1-1997

The Economics of Prefunding Social Security and Medicare Benefits

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Volume Title: NBER Macroeconomics Annual 1997, Volume 12

Volume Author/Editor: Ben S. Bernanke and Julio Rotemberg

Volume Publisher: MIT Press

Volume ISBN: 0-262-02435-7

Volume URL: http://www.nber.org/books/bern97-1

Publication Date: January 1997

Chapter Title: The Economics of Prefunding Social Security and Medicare Benefits

Chapter Author: Martin Feldstein, Andrew Samwick

Chapter URL: http://www.nber.org/chapters/c11038

Chapter pages in book: (p. 115 - 164)

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HARVARD UNIVERSITY AND NBER; AND DARTMOUTH COLLEGE AND NBER

The Economics of Prefunding Social Security and Medicare Benefits

1. *Introduction*

The most profound demographic trend shaping our budgetary and economic future is that older Americans are living much longer. Although the maturing of the baby-boom generation will soon accelerate the aging of the population, the shift to an older age structure is a permanent change that reflects better medical care and improved lifestyles.

The percentage of the population 65 years old or older is projected to rise from 12% now to 20% in 2030, a 65% increase in the relative number of individuals eligible for social security retirement benefits and federally financed health care. Even more startling is the projected increase in the very old, who are the most intensive consumers of medical care. The Census Bureau anticipates[1] that the group over 75 will rise from 6.1% of the population in 2000 to 11.2% by 2050. And the group over 85 is expected to rise from 1.6% of the population to 4.6%.

Under current law, the aging of the American population during the next four decades will require doubling the share of national income that the government spends on retirement income and healthcare for those

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1. These are the Census Bureau's intermediate projections. More rapid medical progress and greater changes in lifestyles could significantly accelerate the proportion of older persons in the population.

who are no longer employed. Since medical costs rise sharply with age, the demographic trends will cause the costs of Medicare and Medicaid to rise even more rapidly than the retirement costs.

The social security and Medicare programs now cost 8% of GDP. The federal government also spends an additional 0.4% of GDP on means-tested Medicaid benefits for the aged. The Congressional Budget Office projects that the total cost of these programs will rise to 16% of GDP in 2030 and to about 18% of GDP in 2050.[2]

Financing such an increase in government spending on a pay-as-you-go basis would require a tax increase equal to doubling the personal income tax or to raising the payroll tax from the current 15.3% of covered wages[3] to more than 35% even if the higher tax rates did not shrink the tax base. While reductions in retirement pensions and improvements in the efficiency of the healthcare system could modulate this increase, any plausible level of health and retirement benefits would still require very burdensome tax rates that would greatly increase the distortions and deadweight loss of the overall tax system.[4]

The obvious solution to this problem is for individuals to prefund these expenditures of old age with a system of mandatory saving accounts.[5] Although the life-cycle model of rational individual behavior implies that individuals would do such saving for themselves on a voluntary basis if the government did not provide the current universal benefits for old age, in reality some individuals would not save adequately for their old age, either because of simple shortsightedness or because they explicitly decide to consume all of their earnings during their working years and then to rely on whatever means-tested public and private

2. See Congressional Budget Office (1996, p. 78). The projected social security costs are based on the "intermediate" assumption of the social security actuaries, which many experts believe understate future program costs. The projected healthcare costs are also based on optimistic assumptions, particularly the assumption that the healthcare costs per Medicare enrollee will decline to the rate of increase of private-sector wages after 2007.
3. Covered wages are currently wage and salary income up to $65,400 (in 1997), an amount that is indexed with a lag to changes in the average level of covered wages.
4. The deadweight loss of the payroll tax is the result of changes in labor supply broadly defined (including not only labor-force participation and hours but also such things as individual effort and risktaking, education, choice of occupation, and choice of location) and changes in the form of compensation (substituting fringe benefits and enhanced working conditions for taxable cash). The deadweight loss of the personal income tax also reflects tax-induced changes in the timing of consumption. The increased deadweight loss due to higher tax rates can therefore be large even if there is no change in working hours or in the rate of saving. See Feldstein (1978, 1995b, 1997).
5. Many countries have shifted to such a system or are considering doing so. These include Argentina, Australia, Chile, Japan, Mexico, and the United Kingdom. Sweden has recently made a step in that direction. For further information on the systems in several of these countries, see Feldstein (1996b).

assistance will be available after retirement.[6] Mandatory individual accounts would in effect approximate what individuals would rationally choose to do if they had adequate foresight and were not diverted by the possibility of a means-tested transfer.[7]

The present paper examines the basic economics of replacing the existing pay-as-you-go system with such mandatory individual funded accounts. The primary focus is on social security pensions, but Section 9 extends this to health benefits for the aged.

Although we have emphasized the term "prefunding" and avoided the term "privatize" in this introduction, the system of individual accounts that we discuss in this paper can be described as "privatizing" social security. We regard a system as effectively privatized if benefits are based on defined contribution accounts invested in private securities with the investments controlled by the individuals themselves.[8] The current paper emphasizes the advantage of prefunding and does not deal with other aspects of privatization such as the matching of investments to individual preferences and avoiding the problems of politicization that could come with greater government control.

2. *The Long-Term Outlook for Social Security and Medicare*

Much of the popular discussion and political concern about the outlook for social security and Medicare focuses on the projected "insolvency" or "bankruptcy" of the system. These programs are now in surplus, taking in more in earmarked payroll taxes than they spend on benefits, thus reducing the overall federal budget deficit. But by the year 2010, according to the government actuaries, social security benefits will exceed the payroll tax receipts. The program will be in deficit and that deficit will exacerbate the overall deficit of the federal government. At that time, the social security program will begin to draw down the trust fund that it has been accumulating since the early 1980s, selling the bonds in the trust fund to the public. By the year 2030, the social security trust fund is projected to be exhausted.

6. There is of course an enormous literature on the effect of social security on saving for retirement. For a recent comment on this work, see Feldstein (1996a).
7. Because individuals differ in their tastes, circumstances, and life expectancy, a system of mandatory individual accounts can at best be right "on average" and not for each individual. Mandatory saving accounts therefore involve some inefficiency even if the average level is set correctly. The theoretical alternative of means-tested benefits would however also involve distortions to saving and labor-market behavior. An examination of these options lies beyond the scope of the current paper.
8. We recognize that some would reject the "privatize" label in this case because the government specifies the amount of the annual contributions and restricts the post-retirement payouts.

Although the talk of looming social security bankruptcy has increased interest in fundamental reform, these notions have little economic meaning. The social security and Medicare programs are said to be insolvent and potentially bankrupt because they use earmarked taxes and a trust fund. Other federal programs such as education and defense have no earmarked taxes and no trust fund and therefore cannot be seen as insolvent or bankrupt. Moreover, the trust fund is simply an accounting convention. Once benefits begin to exceed receipts, the social security program must borrow from the general public. The trust fund permits selling bonds that have in principle been previously set aside for this purpose. But the economic impact of the social security deficit will be the same after 2010 whether or not such a fund exists.

Because of the large size of the projected deficits in social security and Medicare, the accumulating debt and resulting debt service under current law would grow rapidly, placing an impossible burden on future generations. The implication of these deficits has been highlighted by the generational account calculations of Auerbach, Gokhale, and Kotlikoff (1991). They show that, with no change in existing programs and taxes, the generations born after the current year would in the aggregate bear *net* tax burdens of more than 80% of their personal incomes. Since this net tax burden is calculated as the difference between the taxes paid and the transfer payments received by those individuals, the actual tax rates they would face would be even higher. This way of describing the implications of the current system makes it very clear that the current arrangements are simply not viable.

The calculations of the Congressional Budget Office (1996) show the same thing in a more familiar and therefore perhaps more transparent way by contrasting the projected primary deficits (i.e., the deficits excluding interest on the national debt) and the projected total deficits including the interest on the national debt. The basic CBO forecasts are summarized in Table 1.

The primary deficit rises in parallel with the growth of the social security and health benefits for the aged, although at a somewhat slower rate. The primary deficits in turn cause the national debt to rise, and the interest on that higher debt leads to even faster growth of the national debt. It is this explosive growth of the national debt and the resulting interest cost that explains why the burden on future generations of taxpayers rises to such high levels in the generational accounting analysis. Table 1 shows clearly that, without the increased budget cost of the entitlement programs for the aged (or with an increase of taxes sufficient to fund their growth), the primary deficit would not increase and therefore the total deficit would not be on its explosive path.

Table 1 SOCIAL SECURITY, HEALTH BENEFITS, AND PROJECTED BUDGET DEFICITS

	Percentage of GDP			
Year	2000	2010	2030	2050
Social security	5	5	7	7
Medicare and Medicaid	5	6	10	12
Total	10	11	18	19
Primary deficit	−1	0	4	5
National debt	51	64	157	311
Total deficit	2	4	12	19

The true financial problem of the social security and Medicare programs is not the potential for insolvency under the existing system of earmarked taxes but the fact that, without fundamental reform, a major tax increase would be required to finance these programs as the population ages. The shift to a system of funded benefits based on individual accounts would avoid such a tax increase. As the analysis in the next section shows, the contributions to such accounts would be very much smaller than the taxes needed in a pay-as-you-go system. Moreover, because those contributions would be directly linked to the benefits that individuals would later receive, the distortionary effects and resulting deadweight losses would be further reduced.

3. *A Realistic Transition Path to Prefunded Social Security*

This section describes a method of shifting from the existing pay-as-you-go financing of social security retirement benefits to a fully prefunded system. The analysis is based on the demographic and economic predictions of the Bureau of the Census and the Social Security Administration, which are described in more detail in Feldstein and Samwick (1996, Section 4). We begin by describing how the funded system and the transition would look to a typical employee and then present the aggregate implications for tax rates, fund contributions, and the accumulation of the capital stock.

3.1 THE FULLY FUNDED SYSTEM IN THE LONG RUN

In the long run, the current pay-as-you-go (PAYGO) system would be replaced by a fully funded system in which employees over the age of 30 (and their employers) make annual contributions to IRA-type accounts

that we shall refer to as *personal retirement accounts* (PRAs).[9] The funds in these accounts would be invested in the individual's choice of stocks and bonds. The income and capital gains on these accounts would not be taxed at any time. In addition, the government would contribute to each account the extra corporate income tax that would be collected as a result of the increased saving. With this rebate of the corporate tax, the accounts would earn the full pretax real rate of return of 9%.[10] When the individual reached retirement age, the accumulated fund would be used to buy an annuity that earns the same rate of return.

The level of the annual PRA saving in our calculations is set so that the resulting annuity equals the benefits that would be paid under the current PAYGO system. This makes it easy to evaluate the gain from prefunding by focusing just on the amounts that employees (and their employers) would pay during their working years. In an actual program, contributions would probably be set at a higher level so that some of the gain from prefunding could be enjoyed during the retirement years.

The use of a 9% real rate of return in these calculations deserves further comment. The real pretax return on capital in the nonfinancial corporate sector can be estimated by comparing the sum of interest, dividends, retained earnings and all corporate taxes with the replacement value of the capital stock. For the years 1960 through 1994, this averaged 9.3%.[11] A 9% real pretax return is also consistent with the long-term portfolio returns with which most of us are more familiar. A portfolio of 60% equity and 40% debt (essentially the financing ratio of nonfinancial corporations) had a yield of about 5.5% over both the postwar period and the period since 1926. Since corporate taxes at the federal, state, and local level take approximately 40% of pretax debt and equity income (Rippe, 1995), a portfolio return of 5.5% of income corresponds to a pretax real return of about 9%. We return in Section 7 to discuss the implications of the riskiness of this rate of return.

With a 9% rate of return, the employer–employee contribution to the personal retirement account in the fully funded system that would be required over the long term to fund the benefits implied by current law

9. In our earlier paper (Feldstein and Samwick, 1996) we referred to these accounts as Mandatory Individual Retirement Accounts (MIRAs). We have renamed them here to avoid the mandatory label because, in principle, individuals would be able to decide whether or not they wanted to save in this way or to continue with the existing PAYGO system.

10. An alternative analysis in which the government does not rebate the extra corporate revenue is discussed later in this section.

11. See Rippe (1995). Poterba and Samwick (1995) found a value of 9.2% for the years 1947 through 1995 and of 8.5% for the more recent period when they ignored property taxes paid by corporations.

would be just 2.02% of covered wages (instead of the 18.75% required in a PAYGO system.[12] Since this figure is the result of a complex simulation embodying many economic and demographic assumptions, it is useful to consider a simple "back of the envelope" calculation that shows the plausibility of this remarkable difference. Consider therefore an individual who saves at age 45 (representing the midpoint of the years when the individual is working and contributing) and subsequently dissaves at age 75 (representing the midpoint of the retirement years). Over this 30-year interval, one dollar grows at 9% to $13.27. In contrast, as Paul Samuelson (1958) taught the economics profession many years ago, the PAYGO system provides a return equal to the rate of growth of the tax base, i.e., to the rate of growth of average wages plus the rate of growth of the number of labor-force participants. Using the 1.1% growth rate of GDP assumed for the long run by the social security actuaries[13] implies that one dollar of PAYGO contributions at age 45 produces benefits of $1.35 at age 75. For every dollar of tax that must be paid in a PAYGO system, a fully funded system requires only 1.39/13.27 = 0.105 dollars. Thus an 18.75% payroll tax could be replaced by a 1.97%-of-payroll contribution to a PRA. This calculation produces a result that is remarkably close to the 2.02% PRA contribution calculated with our much more elaborate model.

If the government does not rebate the incremental corporate tax revenue that results from the additional PRA saving, the rate of return on the PRA accounts will be 5.4%. In the long run this would require PRA contributions of 5.67% of payroll, significantly higher than the 2.02% of payroll with the full 9% rate of return, but still very much lower than the 18.75% tax with the PAYGO system. Of course, the government would have the extra 3.6% of the accumulated PRA balances in new tax receipts with which to reduce other taxes or to increase other government spending.[14]

In Section 8 we discuss the uncertainty of the portfolio return on the

12. The 18.75% is our estimate (see Table 2), but replicates the calculations of the Social Security Administration.

13. See Committee on Ways and Means (1996, p. 69). Such a long-term rate of GDP growth may seem surprisingly low relative to the 3.1% growth over the past four decades. But the recent decades have been characterized by several trends (a rapid growth of working-age population, increases in female labor-force participation, and the rise in educational attainment) that cannot continue indefinitely. Although we know of no other careful forecasts stretching 75 years into the future, it is interesting that the 25-year forecast by Data Resources shows GDP growth declining gradually to 1.4 percent in 2020.

14. The 5.4% rate of return would be the full national rate of return on the PRA saving if that saving replaced foreign capital in the United States or were itself invested abroad. The well-known Feldstein–Horioka (1980) evidence implies that this is not the relevant case.

assets in the PRAs and show that individuals can be virtually certain (i.e., a probability greater than 0.99) to receive at least as much from a funded annuity as they would have in social security benefits if they contribute less than 3% of covered earnings instead of the 18.75% payroll tax that would be required in the PAYGO system. Until Section 8 we ignore risk in our calculations.

3.2 THE BASIC TRANSITION PROCESS

The prospect of making a very low contribution to a PRA instead of paying a much higher payroll tax in a PAYGO system is obviously very appealing. An important practical consideration, however, is the nature of the transition from the existing system to this long-run steady state. A common concern is that the transition generation must "pay twice," i.e., must continue to pay for the existing retirees while also saving for their own retirement. Since the social security payroll tax (excluding the Medicare portion) is now 12.4% of covered wages, this appears to imply that the current generation would be required to pay more than 24%. Fortunately, that perception is false.

Consider for example the following simple method of phasing in a prefunded system by extending it to one annual birth cohort each year: the current 30-year-olds begin prefunding their retirement in year 1 of the transition, they are joined in year 2 by those who then are 30 years old, etc. It is clear that the extra tax that this transition generation would have to pay (in addition to the regular PAYGO tax) would be the 2% of payroll required to fund their own retirement on the assumption that they would receive no PAYGO benefits.

Such a transition is of course very slow and denies the benefits of prefunding to everyone who is over the age of 30 at the time that the transition begins. Because prefunding is introduced so slowly, the present value of the benefit of the transition is less than it could be with a more rapid phase-in. A variety of alternative transition paths are possible. We have selected one to explore what we think combines a moderate pace of phasing in with a relatively low maximum extra contribution rate that starts at only 2.0% of payroll and then declines.

Before we analyze this particular transition path to a prefunded system, it is helpful to consider a simpler and more rapid transition in which there is no phase-in but instead an immediate and complete shift to the funded system for all employees. Retirees continue to receive their PAYGO benefits, and those employees who have contributed PAYGO taxes in the past continue to receive corresponding PAYGO benefits when they retire. For those who are over age 30 when the transition

begins,[15] the funding contributions are set so that the combination of their prefunded annuity and the PAYGO benefits will equal the social security benefits provided in current law.

During the transition to a fully funded system, each employee (and his/her employer) would continue to make payroll tax payments. The amount of the PRA contribution would be taken as a credit against a total payroll tax obligation, thereby making it costless to the individual to contribute the necessary amount to the PRA. The *total* payroll tax rate would be set in each year so that the *net* payroll tax available after subtracting the PRA contributions would fund the existing social security obligations.[16]

Consider first those individuals who are less than 30 years old when the transition begins. Since an employee at age 30 is deemed to have accrued no rights to future PAYGO benefits,[17] as each birth cohort reaches age 30, each individual in that age group would contribute to his or her PRA an amount that, accumulating at 9%, would finance an annuity at age 65 (also with a yield of 9%) that produces the same benefits as would have been provided by the social security system under existing law. The annual contribution rate of this group would remain constant as they age; i.e., they would buy their retirement annuities with a level premium as a percentage of wage. This group would receive no PAYGO benefits when they retired.

Those employees who are older than 30 when the transition begins would also contribute to PRAs, but at retirement would receive a mixture of PAYGO benefits and PRA annuity payments. Their PAYGO benefits would be based on the payroll taxes that they had paid during the years before the transition to the funded system began.[18] The gap be-

15. We focus on age 30 because current social security rules base benefits on the taxes paid during the 35 years of highest earnings, typically between 30 and 64. We therefore assume that individuals do not contribute to the prefunded accounts until they reach age 30.
16. Initially the payroll tax rate would be the sum of 12.4% and the required aggregate PRA contributions. When the trust fund is exhausted, the total payroll tax rate would be set as the sum of the tax required to meet the remaining PAYGO obligations and the required aggregate PRA contributions.
17. See footnote 15.
18. The rate of return imputed to these payroll tax payments would be the rate of return that individuals in their birth cohort would expect to receive on their lifetime tax payments in the existing unfunded system. Although the long-term implicit rate of return is the Samuelsonian growth of the tax base, the actual rate of return varies by birth cohort. We use an updated version of the estimated rates of return derived by Boskin, Kotlikoff, Puffert, and Shoven (1987) that we have described in Feldstein and Samwick (1996, Section 4.3). This implicit return declined from 7.0% among individuals born before 1915 to less than 1.5% among individuals born after 1960.

tween these PAYGO benefits and the benefits that they would receive in the existing unfunded system would be filled by the PRA annuity. There would be no change in their combined PAYGO plus PRA benefits. The only thing that would change is the source of the benefits. The PRA contributions would be set so that, with a 9% real return, they would provide the required level of annuity payments.

This method of calculating each individual's PRA contribution means that during the transition the PRA contribution rate depends on the individual's birth cohort. A 55-year-old, for example, would contribute 3.52% of his covered earnings, while a 40-year-old could contribute 2.05%. Since these PRA contributions would be credited against the individual's total payroll tax liability, these differences in PRA contributions would not translate into differences in total obligations. The payroll tax rate would instead be adjusted uniformly for everyone.

3.3 A GRADUAL PHASE-IN TO A FULLY FUNDED SYSTEM

The transition path that we have analyzed in detail involves a gradual phased introduction to the funded system over a 25-year period. The basic idea of the phase-in is to start with PRA contributions that are 25% of the basic amount (i.e., the amount called for in the immediate phase-in described in Section 3.2) and to increase that fraction by 3 percentage points a year until it reaches 100% at the end of 25 years.[19] Thus, new employees reaching age 30 continue to participate in the PAYGO system for 25 years after the transition begins. Only after the 25th year of the transition do the new 30 year olds cease to accrue PAYGO benefits and new retirees come to depend wholly on their PRA annuities.

Note that this procedure continues to raise the same amount of PAYGO revenue as under current law. This permits maintaining the same benefit payments to existing retirees and the same path of the trust fund (and therefore of the government debt) as under the existing PAYGO program. The incremental payroll tax is fully offset by the credits for "voluntary" contributions to the PRA accounts.

Our calculations (based on the detailed assumptions described in Section 4 of Feldstein and Samwick, 1996) indicate that in the first year of

19. Since each birth cohort pays a level percentage of its earnings, this leads to a phase-in by birth cohort. The oldest birth cohort (those who are 64 in the first year of the transition) contribute only 25% of the full amount. Those who are 63 years old in the first year contribute an appropriately weighted average of 25% and 28% of their earnings for two years before retiring. Those who are 62 contribute approximately 28% of their earnings (an appropriately weighted average of 25%, 28%, and 31%) for the 3 years before they retire.

this phased-in transition[20] the total of all PRA contributions would be equal to 2.00% of payroll.[21]

The second year of the transition differs from the first primarily in that those who become 65 have accumulated some funds in their PRAs.[22] The annuity that these PRA balances generate replaces some of the PAYGO benefits. This in turn permits a smaller PAYGO tax.[23]

In each successive year, the number of retirees with PRA annuities increases and the average size of the annuities increases because the retirees have had more years in which to accumulate PRA balances.

The first phase of the transition is complete at the end of 25 years, when all those reaching age 30 make the full PRA contribution and no longer anticipate receiving any PAYGO benefits. The second phase of the transition is complete at the end of 60 years, when all new retirees have completely prefunded their retirement benefits and do not receive any PAYGO benefits. The only PAYGO benefits paid after the 60th year are to those older retirees who were more than 5 years old when the transition began and who would therefore have earned PAYGO benefits by the taxes they paid before the 60th year of the transition.

Despite this very long phase-in, most of the adjustment occurs in the first 20 years. By year 19, the total of the PRA contributions and the payroll taxes required to meet PAYGO benefit obligations is less than the 12.4% payroll tax under the current PAYGO program.

Table 2 shows some of the key statistics at selected years from the first year to the 75th year. The first row shows the baseline PAYGO tax rate that would be required with no shift to prefunding. The rate continues at 12.4% until the trust fund is exhausted (in year 35) and then rises to the level required to fund benefits in each year: 16.22% in year 55, and 18.75% in year 75.

Subsequent rows refer to the phased-in transition to the funded PRA plan (in which each retiree receives in each year a combination of PAYGO benefits and PRA annuity payments that together equal the benefits provided in current law). Row 2 shows the net PAYGO tax rate needed to

20. The transition is calibrated to actual demographic and economic data with 1995 as the first year of the transition.
21. This 2.00% includes both employer and employee contributions; since this division will always occur and is of no real economic significance, we shall not refer to it again.
22. The required PAYGO tax is of course affected by demographic and income changes from year to year.
23. As a practical matter, the annuity benefits after just one year of PRA contribution would be so small relative to the administrative costs that it would be more sensible to exclude everyone over some age (say 55) from participating in the transition. To simplify the description, we do not impose any such limit.

Table 2 TRANSITION PATH OF TAX RATES, PRA CONTRIBUTIONS, AND BENEFITS

Year[a]	*1*	*5*	*10*	*15*	*25*	*35*	*55*	*75*
1. Tax rate with unfunded system[b]	12.40	12.40	12.40	12.40	12.40	12.40	16.22	18.75
2. Net tax rate[b]	12.40	12.35	12.12	11.62	9.23	5.29	2.77	0.20
3. PRA contribution rate[b]	2.00	1.85	1.69	1.57	1.48	1.62	1.93	2.02
4. Combined tax and PRA contribution rate[b]	14.40	14.20	13.81	13.18	10.71	6.91	4.69	2.23
5. PRA benefit (billions of 1995 $)	0	1	10	29	135	338	813	1385
6. Payroll/employee (thousands of 1995 $)	20.73	21.57	22.67	23.83	26.32	29.07	35.48	43.29
7. Covered earnings (billions of 1995 $)	2927	3156	3453	3752	4273	4789	6064	7526

[a]1995 is year 1.
[b]Percent of covered earnings.

meet the concurrent PAYGO benefit obligations. The tax rate declines gradually from 12.4% in the first year of the transition to 11.62 % in year 15 and 9.23% in year 25. By year 55, the PAYGO tax of only 2.77% of payroll finances all of the concurrent benefit obligations. By the 75th year, the PAYGO tax is less than 1% of payroll.

The third row shows aggregate PRA contributions as a percentage of payroll, starting with 2.0% of covered earnings in year 1. The PRA contribution rate then declines to a low of 1.48%, reflecting changes in the demographic composition and the number of years that individuals have to accumulate annuity funds.[24] In the long run, the PRA contribution is relatively stable at 2.02% of covered earnings.[25]

Row 4 combines the net PAYGO tax and the aggregate PRA contribution and shows the combined mandatory payment, starting with 14.4%

24. Two principal factors are at work in determining the PRA rate in each year: the phase-in of the PRA share from 25% to 100% of the basic PRA amount raises the aggregate PRA, rate while the decreasing number of individuals who begin to participate at an older age reduces the aggregate PRA rate.
25. With the 5.4% rate of return on the PRA accounts that would be possible without the government's rebate of incremental tax revenue, the first-year PRA contribution would be 3.93% of payroll.

in the first year, just two percentage points of payroll more than the current unfunded system. The excess declines gradually, and the total mandatory payment drops below the initial 12.4% in year 19. By the 25th year, employees are paying 1.69% of payroll less than they would with the existing 12.4% payroll tax. The favorable difference between the tax under the existing unfunded system (row 1) and the combined payments in the transition to the fully funded system then grows rapidly. By year 35, the combined PAYGO tax and PRA contribution rate is just 6.91%, just slightly more than half of the PAYGO tax under the current unfunded system.

Comparing rows 5 and 7 shows that PRA benefits are only about 1% of covered earnings in year 15 but rise rapidly to 7% of payroll in year 35 and 18.4% of payroll in year 75, replacing virtually all the PAYGO benefits.

3.4 BEHAVIORAL RESPONSES AND THE SIZE OF THE TAX BASE

The analysis of Table 2 does not reflect the effect of tax rates on the amount of taxable income that individuals earn.[26] 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 better working conditions for taxable cash compensation. The future increase in the payroll tax rates in the PAYGO system would cause a further reduction in taxable payroll earnings. In contrast, the shift to a prefunded system would reduce the tax distortion and cause a rise in taxable earnings.

We model these changes in taxable income as the product of an elasticity and the change in marginal net-of-tax wage (i.e., one minus the effective marginal tax rate). The effective marginal tax rate in the system includes the federal and state personal income tax rates, the effective state and local sales tax rates, and the *net* payroll tax rate (including the portion needed to offset the PRA credits). We assume (quite conservatively) a 20% rate for taxes other than the payroll tax. The *net* payroll tax rate and the tax equivalence of the PRA contribution require more careful descriptions.

The net PAYGO payroll tax rate is the difference between the payroll tax payment (12.4% until year 2030 and then the rates shown in row 1 of Table 2) and the amount that the individual would have to pay to purchase the same benefit at the rate of return available in private pensions or 401 (k) plans. For example, if the payroll tax payment is 12.4% but the same benefits could be purchased in a private annuity for a premium

26. This discussion follows the analysis previously presented in Feldstein and Samwick (1996, Section 5.3).

equivalent to 5% of payroll, the *net* payroll tax is really 7.4% and the remaining 5% can be thought of as saving.

The cost of purchasing the same benefit privately (i.e., the analogue of the 5% in the preceding example) is calculated as follows: if the implicit rate of return that the individual earns on the social security payroll taxes is denoted γ, a dollar of payroll tax paid at age a grows to $(1 + \gamma)^{65-a}$ at age 65. If ann65(γ) 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 $(1 + \gamma)^{65-a}$/ann 65(γ). To purchase the same annuity with a private pension plan that earns a return of μ, an employee or employer would have to spend only $[(1 + \mu)^{65-a}/\text{ann } 65(\mu)]^{-1}$. 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% and a corporate tax rate (including state and local property taxes) of 40% imply $\mu = 5.4\%$; this is of course close to the 5.2% return earned on a market-weighted mix of stocks and bonds over the past four decades.

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 $\gamma = 1.39\%$, each dollar of payroll tax could be replaced by only 21.6 cents of contribution to a private pension fund. This implies that 78.4% of the 12.4% payroll tax is a pure tax. More generally, we define the effective *net* payroll tax rate as $\{1 - [(1 + \gamma)/(1 + \mu)]^{65-a}[\text{ann65}(\mu)/\text{ann65}(\gamma)]\}\tau_p$, where τ_p is the payroll tax rate (currently 0.124). Alternatively, we write the effective net payroll tax rate as $\tau_p - \beta$, where $\beta = [(1 + \gamma)/(1 + \mu)]^{65-a}[\text{ann65}(\mu)/\text{ann65}(\gamma)]\tau_p$ is the present actual value of the benefit per dollar of incremental taxable earnings. 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 denote this 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 $N_0 = 0.703$.

Consider now the net-of-tax share during the transition to a funded system. An individual who earns an additional dollar of wage income in year t must then pay, in addition to income tax at rate θ_t, (1) a payroll tax at rate τ_{pt} to finance the remaining PAYGO benefit obligations and (2) a payroll tax surcharge to offset the revenue lost because individuals reduce their payroll tax obligations by the amount of their PRA contributions. We denote the combined PAYGO tax and PRA contribution rate (shown in row 4 of Table 2) by τ_p^*. The individual's net-of-tax share becomes $N_1 = 1 - \theta - \tau_p^* + \beta$, where β is the same as in the current system, since the value of the benefits is unchanged by switching to the

PRA system.[27] When the transition to the funded system is complete and no further PAYGO benefits are being paid, the value of τ_p^* becomes the PRA contribution rate (which, by assumption, is constant over the working life of each birth cohort.)

We assume that taxable income responds to changes in the net-of-tax share with an elasticity of 0.5.[28] This 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 at the tax rate τ_p with the initial labor supply can be collected at a lower tax rate $\tau_p' = \tau_p(N_1 / N_0)^{-0.5}$ if $N_1 > N_0$. Similarly the personal income tax rate that yields the same revenue falls to $\theta' = \theta(N_1 / N_0)^{-0.5}$.

The path of the tax rates is shown in Table 3. The first two rows compare net-of-tax shares under the existing PAYGO system (with the tax increased to maintain benefits after the trust fund is exhausted) and along the transition path. The next two rows show the payroll tax rates with no behavioral response (row 3) and with the behavioral response implied by the change in the net-of-tax share (row 4). Note that this is the pure payroll tax (excluding the PRA surcharge) needed to maintain the trust fund along the projected path (and at zero after it is exhausted). The personal income tax rate with behavioral response is shown in row 5; with no behavioral response, the rate is a constant 0.20. Row 6 shows the combined payroll and personal tax rates and the PRA contribution.

The combination of the PRA contribution and the unchanged year-1 payroll tax causes the net-of-tax share to fall initially, and that causes taxable earnings to decline. The effect is small and is offset by raising the payroll tax rate from 12.40% to 12.58%. Similarly, the personal income tax

27. It is tempting to ask: "What about the high return that the individual receives on his PRA contribution? Doesn't that act as a negative marginal tax that should be taken into account? For example, in the first year an individual not only pays the PAYGO tax and the PRA surcharge (14.4%, shown in row 4 of table 2) but also contributes an amount to his PRA account which earns a high 9% rate of return. Shouldn't this reduce the net marginal tax rate and imply a higher net-of-tax share?" Unfortunately, the answer to this is no. Any individual who earns an *extra* $100 in year one of the transition pays 14.4 dollars in combined payroll tax and PRA contribution but earns the *same incremental* benefits in retirement as would be earned under the existing PAYGO system. This individual's own PRA contribution does not affect his benefits but lowers the future PAYGO taxes of those who will be working when he retires. Participating in the transition also means that PRA contributions paid by others who are older than he will reduce his PAYGO taxes, but the extent to which that happens does not depend on his own earnings.

28. The relevant elasticity is not just the traditional elasticity of working hours with respect to the net-of-tax wage, but includes a broader definition of labor supply (including effort, occupation, risktaking, etc.) and the change in taxable income that comes from changes in the form of compensation. Although estimates of this elasticity with respect to changes in the income tax are between 1.0 and 1.5 for high-income individuals (Feldstein, 1995a; Auten and Carroll, 1994), we are dealing here with low- and middle-income individuals and with the payroll tax rather than the income tax. We are therefore quite conservative and assume an elasticity of only 0.5.

Table 3 EFFECTS OF TAXPAYER BEHAVIOR ON TAX RATES AND DEADWEIGHT LOSS[a]

Year[b]	*1*	*5*	*10*	*15*	*25*	*35*	*55*	*75*
1. Net-of-tax share in PAYGO system	71.61	71.49	71.39	71.32	71.27	71.29	67.48	64.96
2. Net-of-tax share in transition to funded PRA system	69.61	69.70	69.98	70.54	72.96	76.78	79.07	81.49
3. Payroll tax rate with no behavioral response	12.40	12.35	12.12	11.62	9.23	5.29	2.77	0.20
4. Payroll tax rate with behavioral response	12.58	12.51	12.24	11.68	9.12	5.10	2.55	0.18
5. Personal income tax rate with behavioral response	20.29	20.26	20.20	20.11	19.77	19.27	18.47	17.85
6. Combined payroll and personal tax rates with behavioral response plus PRA contribution	34.87	34.62	34.13	33.36	30.37	25.99	22.95	20.05
7. Change in deadweight loss	0.52	0.47	0.36	0.20	−0.39	−1.15	−2.58	−3.75

[a]Percent of covered earnings.
[b]Year 1 corresponds to 1995 in the underlying demographic and economic data.

rate only has to be raised from 20% to 20.29%. By year 20 the increased taxable income causes the combination of the payroll tax rate (10.66%) and the PRA contribution (1.52%) to be lower than the initial 12.4%. By year 40, the personal income tax rate is reduced from 20% to 19%. The payroll tax rate is also reduced by one-twentieth, from 7.44% to 7.07%.

The variations in the combined rates of payroll and personal income taxes (including the PRA contribution) cause changing distortions in labor markets and variations in the deadweight loss of the tax system. These changes in deadweight loss are shown in row 7 of Table 3. We return to discuss them in Section 4.

3.5 EFFECTS ON CAPITAL INTENSITY, THE RATE OF RETURN, AND THE DISTRIBUTION OF INCOME

Before considering the welfare economics of the PRA transition and the generational distribution of benefits and costs, we examine some of the macroeconomic implications of the transition to a funded system. A

common criticism of calculations of the type presented in Sections 3.3 and 3.4 is that they assume a fixed 9% marginal product of capital (MPK), whereas the process of capital accumulation in PRA accounts would cause the MPK to decline. We analyze that in the current section, calculating also the effect on national income and real wages of shifting to a funded system.

To achieve maximum transparency of this analysis, we begin by looking at the path of accumulated aggregate PRA balances on the assumption that nothing else is changed. This corresponds to the economic assumptions implicit in Table 2. The aggregate PRA balance grows because of PRA contributions and the 9% return on the PRA balance and is diminished by the payment of PRA annuities. Row 1 of Table 4 repeats the aggregate PRA contribution as a percentage of covered earnings. Row 2 shows the net flows into the PRA accounts, i.e., the difference between contributions and PRA annuities. This net inflow declines from the very beginning and becomes negative in the 20th year because the earnings on the PRA balances are more than enough to achieve the needed growth of the PRA fund. Aggregate PRA balances as a fraction of

Table 4 EFFECTS OF PRA ACCUMULATION ON THE CAPITAL STOCK AND THE MARGINAL PRODUCT OF CAPITAL

Year[a]	*1*	*5*	*10*	*15*	*25*	*35*	*55*	*75*
1. PRA contributions (percent of payroll)	2.00	1.85	1.69	1.57	1.48	1.62	1.93	2.02
2. Net inflow to PRA accounts (percent of payroll)	2.00	1.80	1.41	0.79	−1.66	−5.43	−11.48	−16.37
3. Aggregate PRA balance (percent of payroll)	2	11	25	41	82	123	188	230
4. Percentage increase in capital stock	0.30	1.63	3.70	6.07	12.14	18.20	27.82	34.04
5. Marginal product of capital	8.98	8.89	8.76	8.61	8.26	7.94	7.49	7.22
6. Percentage increase in real wage rate	0.07	0.40	0.91	1.48	2.90	4.27	6.33	7.60
7. Percentage increase in real disposable wage	−2.89	−2.27	−1.19	0.31	5.48	12.74	25.55	36.62

[a]Year 1 corresponds to 1995 in the underlying demographic and economic data.

payroll are shown in row 3, increasing from the initial 2% of payroll to 100% of payroll in year 28 and to 2.3 times payroll in the long run.

To understand the possible effect of the accumulating PRA assets on the marginal product of capital, we calculate the percentage change in the capital stock that would occur if the capital stock rises dollar for dollar with the aggregate PRA balance. To estimate the baseline capital stock under the existing PAYGO system, we assume that the current ratio of covered earnings to GDP remains unchanged at 0.40 and that the current ratio of the GDP to the capital stock remains unchanged at 0.37. These assumptions imply that the baseline capital stock is 6.76 times covered payroll. Comparing the aggregate PRA balances in row 3 with this baseline capital stock implies the potential rise of the capital stock shown in row 4: 12% in year 25, 28% in year 55, and an essentially stable 34% after the 75th year. With a Cobb–Douglas technology and a capital share of 0.25, the marginal product of capital declines from 9.0% with the existing capital stock to 8.3% in year 25, 7.5% in year 55, and 7.2% in year 75.

Thus, even with the assumption that PRA assets add dollar for dollar to the capital stock, the decline in the marginal product of capital in the very long run is only from 9% to 7.2%. Substituting a 7.2% rate of return for a 9% return (for the entire transition period) only raises the long-run contribution rate from 2.02% of payroll to 3.40% of payroll, still less than one-fifth of the long-run PAYGO tax rate.

The increase in the capital stock shown in row 4 and the Cobb–Douglas technology imply that the real wage rate is 2.90% higher in year 25 and 7.6% higher in the very long run. These are shown in row 6 of Table 4. These are of course also the proportional increases in the real GDP.

Although the assumption of the Cobb–Douglas technology implies that the shares of capital and labor in GDP remain unchanged, there is a substantial redistribution of capital income. All of the extra capital income is dedicated to paying retirement benefits on wages up to about the 90th percentile of the wage distribution. The decline in the rate of return depresses the capital income of the owners of "old capital." Since this "old capital" is generally owned by those with higher incomes, the shift to a funded system would involve a one-time market-driven redistribution from old-capital owners to workers and an ongoing decline in the return that higher-income individuals get on their savings.

It is interesting to combine the real-income and tax-rate effects to calculate the full effect of the shift to a funded system on the disposable income of employees. With the current PAYGO system, the combination of the 20% income tax and the long-run payroll tax of 18.75% implies that a pretax income of 100 produces disposable income of 61.25. With

the fully funded system, the pretax income is increased to 107.6. If the PRA contribution of 3.40% replaces the PAYGO tax of 18.75%, disposable income rises from 61.25 to 82.45, an increase of more than one-third.[29] The time path of such increases is shown in row 7 of Table 4. Note that the assumptions of the calculation imply that the retirement income would increase by the same proportion as the real wage, i.e., by 7.6% in the long run. It would of course be possible to reduce consumption during the working years to balance the increases in retirement and preretirement consumption.

3.6 ENDOGENOUS RESPONSE OF PERSONAL SAVING BEHAVIOR

In the early part of the transition, individuals experience a decline in lifetime income because the sum of the payroll tax and the PRA contribution rises while benefits remain unchanged. Later in the transition and in the long run, individuals have higher lifetime incomes because the PRA replaces the higher payroll tax. Traditional rational life-cycle saving behavior would imply that people respond to their reduced disposable income by cutting saving in order to spread the reduction in consumption to retirement years.

In fact, however, American households generally do not have the financial assets with which to reduce their saving. Even for those near retirement, the median financial assets is less than one-half of a year's earnings. We have therefore chosen to ignore the potential response of saving to changes in current and future taxes.

Of course, as the transition is completed, the rise in lifetime incomes implies that individuals would want to save more during their working years to raise the level of retirement consumption. We also do not take this into account.

4. *The Welfare Economics of Funding Social Security Benefits*

When the transition from a PAYGO system to a funded system of financing a given set of retirement benefits has been completed, each birth

29. This calculation assumes the value of the PRA contribution that would prevail in the long run when all PAYGO retirees are gone and when the increased capital stock reduces the marginal product of capital to 7.2%. The corresponding figure for year 75 in row 7 of Table 4 is based, like all of the other figures in Table 4, on the assumption of a 9% rate of return (and therefore a PRA contribution of only 2.02%.) A different possibility for year 75 would be to recognize that some PAYGO benefits must still be financed; with a 7.2% marginal product of capital and PAYGO benefits of 0.20% of payroll, the 18.75% PAYGO tax would be replaced by a combination of PRA contribution and PAYGO tax of 3.61%; even in this case, the real disposable income would rise by 34%.

cohort is better off in two important ways. First, the PRA contributions require a much smaller annual payment than the corresponding PAYGO payroll tax to finance the same benefits. This is a first-order effect that would exist even if the existing PAYGO tax did not cause a deadweight loss by distorting economic decisions. Second, substituting the smaller PRA contributions for the much higher PAYGO tax reduces the deadweight loss that results from distortions to labor supply and to the form of compensation. This is also a first-order effect because the payroll tax is incremental to the personal income tax, implying that the resulting deadweight losses are first-order trapezoids rather than second-order triangles.[30]

These permanent long-run gains are paid for in part by temporary increases in taxes and in deadweight burdens on the birth cohorts in the labor force during the early part of the transition. This section discusses the path of changes in tax payments and deadweight losses and presents alternative present-value calculations.

The dollar values of the annual changes in the deadweight loss are estimated using the traditional Harberger–Browning approximation: $\Delta DWL = 0.5\epsilon(t_0^2 - t_1^2)(1 - t_0)^{-1}E$, where E is the current payroll tax base, $t_0 = 1 - N_0 = \theta + \tau_p - \beta$ (the marginal tax rate with the existing system), and $t_1 = 1 - N_1 = \theta + \tau_p^* - \beta$ (the marginal tax rate with the PRA system and in the transition). These values are presented in row 7 of Table 3.

At first, the increase in the combined payroll tax and PRA contribution raises the annual deadweight loss of the tax system. In the first year, the increase is 0.52% of covered wages. Individuals are thus worse off in the first year, both because they are paying 2.00% of their wages in additional mandatory contributions (as shown in row 3 of Table 2) and because doing so increases the deadweight loss by 0.52% of payroll. The PRA surcharge and the deadweight loss then decline rapidly. The extra deadweight loss is halved by year 13 and is completely gone by year 18. By year 25, the lower combined value of the payroll tax and the PRA contribution ($\tau_p^* = 0.1071$ as shown in row 4 of Table 2, instead of $\tau_p = 0.124$) reduces the year's deadweight loss of the tax system by 0.39% of covered wages; the individuals' total burden in financing retirement consumption is thus down by 2.08% of covered wages.

30. There is a third effect on employees: the increased capital stock that results from the accumulating PRA balances raises the marginal product of labor and therefore the real wage of employees. However, since this is (to a first-order approximation) balanced by a decline in the return on the existing capital stock, we ignore this rise in wage income. More formally, with no induced change in labor in each year $Y = f(K,L)$ implies $dY = f_K\, dK = r\, dK$. Allowing for second-order effects (on factor prices) implies $dY = r\, dK + K\, dr + L\, dw$, since $dL = 0$. Thus $L\, dw = -K\, dr$, and these two effects can be ignored in evaluating the change in national income.

By year 55, the combination of the payroll tax and the PRA contribution is down to just 4.69% (vs. an otherwise required PAYGO contribution in that year of 16.22%), and the resulting reduction in the deadweight loss is 2.58% of earnings, implying a total reduction in the net burden equal to 14.11% of wages.

Note particularly that by the 75th year the total cost of financing the retirement benefits is only 2.23% of wages, while the reduced deadweight loss associated with the reduced cost of financing is 3.75% of wages. Thus the reduced deadweight loss is more than enough to pay for the entire PRA contribution. The net gain to the individual is thus more than 20% of covered payroll: the shift from the 18.75% projected payroll tax to the combined payroll tax residual (of 0.20% of payroll) and the PRA contribution (of 2.02%), a gain of 16.52% of payroll, plus the associated 3.75%-of-payroll reduction in the deadweight loss associated with labor-market distortions.

Table 5 shows the estimated present values of the gains from shifting to funded retirement benefits. The analysis distinguishes the present value of the reduced tax and PRA contributions (row 1) and the reduced deadweight loss (row 2). The present-value calculations take into account not only the difference in the tax rate ($\tau_p - \tau_p^*$) but also the growing level of taxable earnings (E). Thus the present value of the increased spendable income that results from the transition to a funded system with unchanged benefits is $\Sigma(\tau_p - \tau_p^*)E_t(1 + \delta)^{-t}$, where E_t is the level of aggregate taxable earnings and δ is the discount rate. Similarly the present value of the changes in the deadweight losses is $\Sigma\ \Delta\text{DWL}_t\ (1 + \delta)^{-t}$,

Table 5 PRESENT VALUE OF DEADWEIGHT LOSS REDUCTIONS

Discount rate	2%			3%			4%		
Years	1–75	75+	All	1–75	75+	All	1–75	75+	All
Billions of 1995 $									
1. Reduced tax	10,385	32,672	43,057	5,890	7,518	13,408	3,344	2,410	5,754
2. Reduced DWL	2,343	8,104	10,447	1,324	1,865	3,189	746	598	1,344
3. Total gain	12,728	40,776	53,504	7,214	9,383	16,597	4,090	3,007	7,097
Percent of 1995 covered wages									
1. Reduced tax	355	1116	1471	201	257	458	114	82	196
2. Reduced DWL	80	277	357	45	64	109	25	20	45
3. Total gain	435	1393	1828	246	321	567	139	103	242

where the annual change in the deadweight loss [$\Delta DWL = 0.5\varepsilon(t_0^2 - t_1^2)(1 - t_0)^{-1}E$] is discussed above. The discounting is to 1995, the first year of the transition, and the discounted values are stated both in 1995 dollars and as percentages of covered earnings in 1995.

The appropriate rate of discount should reflect the rate at which the marginal utility of additional consumer income declines over time as incomes rise. A projection that real per capita income will rise at about 1% a year suggests a discount rate of 2% (if the elasticity of the marginal utility function is taken to be 2) or 3% (if the elasticity of the marginal utility function is taken to be 3). Results are also presented in Table 5 for a discount rate of 4%.[31]

Although numerical simulation results are available for only 75 years, the gain from shifting to a funded program continues beyond that time. Without the shift, the heavy burden of financing retirement income by a high payroll tax and the associated deadweight loss would continue indefinitely. To estimate the present value of the gain associated with the period after the first 75 years, we assume that without the shift the PAYGO tax rate projected for year 75 under the existing system (18.75% of covered wages) would continue indefinitely after that date, whereas with the shift to a funded system the benefits after year 75 would continue to be financed with a PRA contribution of 2.02% of covered wages (the projected value for year 75). If aggregate wages grow at g% a year after year 75 and the benefits of funding are discounted at rate δ, the present value of the reduced payments is

$$V_1 = (1 + \delta)^{-74}(\tau_p - \tau_p^*)E_{75}\sum_1 \left(\frac{1 + g}{1 + \delta}\right)^t, \tag{4.1}$$

where the summation is from $t = 1$ to $t = \infty$, τ_p is the long-run PAYGO tax rate of 18.75%, τ_p^* is the long-run PRA contribution rate of 2.02%, and E_{75} is the aggregate level of covered wages in year 75 ($7526 billion in 1995 dollars). Similarly, the present value of the deadweight loss reductions after year 75 is

$$V_2 = (1 + \delta)^{-74}0.5\varepsilon(t_0^2 - t_1^2)(1 - t_0)^{-1}E_{75}\sum_1 \left(\frac{1 + g}{1 + \delta}\right)^t. \tag{4.2}$$

31. A discount rate of 4% would of course correspond to a marginal-utility elasticity of 2 if the rate of growth of real per capita income were 2. Although this was the case in the past and frequently led to the choice of a discount rate of 4%, the lower real growth rate now projected for the future implies that the discount rate should be reduced accordingly. See footnote 13.

Using the social security actuaries' prediction that the growth rate of aggregate wages in the middle of the twenty-first century will be only about 1.1% a year implies the V_1-values shown in row 1 of Table 5.

With the 3% discount rate, the overall present-value gain from shifting to a funded system is $16.6 trillion at 1995 prices. Most of this net gain (about 80%) is the result of the "reduced tax" (i.e., reduced cost of funding retirement benefits), and the remainder is the reduction in the deadweight loss. About half of the present-value gain is associated with the first 75 years, and the remainder with the years that follow. A 4% discount rate cuts the gain from funding approximately in half but still leaves a very large $7.1 trillion present-value gain, with 60% of that gain in the first 75 years. As the discount rate approaches the growth rate, the gain becomes explosively large; this is seen with a discount rate of 2%, implying a welfare gain from funding of more than $50 trillion.

The important implication of these calculations is that even though the combined payroll tax and PRA contributions have to rise in the early decades of the transition, the present value of the net gains and losses is clearly a very substantial positive number.

5. *Net Gains by Birth Cohort and the Possibility of a Pareto-Improving Transition*

The essential feature of the transition to a funded program of retirement benefits is a period of reduced consumption by employees during the early years of the transition so that a dedicated capital stock can be accumulated. This dedicated capital is then used to finance retirement benefits, thereby permitting lower taxes and more consumption by employees in later years.

With the specific very gradual transition path studied in Sections 3 and 4, the combination of the PRA contributions and the payroll taxes remains higher than the 12.4% payroll tax rate in the pure PAYGO program for 18 years. Anyone who is at least 47 years old when the transition begins will pay more under our calculations than he would with the existing PAYGO system.[32]

For younger cohorts, there will initially be higher taxes-plus-PRA contributions followed by lower tax payments. These changes in tax rates affect real incomes directly and also by the associated changes in dead-

32. This rests on the critical assumption that if the PAYGO system continues there would be no adjustment in taxes during the next 18 years and no reduction in benefits after that time, but an increase in taxes (after 2030) to maintain the existing benefit rules. If either assumption is violated, individuals who are 47 years old or older may be better off with the PRA transition than in the pure PAYGO system.

weight losses. The time path of net losses followed by net gains is presented in Table 6 for three age cohorts, identified by their age in the first year of the transition (1995). Each figure in the table shows the net gain or loss, including the associated change in deadweight loss, as a percentage of taxable wages. The 55-year-olds have a small net loss in each preretirement year. The 40-year-olds have gradually decreasing losses for 18 years and then gradually increasing gains. The 25-year-olds are required to pay a higher payroll tax in the early years even though they are not making PRA contributions until the fifth year. After 18 years of higher contributions they enjoy the benefit of rising gains that reach more than 8% of their wages before they finally retire at age 65.

Although the shift to a funded system is unambiguously a bad deal for the 55-year-olds (assuming that the alternative is to leave taxes and benefits unchanged until 2030), the effect for the other age cohorts depends on the rate at which they discount future real income changes. Table 7 presents the actuarial present values of the net gains for birth groups classified by their age at the time that the transition begins. Results are presented for four real discount rates from zero through 6%. The first part of the table (rows 1 through 3) shows the actuarial present values in thousands of 1995 dollars. The second part of the table restates those present values as percentages of the present actuarial value of the individual's future earnings.

Except for those who are too young to be working when the transition begins, the effect of the shift to a funded system is relatively small. With a discount rate of 4%, the present actuarial value of the net loss is greatest for the 40-year-olds, but their lifetime loss (expressed as an actuarial present value) is only about $5000, or about 1.3% of their future wage income. For the very young, the favorable changes are much larger: with a 4% discount rate, the net gain to those who are 10 when the transition begins has a present actuarial value of $15,230, or about 4.3% of future wages.

Although those who are 40 or older are net losers in the transition, the

Table 6 TIME PATH OF NET GAINS BY DIFFERENT AGE COHORTS

Age in first year of transition	*Percentage of covered earnings*								
	Year[a] 1	5	10	15	20	25	30	35	40
55	−2.44	−2.17	−1.68	0	0	0	0	0	0
40	−2.52	−2.25	−1.75	−0.96	0.27	1.99	0	0	0
25	−2.62	−2.36	−1.79	−0.99	0.28	2.06	4.23	6.45	8.62

[a]Year 1 is 1995.

Table 7 ACTUARIAL PRESENT VALUES OF NET GAINS BY AGE AT THE START OF THE TRANSITION

Age at start:	*Present value*									
	5	10	15	20	25	30	40	50	55	60
	Thousands of dollars per worker ($1995)									
Discount rate (%)										
0	104.85	77.27	53.03	32.33	16.37	4.97	−5.79	−5.73	−4.06	−2.09
2	43.37	33.70	23.81	14.11	6.40	0.58	−5.46	−5.13	−3.75	−2.01
4	18.88	15.23	10.73	5.54	1.51	−1.61	−5.09	−4.64	−3.49	−1.94
6	8.64	7.10	4.73	1.47	−0.88	−2.65	−4.73	−4.22	−3.25	−1.87
	Percent of future wages (actuarial present value)									
Discount rate (%)										
0	8.28	6.40	4.60	2.93	1.65	0.58	−1.01	−1.87	−2.11	−2.28
2	7.20	5.31	3.57	2.00	0.95	0.09	−1.18	−1.91	−2.13	−2.28
4	6.15	4.28	2.60	1.16	0.31	−0.34	−1.34	−1.95	−2.14	−2.28
6	5.19	3.35	1.75	0.43	−0.24	−0.72	−1.49	−1.98	−2.15	−2.28

result is quite different if we look at the nuclear family. Combining a husband and wife age 40 with two children below age 20 shows a very large gain to the family.

5.1 THE POSSIBILITY OF A PARETO-EFFICIENT TRANSITION TO A FUNDED SYSTEM

Different phase-in schedules can reduce the number of age groups that are net losers; the simplest example is a transition that leaves employees over some age in the existing PAYGO system. A more interesting question is whether it is possible to structure the transition in such a way that all cohorts gain.

The difficult problem in designing a Pareto-improving transition to a funded system is to accumulate funds that can be used to finance future retirement benefits (and therefore to reduce the future PAYGO tax) without making at least one birth cohort permanently worse off in the process. The following example shows that it may be possible to have such a Pareto-efficient transition to a fully funded program. This transition path is not put forward as optimal or as better than the basic example of Section 3, or even as a realistic option, but only to show that a Pareto-efficient transition is theoretically feasible.[33]

33. We are grateful to Antonio Rangel for discussions about the feasibility of Pareto-improving transitions to funded social security.

For this analysis we make the empirically plausible assumption that individuals do no discretionary saving or that any such saving is not altered by the transition to a funded program.[34] Individuals over age 40 when the transition begins remain in the original PAYGO program and are completely unaffected by the transition. Each individual employee who reaches age 40 is given the option of contributing 5% of earnings to a PRA for 10 years in addition to the ordinary payroll tax. The funds earn a 9% real rate. At the end of the 10 years, when the individual reaches age 50, the individual stops making PRA contributions. Ninety percent of the accumulated PRA balance is then used to fund an annuity over the next 15 years (from ages 50 through 64) with which to reduce the individual's PAYGO taxes. The remaining 10% of the fund is retained and used to finance retirement benefits for the individual. The PAYGO benefits that the individual receives are reduced by the amount of these PRA benefits so that his income in retirement is unaffected.

Note first that no one is worse off. Those who choose to participate are clearly better off, since they have voluntarily chosen to do so (because the 9% return exceeds their personal discount rate as well as the net-of-tax market rate of return that they could otherwise get). Those individuals who are working after the first cohort of 40-year-olds retires are also better off, since their PAYGO taxes can be smaller (because the new retirees use the residual 10% of their PRA balances to finance retirement annuities that reduce their dependence on PAYGO benefits).

The ability to achieve a Pareto improvement comes in this example from the fact that there is initially a tax on investment income that causes individuals to receive a real rate of return that is less than 9% and that the prefunding of social security benefits permits circumventing this distortionary tax.[35] Although it might be objected that the mechanism of this example rests on the assumption that individuals will not offset their PRA saving by other dissaving, we believe that dissaving such large amounts is virtually impossible for most individuals.[36] The transition

34. Recall that median financial assets of households in their immediate preretirement years are equal to only about six months of income. Such small balances are most likely to be regarded as precautionary savings.

35. Readers who are familiar with the recent papers of Laurence Kotlikoff on privatizing social security (e.g., Kotlikoff, 1996a, 1996b) will recognize that his examples of social security privatizations that produce Pareto improvements get those gains by replacing a distortionary tax (in his case the payroll tax) with a less distortionary one (a consumption tax that raises a substantial amount of revenue during the transition by taxing old capital, i.e., by a lump-sum wealth tax).

36. See footnote 34. Antonio Rangel has suggested a modification of our example that would also lead to a Pareto improvement even if individuals are savers who could in principle offset the mandatory PRA accumulation with reductions in other saving. Rangel's solution to this problem is to replace the 10%-of-payroll PRA contribution

implied by this example is extremely slow, and more rapid transitions that made no cohort worse off could no doubt be devised. It is not clear, however, that doing so would be more desirable than a transition with a greater net welfare gain that is not Pareto-efficient.

6. *Recognition Bonds and Alternative Transition Financing*

The use of *recognition bonds* is an alternative administrative mechanism to the gradual transition described in this paper. It is part of a broader class of transition mechanisms that combine the gradual transition of the type modeled in Section 3.3 with the use of government debt to shift the burden of the transition to the more distant future.

A recognition bond is a government bond given to employees at the time that a PAYGO social security program is terminated as compensation for the loss of future benefits or as compensation for the PAYGO taxes that these individuals previously paid. The concept was first suggested by James Buchanan and has actually been used in Chile and Argentina.

Unlike the gradual transition of Section 3.3, the existing PAYGO system could be ended completely and replaced with an exclusively funded system. Individuals would then be given recognition bonds with which they could in principle purchase (from a private financial institution) a single-premium annuity that would begin its payments at age 65. The most natural definition of an appropriate recognition bond would be one that is equal to the present actuarial value of the benefits to which the individual is entitled under the PAYGO system. If the value of such a recognition bond were calculated by discounting future benefits at the same rate at which the market is willing to sell a single-premium annuity, the recognition bond would permit the individual to receive the same benefits that he or she would get from the existing PAYGO program.

Three further requirements would make the recognition-bond approach exactly identical to the gradual transition of Section 4. First, each individual would be required to purchase such an annuity. Second, the

with an offer by the government to permit individuals to receive a 9% rate of return on saving in excess of what they would otherwise have done. In practice, there would be problems of dealing with previously accumulated assets as well as annual saving flows. Samwick (1996) simulates the effects of several reforms in which households buy themselves out of their existing PAYGO obligations with contributions to PRAs. As in Rangel's example, the reduction in the PAYGO tax is a convex function of the amount contributed. Samwick shows that governments will typically find it optimal to offer different schedules simultaneously to those for whom social security contributions are marginal and inframarginal in order to maximize participation while minimizing the reduction in other saving that may occur.

individual would be required to make the same contribution to a PRA as provided in Section 4, so that the combination of the PRA annuity and the recognition-bond annuity exactly replaced the original PAYGO benefits. Third, a payroll tax at the same annual rates as used in the Section 4 transition would be used to finance the principal and interest payments on the recognition bonds.

These equivalence requirements indicate some alternative transition paths that could be achieved with the help of recognition bonds or, more generally, with the use of explicit government debt as part of the transition. For example, the government could shift some of the burden of the transition from the initial generation of employees to future employees by borrowing some of the funds needed to meet the PAYGO benefits and then amortizing that debt very slowly or not at all. An additional opportunity presented by recognition bonds or by other government debt is to substitute the personal income tax or some other tax for the payroll tax in servicing the explicit debt.

In considering the possible role of explicit government debt it is important to recognize the true cost of using government borrowing. Although government borrowing may appear to have only a low cost because of the low interest rate that the government pays, the crowding out of private investment by government borrowing precludes investments that would be expected to earn the 9% real rate of return. We shall not examine the possible uses of debt further at this time.

Table 8 presents estimates of the value of recognition bonds for the United States as of 1995. The table shows the value of the bonds that would be payable to individuals at selected ages from 30 through 75 (in thousands of 1995 dollars) as well as the aggregate value of the bonds (in trillions of 1995 dollars). The first four columns are based on a real interest rate of 2%, essentially the real rate of interest paid on government bonds during the past four decades. The second four columns are based on a real interest rate of 4%.

The recognition-bond values in column 1 are the accumulated value of past payroll tax payments. Thus the average 45-year-old in 1995 had paid (together with his employers) taxes which, when accumulated with interest at 2%, had a cumulated value of $63,830. The aggregate value of the claims of all current employees calculated in this way is $6.703 trillion. For retirees we cumulate the taxes that they and their employers paid and subtract the benefits that they are deemed to have received after age 64. The aggregate value of the remaining claims of the retirees is an additional $1.390 trillion. The total value of the potential recognition bonds calculated in this way is thus $8.094 trillion. Using a 4% rate to cumulate

Table 8 BACKWARD-LOOKING AND FORWARD-LOOKING RECOGNITION BONDS

	Value of Bond ($)							
	Interest rate 2%				*Interest rate 4%*			
	Backward-looking bond	*Forward-looking bond*			*Backward-looking bond*	*Forward-looking bond*		
Age		*Gross SSW*	*SS tax*	*Net SSW*		*Gross SSW*	*SS tax*	*Net SSW*
30	19,950	98,580	79,190	19,390	21,540	41,080	59,570	−18,490
45	63,830	120,060	45,860	74,200	78,920	67,890	39,090	28,800
60	94,980	157,870	10,980	146,890	133,540	119,660	10,580	109,080
75	3,270	72,460	0	72,460	48,830	63,770	0	63,770
Totals in trillions of 1995 dollars								
Workers	6.703	16.317	7.949	8.369	8.474	8.905	6.227	3.838[a]
Retirees	1.390	3.631	0	3.630	2.785	3.153	0.000	3.153
Total	8.094	19.948	7.949	11.999	11.259	12.058	6.227	6.991[a]

[a]Excludes individuals with negative net social security wealth.

past taxes (net of the benefits received by current retirees) produces a total recognition-bond debt of $11.259 trillion (shown in column 5).

The alternative to this backward-looking recognition bond is a forward-looking recognition bond based on the net future benefits to which the individuals are entitled on the basis of the taxes that they have already paid. Our calculation applies the cohort-specific PAYGO rate of return (see footnote 18 above) to the taxes that the individuals in that cohort would pay to calculate the benefits to which they would be entitled in retirement. The present actuarial value of those benefits is the gross social security wealth shown in column 2. The individuals who are 45 years old in 1995 are entitled to benefits under current law that have an actuarial present value of $120,060 when discounted at 2%. However, before retiring they would pay additional taxes with an actuarial present value of $45,860. Their net social security wealth is thus $74,200, and that would be the appropriate value of the forward-looking recognition bond. The cumulative value of such net social security forward-looking recognition bonds, when discounting at 2%, is $11.999 trillion. That this amount is larger than the aggregate of backward-looking recognition bonds shows that the current generation of employees and retirees can expect to receive a real return greater than 2% in the existing program. A more detailed comparison by age shows that this is only true above a certain age, with those in their early thirties or younger receiving a real return of less than 2%.

Applying a 4% discount rate to calculate forward-looking recognition bonds gives a very different result. No working age cohort can expect to receive a real return as high as 4%. Individuals who are less than 35 years old have negative net social security wealth (the present value of their future taxes exceeds the present value of the benefits when discounted at 4%) and would receive no recognition bonds. The aggregate value of the forward-looking recognition bonds paid to the remaining workers and retirees would be only $3.838 trillion, about half the value of the backward-looking recognition bonds calculated with a 4% rate of interest.

7. *Social Security Prefunding and Low-Wage Workers*

The prefunded system of benefits based on individual accounts that is described in Section 3 involves no redistributions and makes retirement annuities proportional to preretirement earnings. It is possible however to introduce a variety of modifications that can make prefunding even more advantageous to low-wage workers than to those with average and above-average wages.

In a previous paper (Feldstein and Samwick, 1996) we used data on the distribution of lifetime earnings to calculate the distribution of PRA fund values at age 65. We found that 19% of accounts had less than half of the value of the median account. The cost of supplementing all such low-value accounts by enough to bring them up to half of the median value could be financed by a one-time tax of 4.7% on all PRA accounts at age 65. Each individual could save enough to provide for his own PRA annuity and to finance that one-time tax by raising his PRA contribution rate by 4.7%; in the current calculation, the long-run PRA contribution would have to rise from 2.02% to 2.1% of payroll.

In the present paper we pursue a very different approach and ask how a low-income worker might fare in a funded system and what would have to be done to provide the same level of retirement benefits that such workers receive in the existing PAYGO system. For this purpose, we follow the Social Security Administration and define a low-wage worker as someone with 45% of average covered earnings, i.e., with earnings of only $11,617 in 1996. Under current law, such individuals receive benefits equal to 55% of their immediate preretirement income if they have no dependents and 83% of that preretirement income with a dependent spouse.

Consider first the fraction of earnings that such a low-wage worker would have to contribute to a PRA account from ages 30 to 65 to finance an annuity equal to 83% of preretirement earnings from age 65 to death. To provide an explicit and transparent calculation, we avoid the complexity of an actuarial annuity and assume instead that the individual receives a fixed annuity for 20 years starting at age 65. If the low-income individual's wage grows at 1% a year from age 30 to age 64 and the PRA account earns a real return of 9%, the value of the PRA account at age 65 is $cw\ \Sigma_1^{35}(1.01)^t(1.09)^{35-t}$, where c is the proportion of the wage that is saved in the PRA each year and w is the wage at age 30. If the annuity is to be 83% of the immediate preretirement wage, i.e., $0.83w(1.01)^{35}$, for 20 years, the value of c must satisfy $c\ \Sigma_1^{35}(1.01)^t(1.09)^{35-t} = 0.83(1.01)^{35}\ \Sigma_1^{20}(1.09)^{-t}$. This implies $c = 0.045$. Thus even with no redistribution, the low-wage earner could obtain the 83% replacement rate of the current PAYGO system with a PRA contribution of only 4.5% of wages instead of the 18.75% long-term contribution implied by current law and PAYGO financing. The low-wage earner would thus have an increase in disposable income equal to more than 14% of earnings.

The idea that the low-wage workers would be required to make higher proportional contributions to their PRAs than higher-wage workers might be politically unacceptable even though such contributions would be very much less than they would have been in the PAYGO system. We

therefore ask how their rate of return would have to be augmented by an explicit transfer to produce the 83% replacement rate if the low-wage worker made the same PRA contribution as a percent of payroll as everyone else. This incremental return might come from the additional corporate-income-tax revenue that the government collects as a result of the PRA capital by giving more of that extra tax to lower-income individuals and less to those with higher incomes.

If the low wage earner contributes 2% of earnings to a PRA and obtains a return of R% on his PRA balances, at the time of retirement the balance in the account would be $0.02w\,\Sigma_1^{35}(1.01)^t\,(1 + \mathrm{R})^{35-t}$. If benefits are to be $0.83(1.01)^{35}w$ for 20 years, R must satisfy $0.02w\,\Sigma_1^{35}(1.01)^t\,(1 + R)^{35-t} = 0.83(1.01)^{35}w\,\Sigma_1^{20}(1 + R)^{-t}$. This implies that the required rate of return for the low wage earner would be $R = 0.118$. In short, if the government used part of the incremental corporate income tax revenue (equal to about 3.5% of all PRA assets) to increase the rate of return on the assets of the low-wage earners by 2.8 percentage points, the low-income earner could obtain the same 83% replacement rate as under existing law with a contribution of only 2% of earnings.

There are undoubtedly other and better ways to achieve any desired redistribution to supplement the benefits of low-wage earners. Although we will not explore this issue further here, we believe that the calculations in this section show that a prefunded system can provide the same level of retirement income to low-wage earners as the current PAYGO system with at least 14% higher income during preretirement years or some combination of higher income during both retirement and preretirement years.

8. *Medicare*

Although we have focused our detailed analysis on the prefunding of social security benefits, we believe that the same logic can be applied to financing the healthcare benefits of the aged. As we noted in Section 1, the cost of funding healthcare for the aged on a PAYGO basis would eventually require a payroll tax equal to about 12% of GDP, or about 30% of covered earnings.

Since the long-run projected cost of the healthcare programs for the aged is about 170% of the long-run level of aggregate social security benefits, a first approximation of the payroll contributions needed to fund these health benefits is 170% of the PRA contributions that are required to fund the social security retirement benefits. This implies contributions to a *personal retirement health account* (PRHA) of 3.4% of taxable payroll. The funds accumulated in this way could be used to purchase conventional

insurance like the existing Medicare coverage plus the long-term care insurance currently provided by Medicaid. Alternatively, the funds could pay for membership in a health maintenance organization or could be used in conjunction with high-deductible health insurance policies as a way of achieving greater self-control over health expenditures. Although the precise way in which the accumulated funds are translated into the financing of healthcare is very important, it is secondary to the financing issue that we consider here.

One further point that does need discussion here is that the health benefits provided by Medicare, unlike the cash retirement benefits, are not related to earnings during working years. The 3.4% of payroll contribution to a PRHA would therefore provide a larger than needed fund for those with above-average earnings but an inadequate fund for those with below-average earnings. One possible solution to this problem is to redistribute the contribution so that each individual pays 3.4% of his earnings up to the maximum taxable earnings for social security ($65,400 at 1997 levels) but only keeps (or receives) enough to contribute the same average amount to a PRHA (i.e., an amount equal to 3.4% of average covered earnings, about $25,900 at the 1997 level).

9. *Concluding Remarks*

Designing an appropriate way to finance the retirement and healthcare benefits of the aging population is probably the most important challenge to government finance in the decades ahead. If it is done wisely, the aged will have comfortable retirements and the advantages of improving medical technology while the working population will avoid the explosive growth of taxes that could otherwise occur.

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Comment

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1. Introduction

Feldstein and Samwick conclude that a transition to a fully funded social security system is likely to have significant benefits to future generations while imposing fairly low costs on transition generations. In my discussion I will first start with a simple overview and then consider a variety of issues not addressed adequately in the paper. My conclusion is that the case for making a transition to a fully funded system may not be as compelling as Feldstein and Samwick suggest and that further quantita-

tive analysis to address the issues I discuss would be very helpful in evaluating the merits of the authors' suggestion.

2. *Simple Overview*

Let's start with the steady state of a simple Diamond (1965) overlapping generations (OG) model with a pay-as-you-go social security system in which the return to capital exceeds the growth rate of the economy. Consider the following policy of transiting to a fully funded system in which benefits to the current old are maintained (paid for by taxes on current young) but all future benefits and future taxes are eliminated. In the long run this implies an increase in the wealth of future generations, since the return on capital exceeds the growth rate of the economy. Consequently, the direct wealth effect is welfare-increasing for future (long-run) generations. For the transition generation (the current young), however, there is a decrease in wealth, since they suffer an elimination of benefits but no reduction in taxes. Therefore, the direct wealth effect is welfare-decreasing for the transition generation.

In addition to the direct wealth effects there are also indirect effects. These arise because there will be an increase in saving by both the future generations and the transition generation. For the future generations there will be an increase in current consumption, which will be less than the increase in current disposable income; and for the transition generation there will be a decrease in current consumption with no change in current disposable income. These effects raise the capital stock, increase the real wage, and decrease the return to capital.

The welfare consequences of the indirect effects on future generations are ambiguous. For the transition generations, at least for those close to retirement, the indirect effect is a further decrease in welfare. For those transition generations far from retirement the indirect welfare effect is again ambiguous. However, for empirically plausible parameter values the overall welfare effect on future generations is significantly positive (see Kotlikoff, Smetters, and Walliser—hereafter KSW—1996).

3. *Discussion*

In my discussion I will question the possible long-run benefits and also question the political feasibility of the transition. My discussion will focus on the following points: (1) risky returns on capital, (2) heterogeneity in portfolios and wealth, (3) Pareto improvement and capital taxation, (4) altruistic bequests; and (5) political economy considerations.

3.1 RISKY RETURNS ON CAPITAL

The return to capital is, of course, highly risky. This fact implies that one has to consider the appropriate risk characteristics of the social security program and use the appropriate contingent claims prices to evaluate whether a change in the program increases or decreases wealth. If the taxes and benefits associated with the social security program are riskless, as is commonly modeled, then it is inappropriate to use the expected return on capital as measured by the expected return on the market portfolio to calculate the wealth effect of eliminating the program. The correct procedure is to use the appropriate risk-free rate. For evaluating the wealth effect of changes in social security taxes and benefits, it is probably reasonable to use some estimate of a long-term risk-free rate. Historical *ex post* real returns on long-term U.S. government bonds are close to zero, which is significantly below the expected return on the market portfolio. Recently, the U.S. government has started issuing ten-year indexed bonds with a real return slightly above 3% per annum. Therefore, it seems likely that the long term risk-free rate in the U.S. is not only significantly below the expected return on the market portfolio but also about the same or perhaps somewhat less than the average growth rate of the U.S. economy.[1] This means that even in the long run, generations that are born when the risk-free rate is above the growth rate of the economy will experience an increase in wealth, whereas generations that are born in periods when the risk-free rate is below the growth rate will experience a decrease in wealth. Since, on average the risk-free rate is about the same as or less than the growth rate, about as many future generations are likely to lose as are likely to gain by eliminating social security.

The above discussion is not meant to suggest that the taxes and benefits associated with the social security program are completely riskless. However, so long as the risks are uncorrelated with the return on the market portfolio, it is not inappropriate to use some estimate of a long-term risk-free rate. Of course, if the risks are correlated, then it is a more complicated task to evaluate the wealth effect of a change in the social security program. This is an issue that bears further scrutiny.

In this connection one should comment on the authors' assumption that the long-run growth rate of real wages (which is the base of social security taxes) is about 1.1% per annum. This is significantly lower than the long-run growth rate of real GDP, which is in the range of 2–3% per annum. The lower growth rate for real wages assumed by the authors

1. This situation can be quite consistent with dynamic efficiency. See Aiyagari and Peled (1991), Manuelli (1990), and Abel *et al.* (1989).

probably reflects several factors, including the discrepancy between covered wages and total wages, the widening skill premium, and the increasing ratio of benefits to wages. Nevertheless, as a steady-state assumption it seems more appropriate to assume that the growth rate of real wages will be in line with the growth rate of real GDP. This makes the comparison of the risk-free rate with the growth rate more damaging to the authors' calculation of the direct wealth effect of a change in the social security program.

The authors do consider the issue of the riskiness of the return to capital in discussing their proposal for prefunding social security benefits. Initially, the authors suggest that workers be made to save a part of their earnings that is just sufficient to replace their social security benefits, assuming that these savings earn the expected return on the market portfolio. Later, in recognition of the riskiness of the return on the market portfolio, they suggest that workers be made to save a somewhat larger amount, enough to replace their social security benefits with a probability of at least 97%. In my opinion these calculations are misleading. To see this, consider how a generation which is saving more due to the elimination of social security taxes and benefits should allocate those extra savings between risk-free bonds and risky capital. If the risk-free rate equals the growth rate, then this generation should put all of its extra savings into risk-free bonds. If the risk-free rate is somewhat above the growth rate, then it should allocate most of its savings to risk-free bonds and a small portion to risky capital. If the risk-free rate is less than the growth rate, then it should actually sell some claims to capital and allocate more than its extra savings to risk-free bonds. That is, when the risk-free rate is about the same as the growth rate, it is never optimal for a generation to allocate all of the extra savings to risky capital. Further, my previous argument says that a generation born in a period when the risk-free rate is less than the growth rate will lose *even if it chooses to allocate its extra savings optimally between risk-free bonds and capital.* Therefore, allocating its portfolio in the manner suggested by the authors will likely result in a further welfare loss. Such behavior can likely lead to a welfare loss even for generations born in periods when the risk-free rate is somewhat above the growth rate, even though the direct wealth effect is positive.

The authors' 97% criterion also ignores the potential for enormous losses that can result from investing solely in a risky portfolio. It's not enough to consider just the probability of a loss; its extent is also relevant for risk-averse investors. The fact that over a long horizon stocks are almost guaranteed to outperform bonds does not imply that one should invest exclusively in stocks. This point goes back to Samuelson (1979)

and is illustrated by the following calculations taken from a recent paper by Jagannathan and Kocherlakota (1996). Consider an investor with a relative risk aversion coefficient of 5 and a horizon of 40 years who can choose between stocks and risk-free bonds. Over that horizon stocks will outperform bonds with a probability greater then 97%. Yet, the optimal portfolio for such an investor consists of 60% bonds and 40% stocks. More interestingly, such an investor will prefer $1 in the optimal portfolio to $3.86 in a stocks-only portfolio. Even more interestingly, such an investor will prefer $1 in a bonds-only portfolio to $2.22 in a stocks-only portfolio. Loss probability is not an adequate measure of risk.[2]

Taking account of individual risk and its possible dependence on aggregate shocks along the lines suggested by Mankiw (1986) and Constantinides and Duffie (1996) suggests that stocks may be even more risky.

3.2 HETEROGENEITY IN PORTFOLIOS AND RETURNS

Do a lot of people for whom social security is important earn the high expected return on capital in their portfolios that the authors assume in their calculations? As is well known, there is considerable heterogeneity in wealth, even among members of a given age cohort. Associated with this is considerable heterogeneity in portfolios and returns. Essentially, people at the lower end of the wealth distribution hold low-risk, low-return portfolios, and people at the upper end of the wealth distribution hold higher-risk, higher-return portfolios. For example, according to U.S. data for 1983 summarized in Kessler and Wolff (1991), people in the lowest quintile of the wealth distribution held 82% of their portfolio in currency and demand and time deposits, 9% in financial securities and corporate stock, 6% in owner-occupied housing, and 3% in other real estate and unincorporated business. So it seems to me that people for whom social security is likely to be important are earning returns much below the expected return on capital and probably more in line with the risk-free rate and the growth rate. Some part of this may be due to lack of financial sophistication, but I suspect that a large part of it has to do with precautionary and liquidity motives which cause these households to prefer low-risk, low-return portfolios.[3]

2. I should admit that I am proceeding as if observed returns on stocks and bonds were consistent with reasonable values of relative risk aversion. This, of course, is not the case. But I am not going to deal with the equity-premium and risk-free-rate puzzles here.
3. Going to a fully funded system may increase their savings in the long run so much that such households will be able to tap into higher-risk, higher-return assets. But the authors themselves seem to discount such a possibility, since they indicate that even for households near retirement the median financial assets are less than one-half of annual earnings.

3.3 PARETO IMPROVEMENT AND CAPITAL TAXATION

There is some discussion in the paper of the possibility of a Pareto-improving transition. This arises when the intergenerational redistribution implied by the transition is combined with a reform of the tax system which reduces distortions. Typically, these proposed reforms involve combining capital levies with the elimination of the capital income tax. Such a combination is achieved for example, by moving from a system of income taxes to a system of consumption taxes. I don't have much to say about capital levies except that it would be wonderful to have a one-time capital levy every time. However, I would like to suggest that the case for eliminating capital income taxation is not so clear-cut.

When individuals are subject to idiosyncratic shocks which are uninsured, a case can be made for capital taxation. In such situations it can easily happen that the aggregate capital stock affects not only the aggregate level of consumption but also its distribution among consumers. Individual consumers do take into account the effect of their saving on their mean level of consumption, but do not take into account its effect on the distribution of consumption among all consumers. The social planner cares not only about the mean level of consumption but also about its distribution and would be willing to trade off a slightly lower mean for a slightly less disperse distribution. Thus, the social planner would want to tax capital in order to have a lower capital stock and less dispersed consumption.

A simple model with this feature is the following: Consider a two-period economy with a continuum of *ex ante* identical consumers of unit measure who receive an endowment of y units in the first period. They consume some of this endowment in the first period and save the rest as capital (K) for the second period. In the second period they have a random and uninsurable idiosyncratic labor endowment denoted by n. Assume that $E(n) = 1$ and, further, that there is a neoclassical production function $F(K,N)$ and competitive factor markets. Then a typical individual's second-period consumption, denoted by c, is given by $c = RK + wn$, where $R = F_1(K,1)$ and $w = F_2(K,1)$. Substituting these, we can write $c = F(K,1) + (n-1)F_2(K,1)$. It follows that $E(c) = F(K,1)$ and $\sigma(c) = \sigma(n)F_2(K,1)$, where σ denotes standard deviation. It can be seen that the aggregate capital stock affects not only aggregate consumption but also its distribution. Further, since $F_2(K,1)$ is increasing in K, it follows that a higher capital stock will increase the dispersion of consumption. In this example, the social planner will prefer a smaller capital stock than what would otherwise obtain.[4]

4. To keep matters simple I have assumed an inelastic labor supply. This raises the possibility of taxing labor income at a 100% rate and returning the proceeds in equal per capita

Or course, a relevant question is whether this effect is quantitatively important. In some previous work of mine on the desirability of taxing capital income with incomplete insurance markets (Aiyagari, 1994), I found that it was quite possible to get optimal capital income-tax rates in the 20–30% range for empirically reasonable values of risk aversion and labor supply elasticities.

Therefore, schemes which rely on reducing or eliminating capital taxation to effect a Pareto-improving transition to a fully funded system may not look so good once idiosyncratic risk is taken into account.

KSW (1996) show that a Pareto improvement may be possible if the accrued benefits to current and future retirees are financed by a consumption tax. This is because the consumption tax is in part a capital levy on current wealth holders, so that it is equivalent to using lump-sum taxes in part to finance the accrued benefits to current and future retirees instead of a wage tax. The reduction in the distortion of labor supply can generate a Pareto improvement. However, they assume that lump-sum redistributions can be used to maintain the welfare of transition generations at their pretransition levels. This in itself limits the long-run welfare gains. If distortionary taxes have to be used to maintain the welfare of transition generations at their pretransition levels, then this will further limit the long-run gains from the transition to a fully funded system. As KSW also show, if a wage tax is used to pay for the accrued benefits to current and future retirees, then the long-run welfare gains are even smaller.

3.4 ALTRUISTIC BEQUESTS

An interesting idea for modeling that is touched on very briefly in the paper is the following: Even if the transition generations are worse off in terms of their own utility, if they care about the welfare of their descendants, then they might be better off overall. Most analyses of social security tend to be carried out in models without altruistic bequest motives. Yet the very fact that we are all talking about how going to a fully funded system would confer such large long-run benefits on future generations suggests that this is a modeling feature that needs to be studied.

In this connection the following argument put forward by Bernheim (1989) is worth noting. He argued that in a setting in which parents care about children altruistically, any equilibrium with positive bequests must

amount. This would effectively complete the missing insurance market and eliminate the need to resort to capital taxation. A simple way around this is to make labor supply elastic, which would bring back the optimality of taxing capital income.

be suboptimal. The reasoning is quite simple. In an equilibrium with positive bequests, reducing the parent's consumption by one unit and increasing the child's consumption by one unit will result in a Pareto-superior allocation. This is because the parent is no worse off (since he was initially making a positive bequest, he must be equating his own marginal utility of consumption with that of his child) and the child must be better off.

Applying the above argument to the transition generations in a transition to a fully funded system, we can conclude that it is not possible for the overall utility of a transition generation (including their valuation of their descendants' utility) to increase. The reason is that, if the transition generation was making positive bequests, then it would simply reduce its bequests and be no worse off. If such a transition generation was not making a bequest, then it must necessarily be worse off, since its own marginal utility of consumption must have been higher than its descendants'.

Taking account of altruistic bequest motives must necessarily reduce the potential for long-term welfare gains arising through increased capital accumulation. This is quite obvious when there are some dynasties which are always bequest-linked, but is less obvious when there are no such dynasties. However, so long as *some* parents are making positive bequests *some* of the time, it is possible for the long-run capital stock not to increase at all. To see a simple example of this, consider again a version of the Diamond (1965) OG model with a continuum of two-period-lived altruistic generations in each period. Assume that the discount factor that these parents apply to their descendant is random and idiosyncratic. A random fraction π of each new generation cares highly for its children and has a discount factor β_h, whereas the remaining fraction cares less for its children and has a discount factor $\beta_l < \beta_h$. Assume that the utility from own consumption is of the form $c_1 + u(c_2)$, where c_1 and c_2 are the first- and second-period consumptions. I will also make a special assumption, which is that parents do not know their children's type (high or low discount factor) when they make a bequest, i.e., parents do not know whether their own children care a lot or a little for their grandchildren. This means that parents cannot condition their bequest on their children's type.

It's now easy to characterize steady states in the above model. Optimal saving behavior implies that $u'(c_2) = 1/R$, where R is the gross return to capital. Optimal bequest behavior implies that $u'(c_2) \geq \beta$ with equality if bequests are positive. One type of steady state is characterized by $R = 1/\beta_h < 1/\beta_1$. In such a steady state, parents who happen to care a lot for their children will make positive bequests, whereas parents who do not care as much for their children will not make bequests. Given the idiosyn-

cratic nature of altruism, there will never be any dynasty that is continuously bequest-linked; once a potential dynasty produces a child who doesn't care much for his own child, the bequest link will be broken. Despite this feature, the long-run capital stock is pegged by the altruism of those parents who care a lot for their children. A transition to a fully funded social security system from an unfunded one will create a lot of distributional effects, but will have no effect on the long-run capital stock, long-run real wage, or long-run per capita consumption.

Admittedly, the above example is somewhat special, but I think it does suggest that taking account of altruistic bequests will further limit long-run gains through the channel of increased saving and capital accumulation from the transition to a fully funded system. So I think that the very argument that the transition generations might be better off once they take into account the higher welfare of their descendants implies that there won't be much gain for future generations on average.

3.5 POLITICAL-ECONOMY CONSIDERATIONS

Political-economy considerations are extremely relevant in designing transition schemes, as these schemes will have to be politically feasible in order to have a chance of being adopted. These considerations help us understand why an unfunded system which yields a lower return than capital and imposes possibly significant long-run welfare losses is so hard to change—see Galasso (1996), Cooley and Soares (1996). The key insight here is that from the point of view of many current workers the social security taxes they have already paid are sunk costs—what matters to them is the taxes yet to be paid and the benefits to be received upon retirement. From this perspective it can easily be the case that the median voter is one for whom an unfunded system yields a higher return than capital. In addition, from the point of view of the median voter, continuing an unfunded system results in lower savings and a lower capital stock, and hence a higher return on accumulated wealth, than does moving to a fully funded system. This latter general equilibrium effect can explain why the median voter might prefer an unfunded social security system with an internal rate of return that is lower than that on capital. In this connection it is very revealing to consider who are the losers in a transition to a fully funded system when there is no compensation scheme in place. KSW (1996) provide the information in Table 1 based on their simulation model.

The table, in combination with the result that significant long-run benefits are unlikely unless the current retirees and the transition generations are made to bear a significant share of the burden of paying off the accrued benefits, shows the difficulties in making the transition politi-

Table 1

Tax scheme for financing accrued benefits	*Losers (years of age)*
Consumption tax	34–74
Income tax	24–74
Wage tax	13–74

cally feasible. A majority of existing voters prefer to keep the current unfunded system, and most of the people who might benefit from the transition to a fully funded system are not around to vote.

4. *Conclusion*

Based on the above considerations I conclude that the case for making a transition to a fully funded system may not be as compelling as Feldstein and Samwick suggest. Further quantitative analysis to take account of the factors I have brought out in my discussion would be very helpful in evaluating the merits of this suggestion.

Editors' Note

Rao Aiyagari died suddenly on May 20, 1997. He will be greatly missed. The Editors thank Rao's colleague Per Krusell for helping us obtain the above discussion. We hope that it will serve as a small reminder of Rao's keen intelligence and insight.

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Comment

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Feldstein and Samwick have produced a provocative, challenging, and useful paper. It's provocative in claiming that we can privatize social security in a manner that will yield very significant long-run welfare gains. It's challenging in asking the reader to wade through a host of welfare, excess-burden, rate-of-return, capital-accumulation, and risk-adjustment calculations. And it's useful in clarifying an important way in which social security might be reformed.

The paper begins with a description of the long-term fiscal fiasco being produced in Washington through the unrestrained growth of pay-as-you-go entitlement programs. Feldstein and Samwick point out that raising payroll taxes to cover social security and Medicare benefits on a pay-as-you-go basis will leave our children paying over a third of their lifetime earnings in payroll taxes alone. This assessment is based on the social security actuaries' intermediate projections. It's important to realize that the intermediate projections made by social security actuaries are routinely overoptimistic. The current intermediate projections appear to be particularly optimistic with respect to real wage growth, which in

recent years has been running at less than one-third the rate assumed by the actuaries, and with respect to future longevity improvements, which our country's top demographers think are way off base. It's also important to realize that the problem is not just demographics. If the CPI commission is right, real social security benefits are rising by as much as 1.5% more each year than they should be. And real Medicare benefits continue to grow many times faster than the economy. Indeed, over the last four years alone, real Medicare benefits per beneficiary grew by one-quarter. Last year, real Medicare benefits per beneficiary grew 12 times faster than the real wages of the workers paying for those benefits.

June O'Neill, the Director of the Congressional Budget Office, recently summarized the long-term fiscal situation in a way which I think is particularly useful. She pointed out that were we to pay for all of the government's entitlement and other spending commitments over the next 75 years with an immediate and permanent increase in federal income-tax rates, the requisite rate hike would be 50%. Were we to wait for five years to raise income-tax rates the necessary tax hike would be 56%. And were we to wait for 20 years, the requisite tax hike would be 87%.

Clearly, we need to take drastic actions to avoid taxing our economy to death. Privatizing social security, the authors claim, is one of them. Their personal retirement system would, over time, fully privatize social security and completely eliminate the distortionary social security payroll tax.

Although the authors put the best spin on their proposal, in essence it boils down to making current workers pay off social security's unfunded liability. Under their plan, workers receive their accrued social security benefits (i.e., the benefits they've earned based on past contributions), but are forced to pay social security taxes for many years in the future without receiving any additional benefits back in exchange for any of these taxes. That's the bad news because, as the authors tell us, under the existing system we can, on average, expect to get back about one dollar in benefits, measured in present value, for every four dollars we are forced to pay in social security taxes. For workers currently nearer to retirement the bad news is, however, worse than that calculation suggests. The reason is that under social security's current structure, the marginal present value of benefits one gets in exchange for marginal contributions is higher for older workers, because they are closer to receiving their benefits. Hence these older workers have the most to lose under the Feldstein–Samwick plan.

The good news is that because current workers will only get their prereform accrued social security benefits in retirement, the amount of payroll taxes needed to cover aggregate social security benefits will de-

cline over time, ultimately to zero. This zero long-run social security payroll tax can be compared with the 18.75% tax rate that would prevail under the existing system were we to annually adjust payroll tax rates to meet annual social security benefit payments. Getting our kids out from under an 18.75% payroll tax will, obviously, help them a lot. The interesting thing we learn from Feldstein and Samwick is that helping our kids out a lot can be done at a fairly small cost to us.

In addition to eliminating the accrual of additional social security benefits and altering the time path of social security payroll tax rates, the personal retirement system forces people to place, on average, about 2% of their earnings in a private account. The precise size of this mandatory saving is cohort-specific, with the rate of contribution set to ensure that one's PRA account plus prereform accrued social security benefits will deliver the level of retirement income that would be received under the current system.

Although the authors will disagree, I view this mandatory saving as a sideshow. Since most American workers are not, in my view, liquidity-constrained, I believe they would respond to this mandatory saving by cutting back on their own private saving; i.e., I think their retirement income would end up the same whether or not the personal retirement system included the mandatory PRA contribution. This undoing of the mandatory PRA contribution can take many forms, including cutting back on 401(k), 403(b), IRA, and other tax-deferred contributions.

Once I separate the social security and mandatory PRA elements of the proposal, I start to wonder about the legitimacy of some of the authors' calculations. To begin with, I wonder what it means to let the PRAs accumulate capital income entirely tax-free. If workers do what I think they'll do and simply put assets they have already accumulated or would otherwise accumulate into the PRAs, the government will, on balance, be out the corporate income taxes and the personal capital income taxes that would otherwise be earned on the income from these assets. Since Feldstein and Samwick don't include the cost to workers of paying additional other taxes to make up the loss in federal revenues, I wonder if they are overstating the welfare gains of their plan.

Of course, based on the authors' maintained assumption—that each dollar contributed to PRAs represents an additional dollar of net national saving—there is no loss in federal revenue. But this extreme liquidity-constrained Keynesian view has, in my view, no empirical basis.

Viewing the mandatory PRA contributions, as I do, as simply a relabeling of private saving also leads me to question Feldstein and Samwick's effective payroll tax rate during the transition. They seem to

treat the PRA contribution as a tax, when it's not, and they also seem to assume that workers will still get something back at the margin for contributing to social security, which, if I understand things right, they won't. The mistakes here, if they are mistakes, are, however, likely to be small and offsetting. Once again, my reference point for thinking about these issues is the life-cycle model. But even under their assumption that workers are 100% liquidity-constrained at the margin, a dollar contributed to a PRA should be valued at more than zero.

My view of the PRA contributions also leads me to question Feldstein and Samwick's calculations of the effect of capital accumulation. I don't think the PRAs per se will alter capital accumulation, since every dollar in a PRA is likely to be matched by a dollar less in a non-PRA account. I think that the main effect on capital accumulation will arise from making current workers pay off the current system's accrued liability. In lowering their remaining lifetime incomes (by giving them a zero gross rate of return on their marginal social security contributions), the proposal will lower their consumption and, thereby, reduce aggregate consumption and raise national saving.

I also have to admit to being worried about Table 5's deadweight-loss calculation. Even assuming the reduction in effective tax rates is correctly calculated, I don't understand how the long-run decline in the rate of social security taxation can be added to reductions in deadweight losses. We know that, for the intertemporal economy as a whole, the only welfare gains are those arising from efficiency improvements. Feldstein and Samwick seem to be acknowledging this in leaving out of their calculation the offsetting effects of changes in factor income arising from the policy's affect on capital accumulation, but they don't seem to realize that the same is true of reductions in net taxes. Apart from efficiency gains, the government's intertemporal budget constraint tells us that, discounted at the future time path of the economy's marginal product of capital, the benefits to future generations of lowering their net tax payments is exactly offset by the costs to current generations of paying higher net taxes. Given the presence of the tax terms in Table 5, and given that Feldstein and Samwick are not discounting at the marginal product of capital, but at a much lower rate, I'm led to view Table 5 as a social-welfare calculation that assumes that the United States is a small open economy whose factor prices are set from abroad. Considered as a social-welfare calculation, Table 5 does not represent a purely scientific description of what happens to particular cohorts. Instead, it represents the authors' personal weighting of income in the present vs. income in the future.

Table 6's cohort-specific net welfare gains should and do include the welfare effects of changes in their net taxes, but they leave out the welfare effects of factor price changes. This is likely to be a big omission.

My bottom line here is that, while I agree with the paper's broad conclusions, I question the precise way the paper reaches many of them. The reason I agree with their broad conclusions is that, together with Kent Smetters and Jan Walliser of the CBO, I've simulated the kind of transition Feldstein and Samwick are considering, albeit in a quite stylized model, and obtained qualitatively similar results. The advantage of using a model like ours that has an explicit utility function is that there is no need to approximate excess burdens. In addition, one can display the precise changes in utility of each cohort and of each member within a cohort. Hence, policy-induced welfare changes can be presented for each and every agent without the need to make interpersonal comparisons.

Discussion

The authors began the discussion by responding to the formal comments. Andrew Samwick emphasized that their plan would not change the benefits paid in retirement, only the time pattern of taxes, as needed to pay for the transition. He disagreed with the argument that their proposal would reduce private savings, on the grounds that—given that 50% of the population have less than six months of income going into retirement and that 60% of the population hold no stock—there is little scope for an offsetting response. Feldstein also argued against the likelihood of a substantial endogenous response of saving in practice, contending that Kotlikoff's simulation results rely too heavily on the assumption of full optimization by consumers. He suggested that the evidence on ownership of financial assets, cited by Samwick, weighs against the conclusion that people are fully forward-looking in their behavior.

Matthew Shapiro questioned the source of the low 2% tax rate necessary to pay for the transition. He suggested that the tax burden would be twice that without the corporate income tax rebate; thus the paper is arguably more about corporate income tax policy than about social security. Feldstein disagreed, noting that the proposed corporate tax rebate would apply only to the returns to incremental capital, not to all corporate revenues.

Continuing on the theme of what the paper is "really" about, Greg Mankiw thought the paper's core idea was exploiting the power of compound interest. Essentially the proposal is to confiscate resources from

the current generation, invest them, then use the compounded returns to mitigate the tax burden of future generations. An interesting question is why people do not take of advantage of the supposedly high real return to capital on their own, without government coercion. One possible answer is disincentives created by the tax system. A second possibility is "myopic" behavior by the public, as suggested by the work of Chris Carroll on buffer stock saving. Mankiw questioned the political feasibility of a plan that mandates savings given the public's apparent preference for holding low levels of financial assets. Responding, Carroll cautioned that it was important to remember what drove the results of his work. In particular, it is not myopia or irrationality per se: Indeed, his models assume a moderate rate of time preference (e.g., 4% per year) and rapid growth in income over the life cycle (implying that most saving should be done later in life). More important to his results is his assumption, motivated by the fact that most people do not own stocks, that consumers face a real riskless interest rate that is close to zero. Carroll conjectured that, in his models, agents would respond to a 9% real rate of return by saving considerably more, and perhaps by investing in risky assets.

Robert Hall put forth the view that the calculations of the paper were driven primarily by the so-called equity-premium puzzle, although in this paper the assumed premium is on physical capital rather than on stocks per se. He argued that the difference between the historical return on capital and the risk-free rate cannot be justified by reasonable levels of risk aversion, and therefore presents an arbitrage opportunity for the government that applies more generally than to social security. The logical implication of this paper, he suggested, is that the government should either borrow or raise taxes, invest the proceeds in capital (or stocks), and use the high returns to finance other types of government expenditure as well.

Angus Deaton brought up the issue of distributional effects. Looking at any given cohort over time, one finds income inequality increasing as the cohort gets older. This phenomenon implies that, if a fixed percentage of wages is earmarked for PRAs, the dispersion in PRA balances would be increasing with age (and at a faster rate than the dispersion in earnings). Further, if returns are positively correlated with the amounts in the PRAs, a Rao Aiyagari suggested, then this plan could easily generate substantial wealth inequality. Feldstein agreed that this is an issue and mentioned some early experimentation they performed to consider it. Using empirical earnings profiles, they found that a redistributive scheme designed to prevent anyone from falling below half the median income in retirement could be financed by a tax rate of 2.5%. It would also be possible to give differential rebates on the corporate tax in order

to generate higher real returns for people in the lower brackets. In sum, Feldstein suggested that there would be ample flexibility in their plan to eliminate poverty among the retired, although perhaps not inequality per se. Kotlikoff did not agree with the concern over inequality, since liquidity-constrained people would be forced to save more and thus would end up wealthier than they would have otherwise. Deaton responded that a person who was unemployed at different times of his or her life, and who kept most savings in the form of cash, would likely end up with a very inadequate sum in the PRA. Feldstein remarked that the corporate tax rate would help even very risk-averse individuals who refuse to hold stocks, as those people would get an extra 3% return even on bonds.

Bennett McCallum wondered why the focus of the paper was initially on the problem of an aging population when the benefits of PRAs are independent of any demographic issue. If the problem is basically demographic, why not focus on proposals such as advancing the retirement age? Feldstein agreed that raising the retirement age is an option but that it would not be enough, particularly for Medicare. He pointed out that their paper showed that approaches such as increasing the retirement age may not even be necessary. Mark Bils followed up on the issue of the retirement age by noting that it distorts investment in human capital and removes one way to adjust to risk, i.e., working longer rather than reducing consumption. Feldstein remarked that, in this regard, current social security reforms were steps in the right direction. These reforms are not only increasing the age of retirement but include actuarial adjustments, so that if one chooses to work longer the benefits eventually collected will increase appropriately.