

Do Private Saving Schemes Offer a Plausible Substitute for Public Pensions? Lessons from the Economic Crisis

by

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Abstract

Old-age income protection is provided in nearly all wealthy democracies by publicly funded defined-benefit pensions. The budgetary challenges facing public pensions have forced policy makers to consider private alternatives to these traditional systems. This paper considers the shortcomings of private saving arrangements in duplicating the advantages of public pensions. Some of the shortcomings can be overcome through the introduction of compulsory elements into private saving plans. For example, worker contributions into such plans can be mandatory, some or all worker accumulations in the plans can be forcibly converted to annuities at retirement, and workers' investment choices can be narrowly circumscribed to a small menu of carefully designed, safe alternatives. These measures unfortunately do not eliminate the biggest weakness of private saving plans. Wide fluctuations in asset prices and returns make it hard for even well-informed savers to select an affordable saving rate and an investment strategy guaranteed to produce a decent income in old age. Public pension systems partly insulate workers against economic and financial market risks by sharing these risks across workers, retirees, and taxpayers in multiple generations

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1. Introduction

THE RECENT FINANCIAL CRISIS should give pause to critics of public old-age pensions. Many of the harshest critics of public pensions believe these programs for assuring old-age income security should be jettisoned, in whole or in part, and replaced with a system of private retirement savings accounts. The crisis highlighted the risks facing workers and retirees who rely solely on private savings to fund their retirements. Savers who invested heavily in equities and corporate bonds experienced extraordinary losses in the value of their portfolios. In rich industrialized countries equity prices fell 40% or more in 2008, wiping out a decade of investor returns. The value of assets held in pension funds plunged (see Figure 1). As the financial crisis demonstrated, old-age income provided under a purely private retirement savings system is highly variable from one year to the next unless workers invest in a very conservative portfolio. Optimistic estimates of workers' expected returns under a purely private retirement system nearly always assume that workers will hold a sizeable percentage of their portfolios in risky assets, such as equities or private bonds. If retirement savers accept the risk associated with this kind of portfolio their pensions are highly unpredictable. This will be true even under optimistic assumptions about their sagacity and self-discipline in maintaining a prudent investment strategy. Considerable evidence suggests that many if not most retirement savers are far less well-informed and self-disciplined than assumed in the standard economic model, implying that the risk-adjusted returns actually obtained by workers who invest their own funds will often fall short of the theoretical returns implied by common calculations.

One reason policymakers have been considering a shift toward private pension accounts is that public pension systems face sizeable problems of their own. In most rich democracies population aging has been a major impetus for reform. The projected budget costs associated with an older population are so large that governments in rich nations have been forced to consider a major overhaul in the structure of their pension systems. With few exceptions, their old systems were based on pay-as-you-go, tax-financed funding of publicly organized defined-benefit (DB) pensions. The tax burden of this kind of system was acceptable when their retired population represented a small fraction of the population of working, contributing tax payers. The tax burden appeared less tolerable when average pensions began to replace a large percentage of average wages and the population receiving full pensions grew to be a large fraction of the active workforce.

In the past two decades policymakers in a number of rich countries have shown interest in following the example of Chile, which in the early 1980s replaced its public, pay-as-you-go pension system with a private system organized around individual investment accounts. Advocates of this kind of reform point to Chile's success in introducing a private account system to replace a failing and under-funded public system, a system the government began phasing out in the early 1980s. In the past three decades, Chile's private pension system has received high marks for sound administration, good returns, and broad political acceptance. (It has, however, received lower marks because of major holes in workforce coverage.) The expected surge in public retirement costs in rich industrialized countries has made many economists and some policymakers receptive to the idea of a Chilean-style private substitute or supplement to existing unfunded public systems.

The question I pose in this paper is whether improvements in workers' financial market access can serve as a substitute for the kind of social protection provided by traditional public retirement systems. I interpret these "improvements" to involve new kinds of financial instruments, ones different from those available to ordinary workers in the past. In particular, the new instruments would be suitable retirement saving vehicles for ordinary mortals as opposed to the ideal, far-sighted and well-informed investors assumed in most economic text books. The new instruments would expose workers to less risk than investment alternatives available in the past, and they would offer workers better assurance that their private savings could sustain them through a retirement of unknown duration. Because the new instruments would be private, however, there would be little scope for redistribution in favor of workers with low lifetime earnings. Redistribution in favor of low-wage or other kinds of disadvantaged workers would have to take place outside these purely private financial instruments.

2. Background

The fundamental problem of old-age income security is assuring adequate consumption to aged people who have sharply reduced capacity to support themselves through work. Capitalist institutions, like banks, insurance companies, and mutual funds, offer one set of alternatives for solving this problem. Government social protection and public pensions offer another. Both the private and public alternatives permit workers to fill the gap between their consumption needs and their earnings capacity when they reach old age.

Consider the private instruments for achieving old-age income security. When workers retire, they withdraw from their normal occupations and reduce their work effort or stop work altogether. For active workers, paid employment is ordinarily the main source of income. When employment ceases the worker must find another source of income or a store of resources to support consumption. In an economy that lacks any government programs to support old-age

consumption, a likely source of support is the worker's own (private) savings. The classic statement of the relationship among lifetime earnings, retirement, and private savings was offered in a series of articles written or co-authored by the economist Franco Modigliani. Modigliani's lifetime consumption theory is built on the assumptions that workers have the far-sightedness to recognize the need for retirement savings, the self-discipline to defer consumption to the future, the capacity to calculate the optimal saving rate needed to pay for their retirement, and access to financial instruments that allow today's deferred consumption to be translated into predictable consumption at a future date. The model is comparatively easy to solve if workers are certain about the future state of their health and age at death, the precise trend in their future wages, and the future real returns they will earn on their savings.

In the real world, ordinary mortals face four main challenges to achieving a comfortable retirement with purely private savings instruments. First, many workers lack the self-control needed to defer consumption into the future. Workers are required to postpone something that is pleasant – current consumption – in order to obtain a benefit that is far in the future. There is an abundance of psychological evidence that most people have serious problems exercising consistent self-control. For worker-savers, the failure of self-control is likely to lead to under-saving. Second, many workers lack the aptitude to calculate the saving rate needed to pay for a comfortable retirement. An even greater fraction lacks the knowledge and ability to choose the investments that are best suited to achieving their long-term savings objectives and that are consistent with their attitudes toward risk. Third, unexpected personal events like involuntary unemployment, injury, and serious illness can reduce workers' capacity to make a living long before workers reach the age when they expect to retire. Fourth and finally, long-term savers face the risk that their savings will earn a lower rate of return than what they anticipate when they make their saving and retirement plans.

In view of the risks of purely private provision for retirement savings, it is not surprising that nearly all rich democracies adopted some kind of public pension plan backed by the taxing power of the state. Public pension systems and state-provided old-age income protection solve many of the challenges associated with a purely private saving system. In a public pension system workers who lack the self-control to save on their own face mandatory taxes that pay for old-age pensions. Money is withheld from their paychecks for retirement consumption before workers have the opportunity to spend it. Assuming the government has chosen a retirement benefit schedule that guarantees a minimally adequate pension, workers can be assured of comfortable retirements even if they lack the capacity to calculate an optimal saving rate, devise a successful investment strategy, or determine a prudent savings withdrawal rate in old age. In the uncommon case where the public pension is fully funded (that is, backed by a capital reserve), the responsibility for choosing the optimal investment strategy is

not borne by workers but is placed in the hands of specialists who have expertise in portfolio management. Retirees do not have to choose the optimal withdrawal rate for their old-age savings because their collective savings are automatically converted into a life annuity on the date their public pension begins. Workers enrolled in such a system cannot outlive their retirement savings. By collectivizing the risks associated with individual workers' unemployment and poor health, a public pension system can also assure workers they will receive a minimally adequate pension even if they suffer lengthy spells of unemployment or bad health during their careers.

Finally, because public pensions are backed by the taxing power of the state they are insulated against the financial market risks that are a hazard of nearly all private saving instruments. Workers who rely exclusively on private savings to pay for their retirement bear the entire risk if unexpected low returns or high inflation reduce the purchasing power of their nest egg. A government-backed, DB pension system allocates financial risks among workers in a very different way than a purely private retirement savings system. Under most public pension systems, covered workers who are born in the same year and who have similar earnings records and an identical number of dependents receive similar retirement benefits. Because of political constraints on democratically elected legislatures, public pension formulas change slowly and only after protracted political debate. Since both contributors and beneficiaries have a voice in electing legislators, changes in contribution and benefit formulas tend to reflect a compromise between the interests of the two groups. The effects of unanticipated demographic, labor market, and financial market developments are rarely if ever borne by a single cohort. They are spread across a number of cohorts through gradual changes in contribution rates and benefit levels. In contrast, workers participating in a purely private retirement savings system bear essentially all of the risks associated with financial market fluctuations.

Public pensions are not totally secure, of course. Democratic legislatures may adopt benefit schedules that are too generous to be supported by the tax rates that voters are willing to pay. Benefit schedules that appear affordable when first adopted may turn out be unaffordable if population growth slows, longevity improves, productivity growth declines, or nationwide unemployment soars. When these events occur and their fiscal implications become clear, legislators face the unpleasant choice of raising contribution rates, reducing monthly pensions, delaying the age of pension entitlement, or borrowing funds to keep pensions flowing. Because of interest group politics, it is much harder for democracies to curtail benefits previously extended than it is to grant those benefits in the first place.¹ The political difficulty of restoring solvency to an

¹ See Paul Pierson, 1996. "The New Politics of the Welfare State." *World Politics* 48(2) (January 1996): 143-179.

underfunded (or overgenerous) public pension has been the topic of numerous studies and will not be considered further here.

The deep problem entailed in designing public pensions is reconciling the conflicting demands of social equity, optimal insurance, and maintenance of adequate incentives for work and personal saving. By "social equity" I mean establishing a benefit schedule that is widely accepted as just and, in particular, is perceived as fairly balancing the interests of workers with low and high lifetime incomes. By "optimal insurance" I mean providing adequate old-age income protection against the hazards of bad health and involuntary unemployment, regardless of whether workers' expected lifetime incomes are low or high. By "maintaining adequate incentives" I mean providing large enough financial inducements so that workers will work diligently in their prime working years, continue working to an age that is collectively affordable, and accumulate enough personal savings so that the sum of public and private savings is sufficient to sustain economic growth.

It is notoriously difficult to judge whether a given pension system is socially equitable. That depends on voters' sense of what is due to the least well off retired workers and what should be expected of more affluent workers in providing support to low-income pensioners. Perceptions of fairness vary from one society to the next, but all rich democracies make some provision to ensure that the poorest aged workers enjoy a minimum level of consumption. Many economists have written about the design of optimal insurance policies, and there is little reason to add to that discussion here.²

The adverse incentives created by public pension systems have been the subject of extensive research. Many observers claim that public pensions undermine workers' willingness to save, depressing aggregate saving and capital accumulation. The evidence for this is controversial, however.³ One feature of such systems may certainly accelerate some workers' labor force withdrawal. Public pensions provide earnings replacement for workers who have attained the state's eligibility age for benefits. This almost certainly hastens labor force exit among workers who do not formulate long-term plans for retirement or lifetime wealth accumulation. Workers with short time horizons or high rates of time preference often accumulate little savings during their careers. A worker with little savings may decide to retire when the earnings replacement provided by the public pension is high enough so that the worker does not experience an

² See Kenneth J. Arrow, *Essays in the Theory of Risk Bearing*. (Chicago: Markham, 1971); and Kenneth J. Arrow, "Optimal Insurance and Generalized Deductibles" Rand Report R-1 108-OEO (Santa Monica, CA: Rand, 1973); and Artur Raviv, "The Design of an Optimal Insurance Policy." *The American Economic Review* 69(1) (March 1979): 84-96.

³ See Martin Feldstein, "Social Security, Induced Retirement, and Aggregate Capital Accumulation." *Journal of Political Economy* 82(5) (September-October 1974): 905-926; and Dean R. Leimer and Selig D. Lesnoy, "Social Security and Private Saving: New Time-Series Evidence." *Journal of Political Economy* 90(3) (June 1982): 606-629.

uncomfortably large reduction in consumption if he or she stops working. In public pension systems with generous minimum benefits, this point may be reached at the earliest age a pension can be claimed.

Most traditional public pensions also reduce the net return to working an additional year, even for workers who are far-sighted and have a clear understanding of the incentives in the system. If the net return to work is sufficiently low, many workers may withdraw from the labor force well before they would retire if the public pension system gave them stronger incentives to remain at work. Gruber and Wise analyzed cross-national evidence on the relation between a pension program's benefit structure and the level of old-age labor supply.⁴ These authors and their research collaborators examined pension systems and retirement incentives in 11 industrialized countries. Some of the countries allow workers to begin drawing public pensions at age 60 or even earlier, while others do not make old-age benefits available until later. There is also wide variation in the treatment of labor earnings once workers reach the pensionable age. Some countries, like the United States, do not penalize workers for delaying their retirement beyond the early and normal pensionable ages. Other countries, like France and Belgium, provide much more generous pensions and may impose heavy financial penalties on workers who remain employed after the pensionable age. Gruber and Wise find a strong correlation between national retirement patterns and the labor supply incentives that are built into national pension systems. Countries with modest pensions and generous treatment of earned income after the pensionable age have high rates of labor force participation among people between ages 55 and 70. Countries that offer generous public pensions and impose heavy penalties on earnings after the pensionable age have lower participation rates at those ages.

The main reason policymakers and pension experts have sought to reform public pension systems has little to do with work and saving incentives, however. Overgenerous pension commitments and a growing ratio of retired to active workers have pushed many traditional pay-as-you-go pension programs towards insolvency. If left unattended, the funding shortfalls in public pension systems will force national governments either to increase public borrowing or divert funds from other pressing national obligations. Governments can restore pension solvency through higher taxes, reduced monthly pensions, or a delay in the age at which workers can claim benefits. Many industrialized countries on both sides of the Atlantic have taken one or more of these steps, but a number of pension systems continue to face large funding shortfalls. The goal of most past and future pension reforms is simply to improve the solvency rather than the incentive effects of the pension systems.

⁴ Jonathan Gruber and David A. Wise, eds. *Social Security and Retirement Around the World* (Chicago: University of Chicago Press, 1999).

3. Dealing with the risks of private savings

One way to reduce the future obligations of public pension systems is to increase the role of private savings in financing old-age consumption. Of course, legislatures can trim future pension promises even if they leave private saving incentives unchanged. However, this might leave future legislatures with the painful task of dealing with high poverty among the aged. If governments rely on the unaided efforts of workers to save on their own, a large fraction of retirees may find they must sharply reduce their consumption in old age. In the event that workers under-save for their old age or private retirement saving fails, a future government will still be left with the problem of ensuring adequate incomes to indigent retirees.

There are simple ways to address some of these concerns while still relying mainly on private savings to finance retirement consumption. First, contributions to private retirement accounts could be made mandatory, as is currently the case in Australia, Chile, and Sweden. The savings mandate is usually expressed as a required fixed percentage of the worker's earnings. (In Australia the mandatory contribution is 9% of a worker's wage; in Sweden it is 2%.) Mandatory contributions can be withheld by employers from workers' wages and deposited directly into workers' individual retirement accounts. The government can establish rules that make it difficult for workers to make withdrawals from these accounts before they reach retirement age, become disabled, or die. If the rules are enforced, workers' lack of self control will have little impact on their accumulation of an adequate retirement nest egg.⁵ A related mandate can be imposed on workers who have reached the pensionable age and begun their retirements. Rather than permit workers to withdraw funds from their retirement accounts at will, the rules could compel them to convert retirement savings into an annuity to the extent needed to bring their monthly retirement income up to the national poverty line. By definition a savings balance that is converted into an annuity will last as long as the worker (and possibly the worker's spouse) continues to live.

Behavioral economists in the United States have proposed alternative methods to encourage workers to save a minimum percentage of their salaries. One method is to provide subsidies to workers for setting aside a minimum percentage of their pay in a retirement savings account. For example, for every 1% of salary that a worker voluntarily contributes, the employer or the government might contribute an equal amount to the worker's pension account. Many U.S. employers offer to match workers' contributions to their 401(k)

⁵ This is not quite true, because workers might reduce other forms of saving or increase their borrowing in order to offset some or all of the saving they are compelled to accumulate in their retirement savings accounts. Most workers are limited in the amount of borrowing they can take on, however, so it is highly likely that a retirement savings mandate will boost the lifetime savings of workers who would have under-saved in the absence of a mandate.

pension accounts up to the first 3% of the worker's pay. Even so, many eligible workers, especially those earning low wages, do not make contributions to a subsidized 401(k) account. Behavioral economists have proposed automatic enrollment in voluntary savings plans unless new workers specifically tell their employer they wish to decline enrollment.⁶ There is considerable evidence this approach would increase retirement saving among new workers. Choi, Laibson, Madrian, and Metrick studied pension enrollment in several companies that altered the default enrollment choice available to their workers.⁷ When the default choice was that workers were *not* enrolled in the employer pension plan, the percentage of newly hired workers who enrolled in the pension plan ranged between 25% and 43% in the first six months after the worker's hire. In contrast, when workers were automatically enrolled in a pension plan and compelled to opt out if they did not wish to participate, between 86% and 96% of newly hired workers were enrolled in a savings plan six months after their hire. The researchers concluded that when the default option was changed to automatic plan enrollment the participation rate in the retirement savings plan increased by 50 to 67 percentage points.

Workers are still left with the problem of choosing appropriate assets for their retirement savings accounts. Many workers have only a rudimentary grasp of basic financial economics. They may be aware that some kinds of investments, like stocks and real estate, are subject to greater price fluctuation compared with other assets, like bank deposits and short-duration bonds. But most workers are probably unaware of differences across asset classes in expected rates of return over 20- or 40-year investment horizons. Even among moderately well informed worker-savers, investment decisions may be excessively influenced by the recent trailing returns of different asset classes. Empirical research on workers' knowledge and investment skills is not reassuring. Analysts who have surveyed U.S. workers about their financial knowledge are seldom favorably impressed. Annamaria Lusardi and Olivia Mitchell found that “. . . half the respondents . . . in our [survey] cannot make a simple calculation regarding interest rates over a five-year period and do not know the difference between nominal and real interest rates. An even larger percentage of respondents do not know that holding a single company stock is riskier than holding a stock mutual fund.”⁸ The actual investment behavior of participants in worker-directed defined-contribution

⁶ Richard Thaler and Cass Sunstein, *Nudge: Improving Decisions about Health, Wealth, and Happiness*. (New Haven, CT, and London: Yale University Press, 2008).

⁷ James J. Choi, David Laibson, Brigitte Madrian, and Andrew Metrick, “Saving for Retirement on the Path of Least Resistance.” In *Behavioral Public Finance: Toward a New Agenda*, eds. E. McCaffrey and J. Slemrod, (New York: Russell Sage Foundation, 2006).

⁸ Annamaria Lusardi and Olivia S. Mitchell, “Baby Boomer Retirement Security: The Roles of Planning, Financial Literacy, and Housing Wealth.” NBER Working Paper No. 12585. (Cambridge, MA: National Bureau of Economic Research, 2006).

(DC) plans offers grounds for concern. Many U.S. participants fail to diversify their asset holdings, allocate too much of their portfolio to a single company's stock, allocate too little to equity, neglect to periodically re-balance their portfolios to maintain a consistent asset allocation, and are excessively influenced in choosing assets by the specific range and ordering of investment options in their retirement plan. Workers who invest mainly or solely in very safe assets, such as a money market fund, need a very high saving rate to achieve a good pension replacement rate. On the other hand, workers who invest heavily in a single company's stock expose themselves to excessive risk. If the company should fail, their retirement savings would plummet.

U.S. analyses of investor behavior in employer-sponsored DC pension plans show that American workers trade very little. Few 401(k) participants exchange one kind of asset for another, and it is uncommon for workers to reallocate their new contributions among the investment alternatives available to them.⁹ In a 10-year panel of observations in a large DC pension fund, Ameriks and Zeldes found that only 53% of workers made any purposeful change in their allocation of new contributions and only 27% made a change to the allocation of assets already held in their accounts.¹⁰ This means that most workers' portfolio allocations can change substantially over time when there are large differences in the trailing returns on the different assets held in their portfolios. Most investment advisors recommend that savers rebalance their portfolios about once a year in order to maintain the risk profile of their holdings, but very few American retirement savers appear to follow this advice. Those who do not rebalance face unnecessary volatility in the lifetime returns on their portfolio.

A serious problem for most worker-investors is lack of financial knowledge. Unlike the well-informed and fully rational saver imagined in economic models, many actual savers do not take the trouble to become informed about the pros and cons of different kinds of investments, though the payoff from doing so would be substantial. Poorly informed savers invest little or none of their retirement savings in equities and other risky assets, even though nearly all economists and financial planners think such investments should receive at least some weight in a sensible retirement portfolio.

Comparatively few workers show evidence they have carefully weighed their investment options or made knowledgeable decisions about their saving allocation. Many are excessively swayed by the packaging of the investment choices offered to them. In principle, well-informed investors should select a portfolio of assets because its risk and expected return characteristics correspond closely to those they desire. In practice, some investors will prefer to invest in

⁹ J. Agnew, P. Balduzzi and A.E. Sundén, "Portfolio Choice, Trading, and Returns in a Large 401(k) Plan." *American Economic Review* 93(1) (March 2003): 193–215.

¹⁰ J. Ameriks and S.P. Zeldes, "How Do Household Portfolio Shares Vary with Age?" Working paper. (New York: Columbia University Graduate School of Business, 2004).

option B if it is presented as an intermediate alternative between options A and C, but will instead choose option C when it is presented as the intermediate alternative between options B and D. If options B and C are both available on different menus of investment alternatives, investors should always prefer B over C or C over B, regardless of the risk and return characteristics of the other investment options on the menu. Careful experiments by Benartzi and Thaler show instead that some workers' preferences are decisively affected by extreme and intermediate alternatives that are offered on the menu.¹¹ Workers who know little about investment are apparently guided in their portfolio allocation by factors that should be irrelevant to their decision.

One way to reduce the investment errors of retirement savers is to severely limit their investment choices. For example, workers might be offered only four investment choices, say, "conservative," "moderate," and "mildly aggressive" portfolios plus a target-retirement-date investment fund that gradually changes the expected risk-return characteristics of the worker's investment portfolio as the worker approaches retirement age. (Most investment experts suggest that workers shift gradually from a portfolio that is dominated by high-risk, high-return assets early in a career to a portfolio that is dominated by low-risk, low-return assets near the age of expected retirement.) Financial specialists would make the asset-allocation decisions within each of these broad investment choices, relieving workers of the need to learn about asset allocation, keep track of financial news, and periodically rebalance their retirement account balances.

Of course, by severely restricting workers' investment choices this kind of plan also reduces one of the supposed advantages of individual retirement savings accounts. Under a typical public pension system, all workers are compelled to accept the risk-return tradeoff adopted for that single pension plan. The advantage of self-directed individual retirement accounts is that workers can select an investment portfolio that is closely tailored to match the worker's own preferences for risk and expected return. If workers are offered very little investment choice, they will be denied this hypothetical benefit of an individual account system. A possible compromise is to offer worker-savers a wider selection of investment choices, representing perhaps 15 to 20 distinctive asset classes, but to set as a default option a target-retirement-date fund or a multiple-asset portfolio with a moderate risk-expected return profile. When Sweden introduced its mandatory 2%-of-salary DC pension in 2000, Swedish workers were offered a choice from among 500 privately managed investment funds. Workers who declined to make a choice of funds were automatically enrolled in a

¹¹ S. Benartzi, and R.H. Thaler, "How Much is Investor Autonomy Worth?" *Journal of Finance* 57(4) (2002): 1593-1616.

moderate-risk balanced portfolio.¹² For most workers it is hard to believe the huge range of choice added perceptibly to the worker's welfare.

It is worth remarking on the irony that, to make private retirement savings systems effective, the state must enforce some kind of compulsion on either workers or employers to assure that workers reach old age with adequate savings to fund their retirements. In the absence of compulsion, some workers would save too little for retirement, others would invest their savings badly, and others would spend their retirement savings too quickly to maintain adequate consumption through a lengthy old age. Strictly enforced rules can reduce the risks of these unwanted outcomes, but such rules also reduce the scope for worker choice and decision-making, the main advantage that a private retirement savings system is supposed to secure.

4. Financial risk

The previous section described methods for reducing the chance a retirement system built on private savings would leave retired workers with inadequate income because of low saving, lack of self-control, or poor selection of assets. Even after selecting a prudent investment portfolio, however, retirement savers still face the risk of poor returns over their career. Public pension systems typically provide retirement benefits based on a worker's years of coverage under the program and his or her average covered wages while contributing to the system. This kind of system is designed to replace a predictable and relatively stable percentage of workers' average earnings over their later careers. In contrast, workers enrolled in a private DC pension system bear essentially all of the risks associated with financial market fluctuations.

Workers enrolled in private DC plans face three kinds of financial risk. Investment returns may fall short of expectations over their working careers. If workers obtain unexpectedly low returns, their retirement savings will grow more slowly than planned, leaving them with too little retirement wealth to finance a comfortable old age. For workers who want to convert their retirement savings into an annuity, there is also the risk that annuity prices will be unusually high at the time they want to make this conversion. Workers who wish to ensure they will not outlive their assets will use some or all of their retirement savings to buy an annuity around the time they retire. The price of an annuity depends on the yield on safe fixed-income securities. If the yield on safe securities is unusually low, as was the case during and after the 2008 financial crisis, workers in the market for guaranteed lifetime income will face very high annuity prices.

Finally, workers who buy nominal annuities are subject to inflation risk. Unexpected inflation occurring after a worker retires can have a dramatic impact

¹² Edward Palmer, "The Swedish Pension Reform Model: Framework and Issues." Social Protection Discussion Paper No. 23086. (Washington, DC: The World Bank, 2000).

on the purchasing power of a worker's annuity. Even if inflation is only 2% or 3% a year higher than expected, retired workers can reach advanced old age with an annuity that has little purchasing power. Workers can avoid this risk if they buy price-indexed annuities rather than level nominal annuities. Indexed annuities are now available in the United Kingdom and United States, though not in all industrial countries. In countries where indexed annuities are unavailable, retired workers have no obvious way to assure stable consumption after they retire.

The financial risks facing private savers have been vividly illustrated over the past half century. In the 1970s and early 1980s, many industrial countries experienced unexpectedly high inflation, which sharply reduced the purchasing power of fixed income securities and nominal annuities. Retirement savers heavily invested in long-duration bonds and retirees who put their savings in fixed annuities saw their expected or actual retirement incomes fall sharply. Major sell-offs in world equity markets in the 1970s, in 2000-2002, and in 2008 reduced the value of investment portfolios heavily weighted toward stocks. For workers near retirement age, the damage from sinking equity prices in 2000-2002 and 2008-2009 was compounded by the sharp fall in yields on the safest assets. This caused annuity prices to rise and made it more costly for workers to assure themselves of a safe income throughout retirement.

Many advocates of private retirement accounts appear to believe the annual ups and downs in the stock market average out over time, assuring even the unluckiest investor a good return if he or she invests steadily over a full career. A moment's reflection shows that this cannot be true. Between January 1, 2008, and December 31, 2008, the value of stocks traded in U.S. equity markets fell 39% after adjusting for changes in the price level. Even including the value of reinvested dividends, U.S. shareholders lost about 37½% of the value of their holdings in just twelve months. Over the same span of time, Japanese equity investors lost 41% and European stock investors lost more than 44% of the initial value of their stock holdings. For a worker who planned on retiring at the end of 2008, the drop in stock market prices would have required a drastic cut of planned retirement consumption if the worker's sole source of old-age income was derived from stock market investments.

To show the impact of just a single year of bad returns on a worker's retirement income, Figure 2 shows how a worker's return on investment and pension replacement rate vary when there is a sudden plunge in asset prices. Imagine a worker who sets aside 7% of his salary every year and invests it in an asset that earns a return of 9.1% a year. Assume also that the worker converts his retirement saving into an annuity when he retires after a 40-year career at age 62. The experiment I consider is the impact of a single year in which the return on the worker's savings drops to -50%. In all other years of the worker's career, the return is 9.1%. Note that the geometric mean return over the worker's career, even with a single year of -50% returns, is still 7%, a good return by historical

standards. This means that if the worker invested 100 Euros on the first day of his career, by the last day of his 40-year career the 100-Euro investment would have grown at a compound annual rate of 7%. Unfortunately, workers do not save for retirement by investing a single sum at the beginning of their careers. Instead, they invest a fixed percentage of their salaries every year. The amount of their annual contribution rises as their salaries grow over their career. In performing the calculations for Figure 2, I assume that the worker's career wages followed the typical path of an average U.S. wage earner. Given the timing of workers' contributions, their realized returns and expected retirement incomes will depend not only on the geometric mean return over their careers but also on the timing of good and bad returns during their careers.

The experiment I consider in Figure 2 is to vary the year in a worker's career when he experiences a very poor investment return. The year when the worker experiences a -50% return is indicated on the horizontal axis. The bottom line in the chart shows how the worker's realized return on his contributions varies depending on when he experiences the -50% return. Obviously, if the worker earns 9.1% on his retirement savings in every year, his realized career return would be 9.1% a year. If the worker experiences a -50% return in the first year of his career, his realized rate of return over his career would be slightly lower, or 9.0%. If the year of poor returns occurs in the middle of the worker's career, say, in year 20, his realized return over his career would be 7.1%. If the year of poor returns occurs in his last year in the workforce, his realized return would be just 5.6%, 3.4 percentage points lower than the return obtained if the year of poor returns occurs at the start of his career. The top line in the chart translates these calculations into a pension replacement rate. The replacement rate is simply the value of the worker's retirement annuity divided by his annual earnings near the end of his career, when his annual wages are near their career peak. (I assume that all of the worker's retirement savings are converted into a single-life annuity on his 62nd birthday, when he is assumed to retire.) The worker's replacement rate is 114% of his final wage if he earns the poor return in the first year of his career; it is 72½% if he earns -50% on his savings in the 20th year of his career; and it is 53% if the year of low returns occurs in the final year of his career. Even though the geometric average asset return is precisely 7% over the worker's career, his replacement rate can vary between 53% and 114% depending on the year in his career when asset prices plunge. Clearly, workers have good reason to worry about this level of risk. There is a simple intuition behind the results displayed in Figure 2. If workers face a single stock market crash during their careers, it is better if the crash occurs at the beginning of their career, when they have accumulated little retirement savings. If instead the crash occurs at the end of their careers, all of their career contributions will be adversely affected by the market decline. Because the timing of market declines is impossible to forecast, workers face enormous uncertainty in predicting the retirement value of their nest egg, even when the expected 40-year return on assets falls within a fairly narrow range.

Figure 3 shows calculations of the pensions that U.S. workers could expect under a private DC pension account plan if they invested all their pension contributions in the U.S. stock market. These calculations are similar to those I have published earlier, although the estimates now reflect investment experience through the end of 2009 and updated information about U.S. mortality rates.¹³ My estimates are based on information about annual U.S. investment returns, interest rates, and inflation dating from 1872 through 2009. I start with the assumption that workers begin to make pension contributions at age 25 and work for forty years until reaching their 65th birthdays. I also assume they contribute 4% of their wages each year to their retirement savings accounts. Wages typically rise through workers' careers until they reach their mid or late fifties, and then earnings begin to fall. When workers reach age 65, I assume they use their retirement savings to purchase a single-life annuity. As noted above, a standard measure of the value of an annuity is the replacement rate, that is, the ratio of the monthly annuity expressed as a percentage of the worker's monthly wage near the end of his career.¹⁴¹⁵¹⁶ Figure 3 shows replacement rates for workers who

¹³ Gary Burtless, "Social Security Privatization and Financial Market Risk: Lessons from U.S. Financial History," in *Social Security Reform in Advanced Countries*, T. Ihori and T. Tachibanaki, 52-80 (London and New York: Routledge, 2002); and Gary Burtless, "What Do We Know about the Risk of Individual Account Pensions? Evidence from Industrial Countries." *American Economic Review* 93(2) (May 2003): 354-59.

¹⁴ I assume that the age profile of earnings in a given year matches the age profile of earnings for American men in 1998-2000 as reported by the U.S. Census Bureau in J.C. Day and E.C. Newburger, *The Big Payoff: Educational Attainment and Synthetic Estimates of Work-life Earnings*, Current Population Report, 23-210 (Washington, DC: U.S. Census Bureau, 2002). In addition, I assume that average real earnings in the economy as a whole grow 1.0% a year. In the calculations that follow I assume all contributions are invested in some combination of U.S. stocks, long-term U.S. government bonds, and low-risk, short-term commercial paper or 6-month certificates of deposit. The total return calculation for stocks is based on the return for the Standard and Poor's composite stock index; the total return calculation for bonds reflects the return on U.S. government debt with a constant maturity of ten years. For years up through 1997 the total return on safe 6-month securities is based on the yield on commercial paper published by the Federal Reserve; for years after 1997, when the Federal Reserve series was discontinued, the safe short-term total return is calculated from the yield on 6-month certificates of deposit. Interest and dividend payments from the worker's investment portfolio are immediately reinvested in the same security, and the worker's portfolio is rebalanced at the end of each year to achieve a planned percentage distribution of stock, bond, and safe short-term investment holdings. I assume that workers incur no expenses buying, selling, or holding stocks, bonds, and safe short-term securities. This biases upward estimated rates of return. When workers reach their 65th birthdays, they use their asset accumulations to purchase a single-life annuity for males. (Joint survivor annuities for a worker and a spouse would be about one-fifth lower than the ones displayed in the charts.) To determine the annuity company's charge for the annuity, I use the Social Security Actuary's projected-life table for males reaching age 65 in 2015 as reported by Felicitie C. Bell and Michael L. Miller, *Life Tables for the United States Social Security Area 1900-2100*. Actuarial Study No. 120 (Baltimore, MD: Office of the Chief

invest all their retirement savings in U.S. equities. I track replacement rates for workers retiring at the end of successive years from 1911 through 2009. The hypothetical experiences of ninety-nine workers are shown in the chart. The worker who started saving for retirement in 1872 and retired at the end of 1911, for example, would have accumulated enough savings in his individual retirement account to buy an annuity that replaced 34% of his peak lifetime earnings (that is, his average earnings between ages 55 and 59). The worker who started saving in 1967 and retired at the end of 2006 could have purchased an annuity that replaced 58% of his peak earnings. The highest replacement rate (101%) was obtained by a worker who began saving at the start of 1960 and retired at the end of 1999. The lowest (14%) was obtained by a worker who began saving in 1881 and retired in 1920. Nine-tenths of the replacement rates shown in the chart fall in the range between 19% and 92%. Clearly, this is an unacceptably wide range if an annuity financed with private savings is to serve as the cornerstone of a worker's retirement income. On the other hand, the *average* replacement rate compares favorably to that obtainable under many public pension systems. Over the full 1911-2009 analysis period it is 48%. For workers retiring after 1945, the replacement rate averages 59%.

The main lesson to be drawn from the chart is that individual retirement accounts invested solely in the stock market offer a very uncertain foundation for retirement income. Workers with the good fortune to retire when stock prices are high obtain big pensions, while those with the bad luck to retire after a market crash can be left with a very meager retirement income. The largest pension shown in the chart is more than seven times larger than the smallest one. Even in the years since 1960, the experiences of retiring workers have differed dramatically. The biggest pension was more than 3½ times the size of the smallest one. In the six years from 1968 to 1974, the replacement rate fell 54 percentage points, plunging from 99% to 40%. In the six years from 1993 to 1999, it jumped 57 percentage points, soaring from 44% to 101%. In the twelve months from December 2007 to December 2008, the predicted replacement rate fell in half, shrinking from 53% to 27%, the smallest replacement rate in more than fifty years.

Actuary, U.S. Social Security Administration, 2005). The annuity company is assumed to invest solely in long-term U.S. government bonds, so when it determines the price of an annuity, it uses the current yield on long-term government bonds. I assume that the annuity company sells a fair annuity. It does not earn a profit, incur administrative or selling costs, or impose extra charges to protect itself against the risk of adverse selection in its customer pool. These assumptions are unrealistic. Annuity companies typically charge an amount that is between 10% and 15% of the selling price of annuities to cover these items. My assumptions therefore yield an overly optimistic estimate of the pension that each worker would receive.

The calculations shown in Figure 3 refer to the experiences of workers who invest all their contributions in the U.S. stock market. This investment strategy has on average yielded the best pension available to most U.S. workers. Workers who do not want to accept the risks of equity investment can put some or all of their savings in less risky assets, such as corporate or U.S. Treasury bonds or very safe short-term securities. Figure 4 shows replacement rates when American workers invest part or all of their retirement savings in U.S. government bonds. Under one of the alternative investment strategies, workers place half their savings in long-term government bonds and the other half in stocks. Under the less risky strategy, they invest all their savings in government bonds.

As can be seen in the chart, workers who choose a less risky investment strategy will experience less variability in replacement rates. Between 1999 and 2002, workers who invested everything in stocks saw replacement rates fall 60 percentage points, while workers who invested half their savings in bonds saw replacement rates fall only 19 percentage points. Those who invested all their savings in bonds saw the replacement rate fall just 0.1 percentage point. Of course, workers who opt for a low-risk investment strategy will also receive a lower replacement rate on average than they would obtain if they invested all their savings in equities. Whereas the average replacement rate under a 100% stock investment strategy is 48%, the average under the 50% stock / 50% bond strategy is only 28%. Under the 100% government bond strategy, the average is just 15½%. Figure 4 emphasizes the trade-off workers face between good returns on their retirement savings and uncertainty over the value of their nest eggs as they approach retirement. A worker's retirement income is more predictable and less risky if funds are invested solely or mainly in very safe assets, but retirement income is almost certain to be considerably lower. In 22 out of the 99 careers analyzed in Figure 4, workers who invested all their retirement savings in safe government bonds earned a negative lifetime rate of return on their contributions. That is, the workers who adopted the lowest risk investment strategy obtained a worse real return on their contributions than they would have obtained on their U.S. social security taxes.

Besides investing in very safe assets, there are a couple of other strategies DC-covered workers can follow to reduce the uncertainty of their retirement incomes. One of these is to shift gradually from a portfolio that is dominated by high-risk, high-return assets early in a career to a portfolio that is dominated by low-risk, low-return assets near the age of expected retirement. Robert Shiller has proposed three life-cycle portfolio allocations for retirement savers that follow this basic strategy.¹⁵ Under his baseline proposal workers below age 29 would invest 85% of their savings in equities. Starting at age 29 this percentage would fall steadily until it reaches 15% of the portfolio by age 60. The remainder

¹⁵ Robert J. Shiller, "The Life-Cycle Personal Accounts Proposal for Social Security: An Evaluation." NBER Working Paper No. 11300. (Cambridge, MA: National Bureau of Economic Research, 2005).

of the portfolio would be invested equally in long government bonds and safe commercial short-term securities. Given the heavy allocation to very safe assets, the Shiller portfolio exposes retirement savers to less risk than the target-date portfolios favored by many mutual fund companies. Shiller also proposes “conservative” and “aggressive” versions of his lifecycle allocation model. These alter the maximum share in the portfolio that is allocated to equities. In the conservative version of his lifecycle portfolio model, a maximum of 70% of savings is invested in equities, and this fraction gradually falls to 10% by age 60. In the aggressive version, the maximum allocated to equities rises to 90% of the portfolio and never falls below 40%. Figure 5 compares the historical replacement rates that would have been obtained under the three Shiller target-date portfolios. Two of the three portfolios proposed by Shiller produce less variation in replacement rates than the 50% stock / 50% bond portfolio. Some of the reduction in variance occurs because the portfolio is less likely to produce very high replacement rates.

The mean and standard deviation of pension replacement rates under the six alternative investment strategies are displayed in the top and bottom panels of Figure 6. Not surprisingly, both the mean and the standard deviation are highest under an investment strategy that places 100% of a worker’s portfolio in U.S. equities. The lowest expected replacement rate and standard deviation are obtained under an investment strategy that places 100% of assets in long government bonds. The reduced variability of pension outcomes under this investment strategy is obtained at considerable cost, however. The average replacement rate with a 100% bond portfolio is two-thirds lower than the mean replacement rate when all retirement savings are invested in stocks. The other four portfolios show considerably less variability in replacement rates than the all-stock investment strategy. Two of the target-age portfolios recommended by Shiller yield only slightly more variability than the all-bond portfolio, yet the mean replacement rates of those two life-cycle portfolios are notably higher than the average replacement rate under the all-bond investment strategy. Thus, in comparison with the all-bond portfolio, the Shiller investment strategies have a sizeable advantage in generating better retirement incomes.

Figure 7 shows the average realized rates of return under the six lifetime investment strategies. The highest average realized rate of return is achieved with the strategy of investing all savings in U.S. equities; the lowest average return is obtained with the 100% government bond portfolio. The other four investment strategies yield intermediate returns on workers’ lifetime pension contributions. The lower panel in the same chart shows the standard deviation of realized returns. Interestingly, the smallest standard deviation in realized returns is achieved when worker-savers follow the most aggressive lifecycle investment strategy proposed by Shiller. Not only does this investment strategy yield the second highest realized average return, it also produces smaller variance in realized returns than the other five investment strategies I consider.

Another strategy to reduce the uncertainty of private savers' retirement incomes is to offer workers deferred annuities before they reach the retirement age. If workers buy deferred annuities over a number of years before they retire they will face a lower risk that all of their retirement savings will be converted to an annuity when asset prices are exceptionally low or annuity prices are exceptionally high. In an earlier paper, I looked at the success of this strategy in reducing the variability of workers' initial replacement rates.¹⁶ Workers who purchased annuities in annual installments beginning five years before retirement were able to reduce the standard deviation of initial replacement rates by about one-sixth compared with workers who converted all of their savings at retirement. For workers who invest heavily in stocks before converting to an annuity, this strategy unfortunately reduces the expected return on lifetime savings, because assets are held as relatively safe, low-return annuities for a greater percentage of the worker's career.

5. Conclusion

Traditional public DB pensions help solve a number of problems that most workers face in paying for retirement. A public pension system automatically sets aside a portion of current compensation as savings for retirement. Money in the account only becomes available when the worker is old or retired. Workers do not have to rely on their own judgment to select a retirement saving rate, nor do they have to rely on self-discipline to stick with the saving plan they adopt. Workers do not need any investment expertise to manage their retirement savings. In nearly all public pension programs run by rich democracies, it is the government and taxpayers who bear most of the economic and demographic risks associated with financing pensions. Retirees and workers near the retirement age bear only a modest share of the risks. In contrast, a retirement system founded on workers' private savings forces workers and retirees to bear most of the inflation and financial market risks inherent in long-term saving. When workers reach the end of their careers under most public pension systems, their retirement nest eggs are converted into a monthly annuity payment that lasts for as long as the workers live. Workers do not need to worry about living too long or spending their nest egg so quickly that they exhaust their retirement savings before they die.

A retirement system based solely on voluntary private savings can solve some of the problems addressed in a typical public pension system. If contributions to the private saving system are compulsory, a private DC pension solves one of the major problems just mentioned by requiring workers to contribute a fraction of wages to a pension fund. If the mandatory pension also includes a provision requiring workers to convert their pension savings into an annuity it solves a second problem as well. Workers will not have to worry about out-living their retirement savings. Workers are still left with the problem of

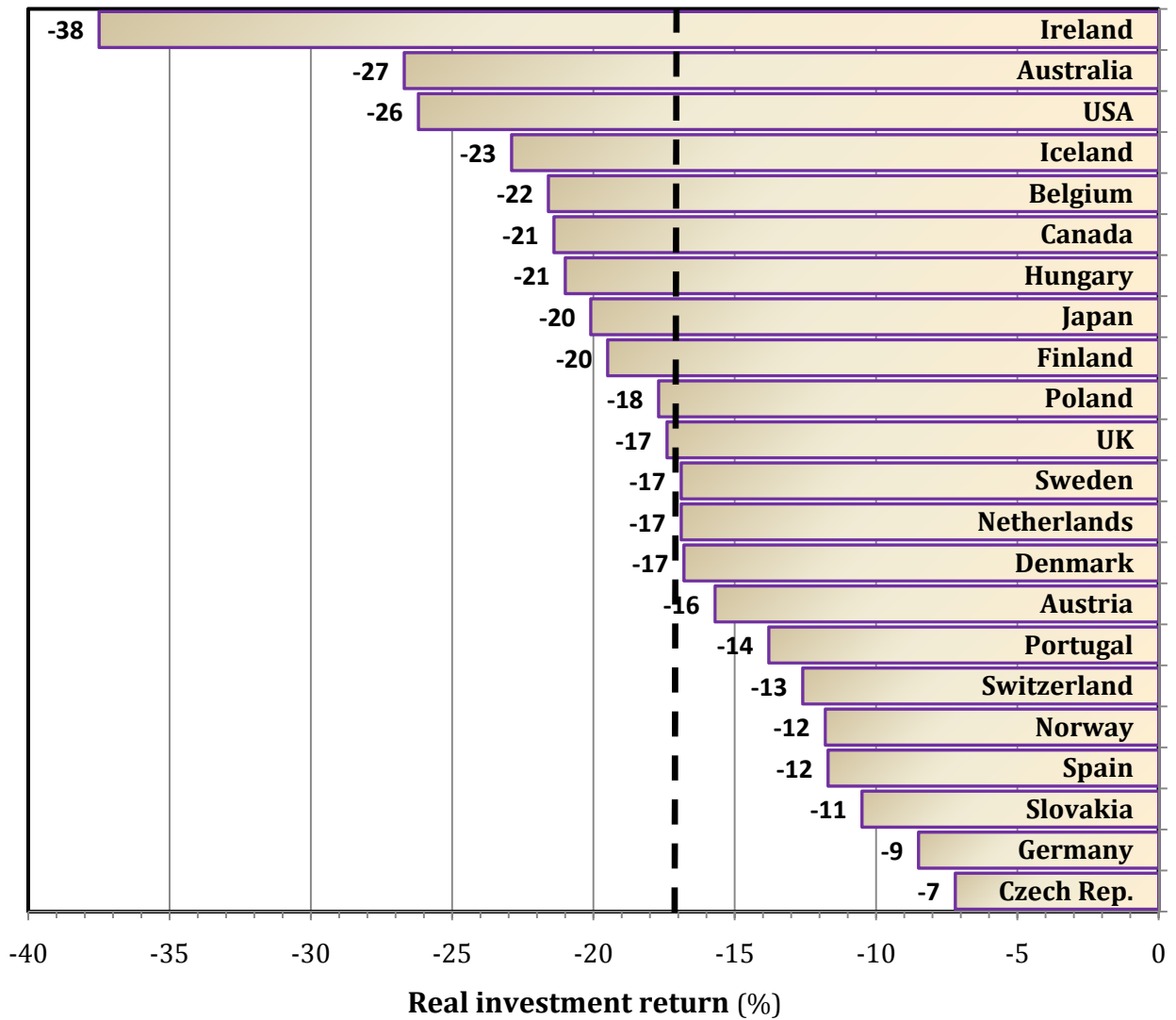
¹⁶ Burtless, "Social Security Privatization and Financial Market Risk" (2002).

highly uncertain pensions because the real return they will obtain on their retirement savings is unknown. They can of course adopt a very conservative investment strategy. Their pensions will be less variable but their expected returns on contributions may be much lower than they would have been under a collective retirement system, one in which investment risks are broadly shared across workers and taxpayers.

The financial market turbulence that began in 2000 should remind both policymakers and workers that even conservative investment strategies offer little assurance workers will reach old age with enough private savings to pay for a comfortable retirement. As we have seen, the risks facing workers can be reduced through better financial education and the development of new retirement investment products. Nonetheless, recent experience suggests that neither the value of financial assets nor their real return is predictable enough to assure workers they will enjoy a comfortable income in old age. Workers who follow identical investment strategies but who retire a few years apart can receive pensions that are startlingly unequal. By diversifying risks across generations and across different sources of pension funding, a sensibly designed public pension system can sharply reduce some of the risks inherent in a mainly private, capital-funded retirement system.

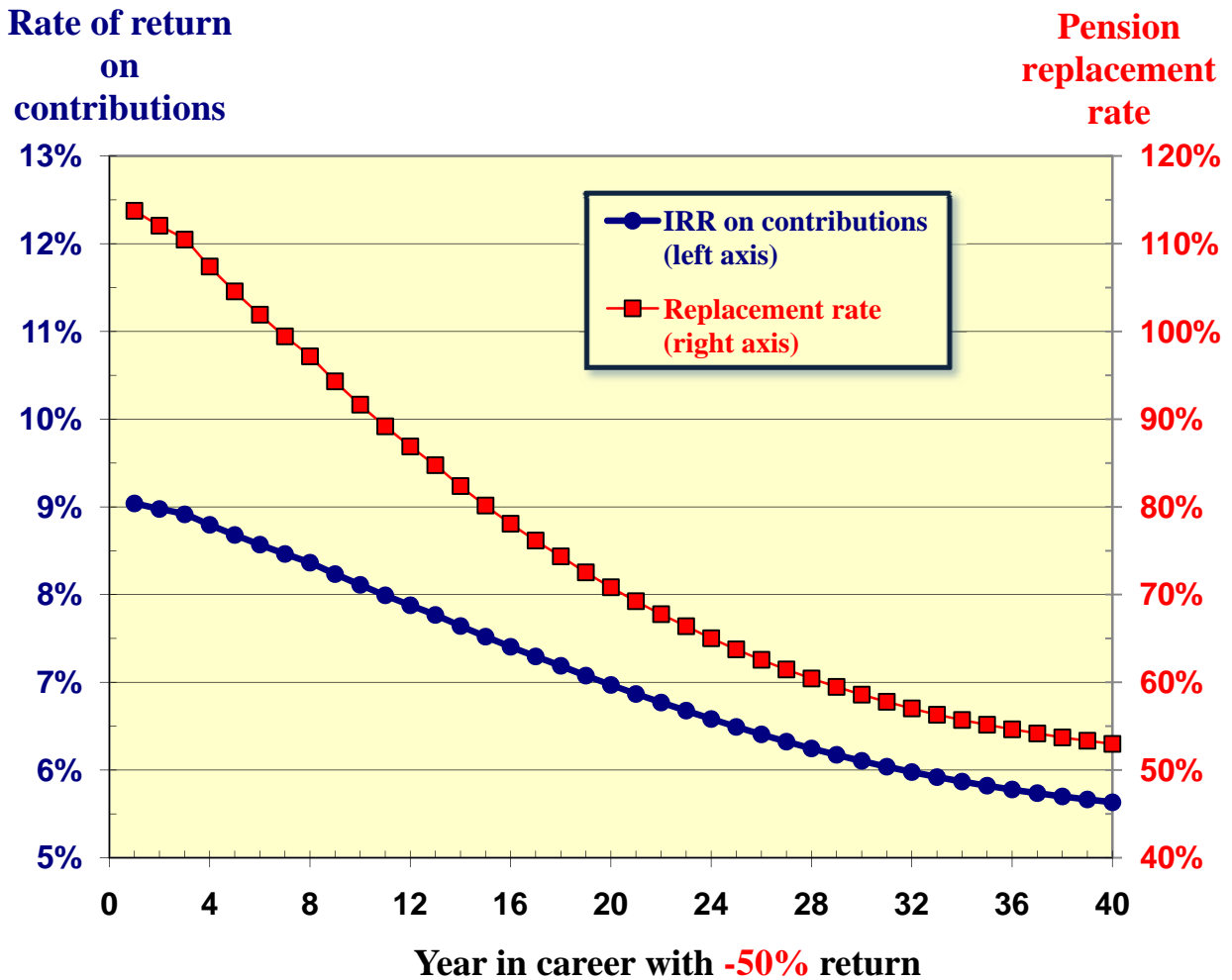
Of course, no democracy is confronted with a stark choice between purely public or purely private provision of retirement income. Nearly all have adopted an intermediate system that combines elements of both public and private provision, with a heavier weight on public pensions for workers who have low lifetime incomes. An urgent question is how the rising burden of public pensions in an ageing society can be kept affordable while simultaneously ensuring that retired workers enjoy reasonably safe and comfortable incomes in old age. The sudden, sharp asset price meltdown in the financial crisis offered a reminder of the shortcomings of purely private pension provision. Even though private retirement savings can be made safer through sensible regulation and prudent investment choice, the future value of private investment alternatives can never be safely predictable. For most liberal democracies this basic reality places practical limits on how much the government can reduce the scale of public pensions.

Figure 1. Pension Funds' Real Returns in 2008



Source: *OECD Pensions at a Glance 2009*, Figure 1.3

Figure 2. Impact of One Year of Poor Returns on Pension Replacement Rate and on Realized Rate of Return of a Full-Career Worker

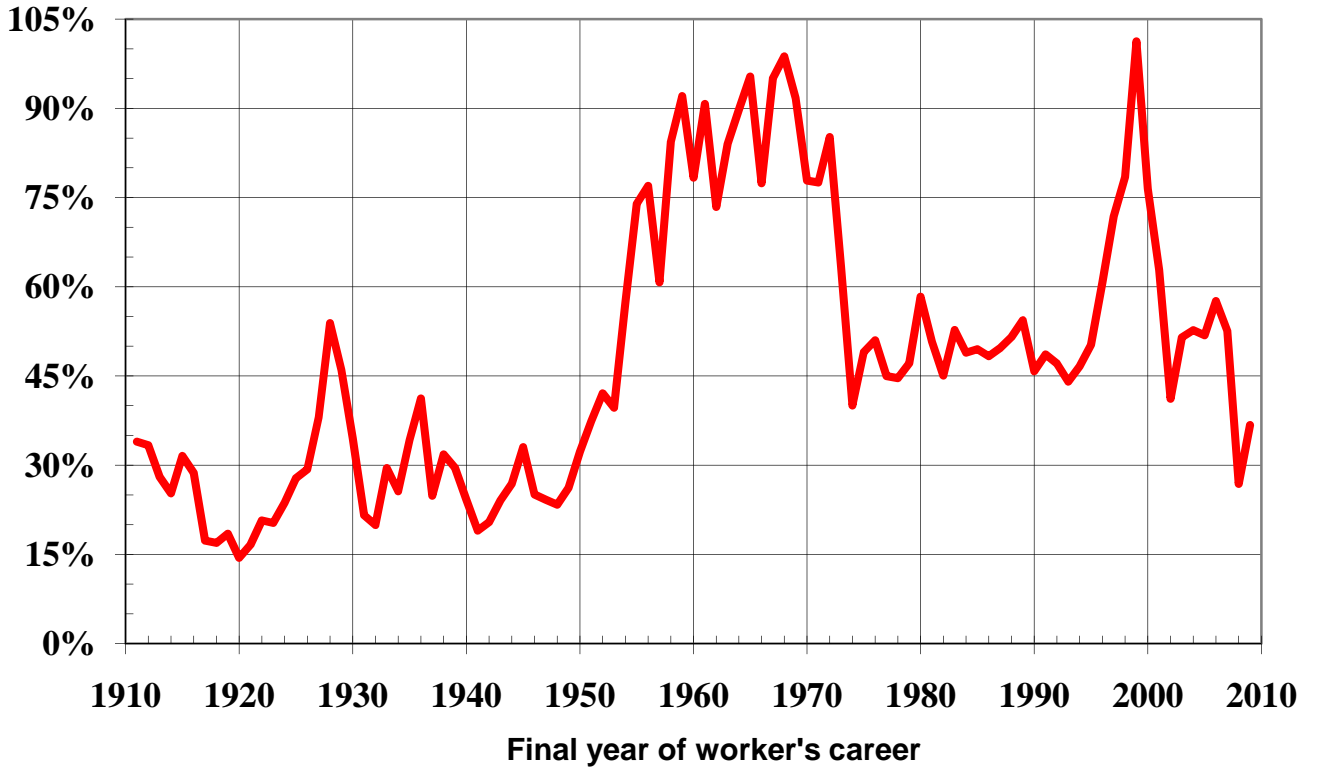


Note: The geometric mean return during the 40-year career is 7.0%. In one year of the worker's career, the return is minus 50%; in the other 39 years it is 9.1%. This chart shows the impact of varying the year in the worker's career when the low return occurs.

Source: Author's calculations as explained in text.

Figure 3. Replacement Rates Obtained from Personal Savings of Workers Who Invest Solely in U.S. Stocks and Contribute 4% of Annual Salary over a 40-Year Career

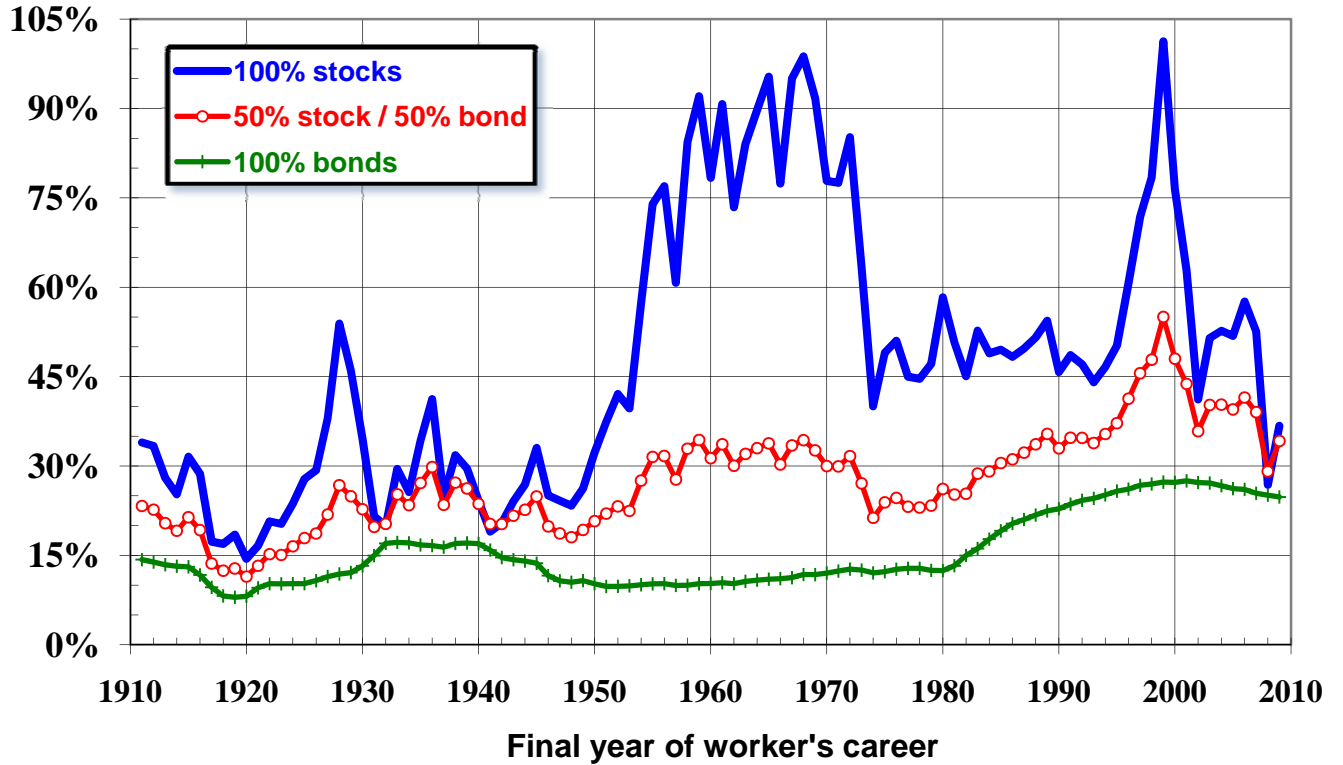
Replacement rate
(Annuity / Final wage)



Source: Author's calculations as explained in text.

Figure 4. Replacement Rates Obtained from Personal Savings of Workers Who Invest in Alternative Portfolios and Contribute 4% of Their Salary over a 40-Year Career

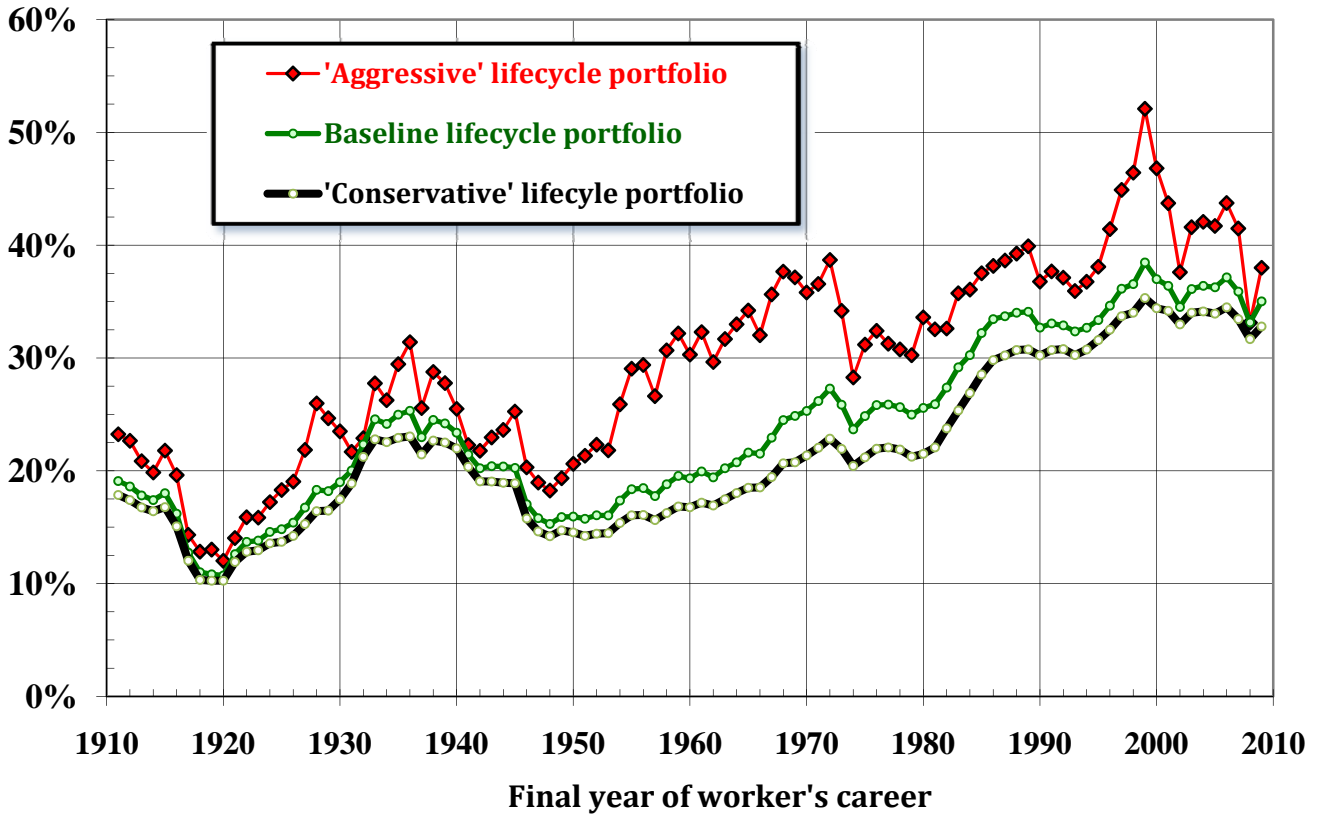
Replacement rate
(Annuity / Final wage)



Source: Author's calculations as explained in text.

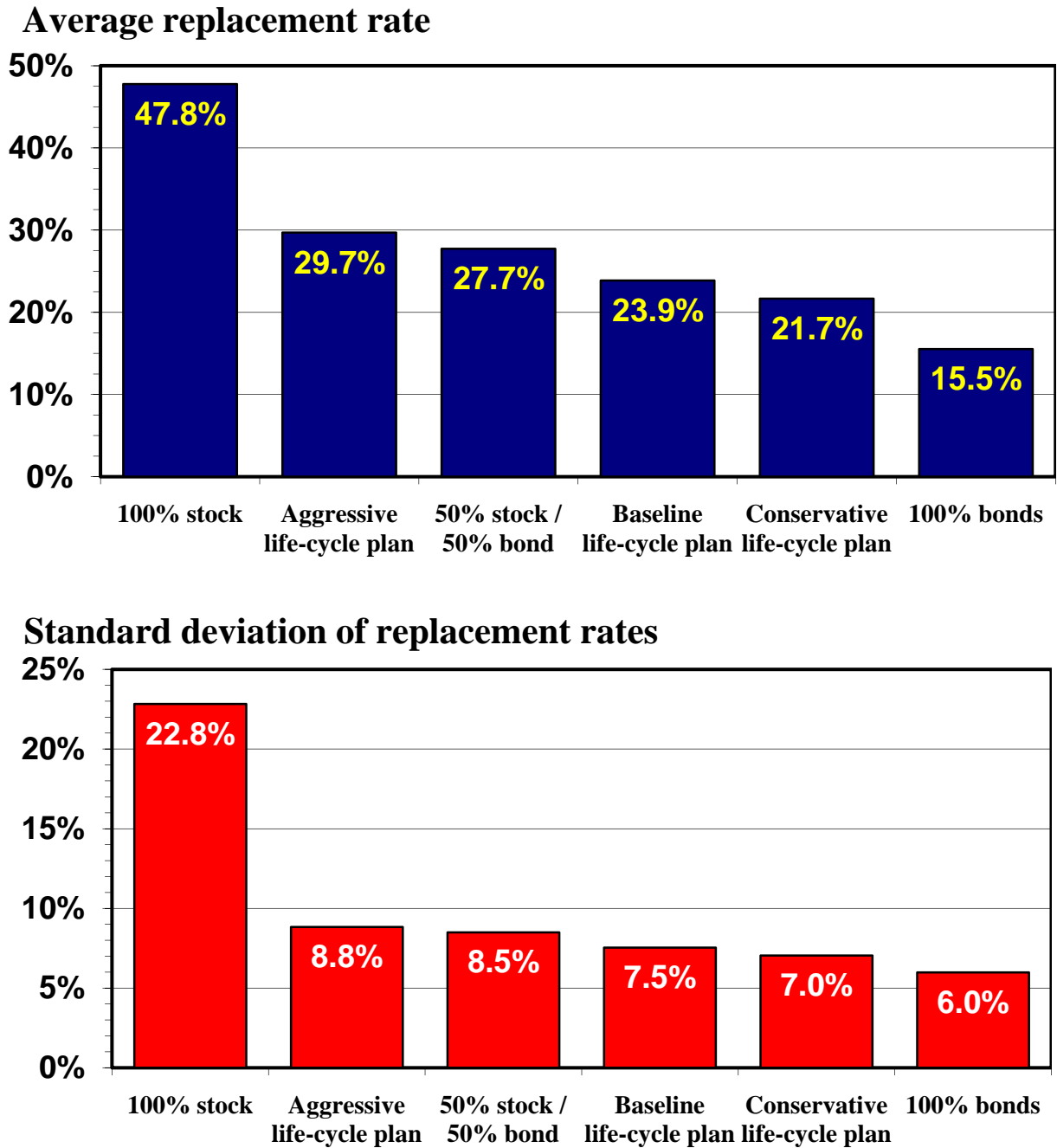
Figure 5. Replacement Rates Obtained from Personal Savings of Workers Who Invest in Alternative Lifecycle Portfolios Proposed by Robert Shiller

Replacement rate
(Annuity / Final wage)



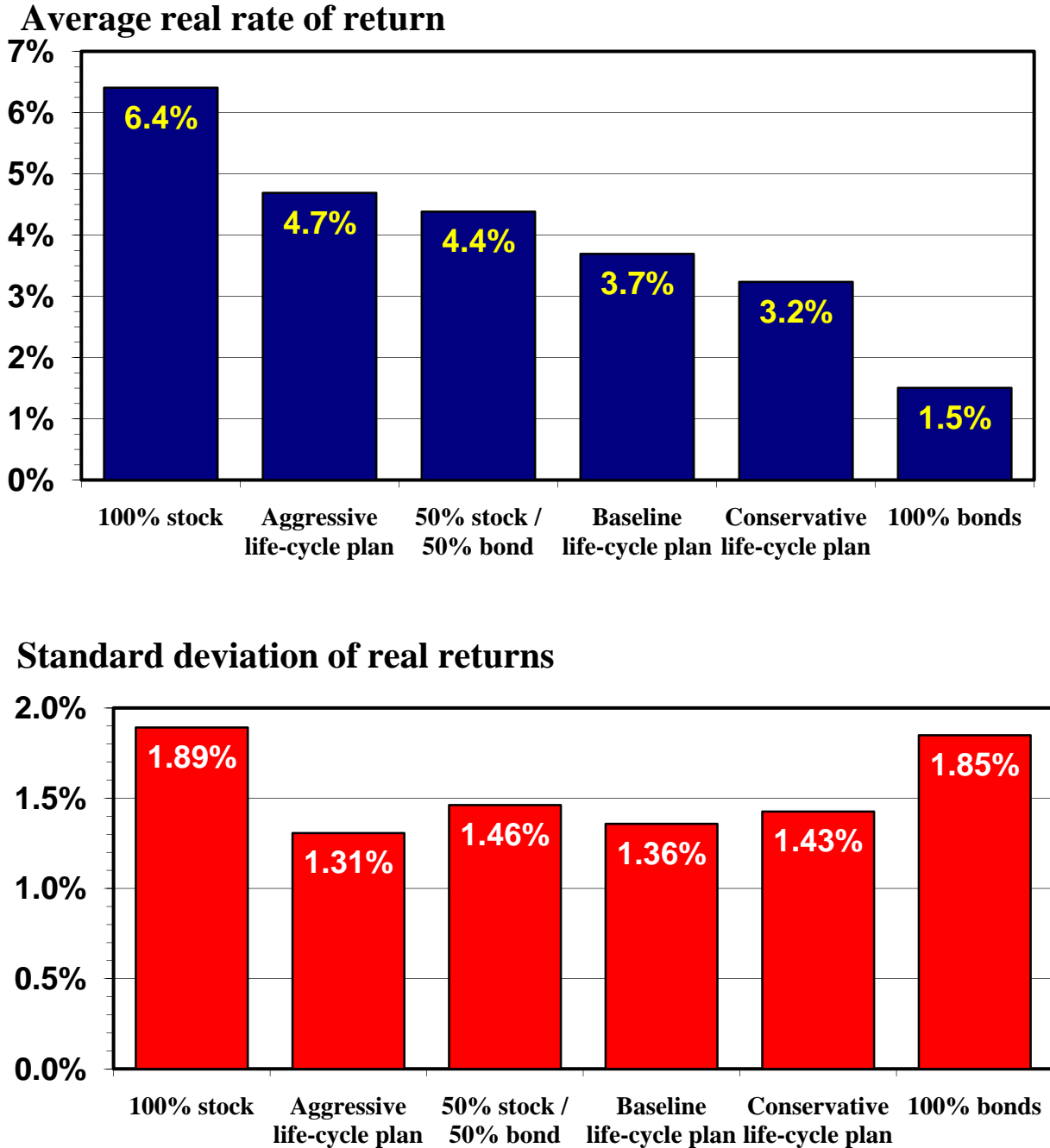
Source: Author's calculations as explained in text.

Figure 6. Mean Replacement Rates and Standard Deviation of Replacement Rates Obtained by Workers Who Invest in Alternative Portfolios over a 40-Year Career



Note: The two panels in the chart show estimates of the mean replacement rates and the standard deviation of the replacement rates for workers who contributed to a retirement savings account under six alternative investment strategies. Author's calculations as explained in text.

Figure 7. Mean Real Returns and Standard Deviation of Returns Earned on Personal Savings for Workers Who Invest in Alternative Portfolios over a 40-Year Career



Note: The two panels in the chart show estimates of the mean realized real rate of return and the standard deviation of the realized returns on workers' contributions to a retirement savings account under six alternative investment strategies. The calculations are based on estimated returns for 99 simulated workers who stop working after 40-year careers. Their careers end in successive years from 1911 to 2009.