Government Policy on Distribution Methods for Assets in Individual Accounts for Retirees

Life Income Annuities and Withdrawal Rules

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Abstract

As the baby boom generation begins to retire, more and more workers will have accumulated considerable assets in 401(k) plans and IRAs that have no particular method of payout. This paper examines the two basic, opposing methods that have been proposed as solutions to this problem. The first is the immediate life annuity, while the second is a fixed percentage of 4 percent of the initial account balance, increased each year after the first year of distribution by the rate of inflation. I calculate the lifetime income levels and risks these methods produce using a historical simulation of asset returns, interest rates, and inflation, as well as recent data on the pricing of immediate life annuities. I judge the life annuity an effective instrument to produce lifetime retirement income—generally somewhat better than the commonly used withdrawal rules. Because household needs and preferences are diverse, however, the government should not go beyond mild encouragement and education to promote the life annuity.

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As the baby boom generation begins to retire, fewer and fewer private-sector workers have traditional defined benefit pension plans, which usually pay lifetime annuity benefits. Instead, they have accumulated considerable assets in 401(k) plans and individual retirement accounts (IRAs) that have no particular method of payout. Federal government policy, which has regulated defined benefit plans heavily and mandated plan designs for distributions, has tread more lightly on defined contribution plans because of their historical secondary nature. Questions are now arising about whether this stance needs to change and, if so, how. At the same time, discussions have heated up in state governments about replacing underfunded pension plans for government workers with defined contribution plans and about providing uncovered private-sector workers with individual account plans. Hence, the policy and design issue of how most retired households can get orderly lifetime distributions from their current or potential future accounts must be faced soon and squarely.

This paper examines the two basic methods put forth in professional literature and practice as opposing solutions to this problem facing retired households. The first is a simple insurance contract that has been around for centuries: the immediate life annuity. In exchange for a premium paid to the issuing insurer, it makes payments periodically (sometimes annually, usually monthly) at a level fixed at issuance for insured's lifetime. The contract has no liquidity and little or no bequest value. The second is a simple, easy-to-explain, and popular rule that many financial advisors employ and financial companies recommend. A fixed percentage, often 4 percent, of an invested portfolio is distributed initially, and its dollar value

is adjusted every year by the actual inflation rate.[1] This approach gives the retiree complete liquidity and allows the use of the account as a bequest, but also comes with the possibility of running out of spending resources if returns are poor or the participant has a long life. Moreover, the inflation-adjusted income flows, at least initially and for several years thereafter, will likely be lower than those of a life annuity because of the latter's "mortality credit," the sharing of mortality gains among survivors in the annuity purchase pool. There are theoretically more complex strategies and products on both sides of this debate, but both practically and for policy purposes, an empirical investigation into the basic choices is an excellent starting point for discussion.

I calculate and compare the income levels and risks these two methods produce over retirees' lifetimes using a historical simulation of asset returns, interest rates, and inflation. I also consult more recent data on the pricing of immediate life annuities by several insurance companies. The empirical investigation of risk and return properties of single-premium immediate annuities modeled using historical data is a unique and original contribution here. This comparison examines the characteristics of the methods and serves as an empirical basis for discussions about retirement-income policy issues, such as projected-income illustration requirements, default annuitization in 401(k) plans, minimum distribution rules for individual accounts, and retirement-plan design by sponsors. This analysis will also be useful, in future work, as a basis for understanding, explaining, and designing more sophisticated distribution methods that plan sponsors and financial organizations can use to assist retired households, as well as the government policies that affect those products and strategies.

[1] Suppose the retiree has an account with $100,000, using the initial 4 percent distribution rate. In the first year $4,000 will be distributed. In the second year, if the inflation rate is 3 percent, $4,120 will be distributed. Each year this calculation is repeated with an updated inflation rate.

The life annuity is indeed an effective instrument for distributing retirement assets to produce lifetime income; it functions generally somewhat better than the withdrawal rules in widespread use. Because the life annuity is subject to inflation risk and is illiquid, and because household needs and preferences are so diverse and critical, the governmental stance toward this issue should be one of mild encouragement of and education about life annuities. Policies discouraging creative strategy and plan design using annuities should be abandoned. When designing retirement plans for government employees, if defined benefit plans are to be replaced by defined contribution plans and individual accounts, the position in favor of the individual income annuities should be stronger still—as a default selection. These considerations would also be relevant in designing a system of individual accounts in a reformed Social Security program.

Literature Review

There are large professional literatures on retirement income, in particular on withdrawal rules of thumb by financial planners and on life income annuities by economists. Those literatures, because of their diverse authorships, do not often talk to one another, but the summary review here undertakes such a conversation, examining implicit assumptions and key premises and results.

Withdrawal Rules

William P. Bengen, a solo practitioner of financial planning and investment management, published an influential paper in his profession's primary journal (Bengen (1994)) giving a solution to the retirement-income problem. In a simple empirical analysis, he showed how a 4 percent initial annual withdrawal rate from the portfolio, subsequently increased by the rate of inflation (or decreased by the rate of deflation), could be sustained for more than 30 years from

an investment portfolio evenly and consistently allocated between stocks and bonds (50/50). Thirty years was considered the most relevant horizon because the life expectancy of most retiring households, even with some years added for conservatism, did not extend past this horizon unless a particularly early retirement age was chosen. (In fact, at age 62, the probability of a single man surviving to age 92 is 12 percent, and the probability of a single woman surviving to age 92 is 23 percent; for a mixed-gender couple, both age 62, the probability of at least one surviving to age 92 is 33 percent.[2] At age 65, the comparable probabilities—the chances of surviving 30 years to age 95—are 6 percent, 13 percent, and 18 percent, respectively. At age 70, the comparable probabilities of survival to age 100 are 1 percent, 4 percent, and 5 percent, respectively. So the focus on a 30-year horizon, although standard, bears some risk for most retirees, especially younger ones, and researchers should examine longer horizons when possible.)

Bengen examined the investment experience of cohorts of households retiring each year over the period 1926–1976. He assumed annual withdrawals from a tax-deferred retirement account that was rebalanced annually to maintain a fixed asset allocation at 50 percent bonds and 50 percent equities. To produce at least 50 years of portfolio experience for that period, Bengen used historical data on returns and inflation through 1992 and then added for subsequent years the historical average returns on stocks and bonds and the historical average rate of inflation. (This "smoothing" methodology likely reduces the appearance and measurement of risk in the analysis.) At a 3 percent withdrawal rate, the portfolio lasted at least 50 years in each simulated cohort. At a 4 percent withdrawal rate, no one will get less than 33 years of coverage from a portfolio, according to the augmented historical record. By contrast, a 4.25 percent withdrawal rate could lead to

[2] According to a calculator on the Vanguard website, using mortality statistics from the Society of Actuaries. See https://personal.vanguard.com/us/insights/retirement/plan-for-a-long-retirement-tool.

exhaustion in as few as 28 years, and a 5 percent withdrawal rate experiences exhaustion in 20 years for several cohorts, owing to the severe impact of the stock market's deeply negative returns and high inflation in the 1973–1974 recession.

Bengen also examined the effect of changing the portfolio asset allocations. He found that having too few stocks shortened the minimum portfolio life, as did having too many stocks; allocating 50–75 percent to stocks seemed to be ideal for maximizing the years to depletion and increasing the strategy's expected residual (bequest) value. Bengen preferred the 75 percent allocation because it increased significantly the number of simulation cohorts resulting in portfolio longevities of 50 years, and it shortened portfolio longevities only slightly in two terrible-outcome cohorts. Moreover, the portfolio's value if the holder dies before exhaustion (serving a secondary goal of leaving a bequest) is generally much larger with the higher allocation to stocks. Bengen concludes by arguing somewhat heuristically that the 4 percent withdrawal rule and 75 percent allocation to stocks should be observed through thick and thin for the retiree's lifetime, with the slight exception that withdrawals could be reduced modestly and temporarily in the worst return and inflation circumstances. In other words, Bengen did not believe much in a dynamic strategy of reacting continually to changing economic and personal circumstances because of its complexity, challenging governance, added expense, and inability to address the assumed strong desire for fixed real consumption levels over the retired household's lifetime. In subsequent work, Bengen (2006) increased his recommended withdrawal rate to 4.5 percent by adding small-cap stocks, which have higher expected returns, to the portfolio.

Three finance professors at Trinity University—Philip L. Cooley, Carl M. Hubbard, and Daniel T. Walz—subsequently conducted an analysis similar to Bengen's with a few

methodological differences (Cooley, Hubbard, and Walz (1998)). Bengen used intermediate-term Treasury bonds, whereas the Trinity group used higher-yielding long-term corporate bonds in its historical simulated portfolios. The Trinity group limited the payout periods analyzed to 30 years, thereby cutting off analysis of later exhaustion dates, and only used historical data. For the historical period of 1926 to 1995, the professors had only 41 overlapping 30-year payout periods (cohorts) compared with the "smoothing fix" Bengen used to extend the data in later years by assuming average values of returns and inflation. Like Bengen, the Trinity group did not consider investment fees or other transaction costs. Overall, the Trinity group had a slightly more rigorous methodology than Bengen's, with factors tending to increase both risk and return somewhat.[3] Nonetheless, the group's conclusion was identical to Bengen's: a 4 percent initial withdrawal rate subsequently adjusted for changes in the general consumer price level (inflation), combined with a 75 percent allocation to stocks, gives the highest portfolio success rate, with no exhaustion in 98 percent of the cases for 30-year periods.[4] The Trinity group in subsequent work extended the analysis to monthly withdrawals and data through 1997; the results were nearly identical, but the group interpreted them more liberally than before and supported withdrawal rates higher than 4 percent to maximize consumption spending during retirement.

[3] Another criticism of the historical simulation approach is that in overlapping periods, the middle of the period plays an overly important role; in particular, the severe bear market for bonds found in the 1955–81 period may be overweighted. So Spitzer, Strieter, and Singh (2007) used "bootstrapping," whereby simulated return sequences were determined by randomly selecting 30, one-year real returns from 1926 to 2005 for each 30-year period. A total of 10,000 separate 30-year sequences were calculated. Spitzer et al. suggest a stock allocation closer to 50 percent rather than 75 percent, while the optimal withdrawal rate remains at 4 percent, albeit with somewhat more risk. Note, however, that these authors may be too clever by half because their assumption of return independence is belied by the now widely accepted observations of serial correlation and reversion to the mean for bond returns and inflation, which is implicitly preserved in simple historical simulations. An even more sophisticated methodology uses Monte Carlo simulations based on a model (such as the logarithmic normal distribution) of returns and inflation with parameters estimated on the historical experience, although model risk arising from misspecification is possible and even likely. No methodology is perfect.

[4] The Trinity group found that historical simulations for 30-year periods indicated fixed-percentage withdrawal rates as high as 6 percent. Of course, fixed-percentage withdrawal rates will produce more volatile withdrawal amounts than the Bengen rule, increasing in good times and decreasing in bad times. Traditional economic and finance theory would support the fixed-percentage rule, however, as consumption is viewed as "more expensive" in bad times.

As documented by Jason Scott, William Sharpe, and John Watson, associates of investment advisory firm Financial Engines, Inc. (Scott, Sharpe, and Watson (2009)), the 4 percent rule spread quickly and widely throughout the financial services communities: advisors, brokerage firms, mutual fund companies, and the personal finance media. These associates acknowledged the attractiveness of the rule's simplicity, even while criticizing the weakness of the empirical test using overlapping time periods. They also complained about the large inefficiency of the rule's unspent surpluses and overpayments implicitly used to purchase its payout policy, compared with a ladder of inflation-indexed bonds of various maturities.

More recently, however, other analysts using methodological approaches broadly similar to those originally employed by Bengen and the Trinity group have had some success among the media and financial communities in reducing the accepted sustainable withdrawal rate and the allocation to stocks to be used in retirement-income planning.

Professor Wade Pfau of the American College uses return and inflation data from 1926 through 2010 and a more sophisticated Monte Carlo simulation methodology to give a safe withdrawal rate of only 3.4 percent if the portfolio holder desires a failure rate of 1 percent for a 30-year period, and withdrawal rate of only 3.0 percent for that conservative failure rate for a 35-year period (Pfau (2012)). If a failure rate of 5 percent is tolerable, then the withdrawal rates could increase to 3.9 percent and 3.6 percent, respectively, but Pfau also finds uniformly that a lower allocation to stocks is optimal, at around 35 percent instead of 50 percent or 75 percent.[5]

In other papers, perhaps influenced by the recent searing experience of the global financial crisis in 2008 and 2009, Pfau, joined by financial planning professor Michael Finke and Morningstar's head of retirement research, David Blanchett, notes that the historical American

[5] Pfau posits a riskier world than Bengen, so the optimal allocation to risky investments such as stocks is lower.

record used in all the prior studies is uniquely favorable compared with Asian and European historical experience. Moreover, they believe that American prospects may not be as rosy as in the past (Finke, Pfau, and Blanchett (2013)). In particular, they emphasize that as of January 2013, intermediate-term real interest rates were −1.4 percent compared to the historical average of about 2.5 percent. If zero or negative real interest rates continue, even maintaining the historical equity return premium over bonds, then the 4 percent Bengen rule for a 30-year period will result in failure rates of 33 percent or 57 percent, respective to real interest rates, assuming a 50/50 investment portfolio.

Even if real bond returns were to increase gradually, and ignoring the resulting price losses on bonds, failure rates would still be unacceptably high for the Bengen rule—about 20 percent or more, according to Finke, Pfau, and Blanchett. Indeed, even a 3 percent withdrawal rate results in failure 21 percent of the time, assuming the new economic conditions continue, even when increasing the allocation to stocks to 70 percent. The maximum sustainable initial withdrawal rate, allowing for a 10 percent failure rate, drops to 2.5 percent, using an allocation of 45 percent stocks and 55 percent bonds that is common to older portfolio holders. Finke, Pfau, and Blanchett speculate that such a low spending rate in retirement might necessitate the inclusion of assets that provide a mortality credit (explained later) and longevity protection: life annuities, a product that financial advisors and many fund companies have avoided heretofore.[6]

As a real-world reflection of this shift in views, consider changes in the advice given by Vanguard, a large mutual fund company, through its website. In 2008, it advised a retiree with a 30-year horizon to withdraw at an initial rate, subsequently inflation adjusted, of 3.75 percent,

[6] In the advisor vernacular, inclusion of an immediate life annuity in the retirement plan is called "annuicide," perhaps reflecting the lower advisor compensation received compared to the typical fee charged for investment account management. This incentive asymmetry may also explain the aversion of several mutual fund companies, expressed in educational material and comment letters to regulatory bodies, to the widespread use of life annuities.

4.75 percent, or 5.25 percent, if invested in a conservative (less than 35 percent stocks), moderate (between 35 percent and 65 percent stocks), or aggressive (greater than 65 percent stocks) portfolio, respectively. In May 2014, by contrast, Vanguard's suggested withdrawal rates were 3.4 percent, 3.8 percent, and 4.0 percent for conservative, moderate, or aggressive portfolios, respectively. For a 40-year horizon and a moderate-risk investment portfolio, Vanguard recommended a withdrawal rate of 3.2 percent. What differences to recommended withdrawal rates six years' experience and changing professional views make!

Finally, it is worth noting the interesting results of a somewhat overlooked financial planning paper by John Ameriks, head of the Quantitative Equity Group and portfolio manager of the Vanguard Group; Robert Veres, editor of the financial planning newsletter *Insider Information*; and Mark Warshawsky (Ameriks, Veres, and Warshawsky (2001)). They make a few adjustments to the standard withdrawal methodology: that is, they consider only the postwar period, subtract 100 basis points from investment returns to account for investment management and advisory fees, and evaluate withdrawal periods as long as 40 years. Their most significant innovation, however, is to consider using an immediate life annuity in the initial portfolio allocation.

In particular, Ameriks, Veres, and Warshawsky use up to half of the initial portfolio (for an individual age 65) to purchase an immediate life annuity, assuming that it is priced with a 7 percent interest rate and annuitant mortality. Then, the income from the nominal annuity and portfolio withdrawals is combined to try to reach a goal of 4.5 percent inflation-adjusted continual income from the portfolio. If the remaining portfolio after purchasing the annuity uses an aggressive asset allocation (85 percent to stocks) and the initial allocation is 50 percent to the life annuity, then in 95 percent of the simulations, inflation-adjusted income of at least 4.5 percent can be distributed over 35 years (meaning there is a 5 percent failure rate to age 100

when starting at age 65). Moreover, in only 7.4 percent of simulations does the portfolio fail over 40 years (although failure is not complete because the life annuity continues to pay). These failure rates are substantially lower than if a life annuity had not been used (for example, 11.8 percent over 35 years for the no-annuity case).

Moreover, according to Ameriks, Veres, and Warshawsky, the residual portfolio value on the upside is not that much smaller for the median simulation—2.28 times the original portfolio value over 35 years with a 50 percent initial allocation to the life annuity, compared to 2.78 with no annuity. This finding illustrates Finke, Pfau, and Blanchett's speculation that the (partial) use of a life annuity in the portfolio may well be a worthwhile tradeoff of residual wealth for income and security. It must cautioned, however, that the assumption by Ameriks, Veres, and Warshawsky in their analysis of a relatively high point in the interest-rate cycle in 2000 (and a low point in the fixed-annuity pricing cycle) may bias the results in favor of the annuity. This issue bears further empirical investigation and a more refined methodology with comprehensive historical data and simulations, particularly on the life annuity side, as I will perform in this paper for the first time in the literature.

Life Annuities

Academic economists, in contrast to financial advisors, have focused on immediate life annuities as the solution to the retirement-income problem. In one of the first mathematical papers to address the issue of determining optimal withdrawal rates in retirement under conditions of lifetime uncertainty, economics professor Menahem Yaari considers first the case without access to life annuities (Yaari (1965)). He finds that the optimal withdrawal rate declines with age, inversely proportional to the mortality rate, which, of course, increases with age. This decline in

the optimal withdrawal rate occurs because, in standard economic theory, the consumer discounts the future more heavily than the present, in part because the consumer realizes that it is uncertain how long he or she will live to experience the future.

Yaari then considers the case where the retiree has access to fairly priced immediate life annuities. Fairly priced means the "actuarial" rate of return exceeds the market interest rate on bonds by the "mortality credit"; the return on a life annuity, if the retiree is alive, is higher than the return on a bond by the rate of mortality. Purchasers may be charged a load in the insurance product for sales charges and profit margins, but these should be no higher than for otherwise comparable investment products. In a competitive insurance market, or through a well-governed nonprofit insurer, life annuities will give a mortality credit because payments are made to policyholders only if the insured is alive; if some die, as will inevitably occur if the risk pool is large enough, then the annual distribution will be larger because it is shared just with the living. Because annual mortality rates in retirement ages start at 1 to 2 percent and increase thereafter, this is a significant return enhancement for the same level of investment risk, compared to a bond, contingent on survival.

If the retiree has no desire to leave a bequest, then the optimal strategy is to place *all* retirement assets into life annuities, as annuities clearly dominate bonds as an income-producing investment. The resulting spending path, moreover, is likely to be fairly flat, depending on whether the time-preference parameter measuring the retiree's impatience to consume over time is greater or lesser than the market rate of interest. The retiree is much better off with access to annuities compared with no access, because the annuity insures against the risk of outliving assets or having to artificially lower living standards by limiting spending. The lifetime sustainable rate of spending is much higher with a life annuity. Finally, where there is a bequest

motive, Yaari proves a "separation theorem," whereby life annuities are best used for spending in retirement, and bonds and other conventional assets are best preserved for the bequest.

The technical assumptions that Yaari used in his mathematical demonstrations were somewhat restrictive. In a recent paper, Thomas Davidoff, a business professor at the University of British Columbia; Jeffrey R. Brown, a professor of finance at University of Illinois; and Nobel laureate in economics Peter A. Diamond relaxed these restrictions and still found Yaari's striking results (Davidoff, Brown, and Diamond (2005)). Even with more general forms of consumer preferences, if there is no bequest motive and there are complete markets—if insurance and financial instruments are available to hedge all personal and macroeconomic risks—then annuities need not be completely fair to dominate other assets and to obtain optimal full annuitization. The insurance load could increase to account for adverse mortality selection (explained later) or higher expenses and profits. Annuities only need to pay surviving investors a rate of return, net of administrative costs, that is greater than the return on conventional assets of matching financial risk, not one fully embodying the mortality credit.

Relaxing the assumption of complete markets, Davidoff, Brown, and Diamond back off from recommending full annuitization, particularly if there are risks during retired life that are not insurable or hedgeable. In such circumstances, the liquidity of conventional assets (they may be easily sold when funds are needed) may be valuable and dominate the illiquidity of annuities (once income payments start, the remaining annuity value generally is not redeemable for cash).[7] Even so, partial annuitization is still usually optimal. Also, even with unusual patterns of desired

[7] For example, long-term care expense risk in the absence of comprehensive long-term care insurance has been cited as a reason to avoid life annuities. But Pang and Warshawsky (2010) have shown that this is not necessarily so, if the long-term care risks increase with age (as they do) and if retirees gradually expand with age their purchases of annuities to realize higher and higher returns arising from the increasing mortality credit, to at least partially hedge the long-term care expenses.

spending in retirement, Davidoff, Brown, and Diamond find that significant use of life annuities paying a fixed stream of income for life is still optimal.

These theoretical findings from economics fly in the face of reality, where the use of immediate life annuities outside of formal pension and social security programs is small. This is the so-called "annuity puzzle." A substantial and sophisticated academic literature has developed to solve this puzzle. (This paper is not the place to review all of it.) Basically, an amalgamation of reasons and considerations left out of simpler models answers the problem in specific, albeit fairly common, contexts, but does not provide a general solution.

First, Social Security and sometimes defined benefit pension plans provide life annuities for retired households; for lower- and modest-income households, these programs are relatively complete, replacing large parts of preretirement earnings. Even for middle- and upper-income households, these programs and plans give significant lifetime income flows. (The benefits from Medicare and Medicaid to the elderly may also be considered as a life annuity, in kind.) Still, there remains much scope for the optimal voluntary use of life annuities, particularly as defined benefit plans disappear in the private sector. Second, many retirees, particularly those in upper-income brackets, likely have a bequest motive. Although Yaari showed that the bequest motive still would leave much room for annuities, that was only true if annuities were fairly priced, which leads to the third consideration: cost.

Although annuities carry the typical expenses of other insurance and financial products—commissions, corporate expenses, and profits—they also bear the cost of adverse mortality selection: the tendency of those with impaired longevity prospects owing to poor health or lifestyles to naturally avoid the purchase of life annuities. Friedman and Warshawsky (1990) found that this tendency increased the cost—the fair value plus the load—of immediate life

annuities by about 10 percent, an empirical result confirmed by others in later papers. A 10 percent load is not that large taken in isolation, but in combination with other factors, it may be more important. When compared with pricing that assumes mortality improvements, on top of annuitant mortality as opposed to general population mortality, and the use of Treasury bond yields, recent research like Warshawsky (2013) has found annuities to be fairly priced, with essentially no load. But if the potential annuity purchaser is in poor health and has impaired longevity prospects, then the life annuity may indeed be costly unless underwriting is available.[8]

A fourth possible explanation for the lack of annuitization is based on the fact that most households begin retirement as couples. Such two-person households (or even three or more persons, if parents or siblings are included) exhibit inherent mortality-risk pooling: they share resources and experience some economies of scale in spending—for example in housing. If life annuities, including joint-and-survivor annuities, were fairly priced, the existence of multimember households would not matter, and full annuitization would still be optimal. But as I just described, there may be a load on annuities, depending on the retiree's health status and investment perspective, and this load will reduce or even eliminate couples' demand for life annuities. Still, when one spouse dies, there should be a strong residual need for an individual straight life annuity.[9] Similarly, delaying the annuity purchase to an older age may make sense, because the mortality credit will be larger then and will overcome the load on the annuity. Indeed, a laddering strategy of purchasing immediate life annuities gradually over several years during retirement, and not all at once even if delayed, may be the better approach, as proposed

[8] Underwriting annuities in the United States is common in situations involving legal settlements, particularly injuries and medical malpractice, but uncommon elsewhere; moreover, it adds to overall administrative costs.
[9] Brown and his various coauthors have also proposed that the low demand for marketed annuities may be caused by the lack of inflation indexing and the lack of customization in terms of desired consumption paths. But these explanations are not compelling because presumably insurers could have introduced these features if there was consumer demand for them (indeed, more recently, inflation-indexed annuities have been introduced and variable immediate annuities now allow some choice in the slope of the lifetime distribution path).

and supported empirically by Pang and Warshawsky (2009). It is more flexible, maximizes the mortality credit in total, and hedges interest-rate and inflation expectations fairly well.

More recently, economists have given a "framing" explanation for the small market for annuities (Brown et al. (2008)): it is indeed rational and optimal to buy life annuities to finance retirement spending, but consumer confusion and misunderstanding of the product lead to its underutilization. Brown and colleagues find some evidence for this explanation in survey data. In particular, they hypothesize that when retirees think in terms of consumption, they view annuities as valuable insurance, whereas when retirees think in terms of investment risk and return, they view annuities as risky assets because the payoff depends on an uncertain date of death.

Brown et al. support this framing explanation of behavior through data gathered via online survey. Respondents were divided into two groups: those primed through the survey questions to think in the broader *consumption frame* (through terms like "spend" and "payment" and "periods in terms of age") and those primed to think in the narrower *investment frame* (through terms like "earnings" and "account value" and "periods in terms of years"). Respondents were presented with the investment and spending decisions of two fictitious people and were asked who made the better choice among actuarially equivalent alternatives. Brown and colleagues found that about three-fourths of respondents in the consumption frame chose the life annuity, while only about one-fifth chose it in the investment frame. Because framing often depends on policy features, design, setting, and information, this explanation leads directly to discussions of public policy.

Before turning to public policy, however, I need to address briefly the issues of inflation adjustment and indexation. There is no doubt that any empirical analysis of retired household spending should account for inflation and inflation risk, because the household has to expend

resources in terms of the actual prices of goods and services. In a period of high inflation, these prices will be increasing rapidly. I perform such an adjustment in my simulations later. Similarly, logic would dictate that the life annuity product examined and used should pay benefits in inflation-indexed terms, as Social Security does. However, such inflation-indexed annuities have not existed in commercial markets in the United States until recently. Even now, they have higher loads and depend on fewer issuers than nominal fixed annuities.[10] Indeed, in the CANNEX annuity-pricing data (described later) that I use for some aspects of my analysis, only two insurers issue inflation-indexed life annuities out of about 20 in the database.

Therefore, the simulation analysis in the later part of this paper will model only nominal annuities, even as all simulated quantities shown are inflation-adjusted. But, for reference, averaged over the January 2013 to June 2014 period, the initial (and fixed nominal) income from the traditional fixed immediate life annuity is about 40 percent higher than the initial (inflation-indexed) income from an otherwise identical inflation-indexed annuity.

Public Policy

Some economic analysts believe that (1) life annuities are the best and most efficient way to distribute retirement-account assets and (2) public policy should play a big role in this issue because it would (a) encourage the take-up of annuities, thereby reducing the extent of adverse selection and loads, and (b) establish the appropriate consumption framework for the thinking and behavior of plan participants about the use of retirement-account assets to produce lifetime income payouts. Others, however, think that (1) withdrawal rules produce the best result and (2) retirees can rationally decide, with no guidance, what is best for their situation on their own or as

[10] See Warshawsky (2013) for an empirical analysis for the United States, and see Finkelstein and Poterba (2004) for the longer and more extensive UK experience.

provided for by the market. In the retirement plan context, the discussion is often framed as a debate of life annuity versus lump-sum distribution upon retirement rather than life annuity versus the withdrawal rule. These discussions suppose that with a lump-sum distribution from a plan account, the retiree will get professional advice leading to the use of a withdrawal rule, or will figure it out and implement it alone, perhaps using the guidance of a mutual fund company's website. It is unclear whether these are reasonable suppositions for most retirees, particularly those with lower balances and fewer professional management resources.

Two things in the last two decades have raised the profile of this debate. First, many discussions of Social Security reform introduce personal retirement accounts as either a replacement or addition to part of the current defined benefit inflation-indexed life annuity income. The question then arises whether the personal account should be converted, on a mandatory or default basis, into a life annuity for payout, or be left to the account holder's discretion to manage during retirement.

Second, there has been a strong trend among private-sector employers to close or freeze defined benefit pension plans and replace them with 401(k) plans. Pari passu with this shift is a change in the payout method used. Defined benefit plans traditionally have only paid out automatically as lifetime benefits, while defined contribution plans, such as 401(k)s, generally pay out as a lump sum and only rarely offer a life annuity as a payout choice. Some advocacy groups, such as the Pension Rights Center, have regretted this trend as a policy matter precisely because of the consequences for distribution methods. However, per se defined benefit plans can pay out as lump sums (as they increasingly are doing through, for example, cash balance plans), while defined contribution plans can pay out as a mandatory life annuity (rarely, but older money-purchase plans sometimes do). The withdrawal rule–life annuity debate is broader than

retirement plans and IRAs because it includes nonqualified assets, although the analytics and empirical investigations, as noted earlier, are largely undertaken in the context of qualified retirement assets.

While the Social Security reform and design questions have not been implemented because of a political stalemate, the debate about the income and distribution features of retirement plans and products is real and consequential in terms of current and potential future laws and regulations. As I have explained in previous work (Warshawsky (2012), chapter 10), these laws and regulations include the following:

- The terms (the financial and actuarial assumptions) that must be used when converting from a life annuity form benefit to a lump-sum distribution when a defined benefit pension plan sponsor offers a choice. Should these terms be neutral or should policymakers encourage the life annuity choice?
- A joint-and-survivor life annuity is the default distribution form for defined benefit plans for married retiring workers. What is the appropriate "percent to survivor"—50 percent, 67 percent, 75 percent, or 100 percent—given the policy goal to reduce poverty among widows?
- If a defined contribution plan sponsor offers a life annuity as an investment or distribution choice through the plan, that sponsor has a fiduciary obligation to select the right annuity carrier. Some say the current fiduciary rules are vague; others say the rules are too strict. Either way, the rules may be discouraging such offerings by plan sponsors. Should the rules be made more specific? Less strict? What would be the consequences of such changes for participants' retirement security?

- Complex federal regulations state that at age 70 and six months, individuals must take required minimum distributions (RMDs) from all types of qualified retirement plans and assets. RMDs increase with age and are taxable as income. If the distributions are made through a life annuity, the regulations also specify the annuity's required features. The purpose of these rules is to make sure that retirement plans are not used as vehicles to transfer assets across generations without the payment of income taxes. Are these rules needed? Are they too restrictive in governing the pattern of distributions? Do they discourage innovation, particularly in the design of retirement-income strategies and the use of life annuities?

Several policy proposals, summarized in Warshawsky (2012, chapter 10), are intended to encourage annuitization, consistent with the view that the lack of annuity demand is irrational and needs correction through appropriate framing or that adverse selection is a significant cost that should be ameliorated. These proposals are as follows:

- Mandate a minimum level of annuitization in percentage or dollar terms across all qualified retirement plan types and assets. Note, however, that a similar requirement in the United Kingdom was completely rescinded in 2015 and replaced by enhanced advice, to be determined. Analysts attribute the recent unpopularity of mandatory annuitization to low interest rates, which have caused the impression that income levels from annuities are too low, ignoring that expected investment returns overall have also fallen.
- Make annuitization the default option for defined contribution plan distributions, as it is currently for defined benefit plans. This change is consistent with the move toward default options that increase participation in 401(k) plans, increase employee

contributions, or move investments toward target-date funds in the accumulation phase. It would, however, represent a major administrative burden to plan sponsors.

- Mandate that retirement plan sponsors offer a life annuity distribution option to retiring plan participants. This mandate would be limited to those sponsors who do not have an open defined benefit plan. This policy is less intrusive to participants while giving them more choice, but it is still costly to the plan sponsor.
- Encourage annuitization among retirees through favorable tax treatment, such as exempting a portion of annuity income from income taxation. Such tax favoritism is most beneficial to high-income households, and, if the framing advocates are wrong, could distort distribution choices and be inefficient.
- Create a government-sponsored clearinghouse of standardized life annuities provided by private insurers. While this change might make shopping for an annuity easier for retirees, it would impinge on the private sector's marketing and design choices, including private exchanges and platforms that already exist.

More recently, other related policy issues have arisen in the area of retirement plan distributions and annuities.

The Treasury Department has recently changed the minimum distribution requirements to encourage longevity insurance through the use of deeply deferred life annuities that begin payments as late as age 85. The policy motivation, as stated in remarks by Treasury officials, is to incent partial annuitization on the view that plan participants could be persuaded, through somewhat more favorable tax treatment, to at least insure the long tail of longevity contingencies. It is unclear, however, why this particular strategy merits special treatment compared with other partial annuitization schemes, such as laddered purchases of immediate life

annuities (mentioned earlier), which are more comprehensive and efficient. Moreover, the change adds complexity in the nature of a "Swiss-cheese" model to the relevant regulations instead of a much-needed simplification. Also, the availability and pricing of longevity insurance in the commercial market are less favorable than that of "plain-vanilla" immediate life annuities.

The Department of Labor proposed in May 2013 that all defined contribution plans provide their participants with a quarterly illustration of the income equivalent of the participant's current account balance. This illustration would be done under actuarial assumptions promulgated by the department, including that the income derives from an immediate life annuity. The department clearly favors the annuity side of the withdrawal rule–annuity debate. Indeed, it explicitly stated that it is persuaded by Brown et al.'s evidence supporting a framing explanation of underannuitization. In particular, the department stated that education and information prominently given to participants can be expected to change the distribution behavior of retiring plan participants by righting the balance now in favor of "lump-sumism" and the account value focus found in 401(k) plans.[11]

In 2012, many sponsors of large, private-sector defined benefit pension plans took advantage of a legislative and financial market arbitrage opportunity to lower their pension liabilities by offering retirees already receiving annuity payouts the option of converting that flow into a lump-sum payment. According to Olivia Mitchell, a University of Pennsylvania professor of business economics and public policy, about 50 percent of participants took this offer (Maas (2014)). Pension activists from the Pension Rights Center have called for outlawing this practice (Friedman (2013)), while other analysts and policymakers prefer that participants retain the right to make their own choices based on their own circumstances and views.

[11] 78 Fed. Reg. 26727–39 (May 8, 2013).

While private-sector employers have largely moved away from defined benefit plans in order to cut costs, public-sector employers are mostly still sponsoring such plans for their employees. At the same time, it is becoming increasingly clear that public retirement plans are woefully underfunded and overly generous to workers. These plans endanger the fiscal health of many states and municipalities, as Detroit, Chicago, Illinois, and various California cities have vividly illustrated. Some have advocated (Fitzpatrick (2014), Warshawsky and Marchand (*Forthcoming*)) that in the most troubled situations, plan participants, including retirees, be offered the lump-sum value of their accrued pension benefits, with some to-be-specified haircut. Some have advocated (Norcross (2015)) closing and freezing defined benefit plans and replacing them with defined contribution plans; it is unclear how these advocates would pay for the state governments' legacy obligations. In either case, the question arises whether the loss of automatic mandatory annuitization is also a welfare loss to plan participants, and, if it is, whether mechanisms other than the continued existence of a defined pension benefit or plan can efficiently and comprehensively address the loss.

Methodology

The analysis in this paper starts with a simple model of life annuity pricing. It focuses on workers at various retirement ages: 62, 65, and 70. It shows the annual incomes from an immediate life annuity starting at these ages for a $100,000 investment, and it calculates incomes for both singles and couples of the same age using joint-and-50-percent, 67-percent, and 100-percent-to-survivor annuities. Annual simulations of the fixed nominal incomes from life annuities illustrated in various years are based on historical yields on constant-maturity 10-year Treasury bonds and unisex mortality tables with a cutoff of age 110. Further, annual simulations

of real (inflation-adjusted) incomes are based on historical observations of price inflation subsequent to the retirement age and date, 10, 20, 30, and sometimes 35 and 40 years later. Graphs for three cohorts—those retiring in 1932, 1966, and 1982—help show methodology and results. Deflation is observed in the historical record during the Depression years and again during the Great Recession, and the calculations reflect this possibility.

As mentioned earlier, the model I use for annuity pricing is simple. It employs the yield on the 10-year Treasury bond and the unisex period annuitant mortality table currently enjoined by the IRS for certain pension and other purposes. The mortality table is a projection 10 years into the future based on conservatively estimated current experience. A more sophisticated model might use the entire yield curve on the fixed-income securities in which insurance companies invest, including corporates and mortgages (which have higher yields than Treasury bonds). It might also use more sophisticated projections of (likely lower) mortality rates into the future using generational tables, estimates of administrative and marketing costs, gender-specific mortality, and so on. Even better would be data on actual historical prices of life annuities reflecting then-current financial conditions. Unfortunately, such data are not available going back so many years, so pricing by model will have to serve. But modeling does have its advantages. By focusing on changes in financial and economic conditions, I can control for historical changes in mortality rates, which actual pricing data do not. Although unisex pricing is legally relevant and required only of employer-provided plans and of annuity sales in Montana, it is generally easier for exposition to combine male and female rates into a unisex rate, or, what is essentially the same thing, to focus on a joint-and-50-percent-to-survivor life annuity.

Still, it is desirable to ground the annuity-pricing model in reality, so I compute an adjustment factor as follows. From 2005 to 2014, I have monthly data from CANNEX, a

commercial provider of insurance-product pricing data to financial advisors and agents, on prices of single-premium immediate annuities (SPIAs) sold in the United States by several insurance companies. I therefore compare market- and model-produced fixed incomes from the life annuities, at various retirement ages, for singles and couples of the same age. This comparison, for the beginning of February for years 2005 through 2013, produces an adjustment factor that can be applied to the historical simulations. In addition, to better understand the characteristics of the annuity market, I briefly examine the time-series and cross-section range of the nominal incomes produced by SPIAs sold in the markets between 2005 and 2014.

I then simulate the equivalent annual income produced by systematic withdrawal rules, using price inflation and historical observations of asset returns on the S&P 500 stock index portfolio and a portfolio of 10-year Treasury bonds. In particular, I model a balanced fund of 50 percent equities and 50 percent bonds, with a low 20-basis-point investment-management fee, that is rebalanced following changes in annual market returns and withdrawals. Annual withdrawals occur according to the simple rule first put forward by Bengen (1994) and since advocated by many financial advisors: 4 percent of the initial portfolio value at the point of retirement, which produces a dollar amount subsequently increased by the actual rate of price inflation. I also examine variants of the Bengen rule, such as those found on the Vanguard website, where 4 percent is replaced by a generally lower percentage. I also explore the consequences of changes in asset allocation. Of particular interest in these withdrawal approaches is whether and when assets run out, assuming retiree survival for various periods, and as simulated by historical financial market and inflation conditions.

The historical annual stock return, inflation, and interest-rate data used in this paper come from a public-access database created by Yale University economics professor Robert

Shiller.[12] The data are from chapter 26 of his book, *Market Volatility* (1989). (His data start in 1871, but my analysis uses only data starting in 1919, after the end of World War I and the establishment of the Federal Reserve System.) Bond returns, based on the annual yield for constant-maturity Treasury bonds, are calculated by formula in the early part of the historical period. For most summary statistics of the historical simulations, the full 30-year results end with the retirement cohort year 1983 for a 65-year-old. Some reported results, however, use more cohorts, even if it means an uneven distribution, with most recent cohort years being included only with shorter horizons.

The annuity-pricing data for the last 10 years are purchased from CANNEX. The annuities covered in the database are those sold by commercial insurers to individuals via agents, brokers, and advisors in the United States. Unfortunately, the data for several months in 2008, 2009, and 2010 are missing from the vendor's historical database.

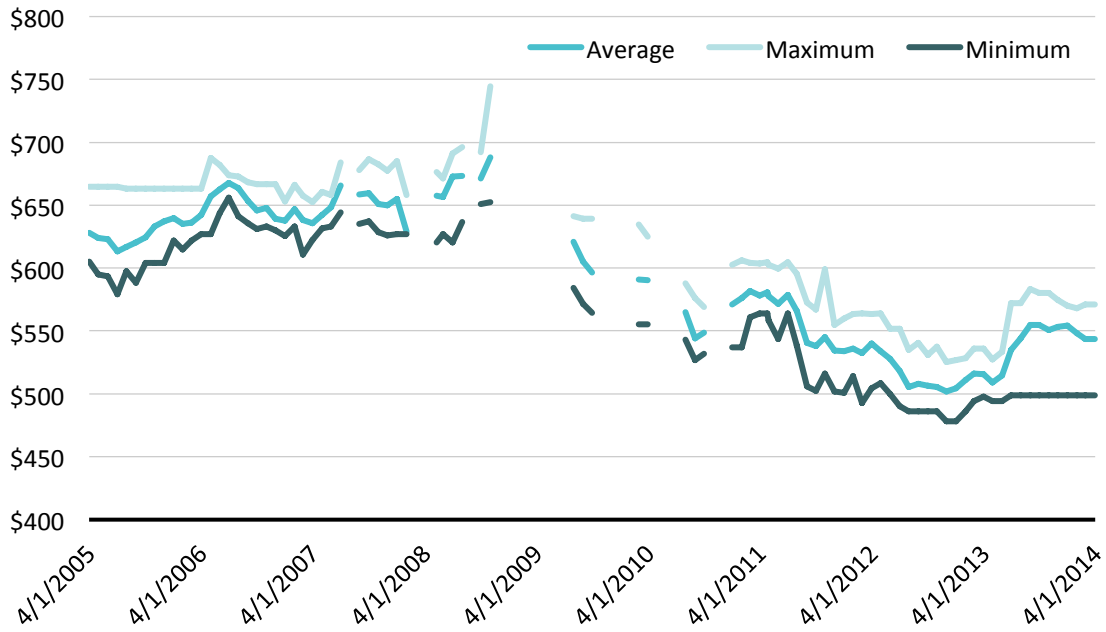
Empirical Results

To get our "sea legs" before considering comparisons of model-derived simulated annual incomes from life annuities and withdrawal rules, let us first look at the monthly market data on lifetime guaranteed income from joint-and-50-percent-to-survivor life annuities sold for $100,000 to 65-year-old couples in Alabama from May 2005 through April 2014. CANNEX gives fixed monthly incomes for life annuities sold by between 9 and 19 large insurance companies, depending on the year. Later in the paper I convert the income averaged across the companies to annual rates to be consistent with model results for the Bengen rule, which is usually given in annual terms. Figure 1 shows the average, high, and low fixed nominal monthly

[12] See "Online Data Robert Shiller," http://www.econ.yale.edu/~shiller/data.htm.

benefits from the life annuities these companies sold at the beginning of the month. I do not yet adjust income for inflation because my focus is on initial levels. Later, in comparing annuity and withdrawal rules over various time horizons and historical periods, I adjust the results for inflation using historical realized inflation rates.

Figure 1. Monthly Fixed Income ($) from Life Annuities Issued to 65-Year-Olds, Commercial Market, 2005–2014



Source: Author's calculations, based on CANNEX monthly data, for a $100,000 joint-and-50-percent-to-survivor life annuity for a 65-year-old couple.

Before the 2008 financial crisis, monthly fixed income on newly issued $100,000 immediate life annuities averaged around $625 to $650 across companies. Although data then become sporadic for a couple of years, indications are that income increased somewhat at the beginning of the crisis in late 2008, perhaps as insurance companies wanted to attract anxious investors and capture market share. Fixed lifetime incomes then began falling as long-term interest rates kept declining. By late fall of 2012, average fixed lifetime monthly income was around $500; more recently, it has recovered to around $550. The lowest and highest incomes

quoted by insurance companies reported in the dataset generally follow the averages, albeit with some noise and occasional lags. Over the period, the highest-income annuity pays 4.6 percent more than the average income annuity. This advantage may reflect the benefit of shopping around, other marketing considerations not known to us, or perhaps that a smaller or higher-risk issuer is trying to attract customers.

I next summarize the average company monthly fixed nominal lifetime income on various immediate annuities issued monthly, averaged over the 2005–2014 period. As table 1 shows, women get about 93 percent of the income men get, for the same premium payment and beginning age, because women live significantly longer than men. As mentioned earlier, income from a joint-and-50-percent-to-survivor annuity is about midway between the male and female income levels for single-life annuities at 100 percent benefits.[13] Those who retire early at age 60 get about 90 percent of the fixed level of income received by those who begin payouts at age 65, again because of the longer expected payout period. Those who start at age 70 get about 114 percent of the fixed income that those who begin at 65 receive.

Table 1. Average Company Monthly Fixed Nominal Lifetime Income from Various Single-Premium Immediate Annuities, Monthly Issues Averaged over 2005–2014

Beginning age	Single life		Joint & 50% to survivor	Joint & 100% to survivor
	Male	Female		
65	$615.87	$573.81	$581.22	
60	542.17	512.07	524.02	
70	691.54	636.61	661.54	
65, 10-year GP	584.20	552.25	566.47	
65, $250,000 SP	1,509.00	1,408.28	1,453.68	
65				$502.32

Source: Author's calculations based on CANNEX monthly data.

Note: Unless otherwise stated, the single premium is $100,000 and the life annuity is straight. GP means guarantee period; SP means single premium.

[13] A joint-and-survivor life annuity that pays 50 percent to each spouse of the same age for as long as he or she is alive, is equivalent to a single life annuity paying 100 percent benefits, abstracting from mortality differences arising from gender.

A joint-and-50-percent-to-survivor life annuity with a guarantee period of 10 years (payouts continue to beneficiaries for 10 years even if the insured dies within 10 years of the first payout) pays about 97 percent of the income of an otherwise comparable straight life annuity with no guarantee period. There are no apparent economies of scale in annuity purchases because the income per dollar of premium paid is almost identical for $100,000 and $250,000 single-premium life annuities. Finally, getting a joint-and-100-percent-to-survivor annuity significantly reduces the fixed nominal lifetime income received for the same beginning age owing to the longer expected payout period for two lives at the same income level. Note that because there are usually economies of scale in living expenses (housing, for example), it may not be necessary for the couple to reduce their income by buying such an expensive life annuity, but instead they could buy a joint-and-67-percent-to-survivor annuity.

Now, I compare market quotes with the results from my simple model of annuity income, explained earlier in the methodology section. I convert the market quotes from monthly to annual income to be consistent with the results for withdrawal rules, which have generally been calculated on an annual basis. The conversion uses a standard actuarial formula, specified in the footnote of table 2. The models for both annuity income and withdrawal rules are based on experience and conditions just through the beginning of the year, generally around January 15, so for the annuity incomes, I compare February 1 market quotes, as table 2 shows.

In general, the model estimate and market average fixed lifetime incomes are close, with the average market quote just above the model, or, more often, just below it. During the unsettled conditions of the financial crisis, however, the market was more substantially above the model results. Over the entire 2005–2013 period, the market adjustment factor is 1.01; this is the adjustment factor that I use in table 3 and thereafter.

Table 2. Model and Market Annuity Pricing, $100,000 Purchases in 2005–2013 of a Joint-and-50-Percent-to-Survivor Life Annuity for a Couple Age 65

Annual Life Annuity Benefit (Nominal)			
February 1, year	Model[a]	Market average[b]	Market-to-model ratio
2005	$7,435	$7,240	0.97
2006	7,566	7,318	0.97
2007	7,788	7,450	0.96
2008	7,126	7,251	1.02
2009	6,355	7,484	1.18
2010	7,119	6,830	0.96
2011	6,902	6,663	0.97
2012	6,017	6,215	1.03
2013	5,980	5,935	0.99
2005–2013 Average			1.01

Sources: Model, author; market, adjusted CANNEX monthly data.

(a) Based on 2013 IRS projected annuitant mortality table and historical yields on the 10-year Treasury bond (constant maturity).
(b) The 2005 observation is for April 1. Market average is based on contemporaneous quotes of nine to 19 large US insurance companies. Monthly benefits quoted are converted to annual by actuarial formula: $A = (12 \times M) / (1 + ((6.5 \times M) / 100000))$.

Table 3 shows the main results from my model calculations, on a comparable basis with the professional literature cited earlier surrounding the Bengen withdrawal rule. For an individual account of $100,000, I examine the results of my historical model simulations of cohorts retiring from 1919 through 1983; of the initial, 10th, 20th, and 30th year inflation-adjusted annual income produced from various immediate life annuities issued at the historical normal retirement age (65); and the Bengen withdrawal rule. I also give the portfolio failure rate for the Bengen withdrawal rule, as well as the remaining fund balances. The statistics reported are the mean and various percentiles of the range of historical experience for each strategy.

The first panel of table 3 shows that in the first year of retirement, for any type of annuity and in any economic scenario, the immediate life annuity provides higher annual income than the Bengen withdrawal rule. The range of initial incomes from the immediate annuity across

scenarios arises from different interest rates, with high interest rates producing more income. The Bengen rule preserves a fund balance, but the balance amount varies with market performance, even as the payout amount remains constant. The question of where to focus attention in terms of annuity type depends on the personal situation of the retired household—whether it is an individual or a couple, and if the latter, the survivor's spending needs. The operation of the Bengen rule is invariant to these considerations, but our evaluation should hold them in mind; in particular, if a couple is involved, then the planning horizon needs to be longer and the portfolio exhaustion date later than with a single man.

The next panel lists the range of income outcomes 10 years into retirement in inflation-adjusted terms. Historical inflation rates are variable and, with nominal fixed-life annuities, produce variable real income flows. Recall that a few years even saw deflation, which benefits the holders of fixed-income instruments, whereas some years had high inflation rates, which hurt the holders of fixed-income instruments. In most scenarios and circumstances, the immediate annuity still gives a higher level of inflation-adjusted income than the Bengen rule. A significant divergence in fund balances also emerges for the latter approach—from $50,000 in the 10th percentile to nearly $180,000 in the 90th percentile.

The third panel shows income outcomes 20 years into retirement in inflation-adjusted terms. Although the mean and upper percentiles still demonstrate a higher flow from the immediate annuity, in the lower percentiles, the force of inflation is evident, with income falling below the Bengen-rule level of $4,000. Moreover, there have been no portfolio exhaustions in this horizon, although the beginnings of such an outcome are apparent, as the 10th percentile fund balance is only $23,000.

Table 3. Means and Percentiles of Inflation-Adjusted Annual Income Produced by Immediate Life Annuities and the Bengen Withdrawal Rule from a $100,000 Individual Account, Historical Simulations of Cohorts Retiring at Age 65 from 1919 through 1983, in the First, 10th, 20th, and 30th Years after Retirement

Year 1

Statistic	Immediate life annuity				Bengen withdrawal rule	
	Normal retirement age					
	Single life	50% J&S	66.67% J&S	100% J&S	Payout amount	Fund balance
Mean	$7,509	$7,509	$7,122	$6,459	$4,000	$100,528
10th percentile	6,184	6,184	5,808	5,176	4,000	86,394
25th percentile	6,466	6,466	6,084	5,434	4,000	91,905
Median	7,214	7,214	6,817	6,141	4,000	100,212
75th percentile	8,132	8,132	7,720	7,010	4,000	108,045
90th percentile	9,310	9,310	8,926	8,246	4,000	116,128
Failure %	N/A	N/A	N/A	N/A	N/A	0.00%

Year 10

Statistic	Immediate life annuity				Bengen withdrawal rule	
	Normal retirement age					
	Single life	50% J&S	66.67% J&S	100% J&S	Payout amount	Fund balance
Mean	$5,905	$5,905	$5,595	$5,065	$4,000	$110,010
10th percentile	3,976	3,976	3,772	3,412	4,000	50,570
25th percentile	4,486	4,486	4,245	3,834	4,000	77,062
Median	5,282	5,282	4,980	4,468	4,000	100,867
75th percentile	7,331	7,331	7,035	6,368	4,000	144,640
90th percentile	8,997	8,997	8,532	7,812	4,000	177,739
Failure %	N/A	N/A	N/A	N/A	N/A	0.00%

Year 20

Statistic	Immediate life annuity				Bengen withdrawal rule	
	Normal retirement age					
	Single life	50% J&S	66.67% J&S	100% J&S	Payout amount	Fund balance
Mean	$4,240	$4,240	$4,018	$3,638	$4,000	$120,294
10th percentile	2,477	2,477	2,350	2,127	4,000	23,123
25th percentile	2,987	2,987	2,856	2,606	4,000	51,199
Median	3,551	3,551	3,335	2,976	4,000	103,287
75th percentile	4,500	4,500	4,330	4,026	4,000	151,742
90th percentile	7,246	7,246	6,852	6,179	4,000	259,400
Failure %	N/A	N/A	N/A	N/A	N/A	0.00%

Year 30

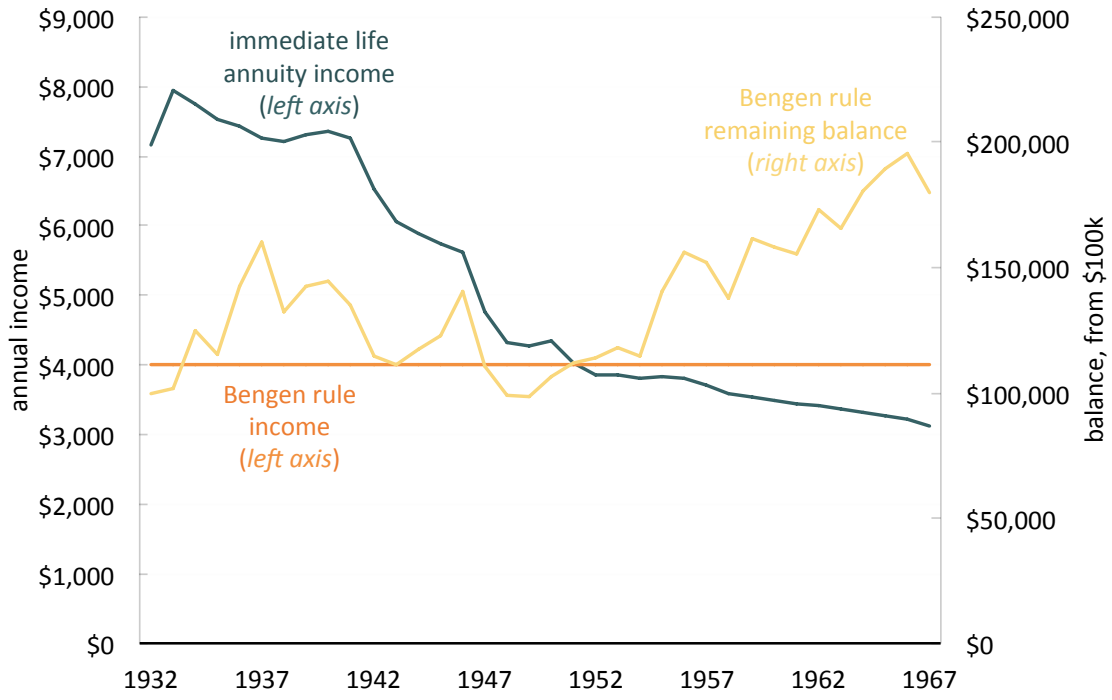
Statistic	Immediate life annuity				Bengen withdrawal rule	
	Normal retirement age					
	Single life	50% J&S	66.67% J&S	100% J&S	Payout amount	Fund balance
Mean	$2,896	$2,896	$2,746	$2,489	$3,482	$115,148
10th percentile	1,618	1,618	1,528	1,375	127	127
25th percentile	1,832	1,832	1,722	1,550	4,000	26,242
Median	2,415	2,415	2,268	2,040	4,000	81,200
75th percentile	3,703	3,703	3,491	3,133	4,000	189,818
90th percentile	4,815	4,815	4,559	4,121	4,000	252,618
Failure %	N/A	N/A	N/A	N/A	N/A	10.77%

Source: Author's calculations.

Finally, the last panel shows inflation-adjusted income outcomes 30 years into retirement, the traditional end of horizon for financial planning (although, as noted earlier, for a couple, there is nearly a one-in-five probability of surviving past this point). The last panel shows the bad consequences of the continued onslaught of financial risks like inflation and market volatility. Although the life annuity continues to pay a steady stream of fixed nominal income, inflation has eroded it in most scenarios and circumstances, to about one-half to two-thirds of its initial level. For many retired households, some diminution in regular spending needs does occur with age, but then health care and especially long-term care costs rise with age and should be insured against. The Bengen rule also suffers in the long run, with a portfolio exhaustion rate of nearly 11 percent and little or no income available to households surviving to age 95, a demographic outcome that about a fifth of couples can expect to achieve. The Bengen withdrawal rule, as traditionally constituted, does not seem to operate well for extended periods; the life annuity has the advantages of higher income flows in the first half or so of the retirement period, and continued flows regardless of life contingencies.

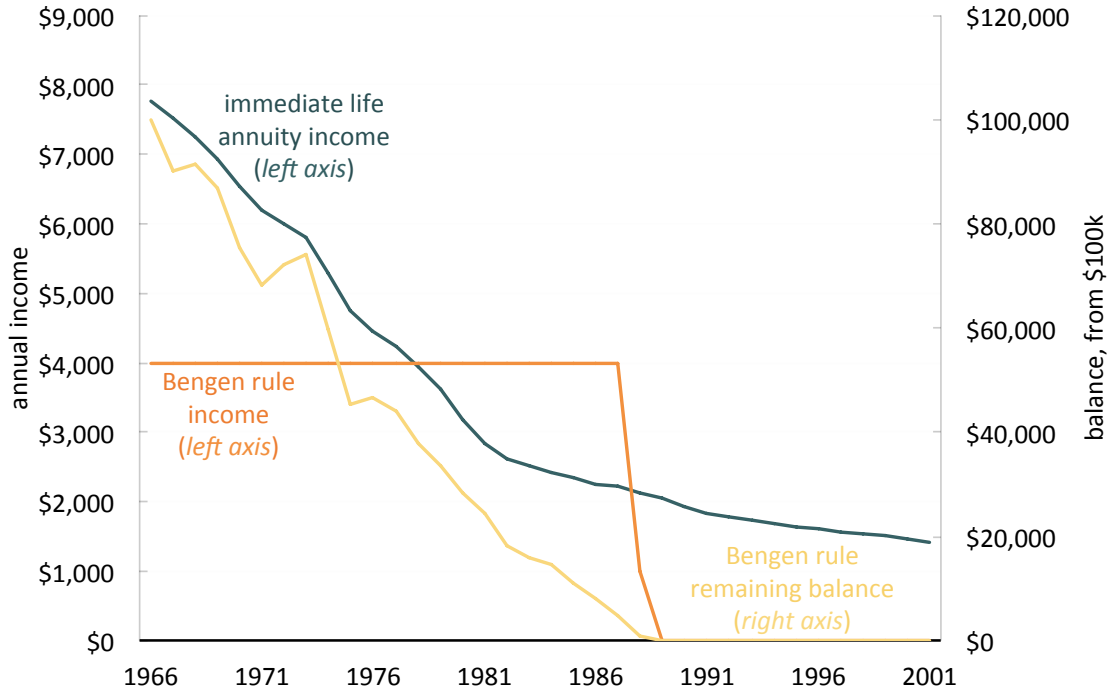
To further illustrate these results, consider three specific cases: retirement at age 65 in 1932, 1966, and 1982, comparing lifetime inflation-adjusted annual incomes from a joint-and-50-percent-to-survivor immediate life annuity with the Bengen withdrawal rule, as well as showing the remaining account balance under the Bengen rule. For the 1932 and 1966 cohorts, "lifetime" means a horizon through 35 years—through age 100—whereas for the 1982 cohort, only a 30-year horizon is available. These three illustrations (figures 2–4) show a wide range of outcomes, reflecting the different historical experiences with interest rates, inflation, and asset returns, which are also included in the summary statistics given earlier.

Figure 2. Lifetime Inflation-Adjusted Income Following 1932 Normal Retirement: Immediate Life Annuity vs. Bengen Rule, and Remaining Fund Balance



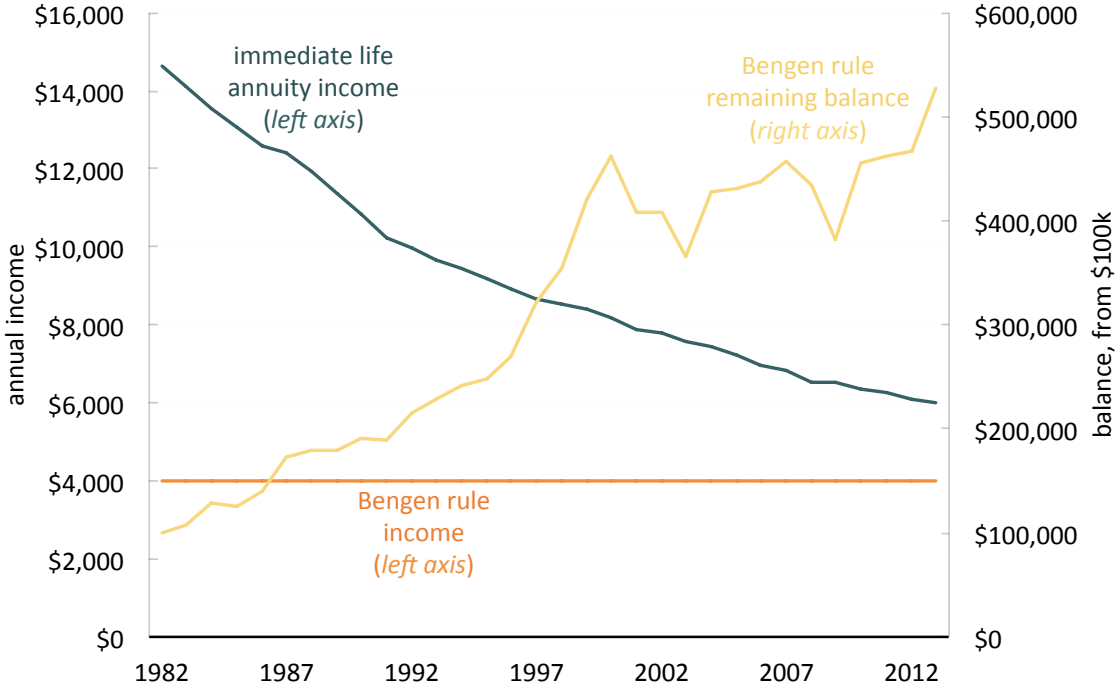
Source: Author's calculations.

Figure 3. Lifetime Inflation-Adjusted Income Following 1966 Normal Retirement: Immediate Life Annuity vs. Bengen Rule, and Remaining Fund Balance



Source: Author's calculations.

Figure 4. Lifetime Inflation-Adjusted Income Following 1982 Normal Retirement: Immediate Life Annuity vs. Bengen Rule, and Remaining Fund Balance



Source: Author's calculations.

For the 1932 cohort, both income approaches perform fairly well, with different strengths. The life annuity gives a higher level of income for the first 20 or so years, starting at nearly twice the Bengen-rule level and then gradually declining with inflation. The Bengen rule maintains the 4 percent inflation-indexed payout through the entire 35-year horizon, and the remaining portfolio mostly stays around $100,000, adjusted for inflation. It increases at the end, in the 1950s, with good asset performance. For the 1966 cohort, however, the experience is much worse, particularly with the Bengen rule. The portfolio is exhausted after just 20 years, when most retired households are still alive, and income under the Bengen rule stops abruptly. The cause is the poor market performance in 1973–1974 and high inflation thereafter. Inflation also severely affects the inflation-adjusted level of income from the life annuity, but payments continue for the entire horizon—that is, for the retiree's lifetime. For the 1982 cohort, by contrast, the experience is excellent for both approaches. High interest rates at the beginning of the period give a high level of lifetime annuity income, while relatively low inflation thereafter maintains that level consistently above the Bengen rule level of income. The Bengen rule easily maintains the constant dollar level of income, adjusted for inflation, while allowing for a substantial buildup in the portfolio, especially after the superior asset returns of the late 1990s, so that the retiree who survives to a very old age may leave a large bequest.

One method employed in the literature and perhaps in practice to improve income outcomes under the Bengen rule is to change the retirement investment portfolio's asset allocation. Although a high allocation to stocks for elderly investors may make some nervous, the model results, not shown, are that increasing the equity allocation to 85 percent will lower the 30-year portfolio failure rate to just above 6 percent. Still, this is not an entirely satisfactory outcome, in terms of both failure rate and investment risks, for an elderly population. I therefore

experiment with changing the withdrawal rate to reduce the 30-year failure rate to zero using the historical data. It is 3.6 percent with an 85 percent allocation to equity, and 3.4 percent with the more common 50/50 portfolio. These latter results support recent findings in the professional planning literature, mentioned earlier, that a withdrawal rate of 3.5 percent or even less is more appropriate for a retirement at age 65 than the classic Bengen recommendation of 4 percent. Reducing the portfolio withdrawal rate does make the life annuity relatively more attractive, extending the number of years in the retirement period with a relatively higher inflation-adjusted income flow, as table 4 shows, focusing on mean results.

Table 4. Means of Inflation-Adjusted Annual Income Produced by Immediate Life Annuities and the Adjusted Bengen Withdrawal Rule, Historical Simulations of Cohorts Retiring at Age 65 from 1919 through 1983, in the First, 10th, 20th, and 30th Years after Retirement

Year	Immediate life annuity				Adjusted Bengen withdrawal rule	
	Normal retirement age					
	Single life	50% J&S	66.67% J&S	100% J&S	Payout amount	Fund balance
1	$7,509	$7,509	$7,122	$6,459	$3,400	$101,156
10	5,905	5,905	5,595	5,065	3,400	117,904
20	4,240	4,240	4,018	3,638	3,400	140,996
30	2,896	2,896	2,746	2,489	3,375	152,179

Source: Author's calculations. Adjusted Bengen withdrawal rule is 3.4 percent, indexed for inflation.

Even with a lower withdrawal rate, at a retirement age of 65, there is a significant risk of living beyond age 95, especially for couples. Table 5 shows the relative mean performance of life annuities and the (original 4 percent) Bengen withdrawal rule at a retirement age of 70, where a 30-year planning horizon, to age 100, may sufficiently alleviate fears of outliving income. The original results with the Bengen withdrawal rule remain; there is an 11 percent failure rate. The immediate life annuity looks better because income starts at a later age and is

much higher: nearly double the level of the Bengen withdrawal approach in the initial retirement year. Indeed, the life annuity provides a higher level of income throughout almost the entire retirement period, and it does not risk portfolio exhaustion.

Table 5. Means of Inflation-Adjusted Annual Income Produced by Immediate Life Annuities and the Bengen Withdrawal Rule, Historical Simulations of Cohorts Retiring at Age 70 from 1919 through 1983, in the First, 10th, 20th, and 30th Years after Retirement

Year	Immediate life annuity				Bengen withdrawal rule	
	Normal retirement age					
	Single life	50% J&S	66.67% J&S	100% J&S	Payout amount	Fund balance
1	$8,639	$8,639	$8,112	$7,233	$4,000	$100,528
10	6,813	6,813	6,392	5,690	4,000	110,010
20	4,889	4,889	4,587	4,085	4,000	120,294
30	3,334	3,334	3,130	2,790	3,482	115,148

Source: Author's calculations.

To round out the analysis, consider an earlier retirement age: 62. It is still common in the United States, with many workers claiming Social Security benefits at the first opportunity. Here I must extend the horizon of analysis to 40 years, to age 102, to avoid the substantial demographic risk of surviving past the planning period. Unfortunately, this extension reduces the number of cohorts I can examine using the historical record to only the cohorts retiring through 1973, so the results here are not totally comparable to those reported earlier. In the interest of brevity, table 6 shows the percentile results just in the 40th year.

Table 6. Means and Percentiles of Inflation-Adjusted Annual Income Produced by Immediate Life Annuities and the Bengen Withdrawal Rule from a $100,000 Individual Account, Historical Simulations of Cohorts Retiring at Age 62 from 1919 through 1973, in the 40th Year after Retirement

Statistic	Year 40					
	Immediate life annuity				Bengen withdrawal rule	
	Normal retirement age				Payout amount	Fund balance
	Single Life	50% J&S	66.67% J&S	100% J&S		
Mean	$1,831	$1,831	$1,739	$1,582	$2,597	$101,931
10th percentile	1,011	1,011	954	858	0	0
25th percentile	1,118	1,118	1,059	956	0	0
Median	1,207	1,207	1,148	1,046	4,000	38,402
75th percentile	2,116	2,116	2,008	1,822	4,000	129,466
90th percentile	3,799	3,799	3,613	3,290	4,000	351,205
Failure %	N/A	N/A	N/A	N/A	N/A	34.55%

Source: Author's calculations.

Over this extended horizon, the Bengen withdrawal rule fails almost 35 percent of the time. This outcome should be entirely unacceptable to advisors and other retirement experts, and it means significantly reducing the withdrawal rate. Inflation has eaten away at the income from the life annuity, which initially was at a lower level than at age 65 because it started earlier. Still, the income flow does continue for life. It would be good to find a more sophisticated retirement-income strategy that provides a lifetime income flow that is at least somewhat hedged against inflation, has some upside potential, and leaves some remaining balance upon death. The solution would seem to entail a combined strategy using immediate life annuities purchased over a long period during retirement, as well as some sort of withdrawals, perhaps other than a fixed real dollar amount, from an investment portfolio, as proposed and examined by Warshawsky (2012).

Finally, consider a simple comparison of the original Bengen rule with the life annuity. In particular, I compute the differences between the inflation-adjusted annual income produced by the Bengen rule and the inflation-adjusted annual income produced by a joint-and-50-percent-to-survivor life annuity, at various retirement ages, averaged over the lifetimes of cohorts and then

averaged (mean) over the cohorts. With younger retirement ages, the number of cohorts available for analysis using historical data will be smaller than with older retirement ages. I calculate the cohort average in two ways: as a simple average over the entire possible horizon (to age 110) or weighted by survival probabilities. I also count the number of cohorts where the Bengen rule produces higher average income than the life annuity at various retirement ages. Table 7 shows the results.

Table 7. Simple Comparisons of Bengen Rule to Joint-and-50-Percent-to-Survivor Immediate Annuity: Differences in Inflation-Adjusted Annual Income Flows, Mean Average and Survival-Weighted Average Values of Complete Cohorts

Retirement age	Number of cohorts where Bengen rule has higher average income	Number of cohorts with higher weighted average income	Total number of complete cohorts	Mean average value of difference	Mean weighted average value of difference
55	30	26	40	$690	−$78
62	24	9	47	−$92	−$1,057
65	23	2	50	−$521	−$1,605
67	18	0	52	−$839	−$2,039
70	7	0	55	−$1,352	−$2,776

Source: Author's calculations.

Notes: Complete cohorts are defined as those with data through age 110, e.g., a cohort that retired at age 55 in 1958 with experience through 2013. Weighted averages are computed using survival probabilities.

For retirement at age 55, the Bengen rule is clearly superior to the life annuity. It produces higher income in more cohorts and the average value of income differences, measured by the mean across cohorts, is significantly positive, at $690. The weighted averages are not as impressive, though. With such an early retirement age and therefore such a long retirement, inflation wears down the annuity, and the possibility of favorable asset returns over the long run favors the Bengen rule. But as the retirement age approaches more common ages, from 62 through 70, the several measures here clearly favor the life annuity, whether as simple averages or weighted averages, or as counts or averages of income differences. For example, at age 67, the

Bengen rule produces higher average income in only about two-fifths of the cohorts, and the average income difference is negative, at −$839. With survival weighting, the results are worse for the Bengen rule.

One should not conclude from these results and from this discussion that the immediate life annuity is always the superior distribution method for assets in individual accounts for retirees compared with the Bengen withdrawal rule. Some retirees will have impaired longevity prospects; the immediate life annuity may be a relatively poor investment for them. Other retirees, who perhaps face idiosyncratic risks or have inadequate insurance coverage, may need liquidity, which the life annuity cannot provide. Some retired households may prefer higher income flows focused on the latter part of retirement. Some retired households may have comprehensive traditional pension coverage or be well-off relative to their desired spending needs in retirement, so that their relative need for life annuity protection is low. Finally, and likely more commonly, retired households may want to leave bequests to children and to charitable institutions. For these and other reasons, the Bengen withdrawal rule, suitably adjusted for reasonable investment expectations and conservative longevity prospects, may be a more appropriate distribution method, at least in part.

Still, given that a retirement plan's or account's main purpose is to produce lifetime income during retirement, it is hard to argue against a significant and widespread role for immediate life annuities in the production of retirement income, in light of the results presented. Warshawsky (2012, chapters 6 and 7) has started on the obvious next phase of analysis—creating strategies that combine laddered purchases of immediate life annuities and different types of systematic withdrawals from a balanced portfolio—to account for the many interests, preferences, and risks present in retirement and among retired households, in optimal and customized ways.

Public Policy Discussion and Specific Application

The current direction of public policy for retirement income in both the United States and the United Kingdom is to allow choice, but to inform and shape choice in a responsible direction. I do not believe that the mandatory provision of a life annuity through a traditional defined benefit pension plan, whether in the private or public sector, is necessary or in the best interest of many workers. At the same time, I worry whether the "lump-sum" culture of 401(k) plans and IRAs will lead retirees to a sufficiently structured and prudent approach to lifetime retirement income. So there is a balance here. The empirical results in this paper may not support default annuitization, as the simple and complete use of immediate life annuities has some drawbacks and lacunae. Still, life annuities have enough advantages, and the Bengen rule has problems, so some information on the annuity-equivalent income flow projected from individual retirement accounts does seem appropriate as a counterweight to current lump-sum tendencies. The Department of Labor's proposed regulation may be helpful in this regard. Moreover, it is clear from my historical simulations that commercial individual annuities should have a prominent role in retirement-income strategies for many workers. The following discussion is a specific application of these basic viewpoints, based on the earlier empirical results, to the current issue of severely underfunded government-employee retirement plans.

The severe underfunding problems with worker pensions promised by state and local governments are becoming increasingly apparent and immediate. The bankruptcies of Detroit and some California towns, the massive pension shortfall in Illinois only partially addressed by recent legislation, the tense situation in Chicago with Mayor Rahm Emanuel asking for municipal worker give-backs, and, especially, higher taxes are just the beginning of the difficulties that will appear across the country. Asset returns have come up short of what has

been assumed, and generous unfunded retirement benefits were doled out to government workers years ago by politicians who are no longer around to be held responsible for their dereliction of prudence and duty to taxpayers.

Pensions face two problems: the legacy obligations promised to retirees and near-retirees, and the funding and nature of retirement benefits being accrued now and in the future by younger and future state and local government workers. The first problem is larger in size and concern because those retirees and long-service workers are legitimately worried that their retirement benefits are now highly uncertain and unsustainable and therefore subject to one-off, arbitrary, and chaotic cuts in the bankruptcy and political processes operating today in a poor fiscal environment. Moreover, many of these retirees, again owing to poor past choices by their representatives and employers, are not even covered by Social Security, and therefore are particularly exposed to financial risks in retirement.

These retirees and older workers would be glad to receive the following offer: a lump-sum payment that represents a significant, but not necessarily full, share of the actuarial value of their promised benefits, to be invested automatically in a structured account that gives them a personalized strategy emphasizing economical lifetime retirement-income flows with some upside potential and flexibility. Government plan sponsors would also be happy to make that deal, as it would remove large and fluctuating net liabilities from their balance sheets, enabling them to move forward, with lower borrowing costs, on sorely needed projects for the social welfare, security, and productivity of their citizens. Current discussions to pass the buck by moving these legacy liabilities to the federal government through Social Security or the Pension Benefit Guaranty Corporation are both politically and economically toxic because of the already large and growing shortfalls facing these programs and the unfairness of

imposing the burden caused by imprudent behavior on those who responsibly funded their retirement benefits.

What would a responsible and prudent structured account given to retirees for their lump sums look like? There are many products and strategies on the market or proposed by analysts. My research has examined carefully many of these products and strategies. I have found that the best approach in terms of lifetime income flows with upside potential, some flexibility, personalization, and low fees and risk is to use a mix of systematic withdrawals from a dynamic portfolio of a mix of asset types, and gradual laddered purchases of immediate life annuities. The income flow to the retiree would result from the combination of lifetime guaranteed benefits from a growing number of individual annuity contracts and withdrawals from the remaining funds invested in a mix of asset types. These assets would be moved toward a higher expected return as more and more fixed immediate annuities take up a larger share of the retirement portfolio.

In this approach, laddering the immediate life annuity purchases over an extended period significantly reduces the pricing risk arising from moving interest rates. Moreover, it grants flexibility to the retiree to alter course if unexpected changes in health or other personal circumstance necessitate a change in direction and a need for more liquid assets and less guaranteed income. Upside potential comes about through the investment fund portfolio and the fact that purchases of immediate annuities at older ages gives higher incomes per dollar paid than purchases at younger ages. Low fees would result from the use of basic investment funds and immediate annuities as well as the economies of scale that a large-scale conversion of government workers' pension benefits would represent.

Personalization of this broad strategy is essential because no two retirees have identical circumstances and some could be harmed by a broad-brush implementation. Due consideration

must be given to age, marital status, health, retirement resources, Social Security or pension coverage, health and long-term care insurance, gender, the retired household's risk tolerance, and goals, such as special income needs or an intended bequest to children or charities. This consideration must be done in a careful, methodical way using the best and most current findings of economics and finance and a comprehensive algorithm or model.

Now is the time to act responsibly and realistically with the large pension-liability problems of state and local governments, for the improved welfare of retirees, citizens, taxpayers, and governments. Good solutions are available. The imprudence, evasion, and buck-passing of the past will no longer work, and joint leadership from politicians and workers' representatives is important to clear past mistakes and to move forward.

Conclusion

The main purpose of a retirement plan or account is to produce lifetime income during retirement. This goal would argue for the exclusive design or automatic use of a life annuity in the distribution phase. At the same time, this presumption could be rebutted if other methods were almost as good in income production but also had the desirable features of liquidity and allowance for a bequest, or if the actual immediate life annuities available in the commercial marketplace were inferior in pricing or other characteristics. The former is generally true, especially for younger retirement ages, except for significant lifetime horizon failure risk. The latter is not true, except for inflation risk, which is a smaller matter for older retirement ages. A more nuanced policy of allowing retiree choice, guided by relevant information, is appropriate, with some weight given to at least partial use of the life annuity in the retirement-income strategy.

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