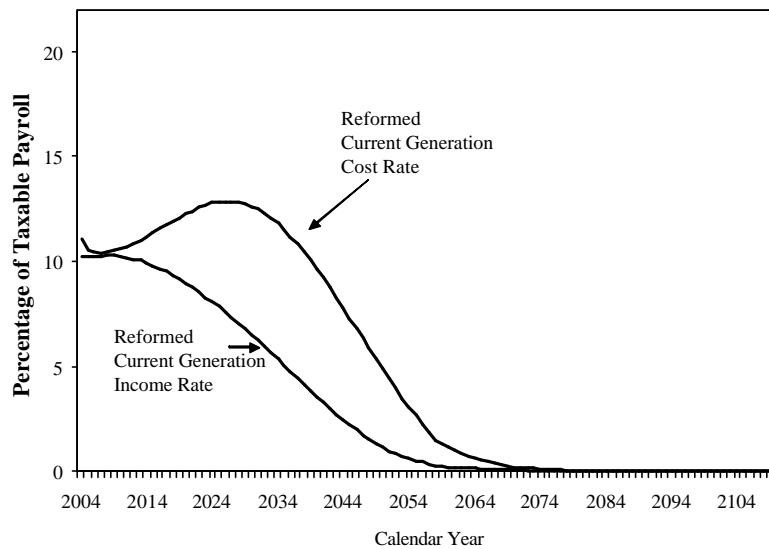
In this example we require all future participants and all current participants 64 years of age and younger to contribute 5% of their earnings to a personal retirement account. Half of the contribution is paid for by a deduction from payroll taxes owed and half is paid by the

participants. The resulting annuity assuming a 5.4% return during the accumulation phase and a 3% return during the annuity phase would replace scheduled benefits for new labor force entrants. For members of the current generation who are 64 and younger in 2004, scheduled benefits are reduced by the expected value of the annuity that this contribution rate would purchase.⁶ In this way, individuals in the current generation prepay part of their retirement pensions. It should be emphasized that the average annuity that can be purchased using the personal retirement account accumulations identifies the benefit reduction schedule for this reform. This benefit reduction schedule is pre-announced and is part of the reform and is thus similar to the pre-announced change to the price indexed benefit formula in the Commission's proposal. Each successive cohort knows at the beginning of the reform, the expected size of their tax financed defined benefit.

Figure 4 illustrates the income and cost rates for the closed group resulting from the full prepayment reform. This reform's cost rates in future years are lower than the rates under the President's Commission reform. As expected, the larger contribution rate leads to a more dramatic and rapid reduction in the cost of the program that would have to be paid through taxes. The income rate over time from the current generation is similar to the income rate in the Commission reform given the similar magnitude of the net payroll deduction due to the personal retirement account contributions.

⁶ Admittedly there would be redistribution issues that would have to be addressed given that higher income workers' annuities would more than offset their scheduled benefits, but our purpose here is to merely illustrate the timing of

Figure 4
Social Security Income and Cost Rates for the Current Generation
(Full Prepayment Reform)



Source: 2004 Social Security Trustees Reports and authors' estimates

Table 4 presents the effects of full prepayment on the current generation unfunded obligation. Given that this reform has the greatest effect on the share of the current generation debt paid by that generation it reduces the current generation debt by \$5.4 trillion, compared to pure pay-as-you-go financing and by \$6.1 trillion when compared to the debt reported by the Trustees.

Table 4
Current Generation Unfunded Obligation
(Full Prepayment Reform)

Category	Full Prepayment
Present Value of Revenues	11.7
Present Value of Expenditures	18.3
Current Generation Unfunded Obligation	-6.6

Sources: Social Security Administration 2004 Trustees Report and authors' estimates.
None of the estimates include the Trust Fund offset as a revenue source.

Some Additional Considerations

In all three reforms, how the deficits are financed determines the degree to which they produce changes in the capital stock. For a reform to increase the capital stock, the implicit debt must be reduced. This means that reforms must be debt reducing to produce beneficial capital stock effects. Financing any reform with debt means that total debt remains unchanged and no capital stock effect occurs as individuals continue to use debt rather than capital to transfer resources across time.

The choice of the tax instrument used to pay the initial burdens of the reforms would also have economic ramifications. A broadly based tax, such as a consumption tax does two things. It has a smaller deadweight loss than a payroll tax that raises the same revenues. It also spreads the burden of the tax to retirees. This second point is important as we look at the timing of the additional burden of each reform. Given that the baby boomers have paid lower lifetime Social Security taxes than will be required of next generation, in a generational equity sense it could be argued that the baby boomers should share in the cost of prepayment. This sharing of the cost could be accomplished by a transitional consumption tax during their retirement.

Conclusion

This paper provides an analysis of the constraints facing pay-as-you-go Social Security systems. Fundamentally, a pay-as-you-go retirement system implies a debt owed to the current generation of participants, those currently working and retired, that must be paid by future generations. The Social Security systems in the entire developed world are facing a financing crisis in the sense that under current benefit and tax rates, the debt owed to the current generation exceeds what future generations are scheduled to pay into the system. If these scheduled benefits

are paid and only scheduled taxes are collected from the current generation, future generations will face tax burdens far in excess of those imposed on the current generation. In response to this crisis, nations around the world have already or are considering doing away with some or all of the pay-as-you-go aspects of their retirement systems.

In this paper we simulate three transitions to a prepaid social security system based on the current United States Social Security program. Ultimately, it is the debt owed the current generation that must be accounted for in any reform. The generational equity issue in the payment of this debt is paramount. The debt can be paid by simply shifting to pure pay-as-you-go financing. This primarily shifts the burden to future generations as illustrated by the first reform we considered. Alternatively, the current generation can take part in dealing with the debt, either by facing reduced benefits or by paying higher taxes. One of the three reforms, The President's Commission reform, is not a complete privatization of Social Security, although it pays off about 28% of the current generation debt, largely through benefit reductions. As the final simulation indicates, the reform that completely prepaids the Social Security benefits shifts the greatest burden to the current generation of the three reforms considered. The full prepayment reform reduces benefits and raises taxes for most of the current generation and leaves only 55% of the current generation debt to future generations.

The estimates presented assume particular transitions to a private system of providing for elderly retirement benefits. There are other approaches, all of which can accomplish the goal of moving us from generation transfer based Social Security to prepaid Social Security. Fundamentally, however, the financing issues addressed here must be faced whether or not any change is made in the basis of Social Security financing. No matter how we make the transition,

the elderly are going to consume real resources, and as the elderly population grows, the younger generations are going to have to give up consumption in favor of the elderly. The only real question is how these younger generations will be induced to give up the resources necessary to provide the elderly with their retirement benefits.

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