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ALLOCATING PAYROLL TAX REVENUE TO  
PERSONAL RETIREMENT ACCOUNTS TO MAINTAIN  
SOCIAL SECURITY BENEFITS AND THE PAYROLL TAX RATE

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to Maintain Social Security Benefits and the Payroll Tax Rate  
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### **ABSTRACT**

In an earlier paper we analyzed a method of combining traditional tax financed pay-as-you-go Social Security benefits with annuities financed by Personal Retirement Accounts. We showed that such a combination could maintain the level of retirement income projected in current Social Security law while avoiding a future increase in the payroll tax rate.

The current paper extends the earlier analysis in four ways: (1) We now specify that the funds deposited in the Personal Retirement Accounts come from allocating 2 percent of the 12.4 percent payroll tax instead of being additional funds provided from outside the system. (2) We discuss the effects of the uncertain return on investment based annuities. (3) We provide estimates of the cost of permitting bequests if individuals die either before retirement or during the first twenty years after retirement. (4) We update the statistical basis for our estimates to be consistent with the 2000 Social Security Trustees Report.

Our analysis shows that a program of Personal Retirement Accounts funded by allocating 2 percent of the 12.4 percent payroll tax collections can maintain the retirement income projected in current law while avoiding any increase in the 12.4 percent payroll tax. The combination of the higher return on the assets in the Personal Retirement Accounts and the use of the additional corporate profits taxes that result from the increased national saving in Personal Retirement Accounts is sufficient to maintain the solvency of the Social Security Trust Fund even though the tax payments to the fund are reduced from 12.4 percent of taxable payroll to 10.4 percent of taxable payroll. Although there is a period of years when the Trust Fund must borrow, it is able to repay this borrowing with interest out of future tax collections. In the long run, the Trust Fund becomes very large, implying that it would be possible to reduce the payroll tax further or to increase retirement incomes above the levels projected in current law.

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In an earlier article<sup>1</sup> we analyzed a method of combining traditional tax financed pay-as-you-go Social Security benefits with annuities financed by Personal Retirement Accounts. We showed that such a combination could maintain the level of retirement income projected in current Social Security law while avoiding a future increase in the payroll tax rate.

More specifically, we specified that the government would contribute an amount equal to 2 percent of each individual's payroll earnings (up to the Social Security earnings limit, now \$76,200) each year to a Personal Retirement Account and that the funds in the those accounts would be invested in a mixture of stocks and bonds that would have a real after-inflation yield of 5.5 percent net of administrative costs. At retirement age, the assets in each Personal Retirement Account would be converted to a variable annuity invested in the same mixture of stocks and bonds. Our analysis showed that with these assumptions and with demographic and economic assumptions based on the projections of the Social Security actuaries, each individual could receive his current-law benefits at retirement age plus 25 percent of the value of the Personal

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<sup>1</sup>Martin Feldstein and Andrew Samwick, "Two Percent Personal Retirement Accounts: Their Potential Effects on Social Security Tax Rates and National Saving," Tax Notes, May 4, 1998, 615-620. The current article can be read without reference to the earlier one. For an updated version of the article in Tax Notes based on the 1999 Social Security Trustees Report, as well as a broader discussion of Social Security reform, see Andrew Samwick, "Social Security Reform in the United States," National Tax Journal, Vol. 52, December 1999, 819-842 (available at [www.dartmouth.edu/~samwick/ssreform.html](http://www.dartmouth.edu/~samwick/ssreform.html)). The 2000 Social Security Trustees Report, and the accompanying 75-year forecasts on which the simulations in this article are based, are available at [www.ssa.gov/OACT/TR/index.html](http://www.ssa.gov/OACT/TR/index.html).

Retirement Account annuity without any need to raise the current 12.4 percent payroll tax contribution. Benefits identical to those in the current system would be paid to spouses, dependents, survivors and the disabled. We emphasized that in each case the combination of tax-financed benefits and Personal Retirement Account annuities would exceed the benefits projected in current law while the tax rate projected in current law would not be increased.

In contrast to the effects of this mixed system, the Social Security actuaries project that because of the aging of the population and the resulting increase in the ratio of retirees to employees, the current pure pay-as-you-go system can only maintain the benefits specified in current law by raising the payroll tax rate from 12.4 percent today to more than 17 percent by 2037 (when the Social Security Trust Fund would otherwise be exhausted) and to nearly 19 percent by the end of the actuaries' 75 year forecast period.

Several proposals to combine traditional pay-as-you-go benefits and payments from investment-based Personal Retirement Accounts have now been made by members of Congress and by private analysts. Some of these proposals, including that of Governor George W. Bush, would finance the contributions to Personal Retirement Accounts by allocating (or allowing individuals to allocate) a portion of their payroll tax payments to the Personal Retirement Accounts. If these shifts of payroll tax payments are not matched by concurrent additional payments to the Social Security Trust Fund from general revenue (as some have suggested), the initial effect would be to reduce the flow of funds into the Social Security Trust Fund, causing the balance in the Trust Fund to be smaller in the early years than it would otherwise be.

The primary purpose of this article is to analyze the effects of shifting 2 percent of payroll

tax payments from the Trust Fund to Personal Retirement Accounts.<sup>2</sup> We show that, with a 5.5 percent real rate of return in the Personal Retirement Accounts, such a system is capable of maintaining the benefits projected in current law without a rise in current or future payroll tax rates. After presenting our basic analysis, we discuss the implication of the fact that future returns are uncertain. We also discuss the role of bequests and the cost of permitting individuals to bequeath their Personal Retirement Account balances.

The primary advantage of the mixed system of financing future retirement is that it does not require raising future payroll taxes from the current rate of 12.4 percent. It also has the ability to permit bequests and to provide a high probability that the combined retirement income will actually exceed the benefits currently projected in Social Security law.

A further advantage of the mixed system is that the contributions to Personal Retirement Accounts increase the level of national saving. This is true regardless of whether the funds come from the “on budget” surpluses as we assumed in our earlier writing or from the “off budget” surpluses that we analyze in the current article. In both cases, the reduction in the government surpluses reduces the likelihood that future Congresses and administrations would use those funds to finance additional government spending or additional tax cuts that finance private spending.<sup>3</sup> The Personal Retirement Accounts are additions to personal saving and therefore to

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<sup>2</sup>We would stress that although the plan described here resembles the proposal of Governor Bush in financing the Personal Retirement Accounts by allowing individuals to allocate a portion of their payroll taxes to Personal Retirement Accounts, our analysis is not of “the Bush plan” since Governor Bush did not provide enough information with which to specify any particular “Bush plan.”

<sup>3</sup>The tendency for future Congresses and Administrations to spend unified budget surpluses is consistent with recent budget history. The surpluses in the Social Security Trust Fund that accumulated as a result of the 1983 Social Security reforms that followed the

national saving.<sup>4</sup>

As we discussed in our earlier paper, the increase in national saving means greater investment in business plant and equipment. That in turn means greater profits and therefore greater corporate tax payments. In the previous paper, we showed how these additional corporate tax payments could be used to finance the government's contribution of two percent of payroll to Personal Retirement Account after the currently projected on-budget surpluses no longer existed. In the current paper, we use the additional corporate tax payments to augment the Trust Fund since the Personal Retirement Accounts are funded directly from a portion of the payroll tax payments.

The additional national saving flows largely but not exclusively into corporate investment since some of the additional saving goes into owner-occupied housing and other non-corporate investments and some flows abroad. The incremental investments in the corporate sector earn a return of about 8.5 percent and are subject to an average corporate income tax rate of about 29 percent, implying that the government receives 2.5 percent of the incremental corporate capital.<sup>5</sup> To recognize that some of the incremental national saving goes into non-corporate investments, we scale down the return that the government receives on these funds by

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Greenspan Commission were more than matched by on-budget deficits, producing overall budget deficits in spite of the off-budget Social Security surpluses.

<sup>4</sup>If households expect that the mixed system of pay-as-you-go benefits and Personal Retirement Account annuities will only maintain the level of benefits projected in current law, they have no reason to reduce other saving or increase spending from existing assets.

<sup>5</sup>See Table 1 in James Poterba "The Rate of Return to Corporate Capital and Factor Shares: New Estimates Using Revised National Income Accounts and Capital Stock Data," Carnegie-Rochester Conference Series on Public Policy, Vol. 48, 211-46.

one fifth, from 2.5 percent of the Personal Retirement Account asset balances to 2.0 percent of those balances.<sup>6</sup> With the Trust Fund augmented in this way and with the Personal Retirement Account annuities permitting smaller pay-as-you-go payouts while maintaining the projected value of retirement incomes, the Trust Fund remains permanently solvent.<sup>7</sup>

### **1. The Social Security Simulation Model<sup>8</sup>**

Our analysis in this paper uses an accounting model developed as part of our research in a broader National Bureau of Economic Research project on Social Security reform. This model is calibrated so that with the current Social Security law it closely approximates the time series of benefits, revenues and Trust Fund assets predicted in the 2000 Social Security Trustees Report.

The unit of analysis in these simulations is the individual. Benefits for spouses, dependents, and survivors, as well as disability benefits, are subsumed in the individual benefit provision which is scaled so that total OASDI benefits correspond to those projected by the

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<sup>6</sup>This transfer of tax revenue to the Trust Fund is similar to the procedure in current law in which the extra personal income tax revenue associated with the personal taxation of Social Security benefits of taxpayers with more than \$32,000 in income for married taxpayers and \$25,000 for single taxpayers is transferred from general revenues to the Trust Fund.

<sup>7</sup>Our analysis of the solvency of the Social Security Trust Fund and the ability to maintain projected retirement income does not depend on this assumption about national saving but only on the willingness of future Congresses and Administrations to deposit an amount equal to 2 percent of the PRA account balances into the Social Security Trust Fund.

<sup>8</sup>This section summarizes the technical features of the simulation model. The analysis here parallels that of the earlier paper and can be skipped by readers who want to get right to the results of the new analysis. Others who want more details can consult Martin Feldstein and Andrew Samwick, "The Economics of Prefunding Social Security and Medicare Benefits," in B. Bernanke and J. Rotemberg (eds) NBER Macroeconomic Annual 1997, Cambridge: MIT Press, 115-148.

Social Security actuaries. We use the current actual age structure of the US population and the Census Bureau's projections of future birth and death probabilities to estimate the population in each future year. We also use projections of the numbers of net new immigrants and scale up the projected population of every age to coincide with the aggregate population projections of the Social Security Administration.

The simulations assume that individuals begin work at age 21 and continue to work until the year before they reach the normal retirement age legislated for their birth cohort (or die if that occurs sooner.) The normal retirement age is currently 65 but will soon begin to rise incrementally to age 67. Since not everyone in the population of working age actually works in each year, we adjust the labor force participation rate to obtain the number of covered workers in each future year that is projected by the Social Security actuaries.

Our calculations embody the historic data for Social Security taxable payroll for the years before 2000 and then use the forecast of taxable payroll in the intermediate assumptions of 2000 Social Security Trustees Report for subsequent years. According to that forecast, the average real wage rises at 1.0 percent per year in the long term. Our calculations assume that the movements of the average real wage reflect changes in the age structure of the labor force and differences among age groups in the relative level of wages as well as the overall rate of increase of age-specific wage rates.

The investments in the Personal Retirement Accounts are assumed to earn a real rate of return of 5.5 percent after inflation. A portfolio invested 60 percent in the Standard and Poors 500 portfolio of common stock and 40 percent in a portfolio of corporate bonds during the fifty

year period through 1995 had a mean real logarithmic return of 5.9 percent.<sup>9</sup> We deduct 0.4 percent per year to reflect the administrative costs of PRAs.<sup>10</sup> The full rate of return earned on non-financial corporate capital before all taxes during the same period was about 8.5 percent.<sup>11</sup> The difference between this 8.5 percent and the portfolio return reflects the taxes paid by corporations and therefore not included in the return earned on PRA accounts. We follow the Social Security Trustees in assuming that the real return on the government bonds in the Social Security Trust Fund will decline gradually to a 3.0 percent real interest rate in the future.

Because we are interested in total benefit payments and not in their distribution by income and family type, we base our calculations on average taxable payroll in each year and do not distinguish among different income levels and family structures.<sup>12</sup> Although we therefore

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<sup>9</sup>The use of the logarithmic rate of return understates the actual level rate of return by about one percentage point. The mean real rate of return of the portfolio in level form was about 6.9 percent during the 50 year period through 1995. We return to this distinction when we discuss risk below. For now, the use of 5.9 percent can be regarded as providing a conservative margin of safety in the mean return. Including the more recent years would of course increase the rate of return.

<sup>10</sup>For a discussion of alternative administrative arrangements and the cost of administering investment based Personal Retirement Accounts, see John Shoven (ed.) Administrative Aspects of Social Security Reform (Chicago: Chicago University Press, forthcoming). Preliminary versions of the papers in this volume can be seen in the “Books in Progress” section of the website of the National Bureau of Economic Research ([www.nber.org](http://www.nber.org)). After the conference at which those papers were presented, TIAA-CREF introduced a variable annuity based on the Russell 3000 stock index with an annual expense charge of only 0.37 percentage points. Our assumption of a cost of 0.40 percentage points may therefore exceed the amount needed in practice, especially since the TIAA-CREF accounts have to manage the collection of account deposits at varying intervals; we assume that all such deposits would come in a single annual payment from the government.

<sup>11</sup>See footnote 5.

<sup>12</sup>For a discussion of the distributional effects of switching from the current pure pay-as-you-go system to a mixed system of the type considered here, see Martin Feldstein and Jeffrey

cannot apply the actual Social Security benefit rules, we use the implicit rate of return on the taxes paid by individuals in each birth cohort to calculate aggregate average benefits for that cohort<sup>13</sup> in a way that produces the same aggregate benefit amounts that the Social Security actuaries project for future years on the basis of current law.

## **2. Personal Retirement Accounts: Deposits, Benefits, and Asset Values**

Our analysis assumes that the Personal Retirement Account (PRA) deposits begin with the year 2000 and that all employees in that year shift 2.0 percent of the 12.4 percent payroll tax to the new Personal Retirement Accounts. The PRA deposits in that year are projected to be \$79.38 billion (at the year 2000 price level). The deposited amounts increase over time as earnings rise, reaching \$93.15 billion in 2010, \$121.45 billion in 2030, \$156.59 billion in 2050 and \$209.53 in 2075, the final year of our analysis. All of these amounts are in prices of the year 2000. These figures are shown in column 1 of Table 1.

We assume that individuals begin to receive payments from their PRAs at their normal retirement ages specified in current law (i.e., 65 now and rising to age 67) in the form of an annuity that earns the same 5.5 percent real rate of return that we assumed for the accumulation phase. The first annuities are paid to individuals who become 65 in the year 2001 and total only

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Liebman, "The Distributional Consequences of an Investment-Based Social Security System," National Bureau of Economic Research Working Paper 7492, January 2000, available at <http://papers.nber.org/papers/W7492>.

<sup>13</sup>The estimated average rates of return by cohorts are modifications of the original estimates developed in Michael Boskin, Laurence Kotlikoff, Douglas Puffert, and John Shoven, "Social Security: A Financial Appraisal Across and Within Generations," National Tax Journal, Vol. 40, 1987, 19-34.

\$70 million.<sup>14</sup> Total annuities grow rapidly, reaching \$1.26 billion in 2005, \$5.68 billion in 2010, \$127.01 billion in 2030 and \$937.48 billion in 2075 (all in year 2000 dollars). These figures and the amounts for selected intervening years are shown in column 2 of Table 1. The rapid rise in the annuity amounts reflect the increasing number of annuitants and the rapid increase in the average annuity amount. The rapid increases in the average annuity amounts in turn reflect the increased number of years of PRA contributions among successive retiree cohorts.

The same annuity payments are shown in column 3 of Table 1 as percentages of the reported taxable payroll of all individuals in each of the selected years. These amounts rise from 0.12 percent of taxable payroll in 2010 to 2.09 percent in 2030, 5.76 percent in 2050, and 8.95 percent in 2075. Since one percent of taxable payroll corresponds to between 0.35 percent of gross domestic product and 0.39 percent of gross domestic product during this time period, these annuity payments rise from 0.05 percent of GDP in 2010 to 3.58 percent of GDP in 2075.

The aggregate value of the funds in all Personal Retirement Accounts grows with the PRA deposits of 2 percent of each year's payroll and with the 5.5 percent rate of return on the existing assets and is diminished by the annuity payouts. The resulting aggregate PRA value is shown in column 4 of Table 1 in billions of year 2000 dollars and in column 5 as a percentage of the corresponding aggregate taxable payroll. The PRA assets rise rapidly, from \$1,224.08 billion in 2010 to \$5,754.74 billion in 2030, \$12,231.66 billion in 2050 and \$20,444.27 billion in 2075. As a percentage of taxable payroll, these PRA assets rise from 26.28 percent of taxable payroll in

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<sup>14</sup>In practice, the program might require a minimum of, say, five years of deposits to avoid very small annual payments.

2010 to 94.77 percent in 2030 and 195.14 percent in 2075. These figures are shown in column 5 of Table 1.

### **3. The Path of the Trust Fund**

As we noted in the introduction, our focus in this paper is on the feasibility of maintaining each individual's total retirement income from a combination of the Personal Retirement Account annuities and the traditional pay-as-you-go benefits. We will show that in fact the mixed system that combines the two sources of retirement income can actually provide an increased level of total retirement income without increasing the payroll tax rate from its current level.

Column 1 of Table 2 shows the benchmark benefits (i.e., the benefits projected according to current Social Security rules) as a percentage of taxable payroll, rising from 10.12 percent in 2000 to 18.54 percent in 2075.<sup>15</sup> The current payroll tax rate of 12.4 percent will no longer be sufficient to finance the projected benefits by 2015. By 2040, there is a shortfall of 4.73 percent of taxable payroll, implying that benefits would have to be cut by 27 percent if the current system and tax rate is left unchanged. By 2075, the required benefit cut would have to equal 6.14 percent

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<sup>15</sup>These figures are the “net cost” of providing the benefits. Total payments in each year are slightly higher, with the difference financed by the personal income tax revenue that is collected on Social Security benefit payments under existing law and transferred from general revenue to the Social Security Trust Fund. In 2020, for example, the total payments financed from the Social Security Trust Fund for all beneficiaries of all cohorts are equal to 14.66 percent of taxable payroll. This is referred to as the “cost rate” of the system in that year. The projected personal income tax revenue on these benefits is equal to 0.51 percent of taxable payroll, leaving a net cost rate of 14.15 percent of taxable payroll to be financed. For 2020, we actually estimate a net cost rate of 14.18 percent of taxable payroll. Although our simulation model does not match the Social Security actuaries' projections exactly, the average absolute deviation of the estimated net cost rate from the Trustees Report net cost rate is only 0.05 percent of payroll. Throughout our analysis, we implicitly assume that the total amount of income taxes on benefits remains the same, regardless of the source of the benefit payment.

of taxable payroll, a 33 percent benefit reduction.

If 2 percent of taxable payroll is allocated to the PRA deposits, the annual net payroll tax becomes 10.4 percent of taxable payroll. The other source of tax revenue to finance benefits in the mixed system is the incremental corporate tax revenue that we assume is transferred to the Trust Fund. This incremental corporate tax revenue is 2 percent of the value of the assets in the PRA accounts. Multiplying the value of PRA assets as a percentage of taxable payroll (shown in column 5 of table 1) by 0.02 implies corporate tax revenue that rises from 0.53 percent of payroll in 2010 to 1.90 percent of payroll in 2030, 3.12 percent in 2050 and 3.90 percent in 2075. Combining the incremental corporate tax revenue with the 10.4 percent payroll tax gives the “tax revenue available to finance benefits” shown in column 2 of Table 2. This total rises from 10.44 percent in 2000 to 14.30 in 2075.

Column 3 of Table 2 presents the PRA benefits as a percentage of taxable payroll (as previously shown in column 3 of Table 1). These rise from zero in the first year to 2.09 percent of payroll in 2030 and to 8.95 percent in 2075.

The combination of the available tax finance and the PRA annuities, shown in column 4 of Table 2, is initially more than sufficient to finance the benefits (shown in column 1), then temporarily are less (requiring net payments from the Trust Fund to make up the difference), and eventually again become more than enough to finance current benefits, implying that it would be possible to increase benefits or reduce the payroll tax. We now look at this in more detail.

In the year 2000, the cost of the benchmark benefit is only 10.12 percent of payroll. The combined tax revenue of 10.44 percent of payroll therefore implies a surplus of 0.32 percent of payroll that can augment the existing Trust Fund balance.

By 2020, the benchmark benefit costs 14.18 percent of payroll. The tax finance of 11.56 plus the PRA annuity of 0.74 percent of payroll are sufficient to finance 12.30 percent of payroll, shown in column 4. The remaining 1.88 percent of payroll needed to reach the benchmark benefits, as shown in column 5, comes from the Trust Fund.

As a result, the Trust Fund balance (shown in column 6) declines from 25.33 percent of payroll in 2019 to 23.78 percent of payroll in 2020. This decline reflects three components: (1) with no change in the assets of the Trust Fund, the increase in taxable payroll from 2019 to 2020 would cause the assets as a percentage of payroll to decline from 25.33 percent to 24.91 percent; (2) the interest earned on the Trust Fund assets would cause the Trust Fund to rise by approximately 0.75 percent of taxable payroll, and (3) the 1.88 percent of payroll needed to complete the financing of the benchmark benefit would reduce the Trust Fund by that amount. Thus, 24.91 percent of payroll plus 0.75 percent of payroll minus 1.88 percent of payroll equals the 23.78 percent of payroll shown in column 6.

The process continues in this way until 2031 when the Trust Fund is temporarily exhausted. After that date, we assume that the Social Security system borrows against future Trust Fund receipts of payroll and corporate taxes, paying the same interest rate on its liability as the Trust Fund would receive if the balance were positive. For 2031, this is a real interest rate of 3 percent.

By 2042, the combination of the payroll taxes, the incremental corporate tax revenue, and the PRA annuities are enough to outweigh the combination of the interest outlays of the Trust Fund and the Social Security benefit payout needed to maintain retirement income at the level projected in current Social Security law.

In 2050, for example, the net cost of the benchmark benefits is 17.17 percent of payroll (column 1 of Table 2), the combination of payroll and corporate tax revenue is 13.52 percent of payroll (column 2), and the PRA annuities are 5.76 percent of payroll (column 3). The total of tax revenue and PRA annuities is therefore 19.28 percent of payroll (column 4), causing a surplus of 2.11 percent payroll (column 5). This surplus more than offsets the interest that the Trust Fund is still paying on its past borrowing and causes the small liability that remained at the end of 2049 to shrink to 2.87 percent of payroll at the end of 2050. By the end of 2052, the Trust Fund has a positive balance.

After 2051, the positive balance of the Trust Fund grows rapidly since the combination of the PRA annuities and the tax receipts is more than enough to finance the benchmark benefits. Note that by 2075 the operating surplus before Trust Fund interest receipts is 4.71 percent of payroll and the Trust Fund is 107 percent of payroll and rising rapidly.

The positive and increasing Trust Fund balance in 2075 is a necessary feature of any Social Security reform than can claim to be permanently successful. Although the 2000 Trustees Report refers to a 75-year average shortfall of 1.89 percent of taxable payroll, closing that gap by a 1.89 percent increase in the payroll tax rate for the next 75 years would leave a zero balance in the Trust Fund in 2075 and a permanent future financing gap of more than 6 percent of taxable payroll.<sup>16</sup> In contrast, the positive and increasing Trust Fund balance for 2075 shown here indicates that there is room to reduce payroll or corporate tax contributions or to increase total retirement income without undermining the financial solvency of the system in years after 2075

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<sup>16</sup>The same is obviously true also for any other reform proposal in which the Trust Fund is permanently exhausted at any time before 2075.

as well.

#### **4. Uncertain Rates of Return**

The 5.5 percent real rate of return that we have assumed in these calculations was the average real logarithmic rate of return on a portfolio of 60 percent equities (the Standard and Poors 500) and 40 percent corporate bonds from 1946 through 1995. The average future rate of return is, of course, both uncertain and subject to year-to-year variation. In earlier work, Feldstein and Rangelova<sup>17</sup> and Feldstein, Rangelova and Samwick<sup>18</sup> studied the implication of this uncertainty and variability in the context of models in which the Personal Retirement Accounts were financed by additional government revenue rather than by allocating a portion of the payroll tax receipts. The analysis in those papers can however be applied directly to the current issue.

The analysis in Feldstein and Rangelova used the historic year-to-year variation in the returns on a 60:40 stock-bond portfolio to characterize the uncertainty of the estimated mean return (the 5.5 percent assumed above) and the future annual variability of returns. They then developed 10,000 80-year simulations of alternative possible futures that reflect this uncertainty and the subsequent year-to-year variation from 1998 to 2077. On the basis of these 10,000

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<sup>17</sup>Martin Feldstein and Elena Rangelova, "Individual Risk and Intergenerational Risk Sharing in an Investment-Based Social Security System," National Bureau of Economic Research Working Paper 6839, December 1998, available at <http://papers.nber.org/papers/W6839>.

<sup>18</sup>Martin Feldstein, Elena Rangelova and Andrew Samwick, "The Transition to Investment-Based Social Security when Portfolio Returns and Capital Profitability Are Uncertain," National Bureau of Economic Research Working Paper 7016, March 1999, available at <http://papers.nber.org/papers/W7016>.

simulations, we can say what the probability is that retirees in any future year would receive total retirement income that is above any given fraction (or multiple) of the benchmark Social Security benefits projected for that year in current law.

More specifically, to model the effect of uncertainty on retirees during the transition period until the Trust Fund returns to a significant positive value (beginning in 2060), we set the level of the pay-as-you-go benefits so that the combination of these pay-as-you-go benefits and the PRA annuity based on a 5.5 percent rate of return would equal the benchmark benefit. Any shortfall or excess of the actual rates of return relative to that 5.5 percent therefore causes total retirement income to be below or above the benchmark benefits. This assumption maintains the path of the Trust Fund shown in column 6 of Table 2.

The relative importance of the PRA annuities, and therefore of the uncertainty of those annuities, increases with the number of years that a retiree has participated in the PRA program. To look at the maximum exposure to the PRA benefit uncertainty, we consider individuals who have contributed to a PRA for their entire working lives. More specifically, we consider first an individual who begins work in the year 2004 at age 21 and retires in the year 2050 at the age of 67, one of the first cohorts of retirees who can contribute for their full working lives. The aggregate benchmark benefits for all retirees in that year are projected to have a cost of 17.17 percent of taxable payroll (Table 2, column 1). The aggregate PRA benefits that would be paid in 2050 if the PRA accounts achieve a 5.5 percent rate of return in each prior year would be 5.76 percent of taxable payroll (Table 2, column 3). This leaves 11.41 percent of taxable payroll to be

paid as pay-as-you-go benefits.<sup>19</sup> Since 11.41 percent of taxable payroll is only 66 percent of the benchmark benefits, the average reduction of the pay-as-you-go benefits would be 34 percent.

The reduction differs, however, by birth cohort. The new retirees have participated in the PRA program for more years than those who retired several years earlier. As a result, their PRA benefits are larger relative to the benchmark than the PRA benefits of those who have already been retired for many years. More specifically, the PRA benefit of the 67 year olds in 2050 would be 45 percent of their benchmark benefit. If we reduce their pay-as-you-go benefit by this 45 percent, they will receive total retirement income equal to or greater than the benchmark benefit if and only if the PRA benefit for those individuals exceed 45 percent of the benchmark benefit.

According to the Feldstein-Ranguelova simulations, a 67 year old who has contributed 2 percent of his earnings each year from age 21 until age 66 has a 71 percent probability that his PRA annuity will exceed 45 percent of his benchmark benefit. This implies that there is a 71 percent probability that the combination of his PRA annuity and his reduced pay-as-you-go benefit will exceed his benchmark benefit.<sup>20</sup> The Feldstein-Ranguelova simulations also imply that there is an 81 percent probability that the combined benefit will exceed 90 percent of the benchmark benefit and a 91 percent probability that the combined benefit will exceed 80 percent

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<sup>19</sup>This is less than the tax revenue available to finance benefits (Column 2 of Table 2) which is equal in that year to 13.52 percent of taxable payroll. The difference is added to the Trust Fund.

<sup>20</sup>Although the Feldstein-Ranguelova simulations assume the same 5.5 percent mean real logarithmic return as we have assumed in the earlier part of this paper, the corresponding level return (i.e., the actual average annual return) for the same 50 year period was a full percentage point higher (i.e., a 6.9 percent total return or 6.4 percent after allowing for the 0.40 percent administrative costs.)

of the benchmark. The risk of a substantial shortfall is thus quite small. There is also a 50:50 chance that the total benefit will exceed 125 percent of the benchmark benefit.

In the year 2050, the Trust Fund is still in debt. The rule of limiting the pay-as-you-go benefit to the difference between the benchmark benefit and the PRA annuity that would result from a 5.5 percent return implies a surplus in that year of 2.11 percent of payroll, almost enough to pay off the entire remaining Trust Fund debt. A slower return to a positive Trust Fund balance would permit higher pay-as-you-go benefits and therefore a lower risk that the new retirees would receive less than their full benchmark benefit from the combination of the pay-as-you-go benefit and the PRA annuity. For example, if the surplus were reduced from 2.11 percent of payroll to 1.0 percent of payroll and the other 1.11 percent of payroll were used to increase all pay-as-you-go benefits, the probability of achieving at least the benchmark level of retirement income would be 77 percent and the probability of achieving at least 90 percent of the benchmark benefit would be 87 percent.

Beginning in 2052, the Trust Fund is again positive. By 2060 the Trust Fund has assets equal to 28 percent of taxable payroll, higher than they are today. Since the combination of the tax revenue and PRA annuities (column 4 of Table 2) is more than enough to finance the benchmark benefits, it is possible, beginning in 2060, to relax the rule that limits the pay-as-you-go benefits to what they would be if the aggregate PRA annuity is equal to the value that would result from a 5.5 percent rate of return.

To see the implication of this, consider a 67 year old retiree in 2060. Since the Trust Fund is then very large (more than 28 percent of taxable payroll), it would be possible to use all of the payroll tax revenue plus the incremental corporate tax payments (a total of 13.92 percent

of taxable payroll) to pay traditional benefits, leaving the Trust Fund to grow at the rate of interest earned on its assets. The total benefits projected in 2060 are 17.84 percent of taxable payroll, implying that the pay-as-you-go benefits would be 78 percent of benchmark benefits. With this share of the benchmark benefits coming from the pay-as-you-go system, the Feldstein-Rangelova simulations imply that there is a 94 percent chance that the combined retirement income will exceed the benchmark benefit level and a 99 percent chance that the combined retirement income will exceed 90 percent of the benchmark level.

Consider finally the situation in 2075. Even if all of the tax revenue beginning in 2060 had been used to finance pay-as-you-go benefits, the Trust Fund in 2075 would be greater than the 28 percent of payroll in 2060 because the interest received on the Trust Fund balance would cause it to grow faster than the increase in taxable payroll. It would continue to be possible to use all of the payroll tax revenue plus the incremental corporate tax payments (a total of 14.30 percent of taxable payroll) to pay traditional benefits, leaving the Trust Fund to continue to grow at the rate of interest earned on its assets. The total benefits projected in 2075 are 18.54 percent of taxable payroll, implying that the pay-as-you-go benefits would be 77 percent of benchmark benefits. With this share of the benchmark benefits coming from the pay-as-you-go system, the Feldstein-Rangelova simulations again imply that there is a 93 percent chance that the combined retirement income will exceed the benchmark benefit level and a 99 percent chance that the combined retirement income will exceed 90 percent of the benchmark level.

Even these relatively low levels of risk can be eliminated by a government program that augments the combined benefit if it falls below the benchmark level. Since an open-ended guarantee would induce excessive risk-taking, the guarantee would have to be limited to the

shortfall that would occur if the individual invested the PRA balances in a “standard” mutual fund that invested in a pre-specified portfolio like the 60 percent Standard and Poors and 40 percent corporate bonds portfolio used in our simulations. Individuals would be free to invest in other portfolios, but the guarantee would only be paid relative to the performance of this standard investment. Calculations reported in earlier research<sup>21</sup> show that the risk to future taxpayers of providing such a guarantee is very small.

## **5. Bequests**

Although the calculations described in this paper assume that current benefit rules will continue to provide benefits to spouses, dependents and survivors, there is general interest in the possibility of allowing individuals to bequeath their PRA assets. The cost of permitting such bequests depends on the form of the bequest that is allowed. The most obvious form would be to allow individuals who die before reaching normal retirement age to bequeath the assets in their Personal Retirement Accounts. Feldstein and Rangelova<sup>22</sup> estimated that the such bequests could be permitted without changing the probability distributions of PRA annuities at every age by increasing the PRA deposits from 2 percent of taxable payroll to 2.3 percent of taxable payroll. This calculation applies to those cohorts that have participated in the PRA system from age 21.

It is also possible to permit bequests after retirement, with a cost that depends on the

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<sup>21</sup>See Andrew Samwick, “Social Security Reform in the United States,” for a discussion of these guarantees and the studies cited in footnotes 17 and 18 for more detail on their cost.

<sup>22</sup>Martin Feldstein and Elena Rangelova, “The Economics of Bequests in Pensions and Social Security,” National Bureau of Economic Research Working Paper 7065, April 1999, available at <http://papers.nber.org/papers/W7065>.

bequest rule. Feldstein and Ranguelova estimated that replacing a lifetime annuity with a twenty year certain annuity<sup>23</sup> in addition to permitting preretirement bequests raises the required saving from 2 percent of taxable payroll to 2.8 percent of taxable payroll.

These same estimates would apply to the current context in which the 2 percent of taxable payroll is taken from the 12.4 percent payroll tax rather than being financed by additional funds.

## **6. Conclusion**

This paper has shown that a program of Personal Retirement Accounts (PRAs) funded by allocating 2 percent of the 12.4 percent payroll tax collections can maintain the retirement income projected in current law while avoiding any increase in the 12.4 percent payroll tax. The combination of the higher return on the assets in the Personal Retirement Accounts and the use of the additional corporate profits taxes that result from the increased national saving in Personal Retirement Accounts (2 percent of the aggregate value of Personal Retirement Accounts) is sufficient to maintain the solvency of the Social Security Trust Fund even though the tax payments to the fund are reduced from 12.4 percent of taxable payroll to 10.4 percent of taxable payroll. Although there is a period of years when the Trust Fund must borrow, it is able to repay this borrowing with interest out of future tax collections. In the long run, the Trust Fund becomes very large, implying that it would be possible to reduce the payroll tax further or to increase retirement incomes above the levels projected in current law.

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<sup>23</sup>A 20 year certain annuity pays benefits for the life of the retiree or for twenty years, whichever is longer. See the Feldstein and Ranguelova study cited in footnote 22.

Table 1  
Personal Retirement Account Deposits and Annuities

Year	PRA Deposits	PRA Annuities	PRA Annuities	PRA Assets	PRA Assets
	(1)	(2)	(3)	(4)	(5)
2000	79.38	0.00	0.00	79.38	2.00
2010	93.15	5.68	0.12	1,224.08	26.28
2020	107.37	39.83	0.74	3,121.31	58.14
2030	121.45	127.01	2.09	5,754.74	94.77
2040	138.51	265.93	3.84	8,857.94	127.90
2050	156.59	451.28	5.76	12,231.66	156.23
2060	176.00	654.28	7.44	15,498.46	176.12
2070	197.84	832.45	8.42	18,785.37	189.91
2075	209.53	937.48	8.95	20,444.27	195.14

Source: Author's calculations based on the intermediate assumptions of the 2000 Trustees' Report.

Notes:

- 1) Columns (1), (2) and (4) are reported in billions of dollars at the 2000 price level.
- 2) Columns (3) and (5) are reported as a percentage of taxable payroll.

Table 2  
Feasibility of Benchmark Benefits and Trust Fund Solvency

Year	Benchmark Benefits	Tax Revenue Available to Finance Benefits	PRA Benefits	Current Funds Available to Finance Benefits	Current Surplus (+) or Shortfall (-)	Trust Fund Balance
(1)	(2)	(3)	(4)	(5)	(6)	
2000	10.12	10.44	0.00	10.44	0.32	24.53
2010	11.24	10.93	0.12	11.05	-0.19	30.23
2020	14.18	11.56	0.74	12.30	-1.88	23.78
2030	16.75	12.30	2.09	14.39	-2.36	3.18
2040	17.13	12.96	3.84	16.80	-0.33	-11.74
2050	17.17	13.52	5.76	19.28	2.11	-2.87
2060	17.84	13.92	7.44	21.36	3.52	28.21
2070	18.30	14.20	8.42	22.62	4.32	76.60
2075	18.54	14.30	8.95	23.25	4.71	107.38

Source: Author's calculations based on the intermediate assumptions of the 2000 Trustees' Report.

Note: All columns are reported as percentages of taxable payroll.