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A new strategy to guarantee retirement income using TIPS and longevity insurance

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Abstract

Retirees investing their savings in stocks and bonds face the risk of financial ruin even when withdrawing as little as 4% annually. This paper proposes a new investment strategy using Treasury Inflation Protected Securities and longevity insurance that would guarantee real annual withdrawal rates in excess of 5% without any risk of financial ruin. The strategy can be implemented at minimal cost by retirees and their financial advisers. Institutional providers can use this strategy to offer products that would provide inflation adjusted lifetime incomes and allow retirees to retain control over most of their savings in retirement. © 2009 Academy of Financial Services. All rights reserved.

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1. Introduction

The search for the optimal withdrawal rate, the rate that minimizes the prospect of either having too small a retirement income or running out of money in retirement, is an ongoing quest for retirees and their financial advisers. The current consensus in the literature suggests that retirees can expect to withdraw at a real rate of about 4% of their initial savings by investing in portfolios of stocks and bonds, though even at this rate they face a small risk of financial ruin or running out of money in retirement. The risk of financial ruin increases significantly with higher withdrawal rates.

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Economists have long contended that retirees can get higher withdrawal rates and lifetime protection from ruin by buying immediate lifetime annuities with their entire savings, rather than investing in securities and living off the income and principal. However, for reasons discussed later, immediate lifetime annuities have not been popular with retirees; it is estimated that less than 2% of retirees annuitize their retirement savings. On the other hand, the need for assured lifetime incomes has become more acute as life expectancies increase and has spurred demand for annuities such as 'longevity insurance' or deferred annuity products.

In this paper, I propose a new financial strategy using a combination of inflation protected securities and longevity insurance (or deferred annuities) that would allow retirees to enjoy real withdrawal rates substantially higher than the 4% suggested above. More significantly, the strategy would allow the retiree to earn these higher rates without any risk of financial ruin. The retirees would be assured a predetermined lifetime real income, similar to the income from social security and most defined benefit pension plans. In addition, the strategy would allow retirees to maintain discretionary control over a large part of their savings in retirement.

This new investment strategy does not require active portfolio or withdrawal rate management. The annual withdrawal or income over the retiree lifetime would be determined at retirement, based solely on the prevailing prices for inflation protected securities and longevity insurance products, and would not be affected by subsequent changes in asset prices and returns over the retirement period. The strategy is relatively easy to adopt and can be managed by retirees and their financial advisers. It can also be used by institutional providers as the basis for products that would package investment management and longevity insurance and provide lifetime incomes to retirees without requiring them to buy an immediate annuity with their entire savings.

2. Literature review

The early literature on determining sustainable withdrawal rates starts with the assumption that retirees prefer to adopt a passive approach in managing their retirement portfolios; that is, they select a fixed withdrawal rate (based on their aversion to financial ruin), make the appropriate asset allocation, and then receive an income stream over a fixed number of years, say 20 to 35 years. Based on this assumption and the historical returns on U.S. stocks and bonds from 1926 to 1992, Bengen (1994) estimates that retirees with a 50/50 portfolio of stocks and bonds can withdraw at a real rate of 4% for at least 35 years; however, a higher withdrawal rate of 5% would last, in some instances, for only 20 years before the retirees run out of money. Cooley, Hubbard and Walz (2003) report that a 4% real withdrawal rate from an all equity portfolio would result in a 12% chance of ruin over 30 years, assuming historical returns repeat in the future; a higher, 5% withdrawal rate increases the chance of ruin to 25% (based on historical returns) or 32% (based on simulated returns). Milevsky and Robinson (2005) incorporate uncertainty about both investment returns and mortality to estimate that a 65-year-old could withdraw at a real rate of 4% (over an estimated life expectancy of 18.9 years) whereas facing a 9.43% chance of ruin; withdrawing at a higher rate of 5% would lead to a 16.8% chance of ruin. These studies suggest that fixed withdrawal rates as low as 4% carry some risk of financial ruin and higher withdrawal rates are fraught with substantially more risk, given the volatility of equity and bond returns. Incidentally, this volatility can result in large terminal portfolios at the end of a retiree's life, a feature that may not be desirable to retirees who prefer to maximize retirement income rather than die rich.

Other studies examine whether actively managing the retirement portfolio (such as varying withdrawal rates and/or asset allocation ratios in reaction to portfolio performance, among other things) allows retirees to earn higher rates and have lower terminal portfolios than those expected from a passively managed fixed withdrawal rate approach. Bengen (2001) examines 'performance adjusted withdrawals' and finds that varying the withdrawal rate moderately in response to the previous year's portfolio return supports a higher average withdrawal rate; he also explores the effects of withdrawing at different rates during the different phases of retirement and makes a case for higher withdrawal rates in the first phase of retirement, followed by lower rates at age 85 and beyond. Pye (2000) estimates that an all-equity portfolio with an assumed annual real return of eight percentage and standard deviation of 18% would support a 4% real withdrawal rate with a 19% chance of financial ruin over a 35 year horizon; a higher withdrawal rate of 5% over the same period would increase the chance of ruin to 34%. Stout (2008) incorporates mortality risk and simulated market returns to show that 65-year-old retirees withdrawing at a fixed annual rate of 4.5% would face a 4.55% probability of ruin before death and would leave behind terminal portfolios that, on average, are 1.44 times the initial amount. However, the same retirees (starting at the initial withdrawal rate of 4.5%) can average a much higher rate of 6.16% over their actuarial lifetime, with a smaller probability of ruin and leave behind a smaller terminal portfolio by varying their withdrawal rate in response to portfolio performance (including withdrawing as little as 3% in years after poor performance). Spitzer (2008) also finds that 'course correction strategies' with varying withdrawal rates would be superior to fixed rate withdrawal strategies.

Dynamically managing withdrawal rates may allow retirees to enjoy higher average withdrawal rates over their actuarial lifetimes but it should be noted that the rates and risks reported in the studies are based on assumptions or projections about portfolio returns and average mortality rates. Individual retirees adopting these strategies and withdrawal rates would not be free from the uncertainties posed by stochastic returns and an unpredictable life span; that is, neither the fixed rate nor the varying withdrawal strategies can provide the individual retiree an income stream that is independent of assumptions of future portfolio returns and is guaranteed for life.

Economists have long argued that the solution to the dual problems of financial ruin or too little income is an immediate lifetime annuity, bought with the retirement savings. A lifetime annuity, by definition, eliminates the prospect of financial ruin. It also offers a higher level of income, because issuers of these annuities typically pool mortality risks and use the assets of the deceased for the benefit of the surviving annuity holders (Yaari, 1965). For example, if 1,000 65-year-old retirees spend $100,000 each to buy lifetime annuities, the retirees would each receive an equal share of the income from the $100 million pool of investments. However, five years later, only 900 of the retirees are expected to survive, given the average mortality of the group. At that time, each of the surviving retirees would earn a higher income (even if the overall return on the $100 million pool remains constant), because the survivors would each earn their own share, and, in addition, get a share of the income that would have gone to the 100 deceased retirees. By factoring in this mortality augmentation, the annuity issuers are typically able to offer annuity buyers a higher level of income than what they would earn by investing the $100,000 on their own.

Therefore, immediate lifetime annuities should be the rational choice for retirees who hope to maximize their lifetime withdrawal rates (and leave nothing behind in terminal portfolios). Lifetime annuities such as these are readily available in the market; for example, in April 2008, the Vanguard Lifetime Income Program was selling a non-cancelable, immediate, single life annuity that offered a 65-year-old male a real annual payout of 6.7% of the premium invested.[1] The payout from this life annuity is substantially higher than the 4% or 5% real rates suggested in the fixed withdrawal rate studies cited earlier and also provides lifetime protection from financial ruin. However, in reality, very few retirees actually choose to annuitize their savings. This puzzling behavior, termed the "annuity puzzle" in economics, has been attributed, variously, to the high fees on annuity products charged by the insurance industry (Friedman and Warshawsky, 1990); the existence of government insurance systems like Social Security that mitigate the consequences of financial ruin (Bernheim, 1991); and the possibility that families, particularly married couples or parents and children, 'self-insure' against financial ruin by relying on each others' assets (Kotlikoff and Spivak, 1981; Brown and Poterba, 2000).

Milevsky (2005) and Hu and Scott (2007) offer some behavioral explanations for the "annuity puzzle." Milevsky (2005) argues that "most people shun life annuities because they want to maintain control of their assets" and that annuitization is "an irreversible financial transaction involving large sums of money (that) will never be appealing to individuals . . . (e)specially when the underlying funds are under complete discretionary control of the annuitant up to the point of retirement." Hu and Scott (2007) use the behavioral insights of mental accounting and cumulative prospect theory to show that buying an immediate annuity can be perceived as a gamble that increases overall risk, partly explaining why annuities have not been popular.

Milevsky (2005) proposes a deferred annuity as an alternative to the immediate lifetime annuity. Under his alternative, the Advanced Life Delayed Annuity (ALDA) plan, participants would enroll at an early age, pay small annual premiums from enrollment until an advanced age of their choice, and then receive a stream of lifetime annuity payments. Milevsky estimates that an ALDA policy with a real annual premium of $100 from age 35 to age 85 would accumulate sufficient funds to pay a real annuity of $3,200 from age 85 to death (assuming real returns of 3.25%).

The income stream under Milevsky's ALDA plan is similar to the defined benefit (DB) pension plans that offer lifetime retirement income to participants, with the highest benefits going to those who retire late and/or contribute over the longest period to the plan. The ALDA plan mitigates the "large irreversible transaction" problem posed by a single premium lifetime annuity purchase, because it allows participants to make small, regular contributions over an extended period. However, as Milevsky notes, there are several potential drawbacks with the ALDA plan. Getting young people to enroll in such a plan and make a long-term commitment to paying premiums may not be easy because survey evidence suggests that people underestimate their life expectancy. The ALDA also poses special problems for the annuity provider, given the administrative costs of collecting and keeping track of small premiums and the increased risks of investing them over 60 to 70 years. Milevsky reports that one provider who tried selling a version of the ALDA plan, the IDS Life Insurance Company of Minneapolis, did not succeed and had to withdraw the product.

Scott (2008) shows that there is a clear economic rationale for a deferred annuity or longevity insurance policy. Most retirees would benefit by spending a small part of their retirement assets on longevity insurance that start paying out benefits at an advanced age because it would reduce their need for precautionary savings and would allow them to enjoy a higher level of spending in retirement. The recent spate of longevity insurance products from MetLife, Hartford, New York Life, and Symetra Life, among others, suggests that this idea is beginning to appeal to retirees.

However, even if retirees buy longevity insurance, the question still remains as to how retirees should invest from age 65 to the advanced age at which the longevity benefits would commence. The typical advice to retirees to invest their savings in a portfolio of stocks and bonds will not suffice since it will not guarantee them a predictable income stream, given the inherent risks of investing in stocks and bonds. To address this issue, I propose a new strategy, termed the Inflation Protected Retirement Annuity (IPRA) strategy, which would assure retirees a lifetime retirement income stream similar to those provided by defined benefit pension plans. The IPRA strategy involves investing the retirement savings in a combination of inflation protected securities and longevity insurance that would generate a predetermined, inflation-protected lifetime income stream. The strategy would allow retirees to retain ownership over most of their savings for an extended period in retirement. It can be adapted to meet varying income needs at different stages in retirement. The strategy can be implemented at retirement and does not require a large, irreversible, immediate annuity premium. It also does not require any portfolio monitoring or rebalancing in response to market conditions or portfolio returns.

In the next two sections, I develop the IPRA concept and show how it would work if offered by an institutional provider. Nothing like this integrated product is commercially available as of now but, as I show, this is a product that institutions could develop using existing securities. In a later section, I show how individual retirees can create their own personal IPRAs by combining Treasury Inflation Protected Securities (TIPS) and longevity insurance policies available in the market today.

3. The inflation protected retirement annuity (IPRA) concept

The basic premise underlying the IPRA is that, at retirement, a retiree would invest the retirement savings in (1) a portfolio of inflation protected securities, such as TIPS and (2) a ‘longevity insurance’ or deferred annuity policy. The TIPS portfolio would provide the income in the first phase of retirement and the deferred annuity would pay out in the second phase. The retirees would be free to choose the length of the first phase, say 15 to 25 years; the second phase would start after that and cover the remainder of the retirees' lifetime.

The TIPS portfolio would be gradually drawn down during the first phase of retirement, reaching a zero balance by the end of the phase. The withdrawal rate in this first phase would depend on the number of years chosen for the phase, with shorter periods resulting in higher withdrawal rates. If the retiree dies during this first phase, the balance in the TIPS portfolio would be transferred to a beneficiary. Retirees would also be free to draw down the TIPS portfolio at any time during the first phase; the only consequence of draining the portfolio would be the loss of the annual payments in the first phase.

Retirees who survive to the beginning of the second phase would receive the longevity insurance policy benefits over the remainder of their lifetime. The size of the annual benefit would be determined by the amount the retiree chooses to invest in the deferred annuity at retirement. These longevity benefits would cease at the retiree's death and the policy would not provide any death benefits to beneficiaries. Together, the income streams in the two phases of the IPRA would assure lifetime income with a zero probability of financial ruin, similar to the benefits paid out under a DB pension plan. As I show later, the IPRA strategy allows the bulk of the retirement portfolio to be held in TIPS and requires only a small fraction of the retirement savings to be used to pay the nonrefundable longevity policy premium; this mitigates the 'large irreversible commitment' inherent in buying an immediate lifetime annuity with the entire retirement savings.

Institutional providers can develop and market plans wherein they would manage a participant's retirement savings portfolio and provide a lifetime income, first from the TIPS portfolio (that the participants could withdraw at any time) and later from the deferred annuity policy. There is a slight possibility that the availability of TIPS may become an obstacle if there is large excess demand from individuals and institutions seeking inflation protection. However, this is unlikely given the growth in the supply of TIPS in recent years and the ever-increasing federal debt. In March 2008, the total value of TIPS outstanding was \$474 billion or about 10% of all the U.S. Treasury securities held by the public; just six years earlier, in March 2002, the total value of TIPS outstanding was only \$145 billion or about 4.8% of the treasury securities.

As an alternative to TIPS, institutional providers with long investment horizons could invest in portfolios of stocks and bonds since historical evidence suggests that these portfolios generate higher returns (and higher risk) over the long term than portfolios of TIPS. Institutions opting for portfolios of stocks and bonds, rather than TIPS, may be able to keep all the excess returns and investment risks as long as they can guarantee investors a minimum rate of return. The IPRA model assumes that retirees would be guaranteed real rates of return that would at least equal the yields on TIPS.

4. Modeling the IPRA

To model the IPRA concept, assume that a group of retirees each invest '*P*' dollars of retirement savings with an institution and request a guaranteed lifetime income stream in return. The institution would use a fraction (‘d’) of the ‘P’ dollars to fund a deferred annuity and would invest the remaining amount [$P*(1-d)$] dollars in a portfolio of TIPS or other investments that would guarantee specific real withdrawal rates to the retirees. To avoid (or mitigate) the reinvestment risk problem, the investments in the portfolio would be laddered to provide an annual payout of ‘A_1’ at the beginning of each of the ‘t_1’ years in the first phase; the portfolio would have a zero balance by the end of the first phase. Assume that all investments in the portfolio yield real annual returns of ‘r_1’. Under these assumptions, A_1 can be computed as the amount on an annuity due, as shown below:

$$A_1 = \{P*(1-d)*(1 + r_1)\} / \{1-[1/(1 + r_1)^{t_1}]\} \ldots \quad (1)$$

At any time during this first phase, retirees would have the right to withdraw any amount of the outstanding balance or even drain the entire TIPS portfolio; the only consequence would be the loss of the A_1 series of payments.

In the second phase, the surviving retirees would receive an annuity of ‘A_2’ for ‘t_2’ years, that is, the period from the end of ‘t_1’ to the date of death. To fund this lifetime annuity, the institution would use (1) the initial premium ($P*d$ dollars) that would have compounded at a real rate ‘r_1’ over ‘t_1’ years and (2) the augmentation from the compounded premiums of retirees who do not survive the first phase. If the fraction of the initial retirees who survive to the beginning of the ‘t_2’ period is ‘m’, then the total principal available to fund the ‘A_2’ payments to each participant equals:

$$[P*d*(1+r_1)^{t_1}] \div m$$

Based on the above principal amount, and a real return of ‘r_2’ in the second phase, the annuity payment ‘A_2’ payable at the beginning of each of the ‘t_2’ years can be computed as:

$$A_2 = \{[P*d*(1 + r_1)^{t_1}) / m]*[1 + r_2]\} / \{1 - [1/(1 + r_2)^{t_2}]\} \ldots \quad (2)$$

The ‘A_2’ series of payments would be payable only if the retiree survives to the second phase; the annuity would not have any cash value or survivor benefits.

The institution would allow retirees to choose t_1, the number of years in the first phase; in this phase, they would have ownership of the portfolio including the right to bequeath their portfolio in the event of an early death or to otherwise divest the assets. The number of years in the second phase, t_2, would be the life expectancy of a retiree who survives to the end of the first phase and could be deduced from mortality tables. The retirees would have the option of choosing either ‘d’, the fraction of savings to be invested irrevocably in the deferred annuity, or A_2, the value of benefits in the second phase. Retirees who choose the fraction ‘d’ will have A_2 determined by the model. Alternatively, retirees who want to choose the value of A_2, (say, retirees who may want the same benefits in both phases or want a lower level of A_2 in relation to A_1) will have ‘d’, the amount they need to invest in the deferred annuity, determined by the model.

The numerical values of ‘d’, ‘A_1’, and ‘A_2’ can be computed by simultaneously solving Eqs. (1) and (2), using estimates for ‘m’, ‘r_1’, ‘r_2’, and the above inputs. The values of

Table 1 Probabilities of survival to different ages for males and females age 60 and older

Probability that a 60 year old retiree would survive to			Probability that a 65 year old retiree would survive to		
Age	Male	Female	Age	Male	Female
65	92.90%	95.40%			
70	82.90%	88.70%	70	89.30%	93.00%
75	69.40%	78.90%	75	74.70%	82.70%
80	52.30%	65.30%	80	56.30%	68.50%
85	33.00%	47.40%	85	35.50%	49.70%
Probability that a 80 year old retiree would survive to			Probability that a 85 year old retiree would survive to		
82	85.50%	89.80%			
84	70.60%	78.50%			
86	55.70%	66.30%	86	88.30%	91.50%
88	41.60%	53.60%	88	65.90%	73.90%
90	29.10%	41.00%	90	46.00%	56.50%
92	18.70%	29.30%	92	29.60%	40.40%

The survival probabilities above are computed from data provided in the Social Security mortality tables (http://www.ssa.gov/OACT/STATS/table4c6.html, accessed on September 23, 2007).

'A_1'and 'A_2', expressed as a fraction of the initial investment '*P*', would be the withdrawal rates available to the retirees.

4.1. An IPRA illustration

As an illustration, I estimate the real withdrawal rates that an IPRA strategy could provide for retirees with retirement savings of $500,000. I assume that the retirees, age 60 or 65 years, select 15 or 20 years for the first phase. I also assume that they elect to receive the same fixed withdrawal rate or real income in both phases.

Table 1 provides the probabilities of survival for males and females at selected ages, based on the mortality statistics used by the U.S. Social Security Administration. This table shows that for a 65-year-old male, the probability of survival to age 85 is 35.5% and, at age 85, the median male life expectancy is approximately five years. For a 65-year-old female, the probability of survival to age 85 is 49.7% and the median life expectancy for an 85-year-old woman is approximately six years.

Given that the retirees require the same level of benefits in both phases of retirement, I set A_1 from Eq. (1) to equal A_2 from Eq. (2) and solve simultaneously for the values of the variable '*d*' (the fraction that has to be invested in deferred annuities) and variables A_1 and A_2, (the income streams in the two phases). For this illustration, I assume that real returns, r_1 and r_2 are the same in both phases of retirement.

Table 2 shows the values of 'd', A_1, and A_2, for a range of real rates of return for male and female retirees. In one example, a 65-year-old male who opts for a 20-year first phase would have to set aside 6.45% of the total retirement savings (or $32,244) for a one-time, non-refundable payment on a deferred annuity under the 2% real returns scenario. The

Table 2 Annual lifetime withdrawal rates that can be supported with an investment of $500,000 in a portfolio of bonds *and* a deferred annuity policy, assuming that portfolios and deferred annuity premiums offer real returns of 0% to 3%

Assumed real returns on bonds portfolio and deferred annuity premium	Deferred Annuity premium ('*d*'), as % of savings	Deferred Annuity premium *('d')*, in dollars	Balance invested in bonds after deferred annuity premium *['P*(1-day)']*	Annual payout or withdrawal in constant dollars ('A_1'), *in first phase*	Annual payout or withdrawal rate, as % of total savings, in first phase	Compounded deferred annuity premium, by the end of first phase	Compounded def. annuity premium, augmented by mortality at end of first phase	Annual withdrawal, in constant dollars ('A_2'), *in second phase*
Male retirees, age 65, 15-year first phase								
3.00%	15.86%	$79,320	$420,680	$34,213	6.84%	$123,577	$219,549	$34,213
2.00%	17.40%	$86,999	$413,001	$31,512	6.30%	$117,090	$208,023	$31,512
1.00%	19.05%	$95,230	$404,770	$28,905	5.78%	$110,559	$196,420	$28,905
0.00%	20.80%	$104,015	$395,985	$26,399	5.28%	$104,015	$184,793	$26,399
Male retirees, age 65, 20-year first phase								
3.00%	5.71%	$28,552	$471,448	$30,766	6.15%	$51,569	$145,125	$30,766
2.00%	6.45%	$32,244	$467,756	$28,046	5.61%	$47,913	$134,835	$28,046
1.00%	7.26%	$36,318	$463,682	$25,441	5.09%	$44,314	$124,709	$25,441
0.00%	8.16%	$40,794	$459,206	$22,960	4.59%	$40,794	$114,802	$22,960
Male retirees, age 60, 20-year first phase								
3.00%	10.81%	$54,051	$445,949	$29,102	5.82%	$97,623	$186,751	$29,102
2.00%	12.22%	$61,111	$438,889	$26,315	5.26%	$90,808	$173,715	$26,315
1.00%	13.77%	$68,865	$431,135	$23,655	4.73%	$84,029	$160,746	$23,655
0.00%	15.47%	$77,331	$422,669	$21,133	4.23%	$77,331	$147,934	$21,133
Female retirees, age 65, 15-year first phase								
3.00%	22.28%	$111,379	$388,621	$31,605	6.32%	$173,525	$253,464	$31,605
2.00%	24.42%	$122,108	$377,892	$28,833	5.77%	$164,341	$240,049	$28,833
1.00%	26.70%	$133,517	$366,483	$26,170	5.23%	$155,009	$226,418	$26,170
0.00%	29.12%	$145,583	$354,417	$23,628	4.73%	$145,583	$212,650	$23,628
Female retirees, age 65, 20-year first phase								
3.00%	9.10%	$45,495	$454,505	$29,660	5.93%	$82,169	$165,495	$29,660
2.00%	10.27%	$51,353	$448,647	$26,900	5.38%	$76,308	$153,691	$26,900
1.00%	11.56%	$57,789	$442,211	$24,263	4.85%	$70,513	$142,020	$24,263
0.00%	12.96%	$64,821	$435,179	$21,759	4.35%	$64,821	$130,554	$21,759
Female retirees, age 60, 20-year first phase								
3.00%	15.92%	$79,575	$420,425	$27,436	5.49%	$143,722	$220,029	$27,436
2.00%	17.99%	$89,972	$410,028	$24,584	4.92%	$133,694	$204,676	$24,584
1.00%	20.26%	$101,312	$398,688	$21,875	4.37%	$123,619	$189,253	$21,875
0.00%	22.72%	$113,583	$386,417	$19,321	3.86%	$113,583	$173,888	$19,321

remaining 93.55% of the savings (or $467,756) would be invested in a TIPS portfolio earning the 2% real return. This portfolio would be used to support a real annual withdrawal rate of 5.61% of the $500,000 savings (or $28,046), during the first phase of 20 years beginning at age 65.

If the retiree lives beyond the first phase, the deferred annuity benefits would commence. This benefit would be funded by the deferred annuity premium (compounded at 2% annually over the first 20 years) *and* the augmentation from mortality. That is, since only 35.5% of 65-year-old male retirees are expected to survive to age 85, each 85-year-old male survivor would have his compounded deferred annuity premium ($47,913) augmented by the mortality factor to rise up to $134,835. This augmented amount would be sufficient to continue the 5.61% real payout for the remaining lifetime of the retiree.

The retirees could earn higher real withdrawal rates by opting for a shorter first phase; for example, 65-year-old males choosing a 15-year first phase, could withdraw as much as 6.3% of the total savings, assuming 2% real returns. Even in the worst-case scenario, where the real returns are 0% over both phases,[2] 65-year-old male retirees could withdraw as much as 4.59% over 20 years without any risk of ruin.

For female retirees the withdrawal rates would be slightly lower, given their lower mortality rates. The withdrawal rates for 65-year-old female retirees (with a 20-year first phase) range from 4.85% to 5.93%, assuming real returns are between 1% and 3%. Female retirees could significantly improve their withdrawal rates by opting for a shorter, 15-year first phase; doing so would allow them to enjoy lifetime withdrawal rates of 5.23% to 6.32%, though they would be investing a larger fraction of their savings in the deferred annuity than male retirees would at the same age.

The range of withdrawal rates shown in Table 2 are significantly higher than the fixed withdrawal rates recommended in the current literature and would eliminate the risk of financial ruin for retirees (though it would also eliminate terminal portfolios). It should be noted that the IPRA withdrawal rates shown above are based on the conservative assumption that real rates would range from 0% to 3%. Over the long run, institutional providers may be confident of earning higher real returns than the 0% to 3% range assumed here by investing in portfolios of stocks and bonds rather than TIPS. If so, they can offer IPRA products wherein they would guarantee real returns of 0% to 3% and then use actual returns earned in excess of the guaranteed returns towards their costs and margins. Alternatively, institutions could stick to investments in TIPS and charge fees or commissions to cover their costs and margins on IPRA products. The relative merit of the many approaches that institutions can adopt is a subject for future debate.

It is important to note that the IPRA withdrawal rates shown in Table 2 can only be achieved because of the mortality or pooling augmentation typically assumed in pure deferred annuities. The withdrawal rates would be significantly lower without this augmentation. For example, if a 65-year-old male retiree were to depend on his savings alone, the retiree would be able to withdraw at the 5.61% rate for just over 22 years before running out of money (assuming real returns of 2%). However, because the retiree can draw from the pool of money available to survivors at age 85, he would be able to enjoy the 5.61% real withdrawal rate over his lifetime.

5. Creating a personal IPRA

The preceding sections describe and illustrate a concept IPRA product that is not yet commercially available. However, retirees and their financial advisors can create personal IPRAs by investing in portfolios of TIPS, laddered to provide equal annual payouts in the first phase of retirement, and deferred annuities from reliable insurers that would pay out in the second phase. These personal IPRAs would offer retirees immediate control over their portfolio and save some of the costs that institutions would charge for IPRA products, if and when they become available.

To see how a personal IPRA can be created, consider the case of a 65-year-old female who retires with $500,000 in savings and wants to use it to generate the highest possible lifetime retirement income. She has no interest in leaving behind a terminal portfolio at death but would like to retain ownership of most of the savings until an advanced age. This retiree can create a personal IPRA by investing in a TIPS portfolio that would provide an income during the first phase of 20 years and in a pure deferred annuity that would pay after age 85. For this exercise, I assume she retires in April 2008 and that she needs income starting at the beginning of 2009. I also assume that the retiree decides to invest $50,000 (or 10% of the retirement savings)[3] in a deferred annuity and the remaining $450,000 in the TIPS portfolio.

For the first phase, the retiree invests in TIPS ranging in maturity from one to 20 years. The first four columns of Table 3 show the maturity, coupon rate, accrued principal, coupon payment, and the asking price of the TIPS that were available in April 2008. The retiree buys a sufficient number of each of these TIPS to generate an annuity over the 20 years. The exact numbers of each bond to be bought and the total investment needed to generate this annuity can be determined using an optimization routine such as the Solver function in Microsoft Excel. The results from such an optimization exercise are presented in the sixth and seventh columns of Table 3.[4] As shown in these columns, the retiree buys 12.45 bonds that mature in January 2009, 13.27 bonds that mature in January 2010, and so on.[5] The subsequent columns show the total cash inflows or the sum of the coupon payments from all the TIPS and the accrued principal on the maturing TIPS, for each of the years from 2009 to 2028.

As shown in the last row of Table 3, the total net cash flow from the TIPS portfolio adds up to $26,075 in each of the years from 2009 to 2028. Because TIPS coupons and principal payments are automatically adjusted for actual inflation, the $26,075 annual cash flow represents a 5.2% real withdrawal rate on the $500,000 retirement savings that can be realized without any exposure to default or inflation risks.

If the retiree survives the first phase and reaches age 85, she can collect the benefits from the deferred annuity that she purchased at retirement. There are several deferred annuities available in today's annuity markets that can be employed as part of a personal IPRA. For this exercise, I assume she buys the Longevity Income Guarantee-Maximum Income Version (LIG-MIV) annuity offered by MetLife; this annuity can be purchased with a single premium payment at any age from 55 to 79 and offers guaranteed lifetime benefits starting at age 85. Unlike most standard deferred annuities, the LIG-MIV is a pure annuity in the sense that it does not provide any refunds, death benefits, cash value or flexibility on starting dates; the sole benefit is the guaranteed stream of payments that flow to retirees who survive beyond

Table 3 Investments in a laddered TIPS portfolio required to generate a cash flow annuity over the 20 years from 2009 to 2028*

The maturity, coupon, accrued principal and prices shown below are from the Wall Street Journal of April 11, 2008.

Maturity date of TIPS bonds	Coupon rate	Accrued Principal on bond	Coupon pmt on bond	Ask Price for the bond	Number of bonds to be bought in 2008	Total investment in 2008	2009 cash inflows	2010 cash inflows	2011 cash inflows	2026 cash inflows	2027 cash inflows	2028 cash inflows
2009 Jan 15	3.875	$1,288.00	$49.91	$1,333.89	12.45	($16,609)	$16,659					
2010 Jan 15	4.250	$1,255.00	$53.34	$1,358.54	13.27	($18,033)	$708	$17,367				
2011 Jan 15	3.500	$1,213.00	$42.46	$1,336.95	14.32	($19,141)	$608	$608	$17,974			
2012 Jan 15	3.375	$1,189.00	$40.13	$1,331.68	15.12	($20,131)	$607	$607	$607			
2013 Jul 15	1.875	$1,150.00	$21.56	$1,232.66	16.16	($19,917)	$348	$348	$348			
2014 Jan 15	2.000	$1,143.00	$22.86	$1,230.87	16.56	($20,385)	$379	$379	$379			
2015 Jan 15	1.625	$1,106.00	$17.97	$1,165.45	17.46	($20,346)	$314	$314	$314			
2016 Jan 15	2.000	$1,064.00	$21.28	$1,147.13	18.44	($21,155)	$392	$392	$392			
2017 Jan 15	2.375	$1,047.00	$24.87	$1,162.17	19.12	($22,216)	$475	$475	$475			
2018 Jan 15	1.625	$1,008.00	$16.38	$1,052.10	20.33	($21,386)	$333	$333	$333			
2019 Jan 15[†]	2.375	$1,120.00	$26.60	$1,229.90	18.59	($22,866)	$495	$495	$495			
2020 Jan 15[†]	2.375	$1,120.00	$26.60	$1,229.90	19.03	($23,409)	$506	$506	$506			
2021 Jan 15[†]	2.375	$1,120.00	$26.60	$1,229.90	19.49	($23,965)	$518	$518	$518			
2022 Jan 15[†]	2.375	$1,120.00	$26.60	$1,229.90	19.95	($24,534)	$531	$531	$531			
2023 Jan 15[†]	2.375	$1,120.00	$26.60	$1,229.90	20.42	($25,117)	$543	$543	$543			
2024 Jan 15[†]	2.375	$1,120.00	$26.60	$1,229.90	20.91	($25,713)	$556	$556	$556			
2025 Jan 15	2.375	$1,120.00	$26.60	$1,229.90	21.40	($26,324)	$569	$569	$569			
2026 Jan 15	2.000	$1,064.00	$21.28	$1,106.56	23.06	($25,523)	$491	$491	$491	$25,032		
2027 Jan 15	2.375	$1,047.00	$24.87	$1,153.34	23.91	($27,574)	$595	$595	$595	$595	$25,626	
2028 Jan 15	1.750	$1,008.00	$17.64	$1,009.26	25.42	($25,658)	$448	$448	$448	$448	$448	$26,075
Total net cash flow, by year						($450,000)	$26,075	$26,075	$26,075	$26,075	$26,075	$26,075

*Cash inflows of only a select number of years are shown in this table, given space limitations.

[†]Bonds that mature in years 2019 through 2024 are not available. However, I assume that bonds that mature in 2025 can be bought in 2008 and liquidated in years 2019 through 2024 at face value (i.e., accrued principal).

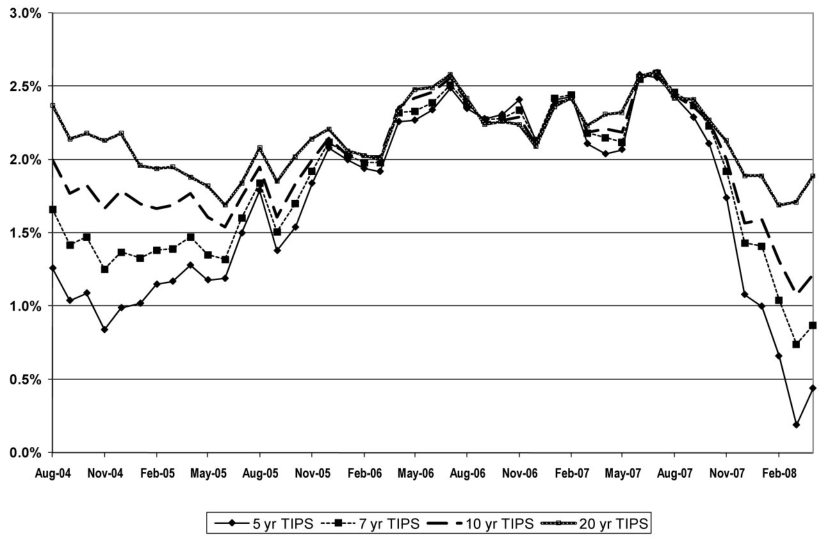

Fig. 1. Historical real yields on 5, 7, 10, and 20-year TIPS.

the age of 85. As a result, the LIG-MIV plan provides significantly higher benefits than other annuities that provide these auxiliary benefits.

In April 2008, MetLife's LIG-MIV plan guaranteed a 65-year-old female paying a single premium payment of $50,000, a lifetime nominal annuity of $40,860 starting at age 85. Unfortunately, the LIG-MIV payments are not indexed to inflation but this nominal annuity would be the equivalent of receiving $25,427 in April 2008 dollars, or 5.1% of the $500,000 initial portfolio, based on an expected inflation rate of about 2.4% (that is the difference between real and nominal yields of 20-year treasury securities). Though the actual rate can vary with unexpected increases or decreases in inflation, this 5.1% real withdrawal rate in the second phase is close to the 5.2% rate that the retiree receives in the first phase of retirement from the TIPS portfolio.

In summary, the IPRA strategy described above shows that, based on products and prices available in April 2008, retirees could create personal IPRAs that would support lifetime real withdrawal rates in excess of 5%, with a zero probability of financial ruin. This is significant, especially in light of the fact that the prices (yields) of TIPS in April 2008 were at historic highs (low); the weighted average real yield on all the TIPS used in the first phase of the IPRA described above is a relatively low 1.45%. Fig. 1 shows the quoted yields on 5-year, 7-year, 10-year, and 20-year TIPS over the last five years. If TIPS prices and yields were at levels seen in earlier periods, the retiree in the above example would have earned a withdrawal rate higher than the 5.2% computed above. For example, if the prices of TIPS were at the August 2007 levels (when the weighted average yield was 2.57%), the real withdrawal rate under an IPRA would be as high as 5.8% of the $500,000 retirement portfolio.

As with any recommendation, the IPRA strategy developed here has to be accompanied by a few caveats. The transaction costs involved in creating a personal IPRA have not been considered and may reduce the withdrawal rates in practice; however, the effect may be minimal, with most of the costs being incurred upfront in purchasing the TIPS securities and deferred annuity. The IPRA strategy described here works best when the first phase is 20 years or less; at this time, longer periods pose a problem because TIPS with maturities longer than 20 years are scarce, though that may change in the future. The effects of taxes have not been considered and can be complex, depending on how the payouts from the TIPS and deferred annuity are treated. If institutions were to combine the two streams in an integrated IPRA product, additional tax complexities may come into play. Finally, the availability of TIPS offering positive yields can also affect the IPRA strategy. As seen in Table 2, male retirees aged 65 or older can enjoy real withdrawal rates in excess of 4.59% when real yields are as low as 0%. However, if the demand for TIPS explodes and real yields for all maturities drop below 0%, then the withdrawal rates would be lower than what is reported here.

6. Conclusion

The gradual disappearance of the defined benefit pension plan is creating an increasing need for retirement products that offer the kind of predictable income and the lifetime protection that DB plans offer, as evidenced by the abundance of newspaper and magazine articles and ‘free’ seminars on how to manage retirement funds and avoid running out of money. Traditional single-premium life annuities that offer attractive real withdrawal rates would meet this need but empirical evidence suggests that retirees are reluctant to give up ownership of the substantial accumulations in their 401(k) and other retirement accounts in exchange for a guaranteed annuity. This reluctance is an issue that did not surface with traditional DB plans since retirees did not own or even know the amount of money that was available to employers and insurers to fund their DB benefits. However, because retirees are now aware of exactly how much they have in their retirement savings account and are reluctant to invest the entire sum irrevocably in a lifetime annuity, it is necessary to create and offer new strategies and products that will address their need for predictable income and lifetime protection, while simultaneously allowing them to retain ownership of a significant part of their savings. The IPRA strategy proposed in this paper does that and can be used to develop integrated financial products that meet the multiple needs of retirees.

Retirees who adopt the IPRA strategy can enjoy freedom from the prospect of financial ruin and attractive withdrawal rates, benefits typically associated with defined benefits pension plans. Beyond this, retirees will find that the IPRA is superior to DB plans in the sense that they would continue to own 70% to 94% of their retirement savings. This will provide them the satisfaction of knowing that their unused savings will pass on to their chosen beneficiaries rather than other survivors in the annuity pool if they do not survive the first phase. Retirees would also retain the right to draw on their portfolios during the first phase of retirement for any reason and, if they survive beyond the first phase, the right to receive a lifetime annuity irrespective of what they chose to do in the first phase. The IPRA strategy offers multiple benefits that are not typically available with financial planning strategies currently being recommended to retirees.

The historical real returns on equity and bond portfolios suggest that institutions can profitably create and offer product based on the IPRA strategy to retirees. However, retirees do not need to wait for institutions to offer such a product. They, along with their financial planners and advisers, can create their own personal IPRAs by combining investments in TIPS along with commercially available longevity insurance products.

Notes

1. Other firms were offering similar annuities with *nominal* annual payouts of 7.9% to 8.9% of the premium investment.
2. In April 2008, some short-term TIPS were trading at negative yields in the markets for the first time ever in the history of TIPS. However, even then, the weighted average yield of TIPS over a 20-year span was a positive 1.4%.
3. If the retiree desires to get the same level of income in both phases, deriving the optimal distribution between the deferred annuity investment and the TIPS portfolio, as done in Table 2, is not possible because deferred annuities commercially available today do not provide inflation adjusted income. However, the retiree can assume different rates of inflation and arrive at the annuity investment amount iteratively.
4. To 'solve' the optimization problem, it is necessary to have bonds that mature at the end of every year. However, there were no TIPS that matured in years 2019 through 2024. To get around the problem, I assumed that bonds that matured in 2025 could be bought now and liquidated at the accrued principal value in each of the years from 2019 to 2024.
5. In practice, the number of bonds to be bought will have to be rounded up to whole numbers and may result in a stream of payments that varies by a few hundred dollars from year to year.

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