Principal®

It's more than money

Provide guaranteed income in retirement … and confidence and higher satisfaction levels.

Case studies and insights from income annuity owners on the efficiency of guaranteed income

Research presented by Principal®,
Michael Finke, Ph.D., CFP®,
and Wade Pfau, Ph.D., CFA®

Table of contents

2 Welcome from the authors

4 Why retirees need annuities

5 Why retirees like annuities

7 Annuities in action — three case studies

11 Research conclusions

12 About the authors

13 Appendices

Welcome from the authors

At retirement, retirees face the momentous challenge of creating a lifestyle from the nest egg they've spent their whole lives building. Here we discuss the benefits you can provide to individuals with guaranteed income to fund the lifestyle they want in retirement.

Research commissioned and paid for by Principal® and conducted by Michael Finke, Ph.D., CFP®, and Wade Pfau, Ph.D., CFA®, takes a closer look at how retirees can use guaranteed income annuities to not only improve financial outcomes, but also increase confidence and reduce stress in retirement. This paper provides insight into both the psychological and quantitative values of annuities.

The bottom line: Income guarantees can help to better meet individual goals in retirement than an investments-only approach in most situations. By helping retirees understand the benefits of using guaranteed income to build a lifestyle, and by providing a clear explanation on the efficiency of income annuities, you can give them the information to make better choices with their retirement savings.

Highlights

- Purchasing an income annuity with a portion of retirement savings can provide a higher potential for success, greater legacy wealth over the long term and increased risk capacity
- Income annuities are less expensive and safer for risk-averse retirees whose primary goal is income security in retirement
- Annuities allow a retiree to spend at a level that would otherwise require a high risk of failure if funded solely from an investment portfolio
- Income annuities provide confidence, the freedom to spend and invest, as well as the opportunity to leave a legacy

For plan sponsor/financial professional use only

Content is written and intended for financial professionals. Consumers should contact their financial representatives to discuss their retirement planning strategies.

Retirees have worked their entire lives to save a nest egg that will give them the life they want to live. Will they spend their money, live well and risk running out of money too soon? Or will they spend too conservatively and sacrifice their lifestyle?

Moving from a savings mindset to a spending mindset is a momentous shift in the life of a retiree, and it can lead to anxiety.

Will there be anything for me to pass along to my family or charities?

How long will my retirement savings last?

Now, combine these questions with uncertainty around keeping money invested while in retirement.

Am I going to outlive my money?

What are the new risks to my portfolio in retirement?

What is there besides stocks and bonds?

The questions continue throughout retirement. One answer is the often-misunderstood **guaranteed income annuity.**[1] At its most basic, the income annuity replicates the traditional defined benefit pension plan by allowing an individual to create their own guaranteed lifetime income.

Finke and Pfau developed this research in two parts: interviews with income annuity owners, and Monte Carlo simulations in a variety of scenarios and range of market conditions. This paper explores the financial and emotional benefits of using guaranteed income to fund a desired lifestyle in retirement.

You'll be able to position this powerful income solution by understanding the characteristics that retirees find most appealing and the financial impacts of guaranteed income in retirement.

To bring it to life, three hypothetical case studies will illustrate how purchasing an income annuity with a portion of retirement savings supports both a higher potential for success and greater legacy wealth over the long term, while increasing a retiree's ability to take investment risk. Success is defined as the ability to support a spending goal and reach age 95 without fully depleting the retirement savings.

[1] Guarantees are based on the claims-paying ability of the issuing insurance company.

Why retirees need annuities

Longer lives + lower interest rates = bonds fall short

Longevity can increase the amount of time in retirement and the cost of funding a retirement lifestyle.

This leads to one of retirement's biggest uncertainties: How much money does a retiree need to fund it? Look at what actuarial tables say about potential longevity, and it seems entirely justified for a retiree to worry about either living well (and risk running out of money) or scrimping (and sacrificing their lifestyle). According to 2012 data from the Society of Actuaries, the average joint longevity of a healthy American couple is between 93 and 94 years.

Bonds are often seen as a safe investment for creating income in retirement. But are they enough? Let's assume a retiree wanted to spend $40,000 per year starting at age 65. At today's low interest rates, is a $500,000 portfolio enough to do that?

If they invested in bonds that earned 3% net of expenses, that half-million would last about 19 years. So, only until age 84.

At today's bond rates, a retired couple would need about $23.50 to fund $1 of spending each year in retirement, and they'd still have a 20% chance of outliving their assets. To reduce that probability to only a 10% chance of running out of money, they would need $24.30 to fund each $1 of spending. This means that a retiree with a $40,000 spending goal needs to set aside $972,000 today, and still faces a 10% chance of outliving their savings.[2] So this begs the question, if bonds aren't enough, what options are there?

There are two alternatives to setting aside such a large chunk of money to fund spending through bonds.

Equities … and investment risk

The first option is to invest in more volatile assets, such as stocks. But increased volatility means increased investment risk. Accepting investment risk in retirement can be challenging both emotionally and mathematically.

The ups and downs of the market can be stressful. And a market downturn early in retirement can significantly increase the risk of outliving retirement savings. Since the goal of taking on the greater investment risk of stocks is to increase market returns and the chance of living better in retirement, it can be harmful and frustrating if investment losses actually cause a retiree to cut back sharply on their lifestyle. For many, this diminishes the appeal of allocating a large portion of a retirement portfolio to stocks.

[2] Sources: Calculations from Society of Actuaries 2012 joint mortality tables; yield curve on US Treasury bonds on September 1, 2017.

To have only a **10% chance of outliving their money**, a retired couple would need about **$24.30 to fund $1 of spending.**

What you want to spend
What you need to save

Add certainty to the mix

All traditional investments contain some uncertainty. Stocks are volatile and can fall in value. So can bonds, if interest rates rise. And a bond mutual fund's value will fluctuate according to its duration.

True guaranteed income does not fall in value. Annuities are the only investment individuals can purchase to create their own retirement paycheck. While an income annuity isn't a liquid investment, each month a retiree can depend on receiving the same amount as the month before. This certainty can have great appeal.

Or, head to the pool … the risk pool

Another alternative is to pool the risk of outliving your money with others through an income annuity offered by an insurance company. A retiree can get a higher income (and a better lifestyle) and bear less risk of outliving their nest egg.

Additionally, when using an income annuity as part of a complete retirement approach, it can make sense to be more aggressive with the other investments. From the retiree's perspective, there is less risk in owning an income annuity than with owning regular bonds, where interest rate increases could lead to a loss of principal. A portfolio of typical bonds risks depletion for those seeking a spending level higher or for longer than the bond yield curve can reasonably be expected to support. Because the income annuity is matched to the life of the retiree, it protects against the risk of outliving retirement assets.

With risk pooling, a retiree can achieve a 100% chance of success at a lower cost since the annuity payments can be structured to last as long as the retiree does. This is the efficiency of income risk pooling.[3]

Why retirees like annuities

How do you find out what retirees really think about annuities? You ask them.

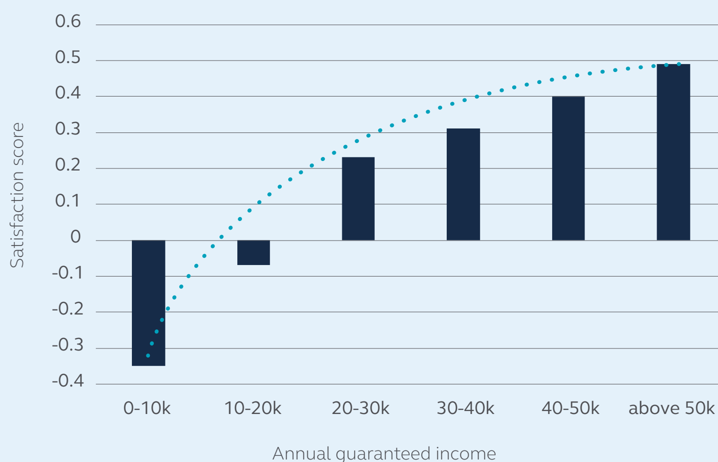
That's exactly what Finke and Pfau did. They interviewed retirees who owned income annuities, providing insight into the emotional impacts of guaranteed income. The following sections include actual quotes from these retirees.

1. Confidence

Certainty provides confidence. This is one of the reasons that retirees who've incorporated income annuities into their retirement planning report higher levels of satisfaction. In a University of Michigan study of around 20,000 older Americans, researchers found that higher levels of guaranteed income in retirement correlated with higher levels of satisfaction in retirement.[4]

Intuitively, it makes sense that retirees with guaranteed income report greater life satisfaction and confidence. Interviews with retirees who had purchased an income annuity help provide insight.

> "One of the best things about an annuity is that you know your basic expenses are always going to be covered. Less worry. Less stress. We don't want to be stressed every month at this point in our life."



More guaranteed income equates to more satisfaction

The University of Michigan study demonstrated that increasing levels of annual guaranteed income improved retirees' perceived satisfaction in retirement. Researchers also found that this relationship held at all levels of wealth.

[3] Success is the ability to support a spending goal for as long as one lives and reach age 95 without fully depleting retirement savings.
[4] The Health and Retirement Study, conducted through the University of Michigan, surveys approximately 20,000 older Americans. The 2014 wave of the survey includes a question that asks retirees to estimate the amount of satisfaction they are experiencing with their life in retirement. At all levels of wealth, more guaranteed income had a strong positive impact on retiree satisfaction. http://hrsonline.isr.umich.edu.

Imagine: You've spent a lifetime earning a regular income, and now you're spending your hard-earned savings without knowing how long you'll need to make it last … and without a reliable way of earning more if you need to.

Guaranteed income means one less thing to worry about. It provides a monthly budget. Retirees may experience less anxiety from worrying about the next market downturn or from spending down their savings.

2. Freedom to spend … and invest

> "An income in retirement has given me a certain amount of freedom because I don't have to worry about it. If you've got that kind of freedom that your money buys, that's worth living for … so I think you are buying freedom, you are buying life — longer, happier life."

Attempting to compensate for this uncertainty, retirees may voluntarily cut back. They'll experience stress, pressure and confusion from not knowing if they can cover basic expenses.

Annuities can counteract that anxiety. Many retirees see the annuity payment and Social Security as their "monthly budget." The same client who doesn't feel comfortable spending their savings — after all, they've spent a lifetime as a good saver — feels license to spend their guaranteed income.

> "Retirees would be more comfortable accepting investment risk if they've got the basics taken care of."

Similarly, most of the annuity owners said that having guaranteed income allowed them to be more comfortable accepting market volatility in other parts of their retirement savings. An investments-only approach means that a retiree's lifestyle is entirely dependent on the performance of stocks and bonds. With guaranteed income, retirees felt better able to maintain their spending, even in a down market, because they knew the annuity payments would not decrease or run out.

> "One of the draws of the annuity payouts is to pay the property tax, utilities, cable, insurance expenses. To take care of those expenses so your investments can grow."

3. Opportunity to leave a legacy

> "The desire to pass on our wealth to our heirs or charity is probably more important to the Greatest Generation because so many came through the Great Depression. I think our first responsibility is not to be a burden to our children and to live life to its fullest as long as we can."

If you outlive your retirement savings, you've lost the ability to pass anything along to your heirs or a charitable organization.

In the interviews, many annuity holders pointed out that they felt more comfortable providing a legacy for their heirs or giving to charity. This is contrary to a common reason for not purchasing annuities: fear that removing those assets will preclude a legacy. However, many who made the decision to buy an annuity felt greater freedom in giving away wealth once they knew that their basic expenses were taken care of through guaranteed income.

Annuities in action — three case studies

The efficiency of guaranteed income

The easiest way to show that annuities are less expensive and safer for risk-averse retirees is through case studies. Three case studies use realistic return projections based on today's stock and bond valuations to demonstrate how combination strategies using both annuities and investments support higher success rates and greater legacy wealth over the long term. Without having to tie spending goals to market performance, the retiree can support a more consistent asset allocation strategy.[5] These case studies are hypothetical examples and do not reflect specific client results.

Finke and Pfau quantified this asset allocation consistency by comparing retirement income planning approaches in terms of the impacts on spending and legacy. Success for each example is the ability to support a spending goal and reach age 95 without fully depleting the retirement savings.

Each example shows that by adding an income annuity to their retirement portfolio, a retiree can get the same or higher income with lower risk of outliving their savings. With an investments-only approach, they'll have to accept the possibility that their portfolio can't match the comparable income from the combination strategy.

Common assumptions for each example

Each starts with $100,000 of their investable wealth, a portion of their overall retirement savings from which they require a specific amount of income.

We'll examine what can happen when they purchase an annuity with the full amount.

We'll then explore what happens when they combine an annuity with investments by purchasing an annuity for half the amount and investing $40,000 of the remainder to equities and $10,000 to regular bonds.

Spending goals will be initially covered by the annuity payments. Any amount above the annuity payment will tap into the investment amount.

We'll assume an annual 3% cost-of-living increase to account for inflation.

We'll also assume that the retirees want a 90% chance of reaching age 95 without running out of money.

Where the numbers came from

This analysis was performed using 10,000 Monte Carlo simulations for stock and bond returns. Portfolio returns were simulated for up to a 40-year period (10 years of deferral and a 30-year retirement through age 95 in the first case study) for intermediate-term government bond yields, the equity premium for the S&P 500 and inflation. The details for the underlying market simulations are provided in the appendices.

[5] You can find more detail on asset allocation assumptions and methodology in the appendices at the end of this paper.

Example 1:

Ten years to go

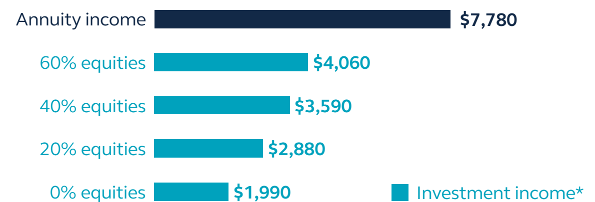
James and Stéphanie Dixans

- 55 years old
- Retiring in 10 years
- $6,000 annual spending goal
- Joint income annuity
- Deferred income annuity with 10-year deferral
- Cash refund provision

James and Stéphanie Dixans are approaching retirement. Both are 55 years old and expect to retire in 10 years' time. The Dixans have a specific spending goal for this money — $6,000 annually — and are exploring the idea of using an income annuity to fund those expenses.

Defining the range of possibilities — If the Dixans were to purchase a deferred income annuity with the full $100,000, their annual income would be $7,780. Compare that to various investments-only portfolios built to provide a 90% chance of success. Even a portfolio of 60% equities would only provide $4,060 in sustainable annual spending. Without any equity investments to provide growth, that level of spending drops to $1,990 per year.

Annuity income versus investment income



*Sustainable spending from investments with 90% success

A combination approach — In this case, the Dixans are purchasing an income annuity with a portion of their savings. The deferred income annuity would support 65% of the retirement spending goal at age 65. Inflation will push this percentage lower over time, and the investment portfolio will pick up the slack. By the time the Dixans reach 95, the spending goal will increase to $14,139 (3% increase per year for 30 years). If market returns are good over that time (90th percentile) or average (median), this goal can be met with remaining legacy assets equal to $2.71 million and $363,000, respectively. The same return scenarios for an investments-only approach would leave $986,031 (90th percentile) and $71,250 (median).

If the Dixans use an investments-only strategy with 40% allocated to stocks, spending can be met with good or average market returns; however, what they'll be able to pass along is substantially less in both cases. With poor market returns, the Dixans will have exhausted all their assets before reaching 95.

	Combination approach*			Investments only**		
	Initial percentage of guaranteed income	Total spending at age 95	Remaining assets at age 95	Initial percentage of guaranteed income	Total spending at age 95	Remaining assets at age 95
Good market returns (90th percentile)	65%	$14,139	$2,714,229	0%	$14,139	$986,031
Average market returns (median)	65%	$14,139	$362,581	0%	$14,139	$71,250
Poor market returns (10th percentile)	65%	$3,890	$0	0%	$0	$0
Probability of success	**77%**			**60%**		

*50% of assets to annuity; 80% stock allocation for remainder (40% of initial assets in stocks)
**40% stock allocation

In terms of the overall probability of reaching age 95 and not outliving their money, combining annuities with investments gives the Dixans a 77% success rate, while the investments-only approach supports a 60% success rate.

Marco and Maria Adesso

- 65 years old
- Ready to retire now
- $4,000 annual spending goal
- Joint immediate income annuity
- Cash refund provision

Example 2:

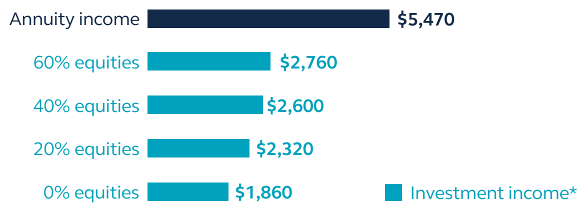
Ready now

Marco and Maria Adesso have reached retirement and are finalizing some of their financial needs. To fund a $4,000 spending goal with their $100,000, they're looking at an income annuity.

Defining the range of possibilities — Purchasing an annuity with the full $100,000, the Adessos would see annual income of $5,470 against their target of $4,000 in spending. Comparable investments-only portfolios built to provide a 90% chance of success might deliver between $1,860 and $2,760 per year.

A combination approach — Dedicating half of their $100,000 to an annuity would cover 68% of their spending in the first year of retirement. Inflation will push this percentage lower over time, and the investment portfolio will pick up the slack. By the time they reach 95, the spending goal will increase to $9,426 (3% increase per year for 30 years). As with the Dixans, with good or average market returns the Adessos would not only be able to meet their spending goals until age 95, but they would also have substantial assets to pass along.

Annuity income versus investment income



*Sustainable spending from investments with 90% success

Similarly, the investments-only approach would meet the Adesso's spending goals in good or average market conditions, but the couple would run out of money before their 95th birthdays if markets were poor. The investments-only approach also leaves only a fraction of the legacy assets that the combination approach would provide.

	Combination approach*			Investments only**		
	Initial percentage of guaranteed income	Total spending at age 95	Remaining assets at age 95	Initial percentage of guaranteed income	Total spending at age 95	Remaining assets at age 95
Good market returns (90th percentile)	68%	$9,426	$691,845	0%	$9,426	$250,989
Average market returns (median)	68%	$9,426	$92,963	0%	$9,426	$4,994
Poor market returns (10th percentile)	68%	$2,735	$0	0%	$0	$0
Probability of success	**71%**			**52%**		

*50% of assets to annuity; 80% stock allocation for remainder (40% of initial assets in stocks)
**40% stock allocation

Using an income annuity would provide the Adessos with a 71% chance of living to age 95 without running out of money. The investments-only approach would provide little better than a 50% chance of success.

Example 3:

Looking for stability

Divina Matatag and her now late husband retired about a decade ago in their long-time adopted home of Los Angeles. Mrs. Matatag has a spending goal of $6,000 for this portion of her retirement savings. She's looking for greater reliability of her retirement income and is considering an income annuity with a cash refund.

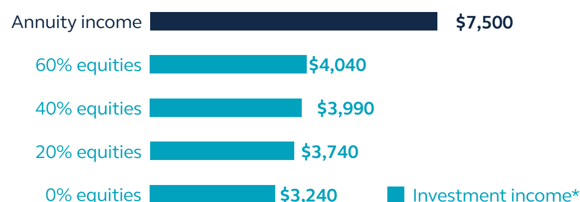
Defining the range of possibilities — If Mrs. Matatag fully annuitized her $100,000 to cover the $6,000 of annual expenses, she'd see annual income of $7,500. An investments-only portfolio with a 90% chance of success could deliver between $3,240 and $4,040 of annual income.

A combination approach — Mrs. Matatag's $50,000 annuity would cover 63% of her spending goal in its first year. With good or average market returns over the next 20 years, she could maintain her spending and have assets left over to pass along to heirs or donate to charity. Under an investments-only approach, only good market returns would allow her to continue spending until age 95. With either average or poor market returns, Mrs. Matatag would run out of money before 95.

Divina Matatag

- 75 years old
- Already in retirement
- $6,000 annual spending goal
- Single life, immediate income annuity
- Cash refund provision

Annuity income versus investment income



*Sustainable spending from investments with 90% success

The combination strategy shows a 61% chance of allowing Mrs. Matatag to reach age 95 with money to spend. The investments-only approach can only muster a 35% chance of success.

	Combination approach*			Investments only**		
	Initial percentage of guaranteed income	Total spending at age 95	Remaining assets at age 95	Initial percentage of guaranteed income	Total spending at age 95	Remaining assets at age 95
Good market returns (90th percentile)	63%	$10,521	$184,552	0%	$10,521	$64,353
Average market returns (median)	63%	$10,521	$18,474	0%	$0	$0
Poor market returns (10th percentile)	63%	$3,750	$0	0%	$0	$0
Probability of success	**61%**			**35%**		

*50% of assets to annuity; 80% stock allocation for remainder (40% of initial assets in stocks)
**40% stock allocation

> As these examples show, using **an income annuity supports higher success rates in retirement.** The outcomes for the combination approach are quite attractive relative to investments-only both in terms of supporting the spending goal and a greater legacy value for remaining assets. Even in poor market scenarios, when the investment portion runs out, the annuity still provides some income.

Research conclusions

This research concludes that a combination approach using income annuities can help better meet goals in retirement than an investments-only approach — both from a financial and emotional perspective.

- Adding an income annuity to a retirement portfolio allows a retiree to get the same or higher income with lower risk of outliving savings than an investments-only approach.
- Income annuities allow a retiree to spend at a level that investments alone would be unable to match without significant risk of running out of money before age 95.
- Using both annuities and investments can enhance the legacy value of assets over the long term.

Through interviews with actual retirees who purchased an income annuity, it is clear that the motive to dedicate a portion of their nest egg to guaranteed income centers around financial security.

The stability and security of guaranteed income helps retirees . . .

- Worry less about the market.
- Feel more comfortable spending on things they enjoy.
- Live a better life with less worry of outliving their savings.

Meeting the financial goals of retirement and managing risk means strategically using all of the income tools and tactics available. It's a great time to look at income annuities with fresh eyes. Consider incorporating income annuities into your retirement income offerings. Your retirees could be better served and more comfortable in their retirements with an income annuity in their portfolio.

For retirees, it's about more than money. Not only do income annuities provide income that can't be outlived, they give peace of mind and more financial security — something you can't put a price tag on.

Lifetime income guarantees serve many functions:

- They help to manage market volatility and investment risks
- They help protect against longevity risk
- They efficiently set aside assets to help cover retirement spending
- They reduce the fear and worry about outliving savings in retirement
- They help simplify the financial plan

About the authors

Michael Finke

Michael Finke, Ph.D., CFP®, is Chief Academic Officer at The American College of Financial Services. He joined The College in June 2016, having served since 2006 as a professor and Ph.D. coordinator in the Department of Personal Financial Planning at Texas Tech University. From 1999 through 2006, he served as the director of graduate studies at the University of Missouri.

Wade Pfau

Wade Pfau, Ph.D., CFA®, is a Professor of Retirement Income in the Ph.D. program for Financial and Retirement Planning at The American College in Bryn Mawr, PA. He also serves as a Principal and Director for McLean Asset Management. He holds a doctorate in economics from Princeton University and publishes frequently in a wide variety of academic and practitioner research journals on topics related to retirement income. He hosts the Retirement Researcher website, and is a contributor to *Forbes, Advisor Perspectives, Journal of Financial Planning*, and an Expert Panelist for *The Wall Street Journal*. He is the author of the books, *How Much Can I Spend in Retirement? A Guide to Investment-Based Retirement Income Strategies*, and *Reverse Mortgages: How to Use Reverse Mortgages to Secure Your Retirement*.

Principal®

Principal® helps people and companies around the world build, protect and advance their financial well-being through retirement, insurance and asset management solutions that fit their lives. Our employees are passionate about helping clients of all income and portfolio sizes achieve their goals — offering innovative ideas, investment expertise and real-life solutions to help make financial progress possible. To find out more, visit us at principal.com.

Appendix 1:

Understanding the case study details

The Monte Carlo simulations used to create the case studies reflect the lower bond yields available today, but included a mechanism for interest rates to gradually increase over time (on average) toward their historical norms. Bond returns were calculated from the simulated interest rates and their changes. Stock returns were calculated by adding a simulated equity premium on top of the simulated (variable-and-rising) interest rates. Strategies were simulated with annual data. The calculations also assumed that withdrawals were made at the start of each year, that fees were deducted at the end of each year and that portfolios were rebalanced annually to restore the targeted asset allocation. Taxes are not part of this analysis, which means Finke and Pfau made the comparisons for assets held inside a qualified retirement plan that provided the same tax treatment to annuity and investment distributions.

The annuity quotes are real quotes provided by Principal. The quoted payout rate is net of internal fees. As for investments, to be comparable, Finke and Pfau applied fees to the indexed market returns. They assumed that investment fund expenses for both stocks and bonds represented a relatively low 0.45% annual expense, and that the financial advisor charges an additional 1% annual assets-under-management fee for assets held in the investments account.

Regarding asset allocation, Finke and Pfau felt it made sense to seek a more aggressive investment strategy to accompany the use of an income annuity. Income annuity premiums are invested into a high-quality fixed income portfolio with the insurance company. From the owner's perspective, there is less risk than with bonds, because there is no risk of a capital loss if interest rates rise, and because the income annuity is a fixed income asset that is matched to the longevity of the retiree. It hedges for longevity risk. A bond portfolio risks depletion for those seeking a spending level higher or for longer than the bond yield curve can reasonably be expected to support.

Appendix 2:

Combination approach methodology

In Finke and Pfau's partial annuitization case studies, they modeled households owning the same amount of stocks with or without the annuity. The household decided not to become more aggressive, but also not to become more conservative.

- With an investments-only strategy, the household is comfortable with a 40% stock allocation, representing $40,000 of stocks in a $100,000 portfolio.
- By annuitizing 50% of their assets, the household moves $50,000 to the income annuity. Finke and Pfau assumed this amount comes from the fixed income allocation so that the amount of stocks held remains the same as before.
- After annuitizing, $50,000 remains in the investment portfolio: $40,000 in stocks and the remaining $10,000 in bonds.

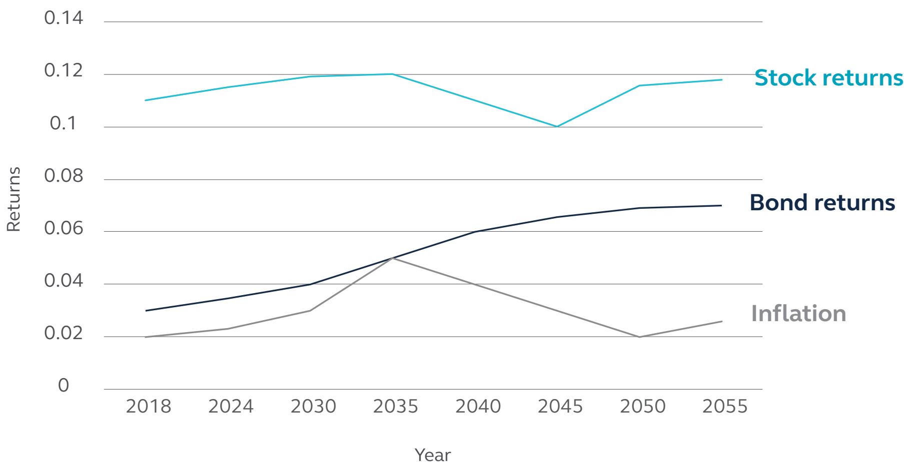
This now represented an 80% stock allocation in the remaining investment piece in order to maintain the same amount of stock investments, with the household treating the annuity as a fixed income investment. They maintained this 80% stock allocation throughout retirement, justified by the greater risk capacity supported through the income guarantee that left the household's standard of living less exposed to market volatility. The household did not become more aggressive because it owned the same monetary amount of stocks both before and after annuitization.

Appendix 3:
Technical details on capital market expectations

The capital market expectations connect the historical averages from Morningstar's Stocks, Bonds, Bills, and Inflation dataset together with the current market values for inflation and interest rates. This makes allowances for the fact that interest rates and inflation are currently below their historical averages, but it also respects historical averages and does not force these values to remain low for the entire simulated time horizon. Using Morningstar data, the US S&P 500 Index represents the stock market, intermediate-term US government Treasury bonds represent the bond market, and the Consumer Price Index represents inflation.

A Cholesky decomposition was performed on a matrix of the normalized values for the risk premium, bond yields and inflation. Finke and Pfau used a Monte Carlo simulation to create error terms for these variables, which preserved their contemporaneous correlations with one another. Then the variables were simulated with these errors using models that preserved key characteristics about serial correlation.

Inflation was modeled as a first-order autoregressive process starting from 2.1% inflation in 2018 and trending toward its historical average over time with its historical volatility. Bond yields were similarly modeled with a first-order autoregression with an initial value of 2.54%. The risk premium was modeled as a "random walk" around its historical average and with its historical volatility. Bond returns were calculated from bond yields and changes in interest rates, assuming a bond mutual fund with equal holdings of past five-year Treasury issues. Stock returns were calculated as the sum of bond yields plus the equity premium. The graph below shows the medians for the key variables.



Drs. Finke and Pfau are not affiliated with Principal.

Quotes were provided by actual Principal customers who were compensated for their time to take part in the study. Quotes are not representative of and should not be construed as guarantees of investor satisfaction. Results are hypothetical and past performance no guarantee of future results. Additionally, illustrations utilized in the case study are based on rates available at the time of publication but could vary based on the date quotes are sought and individual client situation and purchase amounts.

This is not a recommendation and is not intended to be taken as a recommendation. This material was prepared for financial professionals. Consumers should discuss their specific situation and retirement planning strategies with their financial representative.

Annuities are issued by Principal Life Insurance Company, a member of the Principal Financial Group®, Des Moines, IA 50392, principal.com

Principal, Principal and symbol design, and Principal Financial Group are registered trademarks of Principal Financial Services, Inc., a member of the Principal Financial Group.

© 2019 Principal Financial Services, Inc.

RF2417A-01 | 780151-032019 | 03/2019