"Insights" features the thoughts and views of the top authorities from academia and the profession. This section offers unique perspectives from the leading minds in investment management.

TOWARDS REPLACING THE DEFINED BENEFIT PLAN: ASSURED RETIREMENT INCOME PROVIDED BY A LIQUID INVESTMENT FUND

Miguel Palacios[a], Hayne Leland[b] and Sasha Karimi[c]

Traditional corporate defined benefit (DB) plans provided retirees with constant retirement income, but DB plans have now all but disappeared. While defined contribution (DC) plans now permit low-fee wealth accumulation, the conversion of wealth to predictable nominal or real income during retirement remains opaque and expensive. Complicated, illiquid, and high-fee products dominate the landscape. The goal of acquiring low-fee, predictable future income in retirement, has remained elusive. We describe a relatively simple, liquid, and low-cost series of funds that can address this challenge. The key features are: (1) A minimum assured annual income (real or nominal) for a significant period of time. (2) Maximal exposure at all times to a higher-expected-return risky asset, while meeting the income assurance per share. (3) Liquidity that allows investors' flexibility to withdraw funds or change assured levels of income at any time, with minimal cost. (4) A simple but significant "behavior nudge" that gives clarity on the future income levels: each share will provide a minimum income of $1 per year for 20 years with the possibility to be extended for lifetime. An investor will know future assured income simply by knowing the number of shares she/he owns. (5) Scalability through reliance on underlying securities backed by the deepest markets in the world. While a strategy to provide the features above is relatively straightforward for a single investor, a deeper challenge is to create a fund that provides these features to all investors, regardless of when shares are purchased. We consider the nature of asset management that achieves all the previous features in a single fund, and believe that it can be done while qualifying for QDIA status.

[a]Associate Professor of Finance, Haskayne School of Business, University of Calgary, Calgary, AB, Canada, and Principal, A&P Capital, LLC.
[b]Professor Emeritus, Haas School of Business, University of California, Berkeley, and Principal, A&P Capital, LLC.
[c]Adjunct Professor, Hult International Business School, and Principal, A&P Capital, LLC.

1 Introduction

Traditional corporate DB plans provided retirees with constant retirement *income*. The rise of DC plans, however, upended the comfortable situation for plan participants by shifting to them the responsibility for choosing what to invest in *and* how best to withdraw funds from their plans. In response, much emphasis has been placed on helping participants in 401(k)s and similar plans invest their savings, with the target date retirement fund (TDF) pulling ahead recently as the vehicle of choice for a large number of plans. However, while DC plans now permit low-fee wealth accumulation, *the conversion of wealth to constant nominal or real income during retirement* remains opaque and expensive. Complicated, illiquid, high-fee, and relatively little-used products dominate the landscape. Furthermore, future retirees have difficulty making contribution decisions when they have little idea of how much future income their savings will generate. As a result, they may substantially under- or over-save for their projected needs.

We describe below a type of fund that tackles the challenge of helping retirees convert wealth into constant income. This income stream may continue for a known amount of time or until the retiree's death. Its multiple features follow from the dual goals of removing the risk from plan sponsors' balance sheets, as with DC plans, and restoring the simplicity of the DB plan. Its payout promises are backed by a liquid portfolio capable of absorbing the trillions of dollars owned by investors approaching retirement. We justify the fund's features by applying a modern theoretical framework, employing the lessons learned from 40 years of research in behavioral finance, and considering numerous surveys of what plan participants themselves say they need. The main features of the fund are:

Assured minimum income: Program participants, when asked, state that their main goal is to secure a constant source of income in their retirement years.[1] More than high expected returns or high Sharpe ratios, future retirees want to know how much income they will receive upon retirement. Expectations or probability distributions of income are clearly not good enough. They seek what the DB program of the past offered: an assurance of some level of income they can count on. An appealing solution for retirement plan participants therefore must offer assured income. The best assurance one can offer consists of payments fully, and transparently, collateralized by the repayment of government-backed securities, as these would provide payments even if the stock market crashes or interest rates go negative. Such circumstances would likely stress most annuity providers, particularly those with large numbers of participants.

Upside potential: While a constant income is desirable, investors do not want to be left behind their peer group when markets perform well.[2] They also want to enjoy the additional consumption afforded by capturing a lucky streak in the market. As the growing popularity of target date funds shows, investors would rather obtain these benefits without having to manage the allocation to risky securities themselves, implying that the risky allocation should be wrapped inside the fund. Additional consumption can come in various forms, e.g., extended payments—by using some of the gains to purchase a deferred longevity annuity (QLAC), increased income starting at retirement, or whatever else the investor desires.

Liquidity: While expecting a constant income, investors often state that they would like to have low-cost, transparent access to their wealth for emergencies or shifts in their needs that make an early withdrawal preferable. On the other hand,

other investors may wish to defer taking immediately available payouts, and reinvest the proceeds for greater future income. While fund-based products typically offer liquidity and thus flexibility, most annuities do not.

Simplicity: Products that require significant financial literacy in order for the investor to figure out their retirement income are undesirable.[3] Such complexities result in future retirees having difficulty in making contribution decisions since they do not have a clear idea of how much income their savings will generate in the future. Instead, ways to easily and clearly communicate how much *minimum* income an investor can expect, akin to what old DB plans did, are preferred. Similarly, the best solutions will require less active management from investors beyond the contributions they make to the fund.

Suitable for trillions in AUM: A robust retirement solution needs to be able to sustain a multi-trillion-dollar market. A direct implication is that any income-generating product will necessarily have to use government securities as part of its building blocks. A corollary of this result is that investors will need to factor in the cost of investing in government-backed securities, or, in other words, will need to be realistic about the high cost of assuring $1 of annual income in the future.

Can all of the previous goals be achieved? The answer is "to a great extent they can be." Below we describe the implementation of the low-cost fund that achieves all these goals.

2   A Robust, Liquid, Income (RLI) fund

We call the fund that achieves the goals described above the Robust, Liquid, Income (RLI) fund. The fund is divided into two separate components: the Maximum Income Fund (MIF) and a risky

asset portfolio such as an equity index fund. The MIF consists of a Separate Trading of Registered Interest and Principal of Securities (STRIPS) ladder[4] which provides assured income. The assurance is fully collateralized by repayments of US government-backed securities—unique in being able to sustain a multi-trillion-dollar market. Income is assured even if equity markets go to zero and/or interest rates are negative, as long as the US Treasury does not default on repayments. The risky asset portfolio creates upside potential if risky assets perform well during the investment period. Gains from this component can be used to increase the amount or extend the term of retirement income. For purposes of this paper we assume an allocation of 80% of fund AUM to the MIF (c.f. paragraph following Figure 2 on page 10).

The first and most important feature of the RLI fund is its provision of a minimum assured annual income for a significant period of time, typically 20 years, beginning at a future target date. To define the assurance in precise terms we make reference to a hypothetical fund 100% invested in a STRIPS ladder with the same payout period. We call this fund the Maximum Income Fund (MIF) because a fund 100% invested in a STRIPS ladder provides the *highest possible annual income* an investor can hope to receive during the payout period without taking any risk (or taking the least risk of all, assuming US government securities are the safest assets available beyond cash).[5] Achieving any higher income requires taking risk, and rather than expressing the tradeoff as one of higher risk, higher return, we prefer to say that higher expected income requires assuming lower assured income. The assurance provided by the RLI fund is that, per dollar of investment, it will generate at least 80% of the income generated by the MIF during the same payout period.[6] Our investment allocation algorithm assures this minimum

income result, no matter when an investor enters the fund and no matter the future price movements in equity and fixed income markets.[7]

Satisfying the 80% assurance is trivially easy: simply allocate 100% of an investor's contributions to the MIF and the assurance will be met. The second distinguishing feature of the RLI fund is an algorithm for allocating funds between the MIF fund and a risky asset such that the 80% assurance is always met *while maximizing exposure* to the risky asset.[8] Since the risky asset's expected return will be higher than the return from the MIF, another way of expressing the second feature is that the fund rebalances between the MIF and the risky asset so as to maximize the expected return obtained from a portfolio invested in both assets (the MIF and the risky asset) while assuring the 80% assurance is met. Whereas a strategy that satisfies the assurance is relatively straightforward for a single investor, one that satisfies the assurance to all investors, *regardless of when fund shares were purchased by the investor*, presents its own set of challenges. Below we illustrate one such challenge and describe the counterintuitive and appealing properties of the solution we found to confront it.

The third feature of our proposed fund is a behavioral nudge: each share in the fund assures $1 of annual income during the payout period, which we recommend to be 20 years. This design feature exists so that an investor and fund record keepers will know future assured minimum income simply by knowing the number of shares they own.[9]

Finally, because the fund only buys liquid assets, shares of the fund will trade in exchanges like any other fund. Thus, investors can easily sell all or some of their shares at any time, with minimum cost, should they decide to tap into their assured income to finance extraordinary expenses.[10] In this way, the fund fulfills the goal of providing a liquid alternative to other products that demand investors renounce having access to their income before the payout period begins.

The features of the fund described above satisfy all the requirements for Qualified Default Investment Alternative (QDIA) status. In particular, its liquidity allows participants to easily transfer the investment from the fund to other alternatives, and its design satisfies the requirement of being diversified so as to minimize the risk of large losses.[11]

2.1 The theory behind the RLI fund

DB plans offered income assurances under the assumption that what retirees needed was income commensurate with the income they received as employees. Such assumption meant that corporate employers did not have to derive optimal consumption and investment rules for their employees, but instead could focus on the simpler problem of ensuring that they could satisfy the promised future pension payments. Now that DC plans are growing at the expense of DB plans, individuals need to decide what objective they will follow: one where they attempt to maximize a measure of their well-being by optimally choosing how much to consume and how to allocate their investments—call this the DC problem—or one where their focus should be in producing enough income during retirement—the DB problem.

These two problems are obviously related, yet the recent emphasis on income-generating products highlights that the second problem did not receive much attention during the last few decades. One possible reason is the growth of modern portfolio choice theory, which produced striking results regarding asset allocation (only a combination of risk-free securities and a market portfolio is needed) but which was silent about the income (perhaps over many years) an investor could

expect in the future.[12] This silence followed from a set of assumptions that have been shown to be flawed. Updating those assumptions delivers prescriptions for better retirement products. We proceed to explain these below.

The classic maximization of utility of consumption framework used originally by Samuelson, Merton, and others, which served as the foundation for investment and consumption planning used in the asset management industry— including the part of the industry that focuses on retirement products—prescribes a relatively simple optimal portfolio allocation: while accumulating, uninformed investors only need to choose between two funds: a risky and a riskless fund. Optimal allocation between those funds is only a function of risk aversion, and the optimal savings rate (as a fraction of wealth) depends only on the dynamics of the assets. However, the classic utility maximization paradigm suffers from multiple limitations widely recognized by academics and practitioners. One such limitation is the assumption that the utility investors derive from consumption is independent of previous levels of consumption. This assumption appears to fail empirically in several ways. We highlight two here: first, adjusting consumption downwards appears to be disproportionately costly. Research focused on this question, and casual observation, both point towards the opposite: previous consumption matters for the investor's well-being today[13]; and second, the well-being investors appear to derive from their consumption depends on the consumption levels of others.

These observations have direct implications for the investor's optimal investment and consumption. The large apparent cost of adjusting consumption downwards implies that investors will seek investment alternatives that protect their consumption levels over time, i.e., they will seek products that offer income assurance for a cost.

Investors will also experience regret if everyone else can afford higher consumption levels. The implication is that investors will want to hold a fraction of their wealth in risky assets whose values go up when others' wealth goes up.

A broader limitation of the classic utility maximization framework is that investors can calculate their optimal portfolio and consumption decisions over time. In reality, investors find it daunting to decide how much to save and how to allocate their savings.[14] Target date funds grew as a response to the need for a simple and inexpensive solution to address the investor's allocation decision, yet a perhaps more important task remains unaddressed: how to translate wealth accumulation to income upon retirement? A direct implication from this observation is that income-generating products targeting retirees should aim to simplify the calculations of how much to save for retirement. This can be facilitated when investors know at any time how much annual income (over a 20-year retirement period) can be purchased for each $100 invested.

Finally, we note that, following early academic work by H. Markowitz and W. Sharpe, finance practitioners have regularly assessed portfolio performance based on the mean and variance of annual returns.[15] While reasonable under strong assumptions, this metric is poorly suited for evaluating a strategy providing for a stream of future retirement income.[16] For example, consider evaluating a strategy for an investor wanting to secure (nominal) income at a single future date, say 20 years hence. Holding a zero-coupon bond maturing in 20 years with no default risk would eliminate risk, and thus could be considered the riskless asset. Yet the (long duration) bond will experience considerable variation in its market value prior to maturity, and thus will be assigned a high risk (variance) when annual portfolio returns are considered. We also note that

typical mean–variance (or Sharpe) measures do not reflect asymmetric aversion to downside risk or "skewness preference", as studies of investor preferences suggest.[17]

3   Dissecting the RLI fund

The RLI fund consists of two asset portfolios: the MIF, which is a STRIPS ladder, and a risky asset portfolio that can be actively or passively managed.[18] The MIF provides assured income and can be considered the "riskless asset" for income over the retirement period. The risky asset portfolio delivers upside potential if risky assets perform well during the investment period; those assets can be as risky as desired, as long as their minimum possible payoff is zero (thus ruling out explicitly levered positions, but allowing for options and other limited liability instruments). The next section discusses each component in more detail.

3.1   Component 1: The maximum income fund (MIF)

The first component of the RLI is the Maximum Income Fund, which consists of a STRIPS ladder. The ladder is constructed with the first STRIPS maturing on the starting date of the fund's income payouts (say, for example, 2029), and the last

one defined by the length of the payout period, where the maximum length is constrained by the availability of the longest lived stripped security (as of writing, the longest living STRIPS mature in 2049, the maturity date of the most recently issued 30-year Treasury bond).[19] Many different combinations of starting years and payout periods can be used when designing an income-producing product. We focus here on ladders where the first payment begins 10 years after a fund's inception, with a 20-year payout period.

The choice of a 10-year maturity period combined with a 20-year payout period follows from Social Security data, which shows that someone retiring at age 65 today can expect to live roughly twenty more years.[20] Thus, a 20-year payout period covers a retiree's income through the expected length of her/his retirement. Since the longest maturities for Treasuries are 30 years long, we are left with a 10-year planning period ahead of retirement. Throughout the rest of this paper we will use this 10-year maturity and a 20-year payout period, though we emphasize that these are reasonable values, not innate characteristics of the RLI fund. Other potential combinations of maturing and payout periods exist—for example, 15 years until the first payment and 15-year payout period, or 5-year target date followed by a 25-year payout period—with
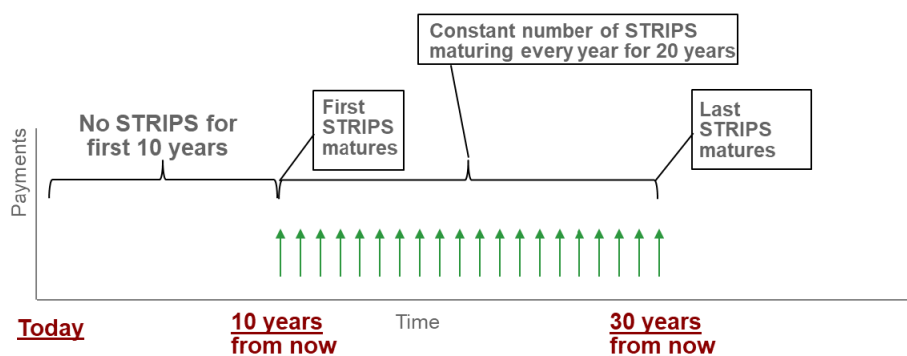

Figure 1   Schematic of a STRIPS ladder, with the first STRIPS maturing 10 years from now and the last STRIPS maturing 30 years from now.

the only constraint being that STRIPS can be found to back the last payment in the fund. As of this writing the constraint implies that one can design income-producing products backed by US STRIPS 30 years ahead. For many investors the 10-year maturity period coincides with the "red zone", the period during which pre-retirees focus intensely on post-retirement, e.g., ages 55–65.

The STRIPS ladder ensures that a participant in the fund will receive a constant income during the fund's payout period, backed by the credit and faith of the US government. A possible alternative to using STRIPS is to employ corporate bonds, or fixed-income securities backed by other entities. Whereas the use of such bonds could provide investors with a higher yield, we note that their supply is inadequate to handle the large accumulations of wealth available to produce retirement income for a significant fraction of the population.[21,22] The most obvious objection to using corporate bond debt, though, is not its size, but the fact that it is risky: the extra yield earned by these products reflects risk to retiree's income. Retirees who have little or no ability to supplement lost income should not bear that risk. Thus, even though the fund we describe in this paper could be pieced together with risky fixed-income securities, we see such an alternative as neither viable on large scale, nor desirable.

A final reason for constructing the bond ladder from STRIPS is that plan sponsors can default plan participants into the RLI fund while minimizing their own legal risk, knowing it is the safest income option available. Additionally, the features of the RLI fund satisfy all the requirements for Qualified Default Investment Alternative (QDIA) status. Permitting sponsors to default participants into the RLI fund will be a major impetus for its inclusion in 401(k) plans, as demonstrated by the growth in AUM for target

date funds that followed when those funds were accorded QDIA status.

We conclude this section by noting that the MIF can be modified to cover expected cost of living adjustments or, in a limited case, to generate inflation-protected income. Cost of living adjustments (COLAs) can be handled with a STRIPS ladder in which the number of STRIPS in the portfolio for payoff years is adjusted upwards to reflect the anticipated inflation rate. More precisely, the number of STRIPS maturing on a given year would be $x\%$ larger than the number maturing the previous year, where x is the desired cost of living adjustment. Of course, this method only hedges expected inflation, and is riskier than a solution that is linked to an actual inflation index.

A second possible modification to the STRIPS ladder is the replacement of STRIPS with Stripped Treasury Inflation-Protected Securities (STIPS). In this case the resulting payments from the maturing of the ladder's securities would adjust upwards with inflation, in effect creating a constant income stream in real terms. Theoretical models of savings and consumption all prescribe the use of inflation-adjusted instruments, and indeed the use of STIPS should be the preferred method for providing retirees with an assured real income.[23] Two problems challenge the current use of TIPS (or STIPS) for a widely-adopted retirement product. First, the supply of outstanding TIPS is a small fraction of that of nominal treasury securities, and currently is insufficient to satisfy demand from a large retired population. Second, few TIPS have been stripped to create STIPS. Of course given investor demand, the US Treasury may decide to increase the availability of TIPS (and therefore STIPS), at which point the optimal implementation of the MIF could switch to providing inflation-protected income using these instruments.

3.2 Component 2: *The risky asset portfolio*

The second component of the RLI fund is a risky asset portfolio (potentially a fund). This component of the RLI fund provides upside potential for the investor and lessens the regret from falling behind at times of high equity returns. Two relevant questions arise: what should be used as a risky portfolio, and how much should the fund allocate to it? We discuss the allocation problem later. Immediately below we discuss possible candidates for the risky security.

Preference for a diversified low-fee market-traded security or portfolio follows from standard practice: such securities plausibly provide investors with the largest compensation for risk (highest Sharpe ratio), implying that for any desired risk level, investors can expect the highest possible return. An important question is whether this return should be leveraged, through futures or options. However, futures require daily resettlement and could potentially violate the income guarantee if STRIPS need to be sold to meet margin calls. Options have limited liability but, unless a liquid option is available that matures on the target date, will also pose uncertain cost. Finally, it is unclear whether a fund using such derivatives would qualify for QDIA status. We therefore conclude that the preferred risky asset is an equity-index portfolio as the risky portion of the fund. We stress that, as with the availability of STIPS, changes in the volume and availability of implicitly levered products on widely diversified securities could change our recommendation.

3.3 Lifelong income assurance: The role of QLACs

The STRIPS holdings in the RLI fund assure income over a fixed retirement period following the retirement target date. Currently the longest available STRIPS maturity is 30 years. If the fund is initiated 10 years prior to a given target date, then a maximum of 20 years assured retirement income can be provided by STRIPS after that date. With investors retiring at 65, the STRIPS portfolio generates income through age 85. How should an investor generate income beyond the age of 85? The lack of availability of STRIPS requires another source to continue lifetime income beyond that age. Fortunately, there is an available product well suited to provide this extension: the Qualified Longevity Annuity Contract (QLAC).[24] These are relatively low-cost annuities, reflecting mortality credits. Recognizing their usefulness, current regulations allow for the inclusion of QLACs as QDIA investments.

The component of the portfolio not invested in the STRIPS ladder can be viewed as the component that will fund the QLAC at the target date. Put differently, the risky component of the portfolio will fund income beyond the assured payout period. Once this consideration is taken into account, then the characteristics of the risky asset—in particular its expected return—define how large the investment in the risky asset should be.

Our analysis leads us to recommend 20% as the initial proportion of the fund allocated to the risky asset. Based on simulations using stylized market data, an allocation of 20% will assure that a retiree can continue with income *at least as high* as their minimum payout-period assured income 94% of the time, and at least 67% of their minimum payout-period assured income 99% of the time. On average the income they can purchase through a QLAC is 17% higher than the minimum payout-period assured income.[25]

3.4 A fund that pays $1 *annual retirement income per share*

A persistent complaint that the general public expresses about retirement products, particularly income-generating ones, is the complexity behind each of them. Widely used Target Date funds,
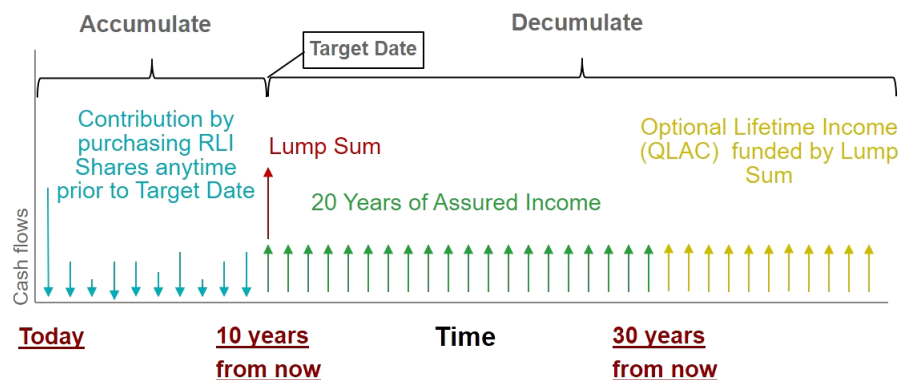
Figure 2 Schematic of the RLI fund's cash flows assuming purchase of the QLAC.

for example, can only make statements about "glide paths", leaving tremendous uncertainty about how each additional dollar contributed will result in additional retirement income. As a result, investors have made poorly informed and occasionally disastrous choices in their savings for retirement—occasionally too much, but all too frequently, too little. In contrast, the RLI fund is designed to deal explicitly with this issue: each share of the RLI fund will assure $1 of income annually during the payout period (20 years in the examples used above). In combination with a QLAC annuity (see above), this income can continue for life. While the share price will fluctuate with asset value over time, the assured income per share will not. This feature makes it transparent to investors what they will get ($1 annual income per share) during the payout period. It will also enable the investors to plan for the number of shares they need to buy to achieve their desired level of income (if the desired income is X, then they need to own X shares upon reaching retirement). The price of each share will fluctuate over time, but the assured income per share will not. Furthermore, when the risky portfolio outperforms the STRIPS portfolio prior to the terminal date, shareholders will receive noncash dividends: additional shares (continuing to provide assured income of $1 per share) will be distributed to current shareholders through a split

of RLI shares.[26] The asset allocation process of the RLI fund therefore permits assured income levels to "ratchet up" with positive risky (e.g., equity) returns through increased shareholdings, while protecting the income level against subsequent declines. This benefit is unique to the RLI fund and cannot be provided by a STRIPS-only fund or by a constant-rebalancing strategy, as explained below.[27]

4 Asset allocation in a fund for multiple investors that pays $1 per share

While it is relatively simple to design a fund assuring a minimum income for a single investor, the asset allocation of a fund in which many investors can participate while still maintaining the minimum income assurance defined above, regardless of when investments into the fund take place is not obvious. A single sophisticated investor who decides to allocate 80% to a STRIPS ladder and 20% to the risky asset can plausibly manage their own retirement portfolio, rebalancing and allocating new contributions appropriately. Less knowledgeable investors, however, will find it challenging to deal with the fractions of STRIPS required to maintain their desired allocation. Furthermore, even sophisticated investors may not want to spend the time required to

systematically allocate and rebalance their investments by themselves.

The RLI fund's shares provide the following benefits below to multiple investors:

(i) Minimum annual retirement income equal to 80% of the maximum possible riskless income for same $ investment at any period, plus potential upside from risky portfolio;

(ii) Minimum assured income of $1 per fund share, no matter how asset returns vary;

(iii) Maximum allocation to risky asset (maximize expected return), subject to (i) and (ii) being satisfied;

(vi) High probability that income level can be extended beyond age 85 through a QLAC;

(v) Returns to any investor are not affected by the contributions/withdrawals of other investors; and

(vi) QDIA status due to asset diversification and fund share liquidity.

Achieving these goals implies that allocation rules must be more sophisticated than the ones followed by simpler funds such as target date funds, or by a constant rebalancing rule (say to 20/80). The example in the Appendix shows why such simple rules will not deliver the desired features above.

How then should the fund be rebalanced? A casual observer will note that the $1 per share assurance can always be maintained, after the original investors have made their first contribution, by subsequently investing 100% of the portfolio in the STRIPS ladder. That solution, of course, is not satisfying as it implies less allocation to the risky asset than desired.

We have formulated the allocation rule that maximizes the fund's exposure to risky assets while maintaining every investor's income assurance (regardless of when s/he contributes or withdraws funds), and analyzed its implications for the fund's behavior. The most surprising result, which goes against the prevailing intuition, is that under mild conditions the fund's returns depend only on the returns derived from the STRIPS ladder and the risky asset, and *not* on the history of contributions and withdrawals of the funds' participants.[28] This extraordinary result implies that the advantages of the fund we described can be had without exposing investors in the fund to negative consequences should others decide to withdraw *en masse*.[29] Simulations show that annual turnover (excluding contributions/withdrawals) to meet fund objectives averages less than 3.6% annually.[30]

The allocation rules do imply that, with some frequency, the fund will generate *too much income* per share. Whenever this happens, the fund shares are split, such that each new share maintains the $1 per share assurance, with previous participants earning extra shares. Every time the fund splits, the assurance for previous investors implicitly increases (since now they have more shares), whereas new investors enter at $1 per share assurance. Thus, when equity returns are strong relative to STRIPS, participants "lock in" gains from the equity portfolio.

To summarize this section, fund management rules exist that can satisfy the desirable features enumerated (i)–(vi) above. These objectives can be obtained with low turnover, even when rebalancing takes place daily. Finally, the trading required by the rebalancing strategy does not accelerate equity volatility: risky assets (e.g., equities) are never sold (barring fund redemptions) after they have declined in value relative to STRIPS.

5 Conclusion

We have presented the design for a fund that achieves many of the current challenges of

converting wealth into income: the Robust Liquid Income (RLI) fund. The fund dynamically allocates between a Treasury securities portfolio and a liquid portfolio of risky assets (active or passive) to achieve the six objectives outlined in Section 4—most importantly, to generate an assured annual income over a fixed period that commences at a target date.[31] The assurance is backed by verifiable holdings of Treasury securities, and will hold regardless of possible stock market crashes or negative interest rates.

The fund's construction includes an important behavioral nudge that will allow future retirees to determine their current required savings for retirement income much more clearly than current investment vehicles. Each RLI share assures an annual payment of $1 during the payout period. Thus buying, say, 100 shares of the RLI fund at current market price per share will assure at least $100 per year of retirement income through the payment period, and likely for the rest of the retiree's life. Compare that promise with investing an equivalent dollar amount in a typical investment fund. Such a fund may provide a probability distribution of future value, but the actual income that will result is uncertain even for investment professionals, much less for the average retiree. Enormous social benefits will accrue from an investment fund that allows future retirees to see how current savings can directly augment future retirement income. As such, it can vastly improve the efficiency of retirement planning.[32]

We believe that the RLI fund provides an excellent tool for Target Date Funds (TDFs) to convert wealth into income. One possible approach is that 10 years before the target date of the TDF, TDF assets are transitioned into an RLI fund, or an RLI allocation process within the TDF, thus converting wealth into assured income in a systematic manner.

The RLI fund can be created today, using known, liquid securities. It simply awaits a first mover to offer it to investors.

Appendix

To see why a constant allocation rule will not satisfy the fund's assurance, consider the following example. Suppose the fund starts with a single investor who buys 1,000 shares of the fund. Given the $1 dollar per share assurance, the fund must hold the MIF consisting of a STRIPS ladder with 1 STRIPS per year (using the maturity value of a US government bond of $1,000). Because this is the first investment of the fund, it allocates 80% to the STRIPS ladder and 20% to the risky asset. (Note, to know exactly how much the fund has invested in the STRIPS ladder and the risky asset, we need their prices. We do not need them for the calculations that follow, and thus do not include them in the example.)

Suppose the risky asset performs poorly, with its value decreasing 10%. In contrast, suppose the STRIPS ladder had no price change.

The weight of the risky asset in the fund is now $20\%^*(1-10\%)/(20\%^*(1-10\%)+80\%) = 18.4\%$.

Now suppose a second investor comes along. How should the new funds be allocated? Note that to maintain the $1 per share assurance, the new investor would have to join with an allocation of 18.4% to the risky investment. The new investor cannot come in with a 20% allocation, as that would require rebalancing the original investor away from STRIPS, in effect preventing the fund from holding a $1 per share assurance. Thus, in this example, to maintain the $1 per share assurance, the new investor's capital would have to be allocated 81.6%/18.4%.[33]

One can find other situations that illustrate the challenges of rebalancing between the MIF and

the risky asset while maintaining the promised assurances to all investors. We point out here that simply maintaining the fund's current allocation between the STRIPS ladder and the risky asset will not suffice.

Notes

[1] See for example Blackrock's "2019 Blackrock DC Pulse Survey," https://www.blackrock.com / us / individual / financial - professionals / defined - contribution / news - insight-analysis/driving-well-being-through-retirement-preparedness#retirement-income.

[2] See evidence on satisfaction linked to relative pay: https://psycnet.apa.org/record/2008-05281-013. More generally, this feature prevents "regret aversion", captured in the popular acronym: Fear of Missing Out (FOMO).

[3] While "glide paths" of TDFs are reasonably transparent, where they "land" at the target date is quite obscure. Participants may be provided means and variances of their ending wealth, but very substantial uncertainty remains as to actual wealth at retirement. And converting that wealth to annual retirement income adds yet further uncertainty.

[4] STRIPS ladders are better suited to deal with an income-generating product whose payments do not start immediately than bond ladders because they do not suffer from reinvestment risk.

[5] A STRIPS is a zero-coupon bond (or "bullet bond") paying a fixed amount (e.g., $1,000) at a given maturity date, fully secured by principal or interest payments on US Treasury notes/bonds. A STRIPS ladder is a portfolio consisting of equal amounts of STRIPs for each year in a specified payout period. STRIP ladders can also be constructed to pay different amounts in different years of the payout period (e.g., an amount that increases by 3% per year). The cost of the STRIPS ladder providing the payouts is simply the sum of the amounts provided in each year times the current price of the STRIPS maturing that year.

[6] The 80% is a parameter of the fund; in general the assurance can be expressed as the RLI FUND providing $X\%$ of the income generated by the MIF. In Section 3 we discuss why we believe that 80% is an appropriate parameter for the fund.

[7] We note two types of funds with "stable income" offerings: (1) those that offer a predictable income for an unknown amount of time, and (2) those that offer random future income, but with constant payments for a short period of time (typically a year). See Angela M. Antonelli's report "Generating and Protecting Retirement Income in DC Plans; An Analysis of How Different Solutions Address Participant Needs", *Policy Report 19-02*, *Center for Retirement Initiatives, McCourt School of Public Policy, Georgetown University,* in conjunction with *Willis Towers Watson*, June 2019. https://cri.georgetown.edu/wp-content/uploads/2019/06/policy-report-19-02.pdf.

[8] We do not address at this point what the best risky asset is, but we note here that it can itself be a portfolio of risky securities.

[9] Blackrock's survey finds that "62% [of plan participants] would save more if their plan offered digital tools that could clearly tell them whether they were on track."

[10] The number of shares the investor sells has a one-to-one relationship with the lower assured income they will have in the future.

[11] As listed by the Department of Labor: A QDIA (1) may not impose financial penalties or otherwise restrict the ability of a participant or beneficiary to transfer the investment from the qualified default investment alternative to any other investment alternative available under the plan; (2) must be either managed by an investment manager, or an investment company registered under the Investment Company Act of 1940; (3) must be diversified so as to minimize the risk of large losses; (4) may not invest participant contributions directly in employer securities; and (5) may be a life-cycle or targeted-retirement-date fund; Balanced fund; or a professionally managed account. See https://www.dol.gov/agencies/ebsa/about-ebsa/our-activities/resource-center/fact-sheets/default-investment - alternatives - under - participant - directed - individual-account-plans. Recently, certain annuities also have been granted QDIA status under the Secure Act of 2019.

[12] One could always calculate some estimate of future income, but under the standard paradigm this did not show up explicitly as an investor planned for the future, all that mattered for the decision on how to save and invest was the individual's current wealth, and the expected dynamics in the value of assets that the individual could invest in.

[13] Multiple theories have been proposed to explain this observation. Two leading ones include utility functions with "habit formation", and the recognition that

consumption cannot be adjusted smoothly over time in response to an investor's changing situation. For example, investors cannot easily adjust their consumption of housing given long-term rental contracts or large transaction costs involved in buying and selling real estate.

[14] See for example from the Northwestern Mutual Planning and Progress Survey 2019: "(56%) of Americans don't know how much they'll need to retire comfortably." https://news.northwesternmutual.com/planning-and-progress-2019.

[15] H. Markowitz, "Portfolio Selection", *Journal of Finance*, 1952; and W. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *Journal of Finance*, 1963.

[16] For further discussion of long-term bonds for long-term investors, see J. Campbell and L. Viceira, *Strategic Asset Allocation*, Oxford University Press (2002).

[17] For further discussion regarding asymmetric aversion to downside risk, see H. Leland, "Beyond Mean-Variance: Performance Measurement in a Nonsymmetrical World," *Financial Analysts Journal,* 1999.

[18] Recently, the Treasury has actively considered issuing longer-term bonds (up to 100 years): see https://www.wsj.com/articles/a-100-year-treasury-11566515504?mod=searchresults&page=1&pos=1

[19] According to Social Security data a man reaching age 65 today can expect to live, on average, until age 82.9; a woman turning age 65 today can expect to live, on average, until age 85.5. But those are just averages. About one out of every three 65-year-olds today will live past age 90, and about one out of seven will live past age 95. The possibility of reaching an advanced age highlights why retirees need to find ways to receive income beyond expected life expectancies. Source: Social Security Administration, Period Life Table 2016. https://www.ssa.gov/oact/STATS/table4c6.html.

[20] Since virtually any US Treasury bond or note can be stripped at almost no cost, the potential supply of Treasury STRIPS approximates the total size of US Treasury bond and note payments available at each maturity. The current supply of *corporate* bonds with highest ratings (AAA or AA) and maturity 20+ years is only $171b.

[21] For data regarding treasury debt, see https://www.treasurydirect.gov/govt/reports/pd/mspd/2019/opds072019.pdf. For data regarding corporate debt, see https://www.sifma.org/resources/research/us-bond-market-issuance-and-outstanding/.

[22] STIPS are adjusted to the CPI-U inflation index. If a retirees' consumption differs from that underlying bundle, the STIPS will not provide perfect inflation protection.

[23] For more details on QLACs, see Fidelity's description to its customers: "A QLAC is a deferred income annuity that allows income to begin beyond age 70½ without conflicting with Required Minimum Distribution rules. QLACs provide you with flexibility to defer the income start date until age 85 and can only be funded with assets from a Traditional IRA, or with assets from an eligible employer-sponsored qualified plan—401(k), 403(b), and governmental 457(b). The premium amount is subject to two limitations: (1) Total sum of QLAC premiums cannot exceed $130,000 regardless of funding source; and (2) QLAC premiums from a given funding source cannot exceed 25% of that funding source's value." Source: https://www.fidelity.com/bin-public/060_www_fidelity_com/documents/QLAC-brochure.pdf.

[24] Simulations based on making one contribution to the fund 10 years before retirement, with i.i.d. market expected returns of 7% per annum, annual volatility of 18%, and QLAC cost estimates obtained from https://www.immediateannuities.com/annuity-calculators/how-life-annuity-reduce-costs.html on September 4, 2019, for a 65-year-old California male. We do not attempt to model probabilities across future QLAC costs.

[25] Although we believe that equities provide an appropriate investment to secure QLAC affordability as well as QDIA status, alternative portfolios may provide an equal or higher probability of providing QLAC affordability. We leave this question to future research.

[26] The investment algorithm assures that negative or reverse splits will not happen.

[27] Under current QDIA guidelines, a STRIPS-only portfolio would lack the diversification needed for QDIA status.

[28] The mild condition is that on any given date contributions from some investors, *but not all current ones,* take place.

[29] The previous statement assumes minimal price impact from trading the securities in the fund. Ensuring this happens is another reason to hold only extremely liquid securities in the fund. Extreme withdrawals are most likely when stocks have suffered large losses. But this is exactly when Treasury securities do well, and they constitute the majority of the fund's assets. Also,

the RLI allocation strategy never sells equity after the equity portfolio declines in value (relative to the STRIPS portfolio).

30 We simulate 10,000 random paths for the assets in the fund and calculate the fraction of the total value of assets that would need to be rebalanced every day. Average annual turnover from these simulations is 3.6%.

31 Our examples focus on a target date that is 10 years from fund initiation, with a 20-year payment period following the target date. Investors would include those who reach retirement age (e.g., 65) at the target date, and receive payouts for the following 20 years. As discussed in Section 4, the fund will generate sufficient value at the target date to purchase afford a QLAC, with high probability, that would extend income throughout the retiree's lifetime. While we have focused on a single fund, we anticipate that a series of funds would be sequentially created with a range of target dates, at 5-year or even 1-year intervals.

32 While annuities provided by insurance companies offer predictable future income (barring insurance company default), typical annuity products are complex, have high embedded costs, are illiquid, and impose substantial penalties if retirees want to alter the contractual terms. With the RLI fund, investors can increase or decrease future income without penalty by buying or selling shares in liquid markets, at readily observed competitive prices.

33 An analysis based on 10,000 simulations using asset dynamics as outlined before reveals that using a constant 80/20 allocation rule would result in the fund having less STRIPS than required 65% of the time. This does not mean that the fund would default on its assurance 65% of the time, it means that the fund would have to liquidate part of its risky asset holdings 65% of the time to satisfy the minimum assurance.

Acknowledgment