

Vanguard®

Comparing spending approaches in retirement

Vanguard research

October 2010

Executive summary. One of the biggest unresolved issues facing investors and financial services providers is how to optimally generate a reliable stream of retirement income. The array of new products being introduced—such as managed payout funds—attests to the retirement income challenge investors contend with in trying to manage their spending to ensure that they do not outlive their savings.

This paper evaluates the potential financial impact of eight retirement spending strategies—three based on systematic drawdowns, three using annuities, and two hybrid approaches. To help investors make more informed choices, we simulated the possible outcomes of these strategies, focusing on metrics that real-world retirees care about—such as cash flow and portfolio residual value.

Authors
John Ameriks, Ph.D.
Michael Hess
Liqian Ren, Ph.D.

Note: This paper is adapted from John Ameriks, Michael Hess, and Liqian Ren, *Comparing Spending Approaches in Retirement*, in *Reorienting Retirement Risk Management*, edited by Olivia Mitchell and Robert Clark (Oxford, England: Oxford University Press, 2010). By permission of Oxford University Press.

Connect with Vanguard > vanguard.com
> global.vanguard.com (non-U.S. investors)

Not surprisingly, we found that the various commonly advocated methods to generate income and manage spending during retirement can produce a wide range of potential outcomes. An investor's choice of strategy will depend on individual circumstances and preferences—including the relative importance of passing on residual wealth to heirs.

For most investors, having a financially secure retirement depends not only on accumulating sufficient savings but also on spending those savings prudently so that they can last a lifetime. Until recently, more attention seems to have been devoted to assisting investors with building a retirement nest egg. However, an expanding array of financial products designed to help investors meet the retirement income challenge is drawing more attention to the spending side of the equation. And as more members of the baby boom generation retire, the focus on generating income to meet spending needs is likely to intensify.

Overview of common spending strategies

Formal solutions for the optimal generation of a reliable and sustainable stream of retirement income have been discussed in academic literature for at least four decades, and investment advisors offer a variety of products and methods. Traditionally, the challenge of transforming a pool of assets into a steady stream of retirement income has been met by annuities, income investing, and systematic withdrawal plans. However, trying to evaluate the merits of the various traditional and newer strategies can be a daunting task for both investors and practitioners, especially because what matters to one retiree—for example, passing wealth on to heirs or a charitable organization—may not be important to another.

To help investors, retirees, and investment professionals understand and evaluate the merits of various approaches, we modeled eight common strategies for meeting spending needs during retirement:

1. Required minimum distributions (RMD) from a traditional individual retirement account (IRA).
2. Systematic distributions from a balanced mutual fund (fixed real withdrawals).
3. Managed payout fund (with either “endowment-style” or “time-horizon” designs).
4. Fixed real lifetime immediate annuity.
5. Variable lifetime immediate annuity.
6. Variable deferred annuity with *guaranteed lifetime withdrawal benefits*.
7. Hybrid strategy: 50% RMD, 50% fixed real lifetime immediate annuity.
8. Hybrid strategy: 50% RMD, 50% variable lifetime immediate annuity.

Each of these spending approaches is briefly described in the pages following (for more details, see also Bruno and Zilbering, 2010). **Figure 1**, on page 7, sets forth the key assumptions we made when modeling each strategy. Note that when comparing the strategies, we ignored the different potential tax consequences of each.

1. Required minimum distributions (RMD) from a traditional IRA. Investors in a traditional IRA are required by the Internal Revenue Service (IRS) to begin taking withdrawals after the account owner turns age 70½. (The first withdrawal may be delayed until the year after the year in which the owner reaches age 70½; see Appendix **Figure A-2**, on page 14, for the IRS withdrawal schedule.) Roth

IRAs, however, do not have RMD requirements. Depending on their circumstances, some investors choose to, or may be obliged to, rely on RMDs to fund all or a significant portion of their retirement spending needs.

2. Systematic distributions from a balanced mutual fund.

One of the spending methods popular among financial planners and advisors is to make systematic withdrawals from a typical balanced mutual fund consisting of stocks and bonds. Ideally, such withdrawals would be a fixed, inflation-adjusted amount to preserve the purchasing power of the payment stream over time. However, although most mutual fund providers permit shareholders to specify a fixed dollar or percentage amount to be distributed (on a schedule chosen by the shareholder), the investor must compute any required inflation adjustment to the payments and must advise the fund provider of changes in the withdrawal amount.¹ Of course, an important risk of this strategy is that these withdrawals may exhaust a portfolio of assets over time.

3. Managed payout funds. Managed payout funds offer a professionally advised investment portfolio (typically a mutual fund) combined with a specific formula-determined mechanism to provide periodic payments to fund investors. First offered to investors in 2007, these funds essentially combine a mutual fund structure—with daily valuation and liquidity—with a systematic withdrawal strategy, and are designed for investors in the spending stage of life.

It is important to note that investors in managed payout funds are not guaranteed either a stated level of periodic payments or returns. Some of these funds are designed so that distributions are declared and paid to all shareholders based on the number of shares owned. Distributions may be characterized as income, dividends, or capital gains—or a combination of these. Under some circumstances, depending on the investment performance of fund holdings, distributions may be characterized as a return of investor's capital.

As with conventional mutual funds, the investment management and asset allocation strategies used in managed payout funds vary across providers. For example, some are actively managed while others use index funds; some include only traditional asset classes (long-only stocks, bonds, and cashlike investments) while others allow long-short strategies, commodities, and other alternative investments. Despite these differences, managed payout funds generally can be characterized as either perpetual-managed "endowment-style" funds or "time-horizon" funds.

As their name implies, endowment-style funds are intended to provide periodic, ongoing payments to fund shareholders, in perpetuity, while striving to preserve (or in some cases grow) the principal. They can be particularly attractive for an investor concerned about longevity risk—the risk of outliving one's savings. In contrast, time-horizon funds are designed

Notes on risk: All investments are subject to risk. Variable annuities are long-term vehicles designed for retirement purposes and contain underlying investment portfolios that are subject to investment risk, including possible loss of principal. If you take withdrawals from a variable annuity prior to age 59½, you may have to pay ordinary income tax plus a 10% federal penalty tax. Annuity guarantees are subject to the claims-paying ability of the issuing insurance company. Managed payout funds are not guaranteed to achieve their investment objectives, they are subject to loss, and some of their distributions may be treated in part as a return of capital.

An investment in a money market fund is not insured or guaranteed by the Federal Deposit Insurance Corporation or any other government agency. Although a money market fund seeks to preserve the value of your investment at \$1 per share, it is possible to lose money by investing in such a fund.

¹ To date, we are not aware of any mutual fund company that provides the service of automatically computing any required inflation adjustment.

A primer on annuities

The word *annuity* has come to mean a variety of things, to the point that many consumers are confused about exactly what an annuity is. Annuities are a form of insurance intended to address the uncertainty investors face when planning for income for the rest of their lives—a length of time they cannot accurately predict. In exchange for permanently surrendering access to a portion of their assets, annuitants can receive a stream of income as long as they live. This primer briefly explains some key terms and concepts that are relevant to understanding the strategy results we present. For a more complete discussion of the various forms of annuities, please see Ameriks and Ren (2008).

There is a basic distinction between immediate annuities and deferred annuities. An **immediate annuity**, also known as an **income annuity**, is a so-called payout contract in which the policyholder, or annuitant, is promised a sequence of payments made according to specified rules and conditions in exchange for a lump-sum purchase price. In simple terms, an immediate annuity can be viewed as a reverse form of life insurance: It pays benefits in the event of a long life span.

An immediate annuity is a commonly used retirement *spending* vehicle, not a saving vehicle. Immediate annuities are of two types: A **term-certain** annuity may involve payments that continue for only a set period, while a **lifetime annuity** offers payments that continue as long as an annuity owner is alive to receive them. In a **lifetime immediate annuity**, payments are made to one or more annuitants for as long as they are alive. Lifetime annuities are the only

annuity products that serve to transfer longevity risk from the purchaser to the annuity provider, directly addressing this key concern of retirees.

Within the class of lifetime annuities, a further distinction exists between **fixed** annuities, which promise a certain dollar amount at each point in the future, and **variable** annuities, which promise to yield an unknown (but formula-based) amount via payments that will fluctuate depending on asset returns over time. Thus, fixed annuities provide “rate of return” insurance, while variable annuities do not. However, both types of lifetime annuity provide “longevity insurance” by promising payments regardless of how long an annuitant lives.

In contrast to an immediate annuity, a **deferred annuity** is essentially a tax-favored investment account bundled with the right to purchase an immediate annuity at a future date. Deferred annuities provide tax-deferred accumulation similar to that offered by a traditional IRA. However, many deferred annuity providers offer investors the opportunity to purchase a **guaranteed lifetime withdrawal benefit (GLWB) rider**. A GLWB rider guarantees the annuity purchaser the ability to withdraw a minimum amount annually, regardless of the market performance of the underlying investments—a feature that some investors find attractive. (Please see pages 5 and 6 for more discussion on the GLWB rider.)

This paper presents the possible simulated financial outcomes of two immediate annuity products: a **fixed real lifetime immediate annuity** (strategy 4) and a **variable lifetime immediate annuity** (strategy 5). We also evaluate a **variable deferred annuity with a GLWB rider** (strategy 6).

to provide formulaically determined payments over a set period (for example, 10, 20, or 30 years), fully distributing all assets in the fund so that there is no remaining balance at the end of the stated time period. In both types of managed payout fund, the amount of the periodic payments can vary based on investment returns, formulaic adjustments to the periodic payments, the impact of fund expenses, or a change in the provider's distribution policy.

4. Fixed real lifetime immediate annuity. In contrast to the first three spending strategies, immediate annuities offer investors a level of income that is guaranteed for life. For our analysis, we modeled a fixed real lifetime immediate annuity, but investors may also choose from products with payments that are not adjusted for inflation.

Although the promise of guaranteed income is attractive, some investors may not want to relinquish control of the assets needed to purchase the annuity contract; such lack of liquidity can be an important consideration in the event of unexpected expenditure shocks—for example, uninsured medical expenses. Additional reasons behind some investors' reluctance to purchase annuities include: potentially high insurance fees; risk and cost of a default by the annuity provider; limited opportunity to participate in equity-market returns; anticipated income from other annuitized resources such as Social Security or an employer-sponsored pension; and the desire to leave a bequest for heirs. Still, relying on periodic payments from a fixed annuity is a common strategy for managing retiree spending.

5. Variable lifetime immediate annuity. Variable immediate annuities are also designed to offer guaranteed income for life. But—in contrast to owners of fixed immediate annuities—variable annuity purchasers have the potential to receive higher payouts when capital market returns are good, while facing the prospect of lower payouts if markets perform poorly. And purchasers of variable annuities, unlike fixed annuity investors, can choose among various underlying investment options (typically stock, bond, and money market subaccounts).

A variable lifetime immediate annuity's payments over time are based on the investment performance of the mutual funds underlying the insurance contract relative to the assumed investment return (AIR). The first payment made is based on the AIR, which is specified in the contract, and in some cases can be chosen by the investor. Subsequent payments can rise if underlying fund performance exceeds the AIR (after certain stated deductions); conversely, payouts will fall if the underlying funds fall short of the AIR. Some investors prefer variable, rather than fixed, annuities because of the opportunity to participate in equity-market performance.

6. Variable deferred annuity with a GLWB rider.

A relatively new form of annuity product is the guaranteed lifetime withdrawal benefit (GLWB) rider offered by many deferred annuity providers. While various types of GLWB riders are available in the marketplace, we confine our discussion to the features we modeled in our analysis.

The product we analyzed has two distinctive design features. First, the insurer establishes a "guaranteed income base" equal to the initial deposit, or premium, paid on the contract (\$250,000 in our analysis). This guaranteed income base cannot decrease, so long as the investor's withdrawals from the contract do not exceed the guaranteed minimum amount—which is expressed as a fixed percentage of the guaranteed income base. Although the guaranteed income base cannot decline as a result of poor investment performance, it can "step up" on the annual anniversary date of the rider if markets perform well. Essentially, this feature protects retirement income from market declines while still allowing participation in the markets' upside potential.

The second design feature of the GLWB rider relates to withdrawals. In contrast to standard immediate annuity products, in which the purchaser permanently surrenders the invested amount, the GLWB rider allows withdrawals. Specifically, the full amount of any investment value—which consists of the initial deposit plus any subsequent investments and returns, minus costs and any guaranteed or other

withdrawals—remaining in the contract can be withdrawn at any time or bequeathed at death (the contract is canceled at that point). In addition, the investor can take withdrawals in excess of the guaranteed minimum amount at any time, but such withdrawals reduce the guaranteed income base in the same proportion as they would reduce the remaining investment value in the contract (potentially to zero).

Although the costs associated with a variable deferred annuity with a GLWB rider are typically higher than for other annuity products, the potential benefit of having a (conditionally) guaranteed withdrawal level while retaining the option to liquidate the balance remaining on the contract at any time has a “have your cake and eat it too” appeal to some investors.

7. Hybrid strategy: 50% RMD, 50% fixed real lifetime immediate annuity. This approach assumes that half of the investor’s initial assets earmarked to fund retirement spending are in a traditional IRA and the other half of the assets are used to purchase a fixed real lifetime immediate annuity. In our analysis, the hypothetical investor has accumulated \$125,000 in an IRA and uses \$125,000 to purchase a fixed real lifetime immediate annuity.

8. Hybrid strategy: 50% RMD, 50% variable lifetime immediate annuity. Similarly, this approach assumes that half of the investor’s initial assets earmarked to fund retirement spending are in a traditional IRA and the other half of the assets are used to purchase a variable lifetime immediate annuity.

Summary of methodology

We used the proprietary Vanguard Capital Markets Model® (VCMM) to help focus on the real-world differences in the simulated outcomes for retirees who pursue any of the eight spending strategies we evaluated. The VCMM is based on the estimation and simulation of a vector-autoregression model of

monthly asset returns, inflation rates, interest rates, and other economic factors based on data from February 1960 through March 2010.² For each strategy, the model generated 10,000 simulations of 30-year sequences of asset returns and inflation rates. For more information on the model itself, please see Wallick, Aliaga-Díaz, and Davis (2009).

Two assumptions were common to all cases: We assumed that the spending strategy was funded with an initial investment of \$250,000 and that the investor was aged 65 at the start of the period. The specific assumptions used to model the potential financial outcomes of each spending strategy are summarized in **Figure 1**. In addition, Appendix **Figure A-3**, on page 15, sets forth the portfolio asset allocation and fee assumptions for each strategy: In most cases, we assumed an initial asset allocation of 48% U.S. equities, 12% international equities, and 40% nominal bonds with periodic rebalancing. Appendix **Figure A-4**, on page 16, shows the simulated 30-year asset-class returns and standard deviations that were generated by the VCMM and then used to model the strategy outcomes.

Comparing the results

To summarize the VCMM simulations, we present the results for three key metrics: cash flow, the median value of the portfolio balance over the retiree’s lifetime, and median annual internal rates of return over different time horizons.

Cash flow

The strategy that ranked highest in generating stable cash flows—across 5-, 20-, and 30-year time horizons—was the **fixed real lifetime immediate annuity**, followed by systematic withdrawals from a balanced mutual fund. Although these two strategies did not produce the highest dollar value of cash flow, the cash flows they generated were highly stable. Appendix **Figure A-5**, on page 17, summarizes the cash flows and associated volatility for each strategy.

² Although the simulated asset-class returns and other outputs generated by the VCMM vary from time to time, these variations have not changed the general conclusions of our evaluation of the eight retirement spending strategies.

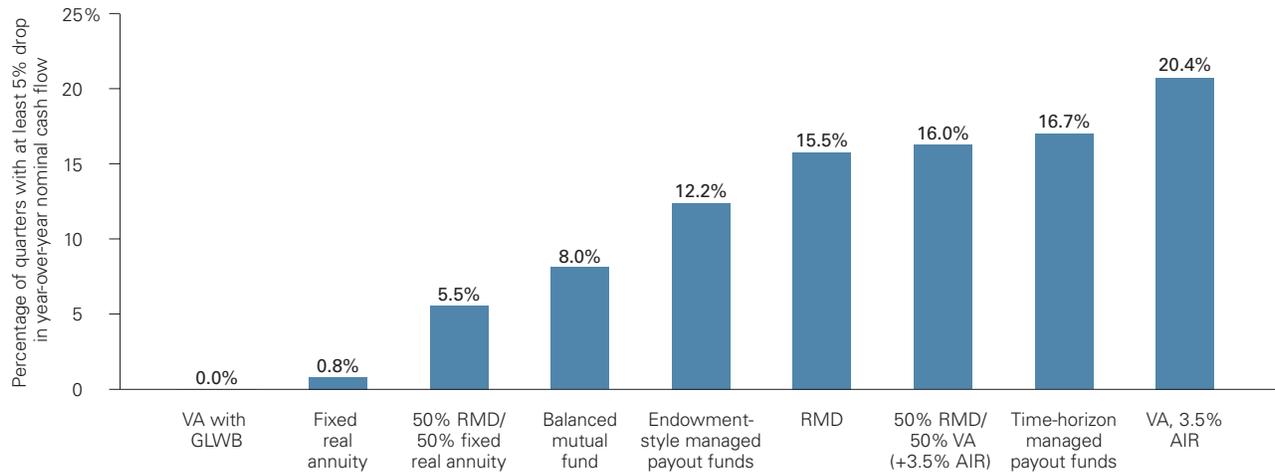
Figure 1. Key assumptions used to model outcomes of spending strategies

Spending strategy	Initial payment amount	Payment schedule	Frequency of payment adjustments	Other model assumptions
RMD: Required minimum distribution from IRA	Minimum annual withdrawal must begin by age 70½ in accordance with IRS regulations.	Investor choice, at least annually.	Annually, based on IRS regulations.	See Appendix Figure A-2 for IRS RMD payout rates.
Balanced mutual fund: Systematic distributions from balanced mutual fund	5% of initial net asset value.	Quarterly.	Annually, based on the previous year's change in inflation (measured by the consumer price index, or CPI).	Investor is responsible for adjusting withdrawals annually, based on inflation.
Managed payout funds:				
Endowment-style	5% of the 12-quarter trailing historical average of net asset value.	Quarterly.	Annually, on a predetermined time schedule.	
Time-horizon	Approximately 5% of initial net asset value.	Quarterly.	Annually, according to the schedule shown in Appendix Figure A-2.	30-year distribution period (shorter or longer periods can be selected) with no remaining balance.
Fixed real annuity: Fixed real lifetime immediate annuity	Initial payment based on an actual insurance quote from Vanguard.	Quarterly.	Annually, based on the previous year's change in inflation (measured by the consumer price index, or CPI).	65-year-old male investor purchases a fixed single-life annuity.
VA (+3.5% AIR): Variable lifetime immediate annuity	Initial payment based on an actual insurance quote from Vanguard.	Quarterly.	Quarterly, based on underlying fund performance relative to the assumed investment return (AIR) chosen by the purchaser.	65-year-old male investor purchases a variable immediate lifetime annuity with an AIR of 3.5%.
VA with GLWB: Variable deferred annuity with guaranteed lifetime withdrawal benefit (GLWB) rider	5% of the guaranteed income base.	Quarterly.	Annually, on the anniversary date of the GLWB rider purchase, the guaranteed income base is reevaluated based on the net investment performance of the underlying mutual funds.	
Hybrid strategy: 50% RMD, 50% fixed real lifetime immediate annuity		RMD: Investor choice, at least annually. Fixed real annuity: quarterly.	Annually.	
Hybrid strategy: 50% RMD, 50% variable lifetime immediate annuity		RMD: Investor choice, at least annually. Variable annuity: quarterly.	Annually for RMD portion, quarterly for annuity portion.	

Note: In all cases, the spending strategy is assumed to be funded with an initial investment of \$250,000, and the investor is assumed to be aged 65 on day one.

Source: Vanguard.

Figure 2. Quarters with at least 5% drop in year-over-year nominal cash flow (30-year horizon)



IMPORTANT: These hypothetical data do not represent the returns on any particular investment. The projections or other information generated by Vanguard Capital Markets Model simulations regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Results from the model may vary with each use and over time.

Note to Figures 2–5 and A-2, A-3, A-5, and A-6: VA = variable annuity; RMD = required minimum distribution; AIR = assumed investment return; GLWB = guaranteed lifetime withdrawal benefit.

Source: Authors' calculations, using simulations generated by the Vanguard Capital Markets Model.

Figure 2 graphs the volatility of the cash flows generated by each strategy. As shown, the **variable lifetime immediate annuity** was the most volatile, with the highest percentage of calendar quarters—approximately 20%—in which *nominal* cash flow was at least 5% *below* the corresponding quarter in the prior year. The second-most-volatile strategy was the time-horizon managed payout fund: Almost 17% of the time, quarterly cash flow was at least 5% below the previous year's level.

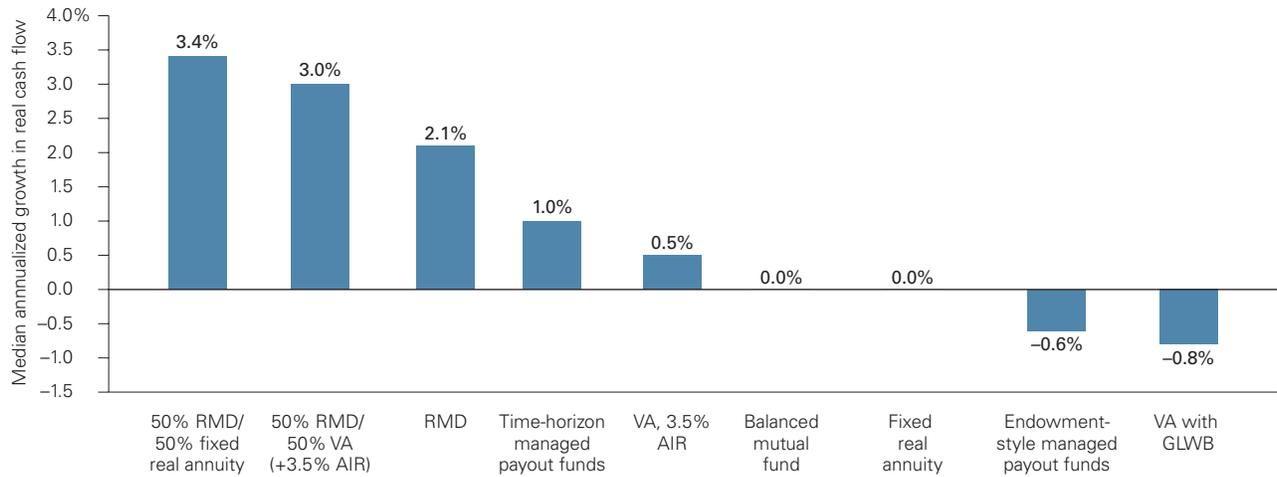
Figure 3 shows the annual growth rate of real cash flow for each strategy over 30 years. The hybrid strategy consisting of **50% RMD and 50% fixed real lifetime immediate annuity** had the highest median annualized growth rate—3.4%, with the other hybrid strategy not far behind.

Portfolio balance

Another crucial metric for many retirees is the value of their portfolio at any point in time. This metric is particularly important for investors who wish to bequeath assets to heirs or charitable organizations. Across all time periods, the RMD strategy produced the highest median ending portfolio balance: The median value remaining in the RMD portfolio after 20 years was more than \$300,000, compared with more than \$225,000 for the endowment-style managed payout fund. For a summary of the results, see Appendix Figure A-6, on page 18.

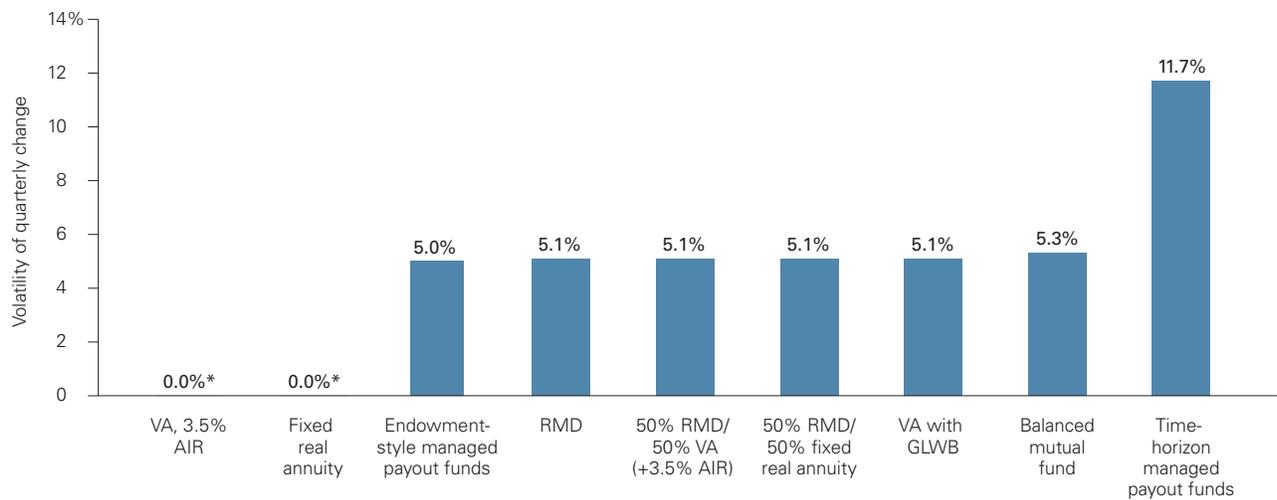
As shown in Figure 4, with the exception of the time-horizon managed payout fund, the volatility in the value of the median ending portfolio balances was similar across the strategies. Note that the two conventional annuity strategies have no remaining balance.

Figure 3. Median annualized growth in real cash flow (30-year horizon)



Source: Authors' calculations, using simulations generated by the Vanguard Capital Markets Model.

Figure 4. Volatility of quarterly change in remaining balance (30-year horizon)



*For immediate annuities, there is no remaining balance.

Note: Results shown represent the median standard deviation of the quarter-over-quarter change in the real portfolio balance over the entire 30-year horizon.

Source: Authors' calculations, using simulations generated by the Vanguard Capital Markets Model.

Figure 5. Median real annual internal rate of return over 5, 20, and 30 years

Strategy	5 years		20 years		30 years	
	Median	Mean/volatility	Median	Mean/volatility	Median	Mean/volatility
Fixed real lifetime immediate annuity	-34.3%	-231.6	1.1%	9.9	3.8%	51.0
50% RMD/50% fixed real lifetime immediate annuity	-6.0	-1.4	3.5	1.8	4.4	2.9
50% RMD/50% variable lifetime immediate annuity (+3.5% AIR)	-4.9	-1.1	4.6	1.6	5.6	2.1
Required minimum distribution	4.2	0.8	4.6	1.6	4.8	1.8
Endowment-style managed payout funds	4.3	0.8	4.4	1.5	4.5	1.7
Variable lifetime immediate annuity (+3.5% AIR)	-28.5	-8.0	4.6	1.4	6.9	2.4
Time-horizon managed payout funds	3.8	0.7	3.9	1.4	3.9	1.5
Systematic distributions from balanced mutual fund	4.2	0.8	4.4	1.3	4.4	1.3
Variable deferred annuity with GLWB	3.4	0.7	3.7	1.2	3.8	1.6

Notes: This table presents the median real (inflation-adjusted) annual internal rate of return (IRR) generated by each strategy over 5, 20, and 30 years. The strategies are listed in order of their 20-year mean/volatility ratios, from highest to lowest. The mean/volatility ratio is a statistical measure of the risk-adjusted IRR generated by each strategy, represented by the following formula: the mean IRR generated across all simulations for the given strategy divided by the lower semistandard deviation. Semistandard deviation is a measure of the dispersion of all the observations that fall *below* the mean value of a data set. Less dispersion means a higher mean/volatility ratio, which is good. The mean/volatility ratio is not linear, meaning that the 9.9 mean/volatility ratio for the fixed real lifetime immediate annuity over 20 years is not approximately 8 times better than the ratio of 1.2 for the variable deferred annuity with GLWB.

Source: Authors' calculations, using simulations generated by the Vanguard Capital Markets Model.

Real internal rate of return

The final metric we evaluated was the real internal rate of return for each strategy at different time horizons. As shown in **Figure 5**, there can be dramatic differences in the inflation-adjusted internal rates of return across strategies for shorter time horizons. One of the starkest examples is the fixed real lifetime immediate annuity: Although this strategy had the lowest real median annual internal rate of

return over the first five years (-34.3%), it produced the best 20-year and 30-year result when measured on the basis of volatility of return. Over longer time horizons, the range of real median internal rates of return narrowed. And among the various drawdown-based strategies, the lack of significant differences in median internal rates of return primarily reflects the similarities in their underlying asset allocations.

Conclusion

All of the approaches we analyzed did achieve, in varying degrees, the objective of providing for retirement spending needs. However, the results of our simulations and analysis clearly show that the various common retirement spending strategies can produce a wide range of possible outcomes when evaluated by certain key metrics.

- Investors who are more concerned about residual—or bequeathable—value, might favor drawdown-based approaches, which tended to result in higher residual value over short time horizons. In fact, residual value was the metric for which we found some of the largest differences across strategies. However, because systematic withdrawal strategies cannot take advantage of the pooling of mortality risk provided by an annuity contract, they were less effective in providing stable income over very long periods.
- Other investors, who are more focused on income needs during retirement, might favor annuity-based approaches that provide relatively stable cash flows—but have strong negative impacts on residual wealth, especially early in retirement.
- Still others may be drawn to guaranteed insurance products, such as the GLWB rider, that can combine some of the features of annuity- and drawdown-based approaches, but at higher cost.

Because no single strategy or metric stands out as “the best,” it’s no wonder that investors and financial service providers find it difficult to choose or recommend a retirement spending strategy. However, an understanding of how these different approaches can affect some key financial outcomes that are of interest, combined with an assessment of individual preferences, should put investors in a better position to select one or more suitable strategies for spending during retirement.

References

Ameriks, John, and Liqian Ren, 2008. *Generating Guaranteed Income: Understanding Income Annuities*. Valley Forge, Pa.: The Vanguard Group.

Ameriks, John, Michael Hess, and Liqian Ren, 2010. Comparing Spending Approaches in Retirement, in *Reorienting Retirement Risk Management*, edited by Olivia Mitchell and Robert Clark. Oxford, England: Oxford University Press; available at www.oup.com.

Bruno, Maria A., and Yan Zilbering, 2010. *Income in Retirement: Common Investment Strategies*. Valley Forge, Pa.: The Vanguard Group.

Wallick, Daniel W., Roger Aliaga-Díaz, and Joseph H. Davis, 2009. *Vanguard Capital Markets Model*. Valley Forge, Pa.: The Vanguard Group.

Appendix. Additional assumptions of spending-strategy simulations

Figure A-1. Comparative information

	Fixed real withdrawals from balanced mutual fund (systematic distributions)	Managed Payout Strategy	
		Endowment-style	Time-horizon
Objective	To gradually spend down a diversified portfolio that is managed for total return, rather than income. The goal is to provide some reasonable level of income over time.	To make monthly (or other frequency) distributions of income while potentially providing long-term capital preservation, or even capital growth. The fund is usually managed with endowment-style goals of providing payout as well as preserving capital.	To make monthly (or other frequency) distributions of income with the explicit goal of exhausting the account value at a future set date.
Payments	Payments are usually made monthly or based on investor choice. Strategies vary from simple percentage spending rules to rules based on more complicated algorithms or models. Spending levels are typically influenced by estimates of both the portfolio's total return and the investor's spending horizon or life expectancy.	Payments are usually based on a pre-set formula determined by the fund provider, which could depend on current and past values of various factors, including share price and number of shares. Payments can include return of capital.	Payments are usually based on a pre-set schedule that clearly lays out the payout rate or amount until fund-exhaustion date.
Costs and Expenses	Expenses vary depending on the provider and the investments in the portfolio, and may include an annual expense charge or in some cases a fund sales load.	Expenses vary depending on the provider and the investments in the portfolio, and may include an annual expense charge or in some cases a fund sales load.	Expenses vary depending on the provider and the investments in the portfolio, and may include an annual expense charge or in some cases a fund sales load.
Liquidity	Usually, shares can be redeemed at any time, depending on the assets involved.	Usually, shares can be redeemed at any time. Changes in share balance usually affect future income payout.	Usually, shares can be redeemed at any time. Changes in share balance usually affect future income payout.
Guarantees and Safety	The investor receives no guarantees; payments and principal can fluctuate significantly.	The investor receives no guarantees; payments and principal can fluctuate significantly.	The investor receives no guarantees; payments and principal can fluctuate significantly.
Fluctuation of Principal	Share prices can fluctuate significantly.	Share prices can fluctuate significantly.	Share prices can fluctuate significantly.
Taxes	Distributions may consist of any combination of income, capital gains, and return of capital.	Distributions may consist of any combination of income, capital gains, and return of capital.	Distributions may consist of any combination of income, capital gains, and return of capital.

Note: The strategy of taking required minimum distributions (RMD) from a traditional IRA is not shown in this table because of the wide range of investment vehicles an investor might choose for the IRA. The two hybrid strategies would combine the features of an RMD strategy with those of the respective annuity strategy.

	Fixed real lifetime immediate annuity	Variable lifetime immediate annuity	Variable deferred annuity with guaranteed lifetime withdrawal benefits (GLWB)
Objective	To provide fixed real (i.e., inflation-adjusted) periodic payments for the life of the annuitant(s).	To provide variable payments adjusted according to a formula that depends on the assumed investment return (AIR), chosen underlying asset allocation, and fees. The payment derived from the formula is guaranteed for the life of the annuitant(s).	To provide a variable or fixed payment that is guaranteed for the life of the investor while potentially giving the investor access to capital.
Payments	Monthly or other frequency based on the annuitant's choice. The payment is inflation-indexed and ends after the annuitant's death.	Monthly or other frequency based on the annuitant's choice. Payments made after the initial payment may fluctuate and are based on a formula that depends on the initial payment, AIR, return of the chosen asset allocation, and fees.	Monthly or other frequency based on investor choice. With various features, such as "step up," payments can increase as underlying assets grow, but will never decrease as assets lose value.
Costs and Expenses	Initial sales loads, charges, or surrender fees could apply, depending on the provider. Fees are incorporated into the initial payment quote at the time of the purchase.	Initial sales loads, charges, or surrender fees could apply, depending on the provider. Fees are not incorporated into the initial payment and are usually decided by the provider.	Expenses vary depending on the provider as well as the underlying assets involved, and include the insurance charge to guarantee the payment as well as costs to manage the underlying assets.
Liquidity	None. Investor surrenders any claim to principal in exchange for the annuity.	None. Investor surrenders any claim to principal in exchange for the annuity.	Usually, shares can be redeemed at any time. Changes in share balance usually affect future income payout.
Guarantees and Safety	Payments are guaranteed based on the claims-paying ability of the insurance company that issues the annuity.	Payments are guaranteed based on the claims-paying ability of the insurance company that issues the annuity.	There are certain guarantees of payment, based on the claims-paying ability of the insurance company that underwrites the insurance portion of the contract. There is no guarantee on the amount of account value remaining if the investor chooses to liquidate the account at any time.
Fluctuation of Principal	Not applicable, because investor surrenders principal.	Not applicable, because investor surrenders principal.	Share prices can fluctuate significantly.
Taxes	Payments are generally treated as ordinary income. Annuities purchased with after-tax dollars will receive a partial return of capital in each payment. Some states may assess a one-time premium tax on annuity purchases.	Payments are generally treated as ordinary income. Annuities purchased with after-tax dollars will receive a partial return of capital in each payment. Some states may assess a one-time premium tax on annuity purchases.	Payments are generally treated as ordinary income. Annuities purchased with after-tax dollars will receive a partial return of capital in each payment. Some states may assess a one-time premium tax on annuity purchases.

Figure A-2. Comparison of payout rates: RMD and time-horizon managed payout fund

Investor age	Year	RMD strategy		Time-horizon managed payout funds strategy		
		IRS withdrawal rate	Assumed payout rate	Assumed asset-allocation glide path		
				U.S. equities	International equity	Nominal bonds
65	1	0.00%	5.09%	50.3%	12.2%	37.5%
66	2	0.00	5.18	49.5	11.9	38.7
67	3	0.00	5.27	48.6	11.6	39.8
68	4	0.00	5.38	48.0	11.1	41.0
69	5	0.00	5.50	47.3	10.6	42.1
70	6	3.65	5.63	46.8	10.1	43.2
71	7	3.77	5.77	46.2	9.6	44.2
72	8	3.91	5.93	45.9	9.3	44.9
73	9	4.05	6.10	45.5	8.9	45.6
74	10	4.20	6.30	45.2	8.5	46.4
75	11	4.37	6.50	44.8	8.0	47.2
76	12	4.55	6.75	44.4	7.7	48.0
77	13	4.72	7.01	43.9	7.3	48.8
78	14	4.93	7.31	43.2	7.0	49.9
79	15	5.13	7.65	42.5	6.6	50.9
80	16	5.35	8.03	41.8	6.2	52.0
81	17	5.59	8.47	41.1	5.8	53.1
82	18	5.85	8.98	40.2	5.4	54.4
83	19	6.13	9.58	39.3	5.0	55.7
84	20	6.45	10.29	37.7	4.6	57.8
85	21	6.76	11.15	36.0	4.1	59.9
86	22	7.09	12.20	33.7	3.7	62.7
87	23	7.46	13.52	31.3	3.2	65.5
88	24	7.87	15.23	27.4	2.9	69.7
89	25	8.33	17.53	23.5	2.6	73.9
90	26	8.77	20.74	19.6	2.3	78.1
91	27	9.26	25.59	15.7	1.9	82.4
92	28	9.80	33.79	11.8	1.6	86.6
93	29	10.42	50.35	7.9	1.3	90.8
94	30	10.99	100.00	4.0	1.0	95.0

Notes: IRS withdrawal rates are based on Table III (Uniform Lifetime) in Appendix C of *IRS Publication 590*, available at www.irs.gov. For the time-horizon managed payout fund, the payout rates and asset allocation glide path are the authors' assumptions used for modeling. Asset-allocation totals may not add to 100.0% because of rounding.

Sources: Internal Revenue Service, U.S. Department of the Treasury, and Vanguard.

Figure A-3. Asset allocation and fee assumptions

	Asset allocation					Fees (basis points)
	U.S. equities	International equities	Nominal bonds	Commodities	Market- neutral strategies	
Required minimum distribution (RMD)	48%	12%	40%	0%	0%	20
Systematic distributions from balanced mutual fund	48	12	40	0	0	20
Endowment-style managed payout funds	35	25	15	10	15	60
Time-horizon managed payout funds*	50	12	38	0	0	67
Variable lifetime immediate annuity (+3.5% AIR)	48	12	40	0	0	79
Variable deferred annuity with GLWB	48	12	40	0	0	100
50% RMD/50% fixed real lifetime immediate annuity**	48	12	40	0	0	20
50% RMD/50% variable lifetime immediate annuity (3.5% AIR)	48	12	40	0	0	50

*Asset allocation in the first year of payout. See Appendix Figure A-2 for detailed glide path for the time-horizon managed payout fund.

**Asset allocation represents the portion that is invested in the traditional IRA portfolio from which RMDs are drawn.

Notes: The fixed real lifetime immediate annuity has no underlying asset allocation or implicit fees and is therefore not included in this table. The fees shown are estimated, indicative fees that could be available in the marketplace and are applicable to the underlying strategy. Fees represent underlying mutual fund fees for the systematic withdrawal strategies, and annuity contract fees for the annuity strategies.

Source: Vanguard.

Figure A-4. Asset-class return simulations over 30-year horizon

	Median annualized return	Median standard deviation
U.S. equities	9.5%	19.2%
International equities	9.7	22.3
Nominal bonds	4.7	6.8
Commodities	6.1	18.9
Market-neutral strategies	3.9	7.8

IMPORTANT: These hypothetical data do not represent the returns on any particular investment. The projections or other information generated by Vanguard Capital Markets Model simulations regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Results from the model may vary with each use and over time.

Notes:

- The median annualized returns and standard deviations shown were generated by the Vanguard Capital Markets Model (VCMM). These median results were then used to model each of the spending strategies. U.S. equities are represented by the MSCI US Broad Market Index; international equities by the MSCI EAFE + Emerging Markets Index; the broad taxable bond market by the Barclays Capital U.S. Aggregate Bond Index; commodity futures by the Dow Jones-AIG Commodity Index; and market-neutral strategies by the Citigroup 3-Month Treasury Bill Index.
- The asset return distributions are based on 10,000 simulations from the VCMM, which uses a statistical analysis of historical data to create forward-looking expectations for the U.S. and international capital markets. The model uses index returns, without any fees or expenses, to represent asset classes. Taxes are not factored into the analysis. Inflation is modeled based on historical data from February 1960 through March 2010 and simulated going forward.
- The VCMM is a proprietary financial simulation tool developed and maintained by Vanguard's primary investment research and advice teams. The model forecasts distributions of future returns for a wide array of broad asset classes. Those asset classes include U.S. and international equity markets, several maturities of the U.S. Treasury and corporate fixed income markets, international fixed income markets, U.S. money markets, commodities, and certain alternative investment strategies. The theoretical and empirical foundation for the VCMM is that the returns of various asset classes reflect the compensation investors require for bearing different types of systematic risk (beta). At the core of the model are estimates of the dynamic statistical relationship between risk factors and asset returns, obtained from statistical analysis based on available monthly financial and economic data from as early as February 1960. Using a system of estimated equations, the model then applies a Monte Carlo simulation method to project the estimated interrelationships among risk factors and asset classes as well as uncertainty and randomness over time. The model generates a large set of simulated outcomes for each asset class over several time horizons. Forecasts are obtained by computing measures of central tendency in these simulations.

Source: Vanguard Capital Markets Model simulations.

Figure A-5. Total real cash flow, excluding any ending portfolio balance

Strategy	5 years		20 years		30 years	
	Median	Mean/volatility	Median	Mean/volatility	Median	Mean/volatility
Fixed real lifetime immediate annuity	\$69,472	171.1	\$277,669	94.7	\$416,500	102.3
Systematic distributions from balanced mutual fund	61,427	171.1	245,389	9.7	367,090	3.8
50% RMD/ 50% fixed real lifetime immediate annuity	34,736	171.1	252,874	6.5	437,432	4.7
Variable deferred annuity with GLWB	61,808	15.5	240,021	5.0	344,734	3.8
Time-horizon managed payout funds	63,390	8.6	270,953	3.9	432,056	3.3
Variable lifetime immediate annuity (+3.5% AIR)	92,509	8.1	384,794	3.9	601,221	3.1
50%RMD/50% variable lifetime immediate annuity (+3.5% AIR)	46,254	8.1	306,632	3.6	529,360	2.9
Required minimum distribution	—	0.0	227,876	3.1	457,701	2.6
Endowment-style managed payout funds	59,867	12.1	229,462	4.1	337,488	3.2

Notes:

- This table presents the cumulative inflation-adjusted median total cash flows generated by each strategy over 5, 20, and 30 years, based on an initial investment of \$250,000. The strategies are listed in order of their 20-year mean/volatility ratios, from highest to lowest. The mean/volatility ratio is a statistical measure of the stability of the cash flows generated by each strategy, represented by the following formula: the mean of the total real cash flow generated across all simulations for the given strategy divided by the lower semistandard deviation. Semistandard deviation is a measure of the dispersion of all the observations that fall *below* the mean value of a data set. Less dispersion means a higher mean/volatility ratio, which is good. The mean/volatility ratio is not linear, meaning that a 94.7 mean/volatility ratio is not ten times better than a ratio of approximately 9.
- The IRA RMD strategy has no cash flow in the first five years because the investor is assumed to be aged 65 at the start of the period; withdrawals are not required until the investor turns age 70½.
- Because endowment-style managed payout funds have distinctive payout rules, this strategy is not shown in rank order.

Source: Authors' calculations, using simulations generated by the Vanguard Capital Markets Model.

Figure A-6. Median real ending portfolio balance

Strategy	5 years		20 years		30 years	
	Median	Mean/volatility	Median	Mean/volatility	Median	Mean/volatility
Time-horizon managed payout funds	\$231,474	4.4	\$134,984	2.5	—	0.0
Required minimum distribution	306,967	4.6	301,599	2.3	\$204,468	2.0
50% RMD/50% variable lifetime immediate annuity (+3.5% AIR)	153,483	4.6	150,799	2.3	102,234	2.0
50% RMD/50% fixed real lifetime immediate annuity	153,483	4.6	150,799	2.3	102,234	2.0
Variable deferred annuity with GLWB	227,652	4.2	163,475	1.8	117,631	1.4
Systematic distributions from balanced mutual fund	238,813	4.1	203,274	1.5	160,402	1.2
Endowment-style managed payout funds	241,424	4.3	225,268	2.2	216,968	1.9
Variable lifetime immediate annuity (+3.5% AIR)	—	0.0	—	0.0	—	0.0
Fixed real lifetime immediate annuity	—	0.0	—	0.0	—	0.0

Notes:

- This table presents the median real (inflation-adjusted) ending portfolio balance generated by each strategy at the end of 5, 20, and 30 years based on an initial investment of \$250,000. The strategies are listed in order of their 20-year mean/volatility ratios, from highest to lowest. The mean/volatility ratio is a statistical measure of the stability of the portfolio balances generated by each strategy, represented by the following formula: the mean of the ending portfolio balance generated across all simulations for the given strategy divided by the lower semistandard deviation. Semistandard deviation is a measure of the dispersion of all the observations that fall below the mean value of a data set. Less dispersion means a higher mean/volatility ratio, which is good. The mean/volatility ratio is not linear.
- Because endowment-style managed payout funds have distinctive payout rules, this strategy is not shown in rank order. Also, consistent with the terms of standard annuity contracts, both the fixed and variable lifetime immediate annuities have no ending portfolio balances. The investor surrenders the purchase price in exchange for receiving a stream of payments with no expectation of any residual value. Accordingly, the ending portfolio balances for the two hybrid strategies are the same for each time period because the annuity component of each hybrid strategy has no ending portfolio balance and the RMD components are the same.

Sources: Authors' calculations, using simulations generated by the Vanguard Capital Markets Model.



P.O. Box 2600
Valley Forge, PA 19482-2600

Connect with Vanguard® > vanguard.com
> global.vanguard.com (non-U.S. investors)

For more information about Vanguard funds, visit www.vanguard.com, or call 800-662-2739, to obtain a prospectus. Investment objectives, risks, charges, expenses, and other important information about a fund are contained in the prospectus; read and consider it carefully before investing.

Managed payout funds are not guaranteed to achieve their investment objectives, are subject to loss, and some of their distributions may be treated in part as a return of capital. The dollar amount of a fund's monthly cash distributions could go up or down substantially from one year to the next and over time. It is also possible for a fund to suffer substantial investment losses and simultaneously experience additional asset reductions as a result of its distributions to shareholders under its managed distribution policy. An investment in a fund could lose money over short, intermediate, or even long periods of time because each fund allocates its assets worldwide across different asset classes and investments with specific risk and return characteristics. Diversification does not necessarily ensure a profit or protect against a loss in a declining market. The funds are proportionately subject to the risks associated with their underlying funds, which may invest in stocks (including stocks issued by

Vanguard research >

Vanguard Center for Retirement Research
Vanguard Investment Counseling & Research
Vanguard Investment Strategy Group

E-mail > research@vanguard.com

REITs), bonds, cash, inflation-linked investments, commodity-linked investments, long/short market-neutral investments, and leveraged absolute return investments.

Please note that managed payout funds may not be appropriate for all investors. For example, depending on the time horizon, retirement income needs, and tax bracket, an investment in a managed payout fund might not be appropriate for younger investors not currently in retirement, in IRAs or other tax-advantaged accounts for those investors under 59½, or for participants in employer-sponsored plans. Investors who hold a managed payout fund within a tax-advantaged retirement account should consult their tax advisors to discuss tax consequences that could result if payments are distributed from their core account prior to age 59½ or if they plan to use the managed payout funds, in whole or in part, to meet their required minimum distribution (RMD) obligations. Distributions from the managed payout funds are unlikely to precisely match an investor's IRA RMD obligations. In addition, use of the managed payout funds may be restricted in employer-sponsored plans by the terms of the governing plan documents and/or at the discretion of the plan administrator. Review the information carefully with your financial advisor before deciding whether a managed distribution fund is right for you.