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Making Retirement Income Last a Lifetime

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To enable investors to spend down the assets in their defined contribution accounts more easily, the authors propose a decumulation benchmark comprising a laddered portfolio of TIPS for the first 20 years (consuming 88 percent of available capital) and a deferred life annuity purchased with the remaining 12 percent. This portfolio can be used directly by the investor (akin to indexing) or as a benchmark for evaluating the performance of a more aggressive strategy.

What is the lowest-risk retirement strategy for an individual? How can we engineer such a strategy so that people can invest in it? Should investors buy annuities, or is there a better strategy for guaranteeing a lifetime income? Is there a behavioral block that prevents investors from acting in their own best interest? Can we do anything to encourage investors to adopt retirement strategies that insure against longevity risk?

The obvious strategy for converting capital into a longevity risk–protected income stream is to purchase an immediate annuity. But very few investors use this strategy, apparently because the capital transfer—the requirement that investors give their money to an insurance company in exchange for an income stream, with no way to get their money back—is too onerous. Thus, investors seek strategies that preserve all, or most of, their liquidity while attaining, to the extent possible, the goals of longevity-risk protection and minimal investment risk.

One such strategy is to buy, with most of one's capital, a portfolio of laddered Treasury Inflation-Protected Securities (TIPS) out to the latest TIPS maturity date, currently about 20 years. The remainder of the capital is used to buy a deferred annuity that begins its payout when the cash flows from the TIPS ladder end. The proportions invested in each asset class—TIPS and a deferred annuity—are set so that the first deferred annuity payout is equal to the last TIPS payout (plus an allowance for inflation). This strategy preserves most of the investor's liquidity for most of her life while incurring minimal investment risk and achieving the goal of longevity-risk protection.

By measuring the expected cash flows from this strategy, we can establish a *benchmark* for post-retirement asset decumulation. Comprising a *set of future cash flows* produced by a given amount invested, such a benchmark differs from ordinary benchmarks, which are lists of securities and security weights that, when summed, produce a market price or present value.

Investors can use this benchmark to evaluate alternative strategies for asset decumulation. It can also serve as the basis for an index product, although that product cannot be an index "fund" per se: The deferred-annuity part of the solution cannot be held in a traditional mutual fund structure but, rather, must be structured as a deal between the investor and a counterparty—that is, an insurance company. This benchmark would help advance the Obama administration's goal of promoting "guaranteed lifetime income products, which transform at least a portion of retirees' savings into guaranteed future income, reducing the risks that retirees will outlive their savings" (White House Task Force on the Middle Class 2010, p. 27).

If investors were not averse to the capital transfer—and resultant illiquidity—involved in an annuity purchase, the obvious benchmark for the generation of post-retirement cash flows would be the payout from an immediate life annuity. If one is primarily concerned with ensuring real, rather than nominal, purchasing power, the relevant immediate life annuity is indexed to inflation. Quotes for such annuities are available. But the cash flows from a real, immediate life annuity are unsuitable as a general benchmark for asset decumulation because the illiquidity of such a strategy is so burdensome that almost no one uses it. Therefore, to calculate such a benchmark, we developed a minimum-risk strategy that does not have this

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drawback. The projected cash flows from this strategy are used as the benchmark; these cash flows can be calculated separately for men and women and for retirees of various ages (e.g., 60 and 65) and can be updated continually.

Background

The shift from defined benefit (DB) plans to defined contribution (DC) plans has been well documented elsewhere, and so we will discuss only the highlights. The DB system, both private and public, has never covered more than half of U.S. workers, and most covered workers have never received cost-of-living adjustments. The Great Inflation of the late 1960s through the early 1980s decimated the real value of pension payouts for many beneficiaries. Thus, the tale of a lost golden age of DB pension coverage contains a grain of truth within a large shell of myth. Still, some DB plan coverage is much better than none. Moreover, regardless of the extent of coverage, DB plans are a model of success in providing annuitized payouts of available assets. Annuitized payouts are beneficial because participants do not have to worry about forming longevity risk–sharing pools or doing any of the other work needed to generate lifetime retirement income—it is all done for them.

This attribute of DB plans explains much of the nostalgia surrounding them because annuitized payouts have been notoriously difficult to achieve with the DC system. The most valuable characteristic of annuitized payouts is the pooling of longevity risk so that the short-lived subsidize the long-lived. Pooling enables retirement income needs to be fulfilled by saving only enough for one's life expectancy, not the (much longer) maximum possible life span. The difference between these two savings goals is startlingly large—Waring and Siegel (2007) estimated that the loss from not pooling is 34.5 percent of total capital saved.[1]

Over the past two decades, DB plans have faced repeated funding crises owing to exaggerated investment return assumptions, stingy sponsors, and poorly performing markets. As a result, DB plan sponsors have mostly closed or terminated their plans and replaced them with DC plans.[2] Economically speaking, DC plans are savings (asset accumulation) plans, not income continuation (pension) plans; the difference is crucial. In a savings plan, the employee assumes the investment risk and is also responsible for converting assets into income upon retirement. This last task is burdensome and includes either (1) finding a way to achieve longevity-risk pooling (e.g., by buying a life annuity) or (2) doing without the pooling and having to save a much larger sum, as discussed earlier.

Most DC plan participants have proven themselves incapable of saving enough money, incapable of making good investment decisions, and, most relevant to our discussion, incapable of sensibly and efficiently converting assets into income for spending in retirement (see Waring, Siegel, and Kohn 2007). One reason for the difficulty in assets-to-income conversion is the lack of proper tools; it is not solely the participants' fault. Thus, the perception of a crisis caused by the shift from DB plans to DC plans is not without foundation. To simply say that we face a retirement income crisis, without apportioning a large share of the blame to the decline of DB plans, would be more accurate.

At any rate, DB plans are not coming back any time soon. Although we are not quite ready to give up on them, the latest news is not good. In the public sector, where DB plans are now heavily concentrated, most such plans are severely underfunded because governments and public sector unions have negotiated with each other in astonishingly bad faith. Seeing that no one was standing up for the taxpayer, unions have demanded benefits that could not be paid at current or even modestly higher levels of taxation. For their part, governments have said to their employees, in effect, "We cannot afford to pay you, so our grandchildren will pay you." Because the result of this standoff is likely to be a substantial cut in earned public sector pension benefits, no one will trust DB plans for a long time, even if a specific plan is properly funded and invested.

Given that the battle has been won by DC plans, those in leadership positions in the industry must think of ways to increase the utility and minimize the risk of DC plans. We believe that a well-engineered DC plan is experienced by the participant much like a DB plan—that is, a DC plan provides high achieved savings rates (generated by high default savings rates, or Save More Tomorrow plans[3]), institutional-quality and low-cost investment management, and (the main focus of our study) cost-efficient and participant-friendly decumulation options that include longevity-risk protection.

Prior Research

Classic finance literature is not particularly helpful in understanding asset decumulation because it does not typically address the pooling of longevity risk across individuals.[4] The relevant literature is in the fields of insurance, risk management, and financial planning and is generally thought to begin with Yaari (1965), although discussions of the principles behind life insurance, annuities, and tontines go back to before the Renaissance (see Bernstein 1998).

Zietz (2003) provided an excellent bibliography of the annuity-related literature in the risk, insurance, and actuarial (as opposed to classic finance) fields.

Note that we have mentioned *tontines*, perhaps an unusual term. A tontine is an agreement in which individuals pool their wealth or some portion thereof, with the contributions of those who die accruing to the survivors. Explicit tontines are illegal in most places because of moral hazard—the possibility that a member of the pool will kill another member to increase his own payoff. Researchers have noted, however, that the tontine structure offers a very good way to understand the payoff on a DB pension plan, as well as the payoff that many individual investors struggle to receive from their DC and other savings (see Goldsticker 2007).

The current travails of both traditional DB pension plans and savings (DC and other) schemes have been well documented. Scanlan and Lyons (2006) and Cohen, Scanlan, and O'Hara (2008) presented a general background on the problems facing the pension and savings system. A thorough treatment of assets-to-income conversion can be found in Ibbotson, Milevsky, Chen, and Zhu (2007). Charupat, Huang, and Milevsky (forthcoming 2012) have written extensively on annuity and insurance issues as they affect individual savers. Brown, Mitchell, Poterba, and Warshawsky (2001) offered a compilation of high-quality research on the role of annuities in financing retirement. Waring, Siegel, and Kohn (2007) issued a wake-up call regarding the inadequacy of existing savings arrangements and suggested ways to fix them.

A few researchers have directly addressed the merits and difficulties of annuity investing. Hu and Scott (2007) considered the behavioral obstacles that seem to prevent investors from buying more annuities than they do, and Scott (2008) suggested why a longevity annuity—a core component of the strategy that we recommend—is a desirable investment.

A general, multidisciplinary review of lifecycle finance can be found in Bodie, McLeavey, and Siegel (2008); Bodie, Siegel, and Sullivan (2009) focused on the in-retirement phase. The literature written explicitly for financial planners is also helpful. Evensky and Katz (2010) provided a comprehensive treatment of strategies for retirement income generation. Fullmer (2007) developed a dynamic asset allocation strategy for managing longevity risk. Chen and Milevsky (2003) presented a means of optimizing among fixed and variable annuities, equities, and conventional riskless assets, whereby the allocation depends on the extent of the investor's bequest motive as well as risk tolerance and other, more typical variables.

Designing a Proper Benchmark

We believe that one tool participants need in order to ease the transition from work and asset accumulation to retirement and asset decumulation is a *benchmark*. A benchmark does double duty. It can be used

- directly as an investment strategy, by holding the assets in the benchmark (akin to indexing); or
- as a baseline with which other, perhaps utility-increasing, retirement income strategies can be compared and judged, in terms of both the utility gain achieved by deviating from the benchmark and the "risk price" that must be paid to obtain that increased utility.

The benchmark portfolio can also be used as a default investment.[5]

A proper benchmark for asset decumulation minimizes all relevant risks to the greatest extent possible (recognizing that one cannot eliminate all risk) while meeting the basic needs of all the stakeholders, principally the participants and the sponsor. Such a benchmark must also be built out of *existing* investment and legal structures; otherwise, we could simply imagine our way out of the problem.[6]

We assume that investors care mostly about maximizing return, subject to a penalty for or concern about risk (in the sense of volatility). We also assume, however, that investors care about liquidity, taxes, and other investor costs (see Ibbotson, Diermeier, and Siegel 1984); some might regard this list of concerns as "behavioral," and we do not mind the label, although we could just as easily argue that a purely rational investor facing friction costs would be averse to illiquidity—and so on down the line of other nonrisk, nonreturn attributes. At any rate, the evidence that investors dislike trading their liquid portfolios for illiquid, but otherwise very attractive, life annuities is overwhelming.[7] The anemic state of annuity sales is testimony to this state of affairs. We thus eliminate the 100 percent immediate annuity solution, which would *be* the decumulation benchmark if investors were not averse to transferring their capital irrevocably to the annuity issuer.

Because there is no riskless way to transfer wealth from the present to the future that will meet the needs of all the stakeholders in a retirement plan, we seek a compromise solution that is very close to minimum risk, where risk has four dimensions:

- Longevity risk, the risk of outliving one's savings
- Investment risk, including inflation risk
- Counterparty risk
- Liquidity risk (i.e., the preference not to hold all or most of the portfolio in annuities)

We describe our solution as a benchmark for the reasons stated earlier. We further denote it as a *decumulation* benchmark because it applies only to the payout or spend-down phase of life, not to the asset accumulation phase. Finally, we note that our solution is most likely to be applied to DC plans, although it could be adapted to DB plans as well.[8] So, we call it a *defined contribution–decumulation benchmark* (DCDB)—those letters are intended to suggest "DC to DB," a technique that makes a DC plan look and feel more like a DB plan than a DC plan, which we consider a desirable goal, as discussed earlier.[9]

Construction of the Minimum-Risk Portfolio

Until very recently, TIPS had a maximum maturity of 20 years, so the TIPS market could be counted on to hedge inflation risk for only that long.[10] Therefore, the minimum-risk portfolio for the first 20 years is a laddered portfolio of TIPS, engineered to be level payment in real terms and self-amortizing. In other words, the income paid out of the TIPS portfolio should grow at the rate of experienced U.S. Consumer Price Index (CPI) inflation, and the principal should be paid out at such a rate that the capital balance of the portfolio is zero at the end of the 20th year.

Beyond the 20th year, inflation protection is hard to achieve, so we purchase a *nominal* deferred life annuity, one that makes its first payment to the beneficiary at the end of Year 21 and that continues until the beneficiary's death. The first payment of the annuity (and thus each of its subsequent payments) is set equal to the last payment of the TIPS portfolio.

The DCDB portfolio thus consists of two assets:

1. The laddered TIPS portfolio
2. The deferred nominal life annuity

Both assets are priced in the market. We now need to determine how much to allocate to the deferred annuity; the balance will be the allocation to the TIPS portfolio.

Let us define x as the percentage of the total investment to be allocated to the annuity in year t_0, which leaves $(1 - x)$ to be allocated to the TIPS portfolio to generate income for 20 years. The TIPS portfolio payout in Year 20, y_{20}, is given by

$$y_{20} = (1-x)\, y_1 (1+i)^{20}, \tag{1}$$

where y_1 is the TIPS portfolio payout in Year 1 and i is the *expected* inflation rate (because we are allocating between the two portfolio assets at time t_0—that is, before we have a chance to observe the experienced inflation rate). The expected inflation rate is assumed equal to the TIPS nominal Treasury breakeven rate for 20-year maturities. We now have the future coupon in 20 years for which a deferred annuity producing the same annual cash flow must be purchased.

The cost of the deferred nominal annuity (as the authors observed in the market in 2010) is \$1.5975—that is, it costs \$1.5975 now to buy \$1.00 of income every year starting 21 years from now and ending at the annuitant's death. Thus, for every dollar at the end of y_{20}, we must have an annuity allocation of \$1.5975, which we can write as

$$1.5975\,(1-x)\, y_1 (1+i)^{20} = x. \tag{2}$$

We can then easily solve for x, the annuity allocation, and $(1 - x)$, the TIPS allocation. Using the annuity price shown and the TIPS yield curve as of 1 August 2010, we find that the allocation is 88.3 percent for the TIPS portfolio and 11.7 percent for the annuity.

Note that the longevity pooling is quite a bargain because we use TIPS for the first 20 years, eliminating the need to purchase longevity insurance over that period. (According to current mortality tables, a 65-year-old male is expected to live for another 19 years; females, another 21.)[11] Most of the academic research with respect to retirement strategies has focused on the right tail, where the concern is outliving one's assets. In our study, we attempted to bring much-needed attention to the left tail, where the concern is getting as much income as possible while a large majority of retirees are still alive. By bridging the gap between the two tails, we tried to reconstruct the whole animal—that is, we paid attention to the whole distribution of longevity outcomes.

Peculiarities of the DCDB as a Benchmark

The DCDB is a bit unusual in the world of investment benchmarks. Conventional benchmarks are lists of securities and security weights that give a price when multiplied through and added up. An obvious example is the S&P 500 Index; over time, a price series evolves (the series of daily closes of the S&P 500), which is what most people think of when they hear the word "benchmark."

Although our benchmark is a list of securities—the laddered TIPS portfolio and the deferred real annuity—and security weights (in our example, initially 88.3 percent for all TIPS bonds combined and 11.7 percent for the annuity), we are concerned not with present value or price but, rather, with future cash flows. The units of our benchmark are cash flows in each year (Years 1, 2, 3, . . . , 20, 21, etc., but we can stop at 20 because there is no more inflation

adjustment after that date) per $100,000 invested. Thus, the benchmark is a vector—a time series of future cash flows—rather than a scalar (a price or other single number).

Because the DCDB is specific to a given retiree's age and gender, the DCDB is a family of benchmarks, not a single benchmark, and is calculated and published for each month-end, separately for men and women and separately for the retirement entry ages of 60 and 65 (for a total of four benchmarks). **Table 1** shows the DCDB vector of cash flows, as of 30 September 2010, for a man entering retirement at age 65. Note that the vector in Table 1 can be characterized by only three numbers: the initial payout, the inflation rate during the laddered TIPS or inflating period, and the length in years of the inflating period. The DCDB vector for a 65-year-old man as of 30 September 2010 can thus be written as ($5,118, 1.91 percent, 20).[12] Adding the portfolio weight of the annuity, x, fills in the picture: ($5,118, 1.91 percent, 20, 11.7 percent); only one weight is needed because the other, that of TIPS, is $(1 - x)$. These short-form expressions are useful in reporting the benchmark, which would otherwise become quite unwieldy. **Exhibit 1** provides a fuller description of the DCDB portfolio.

Properties of the DCDB

Our DCDB offers the following criteria of a good benchmark for retirement income generation:

- The least possible counterparty risk
- Inflation protection for as long as the TIPS market provides such protection
- Longevity-risk pooling

In addition, we have designed a retirement *portfolio* that is

- buildable, using assets that exist today—for example, TIPS out to 20 years' maturity (as the markets change, the composition of the benchmark will change);
- individually executable—all participants in 401(k) and IRA plans must be able to execute the strategy themselves (if only professional investment managers can execute the strategy, it is not a good benchmark portfolio); and
- measurable—creating an index that reflects the benchmark's return must be possible. This index will be made available to the public in the summary form shown earlier: ($5,118, 1.91 percent, 20) for 65-year-old men. As the decumulation industry evolves, providers will

Table 1. The DCDB for a 65-Year-Old Male as of 30 September 2010

Year	1	2	3	4	5	6	7	8	9	10	
Payout ($)	5,118	5,216	5,316	5,417	5,521	5,626	5,734	5,843	5,955	6,069	
Year	11	12	13	14	15	16	17	18	19	20	21
Payout ($)	6,184	6,303	6,423	6,546	6,671	6,798	6,928	7,060	7,195	7,332	7,332

Note: Payout is the annual amount per $100,000 invested.

Exhibit 1. Details of the DCDB Index for a 65-Year-Old Male as of 30 September 2010

	Allocation	
Characteristic	88%	12%
Age range over which portfolio component provides income	65–85	85+
Asset description	20-year self-liquidating TIPS portfolio[a]	Deferred annuity starting in Year 21[b]
Yield or annuity rate	5.69% (including return on principal)	
Annual income per $100,000 invested, Years 1–20	$5,118 in today's dollars, inflating at realized inflation rate	$0
Annual income, Year 21+	$0	$7,332 (in nominal dollars)
How income is calculated	$5,118 = 5.69% distribution rate × 88.3% allocation × $100,000 × (1 + first-year inflation)	Based on $5,118 first-year nominal income, inflated for the next 19 years at 1.91% TIPS breakeven inflation rate
Inflation protected	Yes	No
Investor control of assets	Yes	No

[a]Income consists of coupons plus return of principal. Principal value decreases over time as principal is returned. The value is zero at the end of Year 20.

[b]The annual annuity income level purchased is matched to the final annual payout of the TIPS portfolio that is expected at the time the annuity is purchased (i.e., today).

enter their products into competition, and the public benchmark will enable investors to see which providers are offering products worth considering, in terms of reward, risk, and cost.

Investment return risk is minimized by investing in the lowest-risk asset, U.S. government bonds. (For investors concerned with real returns, TIPS, not nominal Treasuries, are the category of bonds with the least risk.) Counterparty risk is not quite zero for the first 20 years (because even governments can default), but it is as low as can be achieved in practice. Inflation risk is also not zero because the inflation adjustment on TIPS may differ from the inflation experienced by the investor; but this risk is minor compared with not being protected from inflation at all.

Longevity risk is also not quite zero because of the counterparty risk in the deferred annuity. The U.S. government does not issue annuities (except Social Security, whereby one cannot "buy" the number of shares desired but must instead "earn" them), and so one must buy annuities in the commercial market, where insurance companies can go bankrupt.[13] The annuity begins as a small percentage—11.7 percent of the portfolio at current interest and annuity rates—and for most retirees, the dollar amount will be below most state guarantee levels. Moreover, by diversifying among annuity issuers, some reduction in counterparty risk can be achieved, but this risk cannot be eliminated entirely.

From a behavioral standpoint, by allowing the retiree to control 88 percent of the portfolio and still have a structure to provide lifetime income, we have addressed one of the dominant reasons that retirees do not fully annuitize and gain the benefits of pooling.

Although we have focused on a DC plan design, the DCDB strategy could also be implemented by a DB plan, the chief difference being that annuitization would most likely be internally managed by the plan sponsor instead of being farmed out to an annuity provider. The DCDB is definitely a general solution.

Shortcomings of the DCDB

Although appealingly simple, passive, and risk minimizing, the DCDB strategy is not the only strategy that an investor might want. An investor who pursues a different strategy, believing that it offers greater utility, can use the DCDB as a benchmark. For example, many individuals, even in retirement, would find their utility increased by investing some percentage of their portfolio in equities and other risky assets. The expectation of greater wealth and income is balanced against the possibility that wealth and income will fall short owing to investment returns not meeting expectations or, even worse, falling below the risk-free return. Other, more sophisticated approaches to asset allocation for DC plans include diversifying the bond portfolio by adding international inflation-indexed bonds, high-quality corporate bonds, and other securities—which is what insurance companies do to fund the promises made in their inflation-protected annuity products.

Another flexibility-enhancing option would be to borrow some or all of the plan balance, which is not provided for in our design. A retiree facing an emergency expense will thus derive less-than-optimal utility from holding the DCDB directly. But these shortcomings of the baseline DCDB strategy can be addressed when designing a DC plan structure.

Other investors may expect to experience such one-time events as buying or selling property and receiving an inheritance. Such investors must plan for a cash flow stream that is not described completely by an inflating annuity. These one-time events change the optimal strategy for the rest of the portfolio.

Some of the other shortcomings of the DCDB are more conceptual in nature. First, not everyone can buy the benchmark, for the same reason that not everyone can index to the S&P 500; there is no capital allocation process and no trading. Second, the security of deferred annuities depends on the balance sheet of the insurance company that issues the annuity. Finally, the security of the TIPS portfolio depends on the sovereign and its willingness to inflate the coupons and principal at the actual inflation rate experienced by the participant.[14]

Comparison with Other Retirement Strategies

The TIPS and deferred annuity combination is the best default option available today that meets our six criteria for a retirement income benchmark. Some investors will want to hold the benchmark directly, akin to indexing. Those with different circumstances or preferences will want some other arrangement. We can use the DCDB as a baseline for evaluating three alternative strategies: (1) 100 percent in an immediate real (inflation-indexed) annuity, (2) 100 percent in a target-date portfolio of equities and bonds (with a starting allocation of 40 percent in equities), and (3) 100 percent in an immediate nominal annuity.

Immediate Real (Inflation-Indexed) Life Annuity Purchased from an Insurance Company. This strategy would be a likely choice for participants who have the option of annuitizing their

401(k) balance. Comparison with the DCDB would help participants decide whether to use this strategy.

The current annuity quote (payout rate) for a fully inflation-indexed annuity at age 65 is $4,856, almost exactly the same as the first-year payout in the DCDB. The cash flows from both strategies inflate at the CPI rate until the 21st year, when the DCDB stops inflating but the inflation-indexed annuity continues to inflate. Thus, over any life span, the inflation-indexed annuity either dominates or is a breakeven relative to the DCDB if the investor does not care about liquidity or counterparty risk.

Therefore, the participant trade-off is as follows: Is it worth giving up control of the portfolio and also assuming counterparty risk to get guaranteed inflation-protected income for life, as opposed to inflation protection only through age 85? **Exhibit 2** shows a schematic by which the participant can evaluate these trade-offs.

Target-Date Portfolio of Risky Assets (Equities and Bonds). This strategy is the most likely choice for the participant who simply leaves the balance in the fund. Our proxy for risky assets is a target-date fund with an initial (at age 65) allocation of 40 percent in a portfolio of global equities and 60 percent in a bond portfolio. The fund is assumed to be managed to a "glide path" that reduces the equity allocation as the participant ages.

With a first-year income of $5,118, the DCDB clearly dominates the target-date fund's first-year income of $3,800. Income from the target-date fund, however, is expected to grow faster than inflation—although it might not—and so the risky-asset strategy has the potential to dominate in later years.

The trade-off facing the participant is complex and may be expressed as follows: Target-date funds provide additional utility from holding assets that are expected to grow in value (instead of being depleted), but this higher *expected* return is achieved by assuming the risk that the return will be unacceptably low and that the assets will be depleted within the participant's lifetime. Target-date funds also provide the participant with full ownership of the assets. Is this bundle of attributes more attractive than the DCDB, which provides a higher starting income and protects against longevity risk with almost no inflation risk and almost no investment (real return) risk? A schematic expressing this trade-off is shown in **Exhibit 3**.

Exhibit 2. Comparison of 100 Percent Lifetime Inflation-Indexed Annuity Strategy to DCDB Benchmark for a 65-Year-Old Male as of 30 September 2010

	100% in Lifetime Inflation-Indexed Annuity Assets	DCDB Benchmark Assets	
Characteristic	Lifetime Inflation-Indexed Annuity	20-Year Self-Liquidating TIPS Portfolio[a]	Deferred Nominal Annuity Starting in Year 21[b]
Initial allocation to asset	100%	88%	12%
Age range over which portfolio component provides income	65 to death	65–85	85 to death
Yield or annuity rate	4.856%	5.69% (including return on principal)	
Annual income per $100,000 invested, Years 1–20	$4,856 in today's dollars, inflating at realized inflation rate	$5,118 in today's dollars, inflating at realized inflation rate	$0
Annual income, Year 21+	Same as in Years 1–20	$0	$7,332 (in nominal dollars)
How income is calculated	= 4.856% annuity rate × $100,000 inflation rate applied after Year 1	First-year income = 5.69% distribution rate × 88% allocation × $100,000 × (1 + first-year inflation), thereafter inflating at realized inflation rate	Based on $5,118 first-year nominal income, inflated for the next 19 years at 1.91% TIPS breakeven inflation rate
Inflation protected	Yes	Yes	No
Counterparty risk	Yes	No	Yes
Investor control of assets	No	Yes	No

[a]Income consists of coupons plus return of principal. Principal value decreases over time as principal is returned. The value is zero at the end of Year 20.

[b]The annual annuity income level purchased is matched to the final annual payout of the TIPS portfolio that is expected at the time the annuity is purchased (i.e., today).

Exhibit 3. Comparison of 100 Percent Target-Date Fund Strategy to DCDB Benchmark for a 65-Year-Old Male as of 30 September 2010

	100% in Target-Date Fund Assets		DCDB Benchmark Assets	
Characteristic	Diversified Global Equities	Bond Fund	20-Year Self-Liquidating TIPS Portfolio[a]	Deferred Nominal Annuity Starting in Year 21[b]
Initial allocation to asset	40%	60%	88%	12%
Age range over which portfolio component provides income	65 to death	65 to death	65–85	85 to death
Yield or annuity rate	3.1% (yield on blended assets); yield assumed constant, although in practice yield may rise as bond percentage of total portfolio increases with age		5.69% (including return on principal)	
Annual income per $100,000 invested, Years 1–20	$3,100		$5,118 in today's dollars, inflating at realized inflation rate	$0
Annual income, Year 21+	$3,100		$0	$7,332 (in nominal dollars)
How income is calculated	= 3.1% yield estimate × $100,000; no inflation adjustment		First-year income = 5.69% distribution rate × 88% allocation × $100,000 × (1 + first-year inflation), thereafter inflating at realized inflation rate	Based on $5,118 first-year nominal income, inflated for the next 19 years at 1.91% assumed inflation rate
Inflation protected	No		Yes	No
Counterparty risk	No		No	Yes
Investor control of assets	Yes; investor bequeaths fund balance that is expected to be positive at death and could be very large		Yes	No

[a]Income consists of coupons plus return of principal. Principal value decreases over time as principal is returned. The value is zero at the end of Year 20.

[b]The annual annuity income level purchased is matched to the final annual payout of the TIPS portfolio that is expected at the time the annuity is purchased (i.e., today).

Immediate Nominal Life Annuity Purchased from an Insurance Company. In many DB plans—especially cash balance plans—the participant must choose between a lump sum payment from the plan and a nominal (noninflating) annuity within the plan. For example, a participant who is entitled to a $100,000 lump sum payment can also choose a $6,811 annuity (fixed, with no inflation adjustment) administered by the DB plan.[15]

The nominal annuity dominates (in terms of annual cash flow) by a large amount at first, but by Year 17, the DCDB pulls ahead and remains slightly ahead until the participant's death. This scenario is contingent on inflation remaining at the expected level (1.91 percent). If inflation is greater than expected, the DCDB pulls ahead more quickly, and if inflation is very high, the DCDB almost completely dominates.

The participant trade-off is as follows: Does the higher current income provided by the nominal annuity, combined with the mitigation of counterparty risk provided by Pension Benefit Guaranty Corporation coverage (up to some limit), make this deal more attractive than the DCDB? (Note that a beneficiary who does not expect to live long, or who does not expect much inflation, would be justified in answering yes.) **Exhibit 4** shows a schematic for this trade-off.

Conclusion

We have shown that during certain phases of the life cycle or given certain asset return or inflation realizations, a strategy of putting 100 percent in either real (inflation-indexed) or nominal immediate annuities may provide a higher annual income than the DCDB. Specifically, a nominal annuity provides more income in the near future, and a real annuity provides more income in the far future. To some investors, one of these annuity strategies sounds better than the DCDB: Both longevity pooling and lifetime inflation protection are provided. But these advantages are offset by the following risks and costs:

1. Counterparty risk. It is unclear which is more devastating, a default early in the retirement phase (when little or no income has been

Exhibit 4. Comparison of 100 Percent Lifetime Nominal Annuity Strategy to DCDB Benchmark for a 65-Year-Old Male as of 30 September 2010

	100% in Lifetime Nominal Annuity Assets	DCDB Benchmark Assets	
Characteristic	Lifetime Nominal Annuity	20-Year Self-Liquidating TIPS Portfolio[a]	Deferred Nominal Annuity Starting in Year 21[b]
Initial allocation to asset	100%	88%	12%
Age range over which portfolio component provides income	65 to death	65–85	85 to death
Yield or annuity rate	6.811%	5.69% (including return on principal)	
Annual income per $100,000 invested, Years 1–20	$6,811	$5,118 in today's dollars, inflating at realized inflation rate	$0
Annual income, Year 21+	$6,811	$0	$7,332 (in nominal dollars)
How income is calculated	= $6,811 annuity yield × $100,000; no inflation adjustment	First-year income = 5.69% distribution rate × 88% allocation × $100,000 × (1 + first-year inflation), thereafter inflating at realized inflation rate	Based on $5,118 first-year nominal income, inflated for the next 19 years at 1.91% TIPS breakeven inflation rate
Inflation protected	No	Yes	No
Counterparty risk	Yes	No	Yes
Investor control of assets	No	Yes	No

[a]Income consists of coupons plus return of principal. Principal value decreases over time as principal is returned. The value is zero at the end of Year 20.

[b]The annual annuity income level purchased is matched to the final annual payout of the TIPS portfolio that is expected at the time the annuity is purchased (i.e., today).

returned to the participant) or late in the annuitant's life (when there is no opportunity to adjust to straitened circumstances by going back to work).

2. The requirement that the retiree's portfolio must be irrevocably committed to the annuity, eliminating liquidity other than the income provided by the annuity.
3. With respect to real annuities, the active TIPS market currently goes for only 20 years, so the counterparty has no way to directly hedge the income promise, resulting in unavoidable risk that is shared by both the insurance company and the retiree.
4. Many of the real annuities that exist in the marketplace today have caps on the inflation adjustments, limiting the utility for annuitants.

Thus, in our view, the best option today is the combination of a 20-year self-amortizing TIPS portfolio and a deferred annuity represented by the DCDB. This portfolio does the best job of meeting our criteria by using the tools that are available today for lifetime income generation and, just as importantly, provides the basis for a benchmark that uses market pricing and that can be made publicly available over the long term. We would caution that the longevity pooling involved in a deferred annuity is not a perfect solution because some counterparty risk remains, and one must also pay the cost of "renting" the balance sheet of the insurance carrier.

Over time, we expect both the marketplace and the retirement income benchmark to evolve. For example, insurance companies are the only places where longevity risk can be pooled and managed today. In the future, we fully expect capital markets to provide additional pooling solutions to manage this risk.

Those planning for retirement can choose a low-risk lifetime income with longevity pooling, a high degree of inflation protection, and substantial liquidity preservation; or they can choose other options that better suit their individual needs and circumstances. Whichever path they choose, they can do so in an informed and measured manner by using the DCDB as a benchmark.

This article qualifies for 1 CE credit.

Notes

1. Waring and Siegel (2007) estimated that $1,802,431 in savings would be required to generate, from age 65 to age 105, an annual income of $100,000 (in real terms) that could have been purchased in the immediate annuity market for $1,180,000; (1,180,000/1,802,431) – 1 = –34.5 percent.
2. Although *closing* and *terminating* a plan sound the same, closing usually refers to closing the plan to new contributions (or new participants, depending on the situation) while allowing existing contributions to remain in the plan, grow, and be paid out to beneficiaries. In a terminated plan, the contributions, along with some or all of the investment return earned, are returned to the employee, usually in the form of a DC plan balance; the employee then becomes responsible for investing the money and generating retirement income.
3. Save More Tomorrow is a registered trademark of Shlomo Benartzi and Richard H. Thaler.
4. Although the literature on sustainable spending rates for individuals does come from classic finance and is mostly simulation based (see the bibliographies in Dybvig and Liu 2010; Scott, Sharpe, and Watson 2009), this literature is only marginally relevant because it focuses on minimizing the probability of running out of money while still alive. In line with Bodie, McLeavey, and Siegel (2008), we do not want to *minimize* the probability of shortfall—we want to *eliminate* it.
5. In the context of a U.S. DC plan, a default investment is one that is purchased for the participant who makes no explicit investment choice. A list of acceptable default investments (called qualified default investment alternatives, or QDIAs) is maintained by the U.S. Department of Labor, which accords "safe harbor" status to such investments. The purpose of a default investment is to provide an executable investment strategy for an individual client who, owing to skill level or current circumstance, is not in a position to make the complex calculations and investment decisions to create a portfolio that provides either (1) lifetime income or (2) a combination of income and expected capital appreciation that the client judges to be superior to a lifetime income portfolio.
6. Say, by imagining a stand-alone insurance company with infinite reserve capital that holds inflation-indexed Treasury bonds with indefinitely long maturities as collateral and issues against that collateral an inflation-indexed life annuity to anyone who wants one, at actuarially fair prices with no (excess or economic) profit. That would do it.
7. See Charupat, Huang, and Milevsky (forthcoming 2012).
8. DB plans do not need our decumulation strategy because the annuitized or tontinelike payout of a DB plan eliminates the need for a separate strategy, but they could use our benchmark as a measuring stick.
9. Other factors that we do not address here include taxes, health, and medical insurance status (e.g., Medicare coverage). The key to the DCDB is that it is a starting point from which to make better-informed individual decisions.
10. Just as we finished writing this article, the U.S. Treasury issued a 30-year TIPS. But the issue was not very large, and how committed the Treasury is to further issuance of TIPS at this maturity is unclear. In the past, 30-year TIPS have been issued and then discontinued. Thus, our argument that a non-TIPS solution is required beyond the 20th year of the strategy is likely to remain valid for some time.
11. We based our calculations on the mortality rates in the 2010 IRS Generational Mortality Table.
12. A more fully general notation would allow for a nonzero inflation rate in the second period—say, ($5,022, 1.91 percent, 20, 1 percent) if a deferred annuity could be found that provides cash flows inflating at 1 percent a year.
13. Thus far, no annuity money has ever been lost by an annuitant.
14. One innovation is for the government to issue self-liquidating (amortizing) TIPS (see Goldsticker 2010). This innovation would change and improve our strategy.
15. We calculated the annuity rate by using 2010 annuity factors.

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