

The Life-Cycle Personal Accounts Proposal for Social Security: An Evaluation

By Robert J. Shiller

March 10, 2005

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Abstract

The life-cycle accounts proposal for Social Security reform raises important questions regarding economic theory and evidence. The proposal is described and analyzed. A simulation is undertaken to estimate the probability distribution of returns in the accounts based on long-term historical experience. U.S. stock market, bond market and money market data 1871-2004 are used for the analysis. Assuming that future returns behave like historical data, it is found that a baseline personal account portfolio after offset will be negative 32% of the time on the retirement date. The median internal rate of return in this case is 3.4 percent, just above the amount necessary for holders of the accounts to break even. However, the U.S. stock market has been unusually successful historically by world standards. It would be better if we adjust the historical data to reduce the assumed average stock market return for the simulation. When this is done so that the return matches the median stock market return of 15 countries 1900-2000 as reported by Dimson *et al.* [2002], the baseline personal account is found to be negative 71% of the time on the date of retirement and the median internal rate of return is 2.6 percent

Robert J. Shiller
Cowles Foundation for Research in Economics
and International Center for Finance
Yale University
30 Hillhouse Ave
New Haven CT 06520-8281
203 432-3726
robert.shiller@yale.edu

TheLife-Cycle Personal Accounts Proposal for Social Security: An Evaluation¹

President George W. Bush has outlined a specific plan for personal accounts within Social Security, allowing workers to invest a portion of their payroll taxes in exchange for a reduction in their traditional Social Security benefit. He has not, however, unveiled an entire plan to restore solvency. This paper focuses on one aspect of the portion of the plan he has already announced: the life-cycle personal accounts. Specifically, the paper investigates the possible returns and possible risks associated with the personal account option. I use historical returns to assess the potential range of future investment outcomes under the life-cycle portfolio envisioned under the President's plan.

I. How the Accounts Would Work

Consider how the proposed personal account plan alters the social security system. Under the present system, each working individual must contribute 6.2% of his or her earnings (up to an earnings ceiling, currently \$90,000) to social security, and this is matched by another 6.2% of earnings that the individual's employer must contribute. Upon retirement, the individual's and employer's contributions for all the years that he or she worked, updated for inflation using a wage index, are fed into a formula that determines the annual Social Security benefit that the individual will receive upon retirement. The present formula is progressive, that is, people with lower earnings get relatively more in benefits per dollar contributed than do people with higher earnings. The formula does not take as inputs any financial variables such as interest rates or stock returns, and so the benefits ultimately received are independent of the performance of

¹ The author wishes to thank Jason Furman for substantial assistance, and to participants at the finance seminar at the Stern School of Business, New York University, for helpful comments.

financial markets. While social security benefits are subject to political risk and risks about changes in the economy, they historically have not exhibited any of the annual volatility associated with investments in financial markets.

The proposed new personal account system would be optional: people can stay in the old system (subject to future changes in that system that Congress might make) or elect to have 4.0% of their 6.2% contribution (up to a maximum amount that would be phased out by 2041), diverted into personal accounts. They can then allocate these accounts, according to their tastes, into a portfolio of their choosing, subject to the restriction that it be comprised of a few broadly diversified investment funds of stocks and bonds along the lines of the options currently offered to Federal employees through the Thrift Savings Plan (TSP).

But, according to the President's plan, the personal account does not come for free. Indeed, there is a much-discussed budget problem that the President's plan must allow for. A plan that simply allows workers to divert part of their Social Security contribution into a personal portfolio will mean that the government will no longer be able to use this part of current contributions to support the current beneficiaries of Social Security. The government will have to borrow money to make up for the money workers have diverted to the personal accounts. So, in an attempt to preserve balance over an infinite horizon, the plan specifies that when the individual finally retires, an "offset" value, the terminal value of the Social Security contributions cumulated at a 3% real interest rate, will be annuitized (converted into a series of payments for life, analogous to the payments that people make on mortgages) and subtracted from the traditional social security benefit. In addition to this reduced traditional benefit due to the offset, the

worker will also get the lump sum value of the personal account, although he or she would be required to annuitize at least enough of that so that the combined traditional benefit and personal account would be above the poverty line, whenever there is enough in the personal account to make that possible. In effect, the worker has not really “diverted” his or her Social Security contributions into a personal account, but has merely borrowed from the government to invest in a personal account, and must eventually pay the loan back. The offset will eventually help the government deal with the debt it incurred to maintain benefits to retirees.

While the plan is described as a way of “fixing” Social Security, in effect, the new personal accounts are nothing more than a plan to encourage people to buy stocks and bonds on margin, that is to borrow money to buy stocks, with the Federal government as the lender offering a 3% real interest rate on the loan. The computation that is made when a worker retires is the same as one that a brokerage firm would do for customers with margin accounts who elected to put the equity in their margin account into a retirement annuity on the day they retired. In the brokerage business, the “offset” would be called the “debit balance” in the margin account.²

Of course, there is nothing morally or practically wrong with buying stocks on margin, despite popular prejudices against the practice. Encouraging people to do this might help diversify their personal portfolios better, offsetting the anti-equity bias that infects the portfolios of most small investors.³ Encouraging people to buy securities on

² In this case, however, the “debit balance” is subtracted from the traditional Social Security benefit, although in net this is equivalent to subtracting the balance from the personal account itself.

³ The best-stated theoretical argument for personal accounts is that they encourage people to diversify their portfolios better; see Geanakoplos *et al.* 2000. In contrast, many popular accounts of the advantages of personal accounts neglect to note that higher returns that investments such as stocks appear to offer are really just compensation for the higher risk that these investments entail.

margin might also help a broad element of the public learn a lesson in finance, thus furthering the President's goal of promoting an "ownership society." But, we have to think whether this plan for margin purchases of securities is going to work out as well for them financially as the President has been intimating.

II. The Life-Cycle Portfolio

The President's plan seems to be based on the concept that the optimal portfolio for most of the participants is a "life-cycle portfolio." The managers of the life-cycle accounts would invest more aggressively when the worker is young, and gradually more conservatively as he or she ages, in accordance with the advice of most financial advisors. According to the President's plan, the life-cycle portfolio would be an option for younger workers and all personal accounts would be "automatically invested in the 'life cycle portfolio' when a worker reaches age 47, unless the worker and his or her spouse specifically opted out by signing a waiver form stating that they are aware of the risks involved."⁴ Thus, in a sense the life cycle portfolio is the centerpiece of the personal account plan.

The life cycle plans are important to the plan in that they attempt to respond to the complaint that the president's social security plan is too risky, that by encouraging people to achieve higher returns on their social security contributions by investing in risky assets, they will run major risks that a market decline will impoverish them in their retirement. A life cycle plan would involve riskier investments only in the earlier years of the life cycle.

⁴ Office of the Press Secretary, The White House, *Strengthening Social Security for the 21st Century*, p. 7.

However, the life cycle plan may also not live up to its promise of giving workers a return higher than they would have gotten under the original social security plan. Any plan that deals with risk by investing more conservatively will tend to also lower the expected return.

III. Methods and Assumptions Underlying the Analysis

In this note I will do a simulation of the returns from such life-cycle personal accounts, using long-term historical data. Long-term historical data are important to look at, lest our results be overinfluenced by recent years, for which stock market returns have been very high. It is common sense that if we want to assess the returns from a lifetime investing strategy, we should look beyond one or two lifetimes: we need to look at the range of history.

I will use for this purpose a U. S. data set on U.S. stocks, bonds and money market 1871-2005 that I assembled years ago for my book *Market Volatility*, 1989, and also used in my book *Irrational Exuberance*, Princeton University Press, 2005. In this paper I will use these data both with and without adjustments to returns to reflect international experience.

A. Historical Simulation

I will use returns on stocks, bonds and the money market, from 1871 to 2004 to devise 91 separate draws of a worker's 44-year experiences in these markets. Earnings by age for a representative worker are taken from the "scaled medium earner" developed by the Social Security actuaries, this earner is meant to reflect the typical employment and

earnings pattern with rising wages through age 51 and then falling off by 64. In all of the simulations the worker is born in 1990, starts participating in the accounts in 2011, and retires in 2055 at age 65. The simulations hold the earnings path constant and only vary the rates of return experienced by this hypothetical worker. It is assumed that the worker places the full 4%, of earnings, into a personal account, the maximum under the Bush plan.

These simulations require an appropriate series of historical returns and an assumed portfolio.

B. Assumptions on Assets and Rates of Return

The Social Security Trustees have assumed that future real returns for stocks will be 6.5% per annum, for government bonds 3%. This assumption appears close to long-term historical experience for the U. S., see Table I.⁵ For the years 1871-2004, the geometric average real return on U.S. stocks was 6.8%, for U.S. government bonds 2.6%. For the more recent subsample of 1950 to 2004, the returns were broadly similar, higher for stocks, lower for bonds. It might seem, then, that the Social Security actuaries were making reasonable assumptions about future returns.

However, there are important reasons to doubt that the numbers can be trusted as a guide to the next century. We do not know that the successful twentieth century will be duplicated in the U.S. in the twenty-first century. There are reasons to doubt this. The U.S. has been a very successful country. It would be a mistake to assume that the U.S. will be so extraordinarily successful in the next century. In fact, the Social Security

⁵ The reader is reminded that returns are computed as geometric averages of gross returns, which are always lower than the arithmetic averages that are often quoted. See Jeremy Siegel, *Stocks for the Long Run*, 2002. Also, real (inflation-corrected) returns are lower than the nominal returns that are often quoted.

Trustees themselves forecast a considerable slowdown in GDP growth in the 21st century compared to the experience of the 20th century.

Table 1 also shows the median of the geometric average return for 15 countries, including the United States, for 1900 to 2000 as reported in Dimson *et al.* [2002]. Note that the stock return is considerably lower for this international historical sample than it is for the United States alone, 4.8% rather than 7.0% over the same sample. Moreover, bond returns are also lower for the international sample, 1.2% rather than 1.5%.⁶

Brown, Goetzmann and Jorion (1999) did a study of the capital appreciation in the long history of the stock markets of 39 countries, going back as far as the 1920s. They found that while for their sample the U.S. annual real stock market capital appreciation was about 5% a year, the median for the 39 countries was only about 1.5% a year. Their results suggest an even bigger difference between the U.S. and the rest of the world. Indeed, Dimson *et al.* excluded many countries with poor stock market performance, such as many in Latin America, where they could not get data on returns. But I did not include the Brown *et al.* results in the table since their data referred to capital appreciation only, omitting the dividend component of returns.

A February 28 2005 *Wall Street Journal* article by Mark Whitehouse reported the expectations for future stocks and corporate and government bonds for the next 44 years. While he does not describe how he chose his respondents, most of these respondents are prominent economists at top Wall Street firms. The median expected return on the stock

⁶ Dimson *et al.* themselves report the geometric average real return 1900-2000 of 5.8% per year for stocks for a world portfolio comprised of the individual countries, where portfolio weights for the countries are proportional to their GDPs. This figure is higher than the median shown in the table because it is a weighted average of returns that gives a great deal of weight to the United States. For an investor who diversified around the world 1900-2000, their world return is likely to be a better indicator of portfolio return than is the median. However, if we interpret each country's data as providing a separate draw of country experience unrelated to size of country, the median is likely to be a better indicator of likely future experience of a country.

market is 4.6%, very close to the historical experience for the international sample, much lower than the 6.5% assumed by the Social Security Actuaries.

| Table 1. Alternative Real Annual Returns | | |
|---|----------------------|---------------------|
| | <u>Stocks</u> | <u>Bonds</u> |
| Social Security Actuaries | 6.5% | 3.3% |
| U.S. Historical Sample, 1871-2004 | 6.8% | 2.7% |
| U.S. Historical Sample, 1950-2004 | 7.6% | 1.9% |
| U.S. Historical Sample, 1990-2000 | 7.0% | 1.5% |
| International Historical Sample, 1900-2000 | 4.8% | 1.2% |
| WSJ Economists Survey | 4.6% | 2.9% |

Sources:

Social Security Actuaries, "Preliminary Estimated Financial Effects of a Proposal to Phase in Personal Accounts – INFORMATION," 2/3/2005. This table reports bonds as a portfolio that is 60 percent corporate bonds and 40 percent government bonds.

U.S. historical returns are geometric average returns of a portfolio that is invested 50 percent in long-term bonds and 50 percent in one year commercial paper or certificates of deposit. These data are described in Shiller, *Irrational Exuberance*, 2005 and available at www.irrationalexuberance.com.

The international sample is the median across 15 countries (including the U.S.) of the historical geometric average real returns as compiled by Dimson *et al.*, *Triumph of the Optimists*, 2002.

WSJ Survey is median expectations for next 44 years of 10 economists surveyed, published on 2/28/05, in a portfolio that is 60 percent corporate bonds and 40 percent government bonds.

| Table 2. Forecasted Geometric Average Returns for the Next 44 Years (% Per Year) | | | |
|---|----------------------|--------------------------------|-------------------------------|
| | <u>Stocks</u> | <u>Government Bonds</u> | <u>Corporate Bonds</u> |
| Bill Dudley (Goldman Sachs) | 5.0 | 2.0 | 2.5 |
| Jeremy Siegel (Wharton) | 6.0 | 1.8 | 2.3 |
| David Rosenberg (Merrill Lynch) | 4.0 | 3.0 | 4.0 |
| Ethan Harris (Lehman Brothers) | 4.0 | 3.5 | 2.5 |
| Robert Shiller (Yale) | 4.6 | 2.2 | 2.7 |
| Joseph LaVorgna (Deutsche Bank) | 6.5 | 4.0 | 5.0 |
| Parul Jain (Nomura) | 4.5 | 3.5 | 4.0 |
| John Lonski (Moody's) | 4.0 | 2.0 | 3.0 |
| David Malpass (Bear Stearns) | 5.5 | 3.5 | 4.3 |
| Jim Glassman (J.P. Morgan) | 4.0 | 2.5 | 3.0 |
| Median | 4.6 | 2.8 | 3.0 |

Source: *Wall Street Journal*, February 28, 2005

As a result, these simulations use two sets of data on returns: both the actual historical data and an alternative series in which the returns on stocks are lowered by 2.2

percentage point per year, the difference seen in Table 1 between the U.S. data and the rest of the world data in Dimson *et al.* [2002]. This adjusted returns series correspond more closely to projections of financial economists and should be emphasized more as the appropriate evaluation of the accounts going forward.⁷

The Social Security actuaries have asserted that the costs to investing the funds and running the accounts will be 30 basis points per year. Accepting this estimate, the analysis below subtracts 30 basis points from returns of the accounts.

C. Defining Life cycle funds

No one knows exactly what the life cycle funds will look like. Indeed, the asset allocation for such a fund is going to be a contentious issue; economic practitioners and theorists will have plenty to argue about. The White House has been describing the fund as one that is initially concentrated in stocks, but that gradually moves towards bonds.⁸

Ideally, life cycle funds would reflect the risks in labor income over the life cycle and the level of income in retirement, including traditional Social Security defined benefits. The ability to save in the future will reflect the labor income that people receive in the future. Moreover, the funds must reflect as well the other assets, such as the home

⁷ Note, if the life cycle equity account is assumed to invest in international equities, as recommended by most financial advisers and included as an option in the TSP, then including international returns would be appropriate even in a purely historical simulation without any adjustment. Realistically, however, there is a “home bias” in most investors’ portfolios, and most of the portfolio is likely to remain in the U.S. In the Thrift Savings Plan that is the model for the personal accounts, participants chose to invest only 1.8% of account balances in the I Fund (international) as of December 31, 2003.

⁸ A problem with this general notion, as Jeremy Siegel pointed out in his book *Stocks for the Long Run*, 2002, is that over a really long-term sample 1802-2000 for long-term investors, in real terms investments in bonds have actually been riskier than investments in stocks. This is because over long intervals of time changes in the consumer price index (CPI) have cumulated to cause major changes in the real value of long-term bonds, whose values are fixed in nominal terms. However, over more recent samples, such as 1871-2004, stocks have been clearly more risky in real terms than bonds for long-horizon investors.

and claims on future Social Security benefits, owned by the beneficiary. In his classic *Econometrica* mathematical treatise on optimal investment strategies, Robert Merton stressed that portfolio allocation must be designed to hedge future changes in investment opportunities, and John Campbell and Luis Viceira in a treatise on lifetime portfolio allocation showed that variations in future investment opportunities are of some significance for portfolio design. Among those who have worked on the theory of life-cycle portfolio allocation, it is not unanimous that younger people would go more heavily into stocks. Andrew Lynch and Sinan Tan concluded that, quite to the contrary, young people should be relatively light on stocks, given that when stock returns are low (as in a recession) there is both lower mean income growth and higher volatility. Obviously, the design of a life-cycle fund is not a simple matter, and it is difficult to predict now how the concept of life cycle funds will be interpreted in coming decades.

The best model for the life cycle plan that is instituted, at least initially, may be based on existing life cycle plans. Unfortunately, life cycle plans that are currently privately offered vary considerably. Furthermore, these life cycle plans are designed for people to save *in addition* to Social Security and by reducing current consumption. In contrast, the life cycle accounts in the President's plan would be for people who would expect a substantially smaller traditional Social Security benefit. Specifically, in a system reformed to be permanently sustainable, the President's accounts would lead to a traditional Social Security benefit of about \$5,000 or even less for a middle-income worker. As we shall see below, the optimal portfolio for people who are offered a new option to buy stocks on margin would be to invest *entirely* in risk-free Treasury bonds. A

reasonable life-cycle portfolio would fall somewhere between these two extremes of current life-cycle portfolios and investing entirely in bonds.

The Vanguard Target Retirement 2045 Fund is for people expecting to retire around 2045. As of September 30, 2004, this fund had: Vanguard Total Stock Market Index Fund 71.2%, Vanguard European Stock Index Fund 12.4%, Vanguard Total Bond Market Index Fund 11.0% and Vanguard Pacific Stock Index Fund 5.4%. The prospectus says that the allocations will gradually be changed towards those of the Vanguard Target Retirement Income Fund (which is aimed at current retirees): Vanguard Total Bond Market Index Fund 50.0%, Vanguard Inflation-Protected Securities Fund 25.0%, Vanguard Stock Market Index Fund 20.0%, Vanguard Money Market Fund 5.0%.

T. Rowe Price Retirement 2040 Fund starts out, according to its prospectus, investing 90% in stocks, 10% in fixed income, and 0% in conservative fixed income. It will convert into the Retirement Income Fund approximately five years after reaching their target dates. Thus it would eventually be 40% stocks, 30% fixed income, and 30% conservative fixed income.

These funds, which must pass the market test to the general public in its current mindset, may not represent the funds that will be designed for the personal accounts. They may underrepresent money market, since money market returns have recently been very low and apparently unattractive to investors to whom these funds must make a sales pitch, even if money market rates will be much higher in future years when the fund shifts into them. Today's funds may underrepresent inflation-protection securities because the general public has been very cool to these, but it would be rational if inflation

protection securities became a significant portion of the asset allocation of life-cycle funds as year pass, and this may thus be expected to happen.

For the purposes of this historical simulation, for which historical data must be found, I have assumed that the allocation for the life cycle accounts will be between two funds, a U.S. equity fund (analogous to the C Fund in the Thrift Savings Plan that is offered to U. S. government employees) and a bond-money-market fund that is 50% long-term U.S. government bonds and 50% private-sector money market (6-month commercial paper until 1997, 6-month certificates of deposit thereafter). I am assuming that the G Fund offered by the Thrift Savings Plan will not be available for the personal accounts, and under that assumption it would be reasonable to suppose that a bond fund would combine both public long term and private short term debt.⁹

I consider six potential asset allocations:

- **Baseline life-cycle portfolio.** This portfolio is invested 85% in equities through age 29 and then gradually falls to 15% in equities by age 60. This is slightly more conservative than the Vanguard portfolio, reflecting the fact that this portfolio is designed to largely replace the existing Social Security benefit.
- **Entirely bonds portfolio.** This portfolio is invested 100 percent in bonds, specifically 50% in long-term bonds and 50% in money market. This portfolio itself is not risk free.

⁹ The G Fund that invests in short-term government securities specially created for it, not available to the general investing public. These securities pay the long term interest rate as if it were a short rate. Since long-term bonds generally have a higher yield than short term bonds, these securities tend to outperform short-term securities with no additional risk. The G Fund is effectively subsidized by the Federal Government; it may be unlikely that the government will offer such a subsidy to the general public.

- **Conservative life-cycle portfolio.** This portfolio follows the same pattern as the baseline life-cycle portfolio, but falls from 70% in equities to 10% in equities.
- **50 percent stock portfolio.** This portfolio is fixed at 50 percent in equities, it does not vary with the lifecycle. This corresponds to the featured portfolio in the President’s Commission to Strengthen Social Security, which the Social Security actuaries projected would have a real rate of return of 4.6%.¹⁰
- **Aggressive life-cycle portfolio.** This portfolio follows the same pattern as the baseline life-cycle portfolio, but falls from 90% in equities to 40% in equities.
- **Entirely stocks portfolio.** This portfolio is invested 100% in equities in every period.

IV. Simulation Results

Results are shown in Tables 3 and 4. Two benchmarks are used to assess each portfolio. First, the internal rate of return for the stream of payments represented by the contributions. An internal rate of return in excess of 3 percent means that the personal account exceeded the offset and the worker is better off. Second, the tables present the final net value of choosing the personal account after the benefit offset. The tables show various summary measures for these benchmarks for the 5 portfolios.

¹⁰ President’s Commission to Strengthen Social Security, *Strengthening Social Security and Creating Personal Wealth for All Americans*, 2001.

The baseline case shown in the tables assumes that stocks return 6.5% each year and that bonds earn 3.3% each year, the assumption of the Social Security actuaries (assuming “bonds” are a composite of government bonds and corporate bonds). This means that the stocks earn 6.2% a year and bonds earn 3.0% a year after expenses. Note that from the tables that the baseline case for a portfolio 100% in bonds (column 4) ends up with a zero balance, even though the account is associated with some risk because it is partially invested in corporate bonds.

Table 3 shows results using U.S. historical data. In Table 4, the returns on stocks are lowered by 2.2% a year, the difference seen in Table 1 between the U.S. data and the rest of the world data in Dimson *et al.* [2002 Figures 1 and 2 show the internal rates of return for the baseline life-cycle portfolio by the year of retirement.

Table 3. Results of Simulations with U.S. Historical Data

| Column Number | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|----------------------|---------------------|------|-----------|-------|-------------------------|------|------------------------------------|------|-----------------------|------|------------|------|
| | Baseline Life-cycle | | All Bonds | | Conservative Life-cycle | | 50-50 Portfolio (Commission Plans) | | Aggressive Life-cycle | | All Stocks | |
| Initial Equity Share | 85% | | 0% | | 70% | | 50% | | 90% | | 100% | |
| Final Equity Share | 15% | | 0% | | 10% | | 50% | | 40% | | 100% | |
| Actuaries Baseline | \$52,756 | 4.3% | \$0 | 3.0% | \$39,475 | 4.0% | \$69,562 | 4.6% | \$83,852 | 4.9% | \$178,589 | 6.2% |
| Losing Simulations | 29 | | 81 | | 51 | | 18 | | 7 | | 2 | |
| Total Simulations | 91 | | 91 | | 91 | | 91 | | 91 | | 91 | |
| % Lose | 32% | | 89% | | 56% | | 20% | | 8% | | 2% | |
| % IRR < 2% | 2% | | 68% | | 13% | | 4% | | 1% | | 0% | |
| | Net Value | IRR | Net Value | IRR | Net Value | IRR | Net Value | IRR | Net Value | IRR | Net Value | IRR |
| Median | \$15,172 | 3.4% | -\$50,997 | 1.1% | -\$9,564 | 2.7% | \$47,435 | 4.2% | \$67,335 | 4.6% | \$157,708 | 5.9% |
| Mean | \$17,634 | 3.4% | -\$44,932 | 1.2% | \$921 | 2.9% | \$47,861 | 4.0% | \$62,317 | 4.4% | \$206,566 | 6.1% |
| Min | -\$43,197 | 1.5% | -\$87,042 | -1.1% | -\$49,642 | 1.2% | -\$42,709 | 1.6% | -\$35,147 | 1.9% | -\$24,960 | 2.3% |
| 10th pct | -\$20,569 | 2.4% | -\$75,796 | -0.3% | -\$34,108 | 1.9% | -\$19,994 | 2.4% | \$7,330 | 3.2% | \$42,226 | 4.1% |
| 25th pct | -\$5,112 | 2.9% | -\$72,413 | -0.1% | -\$22,396 | 2.3% | \$13,244 | 3.4% | \$29,561 | 3.8% | \$91,797 | 5.0% |
| 75th pct | \$40,460 | 4.4% | -\$15,552 | 2.8% | \$23,395 | 4.1% | \$86,572 | 5.0% | \$93,616 | 5.2% | \$318,653 | 8.3% |
| 90th pct | \$62,814 | 4.5% | \$322 | 3.0% | \$47,960 | 4.2% | \$101,450 | 5.2% | \$111,593 | 5.3% | \$474,990 | 8.6% |
| Max | \$74,355 | 4.7% | \$10,671 | 3.3% | \$54,406 | 4.3% | \$157,821 | 5.9% | \$145,294 | 5.8% | \$580,685 | 9.2% |

Note: Initial equity allocation is through age 29; final equity allocation is starting at age 60.

Table 4. Results of Simulations with U.S. Historical Data Adjusted for Historical World Median

| Column Number | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|----------------------|---------------------|------|-----------|-------|-------------------------|------|------------------------------------|------|-----------------------|------|------------|-------|
| | Baseline Life-cycle | | All Bonds | | Conservative Life-cycle | | 50-50 Portfolio (Commission Plans) | | Aggressive Life-cycle | | All Stocks | |
| Initial Equity Share | 85% | | 0% | | 70% | | 50% | | 90% | | 100% | |
| Final Equity Share | 15% | | 0% | | 10% | | 50% | | 40% | | 100% | |
| Actuaries Baseline | \$52,756 | 4.3% | \$0 | 3.0% | \$39,475 | 4.0% | \$69,562 | 4.6% | \$83,852 | 4.9% | \$178,589 | 6.2% |
| Losing Simulations | 65 | | 81 | | 69 | | 18 | | 35 | | 30 | |
| Total Simulations | 91 | | 91 | | 91 | | 91 | | 91 | | 91 | |
| % Lose | 71% | | 89% | | 76% | | 47% | | 38% | | 33% | |
| % IRR < 2% | 30% | | 68% | | 46% | | 23% | | 14% | | 12% | |
| | Net Value | IRR | Net Value | IRR | Net Value | IRR | Net Value | IRR | Net Value | IRR | Net Value | IRR |
| Median | -\$14,593 | 2.6% | -\$50,997 | 1.1% | -\$29,212 | 2.1% | \$2,578 | 3.1% | \$10,374 | 3.3% | \$27,947 | 3.7% |
| Mean | -\$13,205 | 2.5% | -\$44,932 | 1.2% | -\$20,755 | 2.2% | \$3,046 | 2.9% | \$6,665 | 3.1% | \$56,908 | 3.9% |
| Min | -\$64,572 | 0.5% | -\$87,042 | -1.1% | -\$65,663 | 0.4% | -\$68,745 | 0.2% | -\$66,746 | 0.3% | -\$79,414 | -0.3% |
| 10th pct | -\$44,761 | 1.4% | -\$75,796 | -0.3% | -\$51,188 | 1.1% | -\$49,980 | 1.2% | -\$35,367 | 1.8% | -\$37,218 | 1.7% |
| 25th pct | -\$33,213 | 1.9% | -\$72,413 | -0.1% | -\$41,232 | 1.6% | -\$23,970 | 2.2% | -\$19,640 | 2.4% | -\$12,917 | 2.6% |
| 75th pct | \$5,651 | 3.6% | -\$15,552 | 2.8% | -\$1,412 | 3.4% | \$31,054 | 4.0% | \$29,272 | 3.9% | \$125,471 | 6.4% |
| 90th pct | \$26,124 | 3.7% | \$322 | 3.0% | \$20,472 | 3.5% | \$43,030 | 4.1% | \$42,616 | 4.1% | \$208,396 | 6.5% |
| Max | \$35,627 | 3.9% | \$10,671 | 3.3% | \$26,721 | 3.7% | \$92,489 | 5.0% | \$74,720 | 4.7% | \$270,527 | 7.1% |

Figure 1. Simulated Internal Rate of Return for U.S. Historical Returns

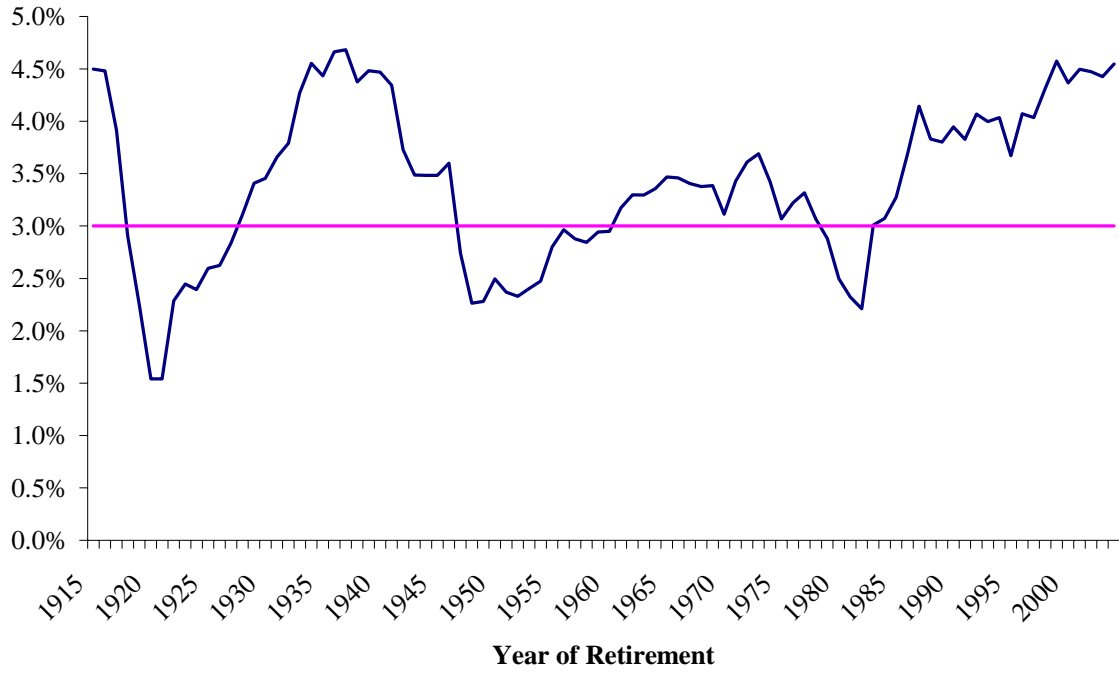
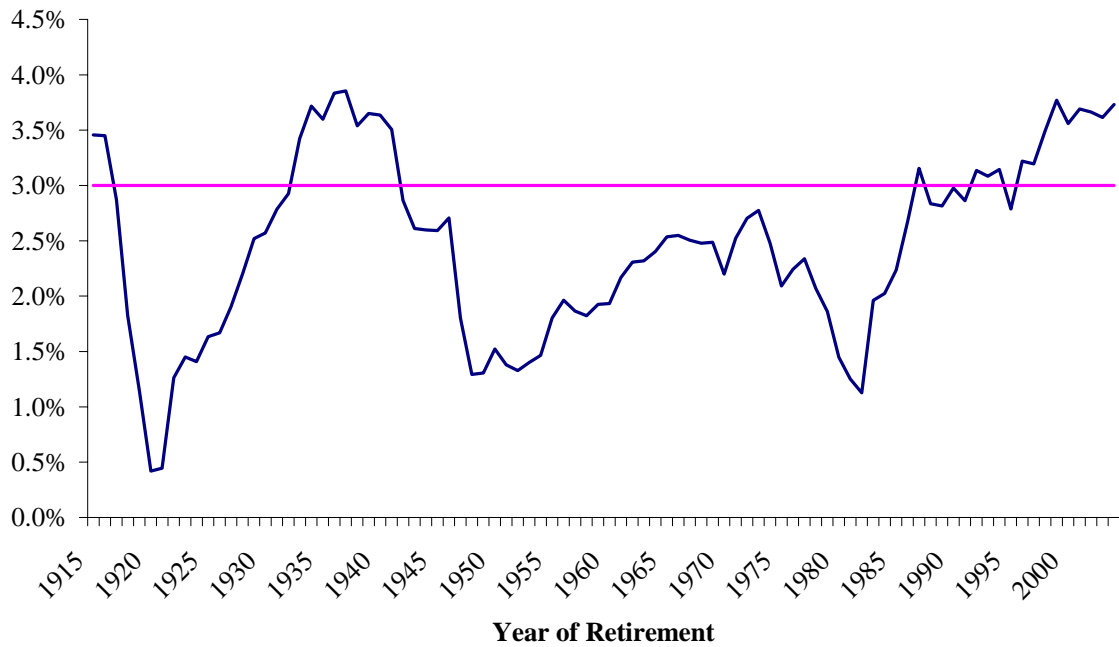


Figure 2. Simulated Internal Rate of Return for U.S. Historical Returns Adjusted for Historical Medians



When historical U.S. returns are used for the analysis, the baseline life-cycle portfolio is at best disappointing, at least compared with the rhetoric that has characterized much of the advocacy for the personal accounts. The real internal rate of return is only 3.4% a year, only slightly above the offset rate of 3%. While the median final portfolio value (after offset) is positive, the portfolio value is rather small, only \$15,172 (net of the reduction in the traditional benefit). The portfolio value after offset is hardly a windfall. The lifetime annuity value of \$15,172 is about \$1,000 a year. Compare this with the benefits for our "scaled medium earner." Those benefits are promised to be \$21,770 under the current schedule, are \$15,934 on the "payable" baseline (which assumes benefits are paid from payroll taxes after the trust fund is exhausted), and would be \$14,025 with price indexing. Any of these conventional social security benefits would dominate the median extra annuity income created by the personal account. Moreover, there is a substantial probability that the worker will actually lose from having participated in the program. The portfolio minus offset winds up with negative value (after offset) 32% of the time.

Workers could do better, of course, if they eschewed the life cycle accounts and went for 100% stocks. In this case (Table 3 columns 11 and 12) indeed the performance of the personal account lives up to the kind of expectations that many recent discussions of personal accounts have suggested. The median net account upon retirement is \$157,708, ten times as large as with the baseline life cycle account, and the internal rate of return on participating in Social Security is 5.9%. Workers who choose the 100% stocks option lose only 2% of the time. The internal rate of return is a little lower than the

6.2% after expenses in the baseline case, substantially because most cohorts miss out on the spectacular returns of the 1990s.

Of course the outcome of a portfolio of 100% bonds, Table 3 columns 3 and 4, is terrible. The final balance is negative 89% of the time. This is no surprise given that bonds have performed historically less well than the 3% offset rate.

Given that a 100% stock portfolio does not disappoint, one might be inclined to think that an aggressive life cycle portfolio would do similarly well. The aggressive life cycle portfolio (Table 3 columns 7 and 8) does less well assuming historical returns than a portfolio that is 100% stocks, but still ends up with a median net account of \$67,335. There is some concern that the balance winds up negative 8% of the time.

The conservative life cycle portfolio (Table 3 columns 5 and 6) does much less well assuming historical returns than does the aggressive life cycle portfolio: the median net account is a *negative* \$9,564, and the account winds up negative 56% of the time. The 50-50 portfolio considered by the President's Commission is somewhere between these two life-cycle portfolios, losing money 20% of the time.

When we look at the more realistic case, returns adjusted for international average returns, Table 4, all the portfolios involving stocks do less well. Notably, the baseline life cycle portfolio now has a negative median value upon retirement, and is negative 71% of the time.

Here, with the adjusted returns, the 100% stocks portfolio does only a little better than the baseline life cycle portfolio that was shown in Table 3: the median net account is \$27,947, and the account is negative 33% of the time.

As one might infer from the weak performance of the 100% stock portfolio, the life cycle funds do really badly. For the aggressive life cycle fund, the median net account is only \$10,374, and the account is negative 38% of the time. For the conservative life cycle fund, Table 4 column 7, the median account is a negative \$29,212, and the net account is negative 76% of the time.

Why is the overall advantage to these life cycle portfolios so low? Much public discussion has implied that, with the historical experience, we should expect great returns from such an account.

The most important reason for the disappointing performance of the life cycle portfolio is just that the returns of the safer assets are below the 3% real rate used to compute the offset. The returns on the stock market are not high enough to make the life cycle portfolio a good investment, especially if we use the stock returns computed from the experience of the world, as shown in Table 4.

Moreover, with these life cycle portfolios, relatively little is contributed when the allocation to stocks is high, since earnings are relatively low in the younger years. Workers contribute only a little to stocks, and do not enjoy a strong effect of compounding, since the proceeds of the early investments are taken out of the stock market as time goes on.

Ultimately, there is no getting around the fact that stocks are risky investments, that the higher average return on stocks is at least in part a compensation for such risk.

V. Which Portfolio Should Workers Choose?

The results are disappointing for the life cycle portfolios, especially when we use the more realistic assumption about future returns that they should match world experience rather than the experience of the U.S. One is tempted to say that workers should eschew the life cycle portfolio altogether, and participate only in the 100% stocks portfolio.

That would appear to be the correct conclusion for many workers. For example, consider a worker who finds it difficult to invest in the stock market because of purely psychological inhibitions, who is excessively fearful about the market, and who invests only in an account at the local savings and loan association. Given the reassurance from the government that the President's plan is a good one, and given the high predicted returns for the 100% stocks portfolio, that worker might just be tipped into electing the personal accounts and investing in the 100% stock market portfolio. If that worker also continues to save a lot in the savings and loan association, the worker's overall portfolio with the personal account 100% in stocks might represent a distinct improvement in the overall portfolio, even if it is not a life cycle portfolio. Advisors might well not mention the life cycle portfolio for this worker, not only because it doesn't look attractive enough that the worker would really follow up and elect a personal account, but also because, when combined with the worker's large savings and loan account, the worker's overall portfolio may not have enough exposure to stocks.

For workers who have a different sort of psychological barrier, who are unable to save, the advice would be different. These workers will be totally dependent on the Social Security system for their survival. As was noted above, the offset has the effect of drastically reducing the guaranteed conventional social security benefit. With any of the

life cycle accounts, and also with the 100% social security accounts, there is a significant chance of loss that will be painful to bear in retirement. For these workers, given their psychological problems, it would appear that the best advice is not to participate at all in the personal accounts.

If we are considering workers who are not inhibited by psychological barriers, workers who will follow the optimal strategy, then the advice we would give would look very different. There are two issues in considering the optimal portfolio in the President's plan: first, is it rational to participate in the accounts? Second, conditional on participating in the accounts, what is the optimal portfolio?

For such workers, who already have optimized their portfolios before being offered the personal accounts, it is not generally rational to participate in the personal accounts at all. Such a worker will already be diversified and will already own both stocks and bonds. We have noted that participating in the personal account amounts to borrowing at a 3% real rate to buy a portfolio of stocks and/or bonds. But, this worker can already in effect borrow at a rate lower than 3%: just sell some of the bonds already owned (which have an expected real yield less than 3%) to get the money to make the desired adjustments in the portfolio. For example, a worker who wished to make his portfolio riskier by investing more in stocks could just sell some of his or her bonds and buy more stocks.¹¹

¹¹ There may be a reason for some of these workers to participate in the personal accounts as a way to lower their federal income taxes, however any such tax-avoidance motivations for participating in personal accounts are complex to analyze, and depend not only on current tax law but also on tax laws decades into the future. Under present tax law, workers desiring to increase their exposure to the stock market because of anticipated high returns on stocks would do better to sell some bonds and put the proceeds in a Roth IRA, which is not subject to taxation at the end as social security benefits often are.

If the individual held no bonds at all and wished to go even more heavily into stocks, he or she could make use of margin lending facilities currently available to the public from brokerage firms,

We have seen that the safest assets available have a historical real return that is less than 3%. Currently Treasury inflation-indexed bonds have average yields that are below 2 percent. As a result, borrowing at 3% to invest in an asset that is yielding less than 3% would entail serious costs.¹²

But, can we advise such an optimizing worker who has already decided to invest in a personal account what account to choose? Suppose that worker is somehow compelled to choose the personal accounts. The worker already holds an optimally diversified portfolio of stocks and bonds so that, on the margin, the average equity premium was just enough to compensate risk associated with stocks. Conditional on participating in the accounts, the rational choice would be to invest the entire portfolio in bonds. That way the risk and return of the overall portfolio would stay essentially unchanged. The personal account portfolio would be used merely to cancel out the debt represented by the offset.¹³

The optimizing investor would be made worse off if he or she used the personal account to acquire more equities because he or she is already just at the point where the additional risks associated with equities outweigh the higher returns associated with equities.

bypassing the personal accounts. Here, however, the real margin rate is unlikely to be as low as 3% except for large accounts.

¹² Some rational constrained investors might choose to participate. For example, someone who is invested 100% in stocks, has such high return expectations for stocks that 100% appears too low, and does not have alternative borrowing opportunities at less than a 3% real rate, would choose to participate.

¹³ Technically, the individual could not perfectly offset the effects of participating in the personal accounts, since the real borrowing rate of 3% does not exactly match, and is likely to exceed, the return obtainable by investing in bonds. Still, if compelled to participate, the best thing to do, to a first approximation from a risk-management perspective, would be to swallow the loss and invest in bonds.

VI. Interpretation of Results and Conclusions

The simulations presented here depended on the historical experience of either the United States or the rest of the world for over a century. While a century may seem like a long enough sample period to prove any point, in fact even with a century of data we do not know the true probability distribution of future returns. The twenty-first century may differ fundamentally from the twentieth. Moreover, whenever we look at long historical data on stock markets, we are of course looking at survivors, stock markets that made it, and ignoring countries where conditions turned out so badly that we get little or no stock market data.¹⁴ Obviously, Russia and China were not in Dimson *et al.* for their century-long data set. While it is highly unlikely that the particular upheavals that hit Russia and China in the twentieth century will repeat themselves in the U.S. in the twenty-first century, it should be remembered that nobody predicted in 1900 the kind of upheavals that were to follow in Russia or China. Similarly, it is difficult for us to imagine all the different kinds of things that might disrupt stock market performance in the future. Thus, there is additional uncertainty, uncertainty of regime change or model uncertainty or survivorship bias, that should ideally be taken into account. Unfortunately, there does not seem to be any objective way of quantifying this additional uncertainty about the future.

We are living in the aftermath of the spectacular stock market boom of the 1990s, a boom that generated irrational exuberance about the outlook for the stock market. A public attitude of exaggerated expectations about the stock market is still with us, and probably accounts for a good portion of the support for personal accounts.

In thinking about the redesign of Social Security, it would be better to get away from thinking about chasing past returns and instead focus more on the theoretical

¹⁴ See Brown, Goetzmann and Ross (1995).

fundamentals that underlie Social Security. From this perspective, the government's offering margin credit to the general public, thereby duplicating a service that is already available from the private sector, should not be the focal point of discussions. There *are* some important theoretical justifications for the government's providing a Social Security system, if not margin credit,.

Notably, a justification for a pay-as-you-go social security system is that the private sector cannot allow people effectively to share risks across generations, since children, and unborn future children, cannot make financial contracts. We could redesign the existing Social Security system to do a better job of managing such intergenerational risk than it does today.¹⁵ But this justification for Social Security would not appear to offer a reason for the government to get involved in margin lending.

The intergenerational-risk-sharing justification for Social Security is so strong and palpable that it is likely to trump any effort to design it along different lines. That is, a design that imposes risks rather than reduces risks will ultimately be discarded. In fact, people likely know this and will likely use this information in their choice of personal accounts. Many people will probably choose the 100% stocks portfolio, thinking that it might do very well, and that if it does poorly, the government will probably change the program and bail out the losers.

In any event, the 3% real offset rate appears to be too high, and if the program is instituted, it should be done with a lower rate. The President's Social Security plan might be described as a plan to allow small investors to use their expected future Social Security benefits as collateral for margin loans, and offering a plan at such a large scale that economies of scale reduce administrative costs, thereby making it possible to charge

¹⁵ See my book *The New Financial Order: Risk in the 21st Century*, 2003, Chapter 12.

a lower rate for margin loans than is available in the private market today. But, providing a lower rate puts the government program in competition with private margin lenders, who do not offer such attractive margin rates to small accounts. More importantly, perhaps, if the government offers a lower rate on the offset balance then the government will be losing an opportunity to lower its long-term budget deficit. The present plan saves the government money by lending to individuals at a rate that is higher than the real rate at which the government can borrow money.

Much of the design of Social Security also depends on the need to design around human foibles, and to provide public goods that might help them out of their errors. The failure of many people to save at all for their retirement is one such foible, and ultimately our society feels a need to protect such people. More broadly, a failure of many people to embrace capitalist institutions, to learn about investing and about the benefits of ownership, may also be a factor justifying actions from a government that provides an educational that will not be provided privately because it is a public good.

One might justify government intervention to help people deal with these psychological failures, and this is indeed part of the justification of the President's ownership society. The personal accounts may indeed help achieve this, even if they are probably not the ideal vehicle for this purpose.

But to say that there is a money machine in the stock market, that it can be tapped to yield great wealth without significant risk if one uses life-cycle investment methods, is a big mistake. The stock market is a uncertain place, and even if the risk is effectively managed over the life cycle, important uncertainty remains.

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