Sequence of returns risk in retirement

Lifetime income guarantees in annuities

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He is a two-time winner of the Journal of Financial Planning Montgomery-Warschauer Editor's Award, a two-time winner of the Academic Thought Leadership Award from the Retirement Income Industry Association, and a best paper award winner in the Retirement category from the Academy of Financial Services. He is also a contributor to the curriculum of the Retirement Income Certified Professional (RICP) designation. He is a co-editor of the *Journal of Personal Finance*. He has also spoken at the national conferences of organizations such as the CFA Institute, FPA, NAPFA, AICPA-PFP, and AFS.

He holds a doctorate in economics from Princeton University and publishes frequently in a wide variety of academic and practitioner research journals. He hosts the Retirement Researcher website, and is a monthly columnist for *Advisor Perspectives,* a RetireMentor for *MarketWatch*, a contributor to *Forbes,* and an expert panelist for the *Wall Street Journal*. His research has been discussed in outlets including the print editions of *The Economist*, *New York Times*, *Wall Street Journal*, and *Money* magazine.

Introduction

Integrated strategies including a role for both lifetime income guarantees and investments can support better retirement outcomes for clients. Lifetime income guarantees help to manage market volatility and investment risks, to protect from longevity risk, to more efficiently earmark assets to cover retirement spending, to reduce the fear and worry that many have about outliving their assets in retirement, and to simplify the financial plan. Lifetime income guarantees provide a way to pool longevity risk and to hedge market volatility risk, allowing for a higher distribution rate than a client may be comfortable with when these assets are managed fully within an unprotected investment portfolio. Because of this risk pooling aspect, payout rates may be higher for annuities than sustainable portfolio withdrawal rates from investments.

For a simple example, suppose a client seeks to spend at a 4% initial withdrawal rate in retirement. If half of the assets are placed into an annuity with a lifetime income guarantee based on 5% of the annuity assets, then only a 3% withdrawal rate is required from the other investment assets to meet the overall 4% spending goal. This lower distribution rate on the investment assets creates less exposure to sequence of returns risk and a greater likelihood that the investment portfolio can sustain its share of retirement distributions as well. To verify this outcome requires an investigation if the income guarantee rider does not offer a strong enough cost-of-living adjustment to match the overall retirement spending goal. In this case, the earlier relief provided by a lower withdrawal rate from investments may be offset somewhat by greater portfolio distribution needs later in retirement to maintain a targeted cost-of-living adjustment. **This article tests the issue to better determine and quantify the role of an annuity with an income guarantee rider to reduce exposure to sequence of returns risk in retirement.**

This research evolves from earlier investigations about building efficient retirement income plans to meet spending and other retirement goals. For instance, Pfau (2013) determined that the efficient frontier for retirement income consists of lifetime income guarantees combined with stock investments as the way to best support spending in downside market scenarios while also supporting the highest average legacy value of assets. More recently, Pfau (2017) investigated the "retirement income showdown" between risk pooling and the risk premium about the best way to support retirement spending goals. Risk pooling provides stronger support for meeting a retirement spending goal and for preserving true liquidity. An investments-only strategy seeking to use the risk premium from stocks to support retirement goals may support greater legacy at the beginning of retirement, but this advantage diminishes at more advanced ages. Using risk pooling through lifetime income guarantees to meet spending goals can provide more comfort and safety for retirement spending, while freeing up more assets that can be used to meet retirement contingencies and to support greater legacy in the long run.

It is much more difficult than commonly assumed for an investments-only strategy to outperform a strategy using lifetime income guarantees to support retirement spending while using investments for other goals. Bonds lock in failure. A retiree requires stocks or income guarantees to stand any chance to fund a higher spending level than the bond yield curve can support. Risk pooling through an income guarantee is much more effective and powerful than commonly perceived. Stocks do not always outperform bonds in the key period of years around the retirement date that matter the most to the success of a retirement plan. An income guarantee may provide a better tool for managing this sequence of returns risk.

A simple income annuity is the easiest way to provide a lifetime income guarantee, but for a variety of reasons income annuities have not been popular with retirees. Though retirees are quite fond of the idea of lifetime income as provided by Social Security and defined-benefit pensions, they have been hesitant on following through with seeing a large lump-sum of assets leave their investment portfolio as a premium for lifetime income. Academics view the lack of income annuity use as a puzzle, since the mortality credits offered through income guarantees can provide a powerful boost to retirement spending.

As a result, the insurance industry has developed income guarantee riders for deferred annuities since the late 1990s as a real-world effort to respond to this annuity puzzle and to create a lifetime income guarantee that satisfies the behavioral concerns of retirees and provides a tool that retirees are willing to use. Annuities with income guarantee riders have gained popularity as a retirement income tool providing behavioral solutions for the annuity puzzle.[1]

[1] Owners are exposed to the credit risk of the insurers, as the guaranteed income rider may not be protected by state guarantee associations.

Their appeal to investors is based upon the combination of downside protection, upside potential and a guaranteed income stream in one package, while also offering the potential for tax-deferred accumulation and for maintaining technical liquidity for remaining assets (unlike an income annuity that removes the asset from the financial portfolio). Clients can see their account values, they can continue to invest in different funds in their annuity subaccounts, and any remaining funds are available as a death benefit in the event of early death. If the annuity subaccounts perform well, many annuities with income riders include mechanisms to increase the guaranteed level of retirement income as well.

We can think about basic retirement tools in terms of fixed income, risky investment assets (such as stocks), and income guarantees supported through risk pooling (insurance and annuities). The dual impact of sequence of returns and longevity risk leaves one open to the possibility of being unable to support the desired lifestyle over the full retirement period. These are risks a retiree cannot offset easily or cheaply in an investment portfolio. Investment approaches seek to reduce sequence and longevity risk by having the retiree spend conservatively. Retirees spend less to avoid depleting their portfolio through a bad sequence of returns in early retirement, and because they must be prepared to live well beyond their life expectancy. The implication is clear: should the market perform reasonably well in retirement, the retiree will significantly underspend relative to their potential and leave an unintentionally large legacy. At the same time, longevity protection (the risk of outliving savings) is not guaranteed with investments, and sufficient assets may not be available to support a long life or legacy. A "reverse legacy" could result if the portfolio is so depleted that the retiree must rely on others (often adult children) for support. This is particularly important considering the ongoing improvements in mortality. Retirees of today will live longer and will have to support longer retirements than their predecessors.

Meanwhile, insurance companies pool sequence and longevity risks across a large base of retirees — much like a traditional defined-benefit pension — allowing for retirement spending that is more closely aligned with average long-term fixed income returns and longevity. This could support a higher lifestyle than that which is feasible for someone self-managing these risks by assuming low returns and a longer time horizon. Lifetime income guarantees mitigate market risk either by having the underlying assets invested in fixed income or by providing a type of put option on stock market returns as income is guaranteed even if markets perform poorly and the underlying portfolio depletes. Overly conservative retirees become so concerned with running out of money that they spend significantly less than they could. An income guarantee can help people feel more confident with spending in retirement. A dependable monthly check from an annuity can also simplify life for those with reduced cognitive skills or for surviving spouses who may be less experienced about financial matters.

Retirement income planning

To provide greater clarity for these issues, it is worthwhile to briefly review the problem we are attempting to solve within the field of retirement income planning. This provides context for understanding the role of an income guarantee within an overall retirement income plan. The challenge we address is to use available income tools and tactics in a strategic manner to meet the financial goals of retirement while also managing the risks confronting those goals. We will discuss the financial goals of retirement, the risks in retirement, and broad retirement income tools.

Four Ls of retirement:

 Lifestyle  Legacy  Longevity  Liquidity

First, Lifestyle and Longevity both refer to meeting spending goals in retirement. Lifestyle refers to the overall standard of living that a retiree seeks to support. This includes discretionary expenses that may have some flexibility built in, relating to travel and leisure, as well as core or essential expenses needed to meet a basic living standard, relating to food, shelter, and health care. Longevity goals refer to the subset of core expenses for which there is little discretion and that should be supported for as long as the retiree lives. Lifestyle goals include Longevity goals, but they can also be distinguished as the spending objectives of a more discretionary nature existing beyond the core spending needs. The next financial goal relates to Legacy. This simply refers to any desires to leave something for subsequent generations. Finally, Liquidity goals relate to the

desire to have additional assets available to meet contingency expenses in retirement. Contingencies are the unplanned spending shocks that can affect retirees, but that fall outside the baseline retirement budget.

The Liquidity goal deserves additional discussion as it can be a source of confusion. While an investment portfolio is generally viewed as a liquid asset, some of its liquidity may be an illusion. Assets must be matched to retirement goals. Some, or even all, of the investment portfolio may be earmarked to meet longevity and lifestyle. While a retiree could decide to use these assets for other purposes, doing so would jeopardize the ability to meet future spending. In this sense, assets are not as liquid as they appear. There may just be an illusion of liquidity. True liquidity can be negative if there are not sufficient assets to cover lifestyle and longevity goals through the planning age with a level of confidence that the retiree seeks. This will be important to remember in the later discussion about retirement income tools, because retirees may find that using risk pooling through an income guarantee to meet their spending goals will allow less assets to be earmarked for this purpose, creating greater overall liquidity for the financial plan. This can make it easier to cover contingencies with truly liquid assets without jeopardizing the retiree's lifestyle.

How much is one willing to risk experiencing worse outcomes in the quest to obtain better outcomes?

Next, we introduce retirement risks and the tradeoffs between seeking better potential outcomes with the associated possibility of experiencing worse potential outcomes. How much is one willing to risk experiencing worse outcomes in the quest to obtain better outcomes? In the context of personal financial planning, risk is the realization of events that force a reduction to one's standard of living. We accept risk when it provides a sufficient opportunity for reward (increased standard of living) when the risk does not materialize, but it also requires us to accept the possibility for a reduced standard of living when risk materializes. Table 1 displays the three major categories of risk for a retirement income plan: longevity risk, market volatility, and spending shocks, as well as the role of an income guarantee rider in managing these risks.

Table 1: Managing major retirement risks with an income guarantee

Retirement risk	Threat to standard of living	Role of income guarantee rider
Longevity risk	Insufficient resources to support long life	By pooling risk, lifetime income guarantee allows for continuing income receipt no matter the length of life.
Market risk	Market losses + distributions lead to faster asset depletion	Income continues even if poor market returns and distributions have depleted the underlying portfolio.
Spending shocks	Unplanned expenditures deplete assets	More efficiently earmarks assets for spending goal, creating true liquidity for spending shocks with other assets.

Longevity risk is the possibility of living longer than planned, which in turn results in not having sufficient resources to continue maintaining one's standard of living. It is the overarching risk for retirement. The longer a retirement lasts, the greater are the chances that other risks will manifest. Increased longevity means more time for another financial crisis, more time for inflation to compound, increased chances for an expensive health problem, etc. Without lifetime income guarantees for spending, the challenge is to pick an appropriate planning age. The longer the retirement, the less one can sustainably spend. Spending too much today will require later spending reductions and a curtailed standard of living. Spend too little and one just simply ends up underspending compared to what would have otherwise been feasible. Retirees do not know how long their retirement will last, and so they face a delicate tradeoff between wanting to spend as much as possible without overdoing it and risking old age poverty. We know about the distribution of longevity for the overall population, but an individual cannot know in advance precisely where he or she will fall in the distribution. The length of one's retirement could be much shorter or longer than their statistical life expectancy. Half of the population will outlive their median life expectancy; some will live much longer. A long life is wonderful, but it is also costly and a continuing drain on available retirement resources.

A lifetime income guarantee provides a way to pool this longevity risk, with subsidies provided to the long-lived from the annuity fees paid by those who do not live as long. This ensures that everyone in the risk pool can be paid as though they will live to an age closer to their life expectancy, rather than having to assume a much longer life and less spending from an unprotected investment portfolio. Without efforts to pool longevity risk, a longer time horizon requires spending less so that available assets can be drawn out for a longer period. The probability of surviving to advanced ages is low. Without risk pooling, individuals must determine how low of spending they are willing to accept today in their effort for planning to live longer and better ensuring that they will not deplete their assets later in life.

Next, market volatility is the risk that poor market returns are realized, leading to a reduced portfolio value and a reduced ability to maintain one's standard of living. Market risks identify the exposure of a retirement plan to macroeconomic forces beyond a retiree's control. These risks include investment volatility related to poor market returns and disadvantageous fluctuations in interest rates. At one time, investments were a place for saving and accumulation, but retirees must try to create an income stream from their existing assets — an important constraint on their investment decisions. Taking distributions amplifies investment risks (market volatility, interest rate volatility, and credit risk) by increasing the importance of the ordering of investment returns. This sequence of returns risk serves as the paper's focus and will be investigated further in the next section.

It can be difficult to reduce spending in response to a poor market environment. Portfolio losses could have a more significant impact on standard of living after retirement, necessitating greater care and vigilance in response to portfolio volatility. Even a person with high risk tolerance (the ability to stomach market volatility comfortably) can be constrained by their risk capacity (the impact of a market downturn on their standard of living) in retirement.

The investing problem fundamentally changes in retirement. Retirees worry less about maximizing risk-adjusted returns and worry more about ensuring that their assets can support their spending goals for the remainder of their lives. After retiring, the fundamental objective for investing is to sustain a living standard while spending down assets over a finite but unknown length of time. The spending needs that will eventually be financed by the portfolio no longer reside in the distant future. In this new retirement calculus, views about how to balance the tradeoffs between upside potential and downside protection can change. Retirees might find that the risks associated with seeking return premiums on risky assets loom larger than before, and they might be prepared to sacrifice more potential upside growth to protect against the downside risks of being unable to meet spending objectives.

The third major risk category is spending shocks. This is the risk that expensive bills materialize, such as for long-term care or health care, which require large expenditures that deplete assets and reduce the ability to maintain one's standard of living. These risks are essentially that the basic budget one has prepared for retirement will not adequately reflect the actual retirement costs. Issues here include unexpected health care and long-term care expenses, the need to support other family members such as adult children or grandchildren, or divorce. Fraud and theft are growing concerns for retirees as well, as a real issue we face is reduced cognitive ability as we age — and predators will seek to exploit this. Though lifetime income guarantees by themselves may not generally provide adequate liquidity for these types of shocks, their importance relates to the ability to earmark a smaller portion of assets to cover spending goals, which then frees up other assets on the balance sheet that are truly liquid for the purpose of covering retirement spending shocks.

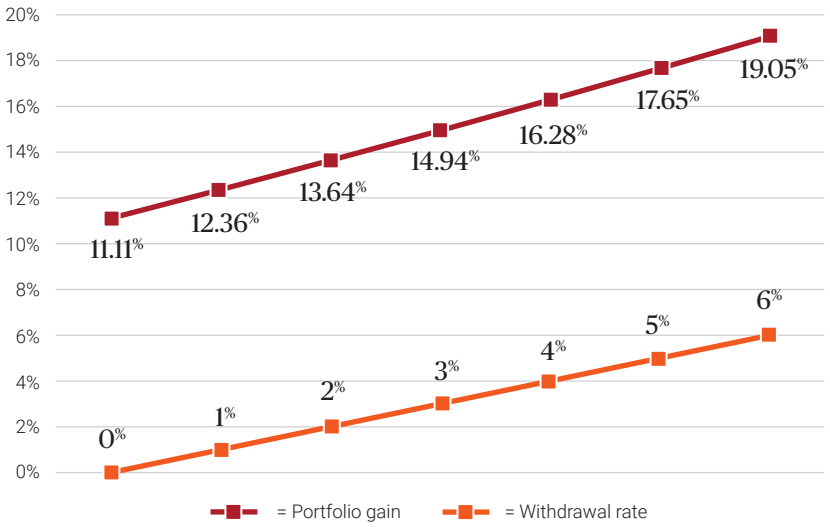
Sequence of returns risk

When spending from a portfolio, the concept of sequence of returns risk becomes more relevant as portfolio losses early in retirement will increase the percentage of remaining assets withdrawn to sustain an income. This can dig a hole from which it becomes increasingly difficult to escape, as portfolio returns must exceed the growing withdrawal percentage to prevent further portfolio depletion. Even if markets subsequently recover, the retirement portfolio cannot enjoy a full recovery. The sustainable withdrawal rate from a retirement portfolio can fall well below what is implied by the average return earned by the market during retirement. Sequence risk is triggered when assets are sold at a loss. Low interest rates further amplify sequence risk by making it more likely that principal must also be spent to support a spending goal, so that any market downturn further depletes the asset base.

The concept of sequence of returns risk becomes more relevant as portfolio losses early in retirement will increase the percentage of remaining assets withdrawn to sustain an income.

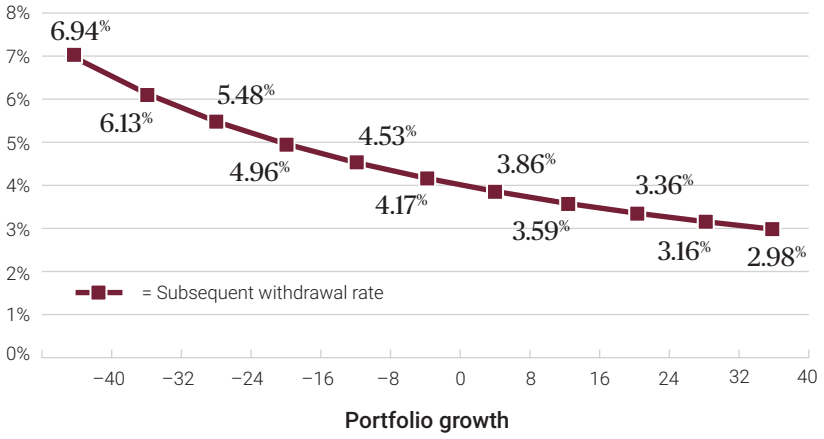
The concept that portfolio distributions increase the necessary return to recover from a portfolio loss is further illustrated in Figure 1. In this case, we consider the return needed to get a portfolio back to its initial starting value after a 10% drop in the portfolio value. Without distributions, the required return is 11.1%. A portfolio at $100 that loses 10% of its value is now at $90. The $10 gain needed on $90 to get back to $100 reflects an 11.1% return on $90. Losses and gains are not symmetric. This problem is amplified when distributions are taken as well. Spending 1% of the initial portfolio value leads to a return of 12.4% needed to recover after a 10% drop. At a 4% distribution rate, the required return increases to 16.3%, and so on. The combined impact of portfolio losses and distributions makes it more difficult for a portfolio to recover even if the overall financial markets return to their previous levels.

Figure 1: Subsequent return to recover from a 10% portfolio loss when distributions are taken



Related to this concept, Figure 2 shows how the first-year portfolio returns impact the withdrawal rate from remaining assets needed in the second year of retirement to continue supporting the spending level provided by a 4% distribution rate from initial retirement assets. Consider a 40% portfolio loss. If initial wealth is $100, then an initial $4 distribution reduces assets to $96. The subsequent 40% drop reduces assets to $57.60. In the second year, the $4 distribution now represents 6.9% of the remaining portfolio balance. This has now effectively created a hurdle in which portfolio returns must be 7.5% for the portfolio in the second year to return to $57.60 and avoid further depletion after another $4 distribution. The portfolio return in year two would need to be 86% for the portfolio to recover to its initial retirement date value. If market returns fall short of 7.5%, the portfolio will decline further in value, which further pushes up the withdrawal rate from remaining assets in subsequent years and further digs a hole from which recovery may never be possible. In the other direction, positive portfolio growth that allows the portfolio balance to grow despite distributions reduces the subsequent withdrawal rate needed to meet the targeted spending amount from remaining assets. This reduction in the withdrawal rate can help to better ensure that assets will not be depleted. Sequence of returns risk works in both directions, with the pace set by early market returns helping to either lock the portfolio into a downward trajectory toward failure, or to reduce the needed withdrawal rate and increase the sustainability of the spending strategy.

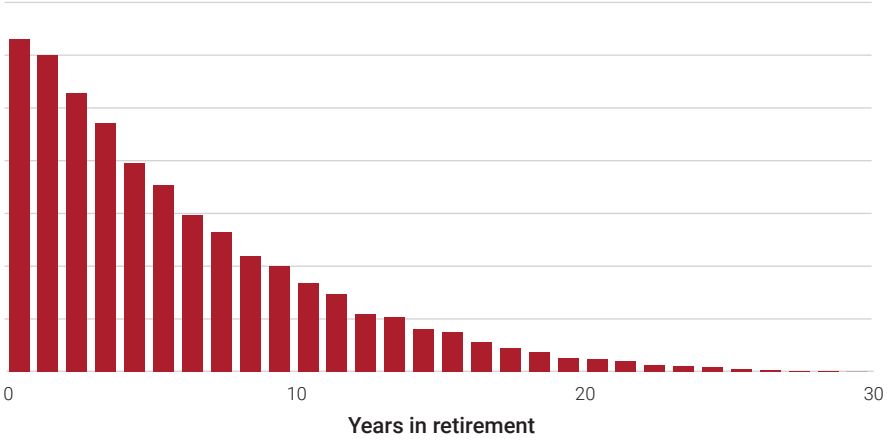
Figure 2: Impact of first-year portfolio return on second-year withdrawal rate for a 4% initial withdrawal rate



Next, Figure 3 provides a clearer picture of how sequence-of-returns risk impacts the retirement phase. This analysis is based on statistical regression, which determines how much of the sustainable withdrawal rate for retirement can be explained by the returns experienced in each year of a thirty-year retirement. The figure isolates the impact of each year's return on sustainable retirement spending using a larger sample of 100,000 Monte Carlo simulations based on a 50/50 portfolio of stocks and bonds. The return in year one represents the first year of retirement; this initial return provides the most explanatory power for the retirement outcome. Retirees are extremely vulnerable to what happens just after they retire. This result would hold even more so with the human capital considerations of the real world, as it is increasingly difficult to return to the workforce after you retire. Sustainable withdrawal rates are disproportionately explained by what happens in the early part of retirement. The market returns in the second half of a thirty-year retirement hardly matter. Returns from later in retirement have minimal impact, as the outcome for that retirement (high or low sustainable spending) was already set in motion earlier. Sequence risk amplifies the impact of investment volatility because it makes outcomes more dependent on shorter periods, and average returns over shorter periods tend to be more volatile than average returns over longer periods.

Figure 3: Sequence of returns risk in retirement

The relative importance of each year's return in explaining sustainable retirement spending



Managing sequence of returns risk becomes an essential part of ensuring sustainable retirement spending.

Deferred annuities with income guarantee riders

Advocates of annuities with income guarantee riders have focused on four advantages relative to an unprotected investment portfolio. These include tax deferral, the ability to lock in growth for the benefit base during the accumulation period, guaranteed income for life during the distribution period, and liquidity, as the contract may be terminated with remaining assets returned.

Our focus is on the retirement income phase, but it is worth mentioning the ability of an annuity to lock in a guaranteed growth rate on the "benefit base" during the accumulation period, including the ability to define the benefit base as the high-water mark of the contract value of the underlying assets over the history of the rider. This benefit base is a hypothetical number used to calculate the amount of guaranteed income paid during the withdrawal phase, and clients do need to understand that it is distinct from the actual contract value of the underlying assets in the annuity.

For example, if the roll-up rate for the benefit base is an annually compounding 6% return, the value of the benefit base would double in approximately 12 years. Conversely, the actual contract value of the underlying assets will be determined by market performance. After the 12-year accumulation period has passed, if the market has underperformed and the value of the benefit base is significantly higher than the contract value of the underlying assets, then the income guarantee is "in the money." In such a case, the client may wish to continue paying for the rider and to receive the guaranteed income as calculated on this higher benefit base. On the other hand, if markets performed well during those 12 years, the contract value of the underlying assets may be close to or the same as the value of the benefit base. In this case, the client may consider whether it is worthwhile to begin taking distributions with the income guarantee or to have the contract value of the underlying assets returned to be reinvested in another vehicle.

An annuity with an income rider is then able to pay a guaranteed income for life based on a fixed percentage of the hypothetical benefit base. For many clients, the most compelling aspect of this feature is that even in cases when the contract value of the underlying assets has been depleted to zero, the income guarantee will continue to pay for the lifetime of the annuitant. Often, once withdrawals begin, a guaranteed roll-up for the benefit will typically no longer apply. Guaranteed income may increase if the underlying contract value of the

assets achieves a new high watermark that increases the benefit base. However, this may become less common after distributions begin, unless market returns are strong enough for the value of the underlying assets to sustain persistent gains that can exceed ongoing distributions and fees. With the declining probability for step-ups, income from an income rider generally will not keep pace with inflation. As a result, most guaranteed income riders provide only nominal protection, as opposed to inflation-adjusted or "real" protection. Though the monetary value of the benefit base and its subsequent income is guaranteed not to shrink, inflation will erode the purchasing power over time. In this analysis, we will assume that the income guarantee supports a nominal spending value in retirement, but we note that when markets do well it may be possible for the guaranteed income level to increase as well.

Four advantages relative to an unprotected investment portfolio:

1. Tax deferral
2. The ability to lock in growth for the benefit base during the accumulation period
3. Guaranteed income for life during the distribution period
4. Liquidity

Another advantage of annuities with income guarantees is liquidity. The guarantee can be ended at any time and remaining assets can be returned. This overcomes the least popular feature of simple income annuities, which is their complete lack of liquidity. Once an income annuity is purchased, assets are relinquished to the insurance company and will be inaccessible at any point in the future, including the event of an early death, unless the income annuity offers other features for a period-certain payout or a rider to refund any remaining principal at death. As has been discussed, though, liquidity within the annuity may be similar to liquidity within an investment portfolio, in that the asset may be earmarked to cover future spending needs and may not really be available as a liquid asset to cover other contingencies. The value of the income guarantee lies more in its potential to earmark less total assets to cover future retirement spending, which then frees up other assets to provide greater true liquidity for the overall retirement income plan.

Methodology

We consider a new retiree at age 65 with a $1 million portfolio who is seeking to fund a $40,000 spending goal with a 2% cost-of-living adjustment throughout her retirement. The retiree considers two income strategies for retirement. The first is to take these distributions from an unprotected investment portfolio that is annually rebalanced to a 50/50 allocation of stocks and bonds. When results are shown, this first strategy is identified as "investments only." The second strategy ("include annuity with income rider") is to carve out 50% of the investment assets at retirement to use with an annuity providing a 5% lifetime income guarantee rider. The other 50% of assets remain in the investment portfolio, and the portfolio asset allocation is changed to 75/25 in favor of stocks because of the increased risk capacity supported by the lifetime income guarantee. The income guarantee serves as a type of put option on stock market performance, as income will continue and is unaffected by the depletion of the annuity account value. Generally, because of this put option, a client may be willing to invest more aggressively within the annuity as well as with the assets remaining in the unprotected investment portfolio. A more aggressive stock allocation within the annuity may help to offset the annuity fees in scenarios that markets perform well in retirement, comparing to a lower cost but less aggressive investment portfolio.

We consider a stylized annuity with an income rider that guarantees income equal to 5% of the initial annuity assets for life, even if the contract value of assets depletes. For a $500,000 premium, this implies $25,000 per year for life without any guaranteed cost-of-living adjustments. To track the legacy value of assets, we also apply a guaranteed return of principal for the annuity. If death takes place before enough distributions have been received to recover the initial premium, then the difference is provided as a death benefit. These are the guarantees provided by the annuity. In the event of upside growth, the annuity is potentially able to support an increased amount of lifetime guaranteed income as well as a sufficiently large contract value to ensure that more than the initial premium is available as spending and a death benefit. We will simplify the analysis to investigate only the guaranteed levels to better understand how the annuity may help to manage the sequence of returns risk in retirement. Since we do not seek to quantify upside potential, it is not necessary to specify an asset allocation or fees for the stylized annuity. For the annuity, spending is deducted from the contract value for as long as assets remain. If the contract value of the

annuity falls to $0, guaranteed lifetime income continues while annuity expenses would cease.

We simulate portfolio returns using 10,000 Monte Carlo simulations for up to a 40-year retirement period, for 10-year bond yields, equity premiums, home prices, short-term interest rates, and inflation.[2] The details for the underlying market simulations are provided in the appendix. These simulations reflect the lower bond yields available to retirees today, but they do include a mechanism for interest rates to gradually increase over time (on average) and approach historical norms. Bond returns are calculated from the simulated interest rates and their changes, and stock returns are calculated by adding a simulated equity premium on top of the simulated (variable-and-rising) interest rates. Strategies are simulated with annual data, assume withdrawals are made at the start of each year, and use annual rebalancing to restore the targeted asset allocation. Taxes are not part of this analysis.

Fees deducted annually at the end of the year from the investment portfolio include a 1% assets under management advisory fee and a 0.2% fund expense. The annuity subaccounts will also surely have fees, but as we only model the minimum guaranteed performance without measuring the potential for upside growth, it is not necessary to model fees or upside. The implicit assumption is that fees are sufficiently high to prevent any realized upside growth. It is within this context that we compare investments-only strategies against strategies including an income rider on an annuity.

[2] Though simulations for short-term interest rates and home prices are included in the modeling to provide for a more complete economic framework, they are not used in this article.

Results

We now consider results for our 65-year-old retiree with a $1 million portfolio who is seeking to fund a $40,000 spending goal with a 2% cost-of-living adjustment during retirement. Figure 4 starts with the median outcome for the progression of the current withdrawal rate throughout retirement. First, with the investments-only strategy, the initial withdrawal rate from investments is 4%. We can observe that portfolio balance growth does not keep pace with cost-of-living adjustments. It must decline in the median outcome, as the current withdrawal rate gets pushed progressively higher throughout the subsequent retirement period. By year 25, the current withdrawal rate exceeds 8% and then quickly accelerates upward. Portfolio growth cannot keep pace with the growing distribution needs from what is left. The current withdrawal rate exceeds 20% by year 34, on average, and it will reach 100% by year 38.

Meanwhile, the strategy using an annuity is shown to provide relief for the current withdrawal rate from investments at the median level. Because half of the assets are transferred to the annuity with a 5% payout rate, the remaining investment portfolio only needs a 3% distribution to meet the overall spending goal. Distribution needs for the portfolio rise over time because of the cost-of-living adjustments sought for spending and the fixed nature of the annuity payout. In seven years, cost-of-living adjustments on the spending taken from the investment portfolio lead to a distribution exceeding 4% of the initial investment portfolio assets. However, Figure 4 clarifies that the reduced distribution needs in early retirement sufficiently mitigate sequence risk such that higher spending later in retirement can be more effectively managed. Because the lower early distribution allows investment assets more opportunity to grow, the current withdrawal rate from investments does not exceed 4% until year 12, and it only reaches 8% in year 34. Lower early distributions do help to manage sequence risk and make it less likely that the portfolio enters into an unsustainable spiral of rising distribution rates.

Lower early distributions do help to manage sequence risk and make it less likely that the portfolio enters into an unsustainable spiral of rising distribution rates.

Figure 4: Median current withdrawal rates from the unprotected investment portfolio

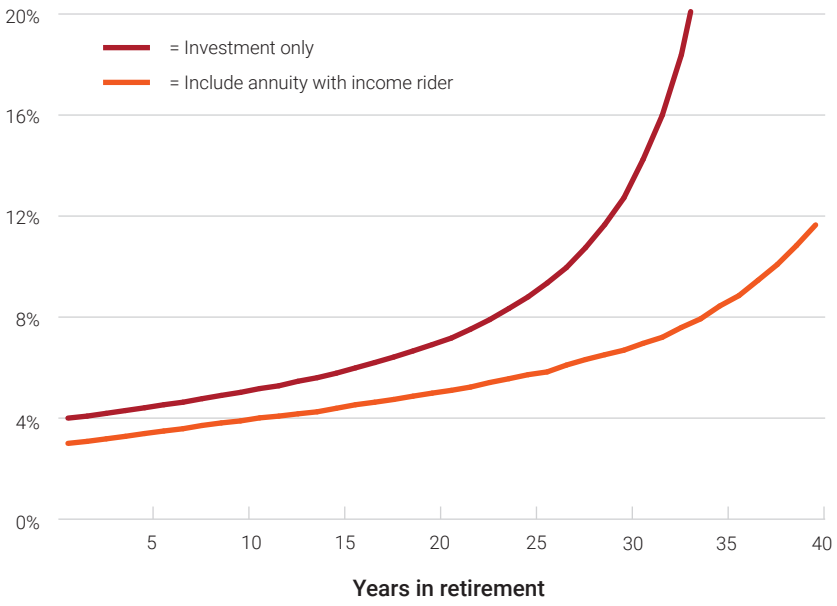
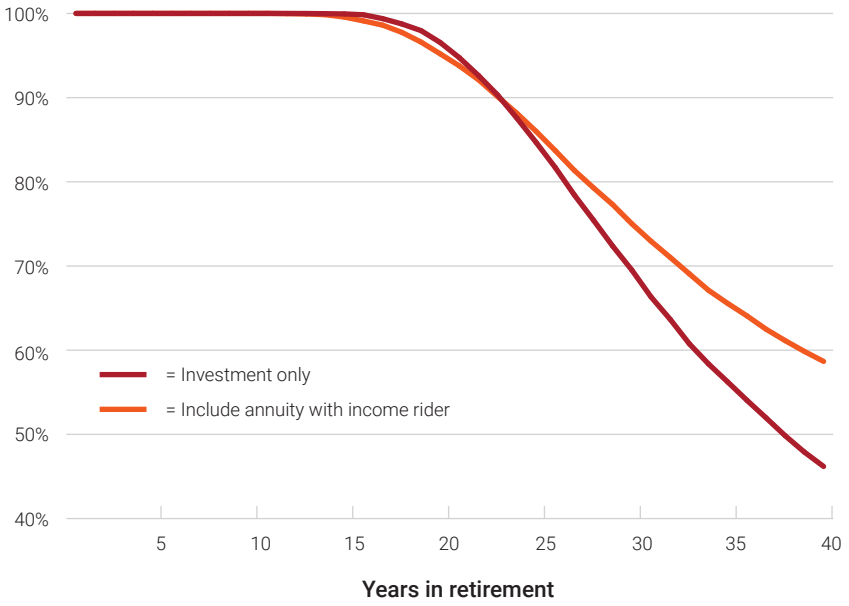


Figure 5: Probabilities of success



Next, Figure 5 shows the probabilities of success over time for each strategy, though this outcome measure only has limited applicability for strategies that include lifetime income guarantees. The probability of success shows the percentage of cases in which assets remain in the investment portfolio. However, the impact of asset depletion is different in each scenario. With investments only, all income stops at this point. With the annuity strategy, the $25,000 fixed nominal income continues for life, providing for a partial ability to continue meeting spending goals in retirement. Nonetheless, after about 24 years, the probability of success remains increasingly higher with the annuity strategy compared to an investments-only approach. Prior to this time, success rates are slightly higher for investments only, resulting from the lower stock allocation it uses due to the lower risk capacity it affords the retiree. The integrated strategy has more potential to seek upside growth because a portion of income is protected from longevity and market risk, and the effort to seek this growth does create a slight risk in the short term for the unprotected investment assets.

Because of the limitations for success rates to account for partial income from the annuity when failure for the investments happens, Figure 6 uses the inflation-adjusted value of cumulative shortfalls relative to the spending goal as a better means for understanding the potential magnitude of failure. The cumulative shortfalls are shown for the 10th percentile of the distribution, which corresponds to a 90% chance for success in the previous figure. For both strategies, success falls below 90% in year 23 of retirement, which explains why Figure 6 shows the beginning of shortfalls at this time. What is important to note is that shortfalls remain consistently lower with the annuity strategy because it continues to support a portion of the spending goal. After 40 years, the cumulative shortfall for investments only at the 10th percentile is $518,000, compared to $330,000 for the annuity strategy.

Figure 6: Real cumulative shortfall at the 10th percentile of the distribution

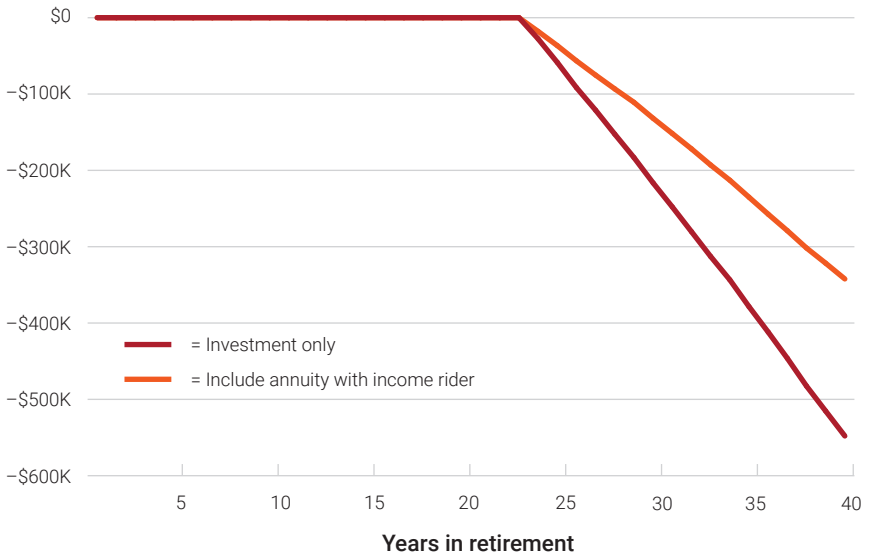
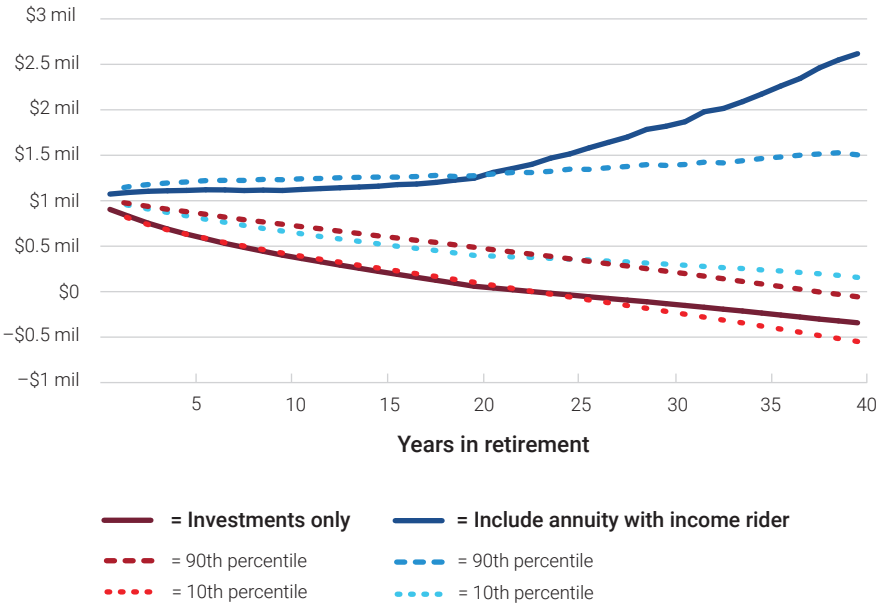


Figure 7: Distribution of real legacy assets

(Median with solid lines, 10th and 90th percentiles with dashed lines)



Finally, Figure 7 illustrates the distribution for the legacy value of assets in inflation-adjusted terms at the 10th, median, and 90th percentiles. Legacy value is defined as the remaining investment portfolio balance plus any return of premium guaranteed from the annuity (which applies for the first 20 years of retirement). Across the distribution, the investments-only strategy shows a slight advantage for the first 20–25 years of retirement. Later in retirement, though, the larger legacy is increasingly provided by the strategy that includes a lifetime income guarantee. This results from the lower distribution needs and the more aggressive asset allocation for the remaining investment portfolio. The lower distribution needs help to manage sequence of returns risk, which in turn improves the odds that the risk premium from the stock market will be realized and investment growth does occur. The 10th percentile for legacy corresponds to the cumulative shortfalls described in Figure 6. At the median, the investments-only strategy faces a real shortfall of $31,000 by year 40, compared to a positive legacy of $171,000 supported by the strategy that includes the annuity. At the 90th percentile, investments-only supports a legacy of $1.63 million by year 40, compared to a $2.76 million legacy with the integrated strategy.

Conclusions

Within the context of the case study provided in this article, integrated strategies that include lifetime income guarantees for retirement spending support improved retirement outcomes. The higher stock allocation used for the investment portfolio with the integrated strategies, which is justified through the increased risk capacity supported by the income guarantee, does increase portfolio risk slightly in a few simulations. But for the vast majority of cases, integrated strategies reduce distribution needs from remaining assets for long enough to better manage lifetime sequence risk, increase probabilities of success for the overall plan, reduce the magnitude of shortfalls when the investment portfolio is depleted, and ultimately support a higher legacy value for assets after the first 20–25 years of retirement. Indeed, we have shown that a lifetime income guarantee for a portion of retirement assets mitigates sequence of returns risk and longevity risk by reducing distribution needs from the remaining unprotected investment portfolio.

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Appendix on capital market expectations

The capital market expectations in this article connect the historical averages from Robert Shiller's dataset (http://www.econ.yale.edu/~shiller/data.htm) together with the current market values for inflation and interest rates. This makes allowances for the fact that interest rates and inflation are currently far from their historical averages, but it also respects historical averages and does not force returns to remain low for the entire simulated time horizon.

Table A1: Summary statistics for U.S. returns and inflation data, 1890–2016

				CORRELATION COEFFICIENTS						
	Arithmetic Means	Geometric Means	Standard Deviations	Stocks Returns	Risk Premium	Bond Yields	Bond Returns	Home Prices	Bills	Inflation
Stock Returns	10.7%	9.2%	18.1%	1.00	0.99	0.05	0.06	0.15	−0.09	0.06
Risk Premium	6.1%	4.5%	18.2%	0.99	1.00	−0.09	−0.01	0.13	−0.20	0.03
Bond Yields	4.6%	—	2.4%	0.05	−0.09	1.00	0.52	0.13	0.85	0.22
Bond Returns	4.8%	4.6%	6.6%	0.06	−0.01	0.52	1.00	−0.06	0.33	−0.09
Home Prices	3.4%	3.2%	7.1%	0.15	0.13	0.13	−0.06	1.00	0.05	0.39
Bills	4.4%	—	3.0%	−0.09	−0.20	−0.20	0.33	0.05	1.00	0.15
Inflation	2.9%	2.8%	5.3%	0.06	0.03	0.03	−0.09	0.39	0.15	1.00

Source: Data from Robert Shiller's webpage. The U.S. S&P 500 index represents the stock market, 10-year Treasuries represent the bond index, the Shiller-Case home price index for homes, 6-month Treasuries for bills, and the Consumer Price Index for inflation.

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