The State of Retirement Income
Safe Withdrawal Rates

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A 4% starting withdrawal rate, with annual inflation adjustments to that initial dollar amount thereafter, is generally considered an appropriate level for retirees. Four percent has been the starting point for spending discussions since 1994, when financial planner William Bengen demonstrated that over every rolling 30-year time horizon since 1926, retirees holding a portfolio that consisted 50% of stocks and 50% of fixed-income securities could have safely withdrawn an annual amount equal to 4% of their original assets, adjusted for inflation.

Under those same assumptions, a 4% withdrawal rate may no longer be feasible. Because of the confluence of low starting yields on bonds and equity valuations that are high relative to historical norms, retirees are unlikely to receive returns that match those of the past. Using forward-looking estimates for investment performance and inflation, Morningstar estimates that the standard rule of thumb should be lowered to 3.3% from 4%.

This should not be interpreted as recommending a withdrawal rate of 3.3%. The conventions that underlie the withdrawal-rate calculations are conservative. They presume: 1) a time horizon that exceeds most retirees' expected life spans; 2) fully adjusting all withdrawals for the effect of inflation; 3) a fixed withdrawal schedule that does not react to changes in the investment markets; and 4) a high projected success rate for the plan (90%). As this paper will demonstrate, by adjusting one or more of those levers, current retirees can safely withdraw a significantly higher amount that the 3.3% initial projection might suggest.

That said, it seems there is little question that current conditions demand greater forethought and planning than in the past, when lower valuations and loftier yields paved the way to higher future returns. Given this, many of today's retirees will have to be more resourceful to support their income needs. With that in mind, this study examines practical ways in which retirees can make their savings last longer without compromising their standard of living and explores the trade-offs some of those techniques entail.

Key Takeaways

► Low starting bond yields and high equity valuations are unlikely to sustain the higher portfolio withdrawal rates that retirees became accustomed to in the past.

► Using conservative assumptions, our research finds that a 50% stock/50% bond portfolio should support a starting fixed real withdrawal rate of around 3.3% per year.

► By relaxing these assumptions or adopting a more flexible spending approach, our analysis finds retirees can safely sustain higher withdrawals, with a 4.5% starting real withdrawal rate achievable under some scenarios.

► Equity-heavy allocations tended to support higher lifetime withdrawal rates under flexible spending methods, reflecting the benefits that stocks' market appreciation can confer as well as the rebalancing "dividends" that flexible spending approaches can yield in the way they adjust spending to changing market conditions.

► That said, retirees don't necessarily need to load up on stocks to achieve a higher starting withdrawal rate under a flexible spending approach, with balanced allocations supporting higher initial withdrawals (subject to later adjustment) than stock-heavy mixes.

► Flexible withdrawal strategies may help retirees consume their portfolios more efficiently, factoring in both portfolio performance and spending, but they also add variability to retiree spending that may or may not be acceptable, as shown in Exhibit 1.

► Variable strategies also tend to lead to lower residual (end-of-life) balances, which makes them most appropriate for retirees who don't have a strong desire to leave money to family members or charity.

► The right level of flexibility in a retiree's spending system will depend on his specific situation — the extent to which fixed expenses are covered by nonportfolio income sources, for example.

► At the portfolio level, retirees can explore additional strategies to enlarge payouts, such as improving tax efficiency or being willing to tolerate a lower success rate than 90%.

► Nonportfolio strategies such as delaying retirement and annuitization will also increase the sustainable withdrawal rate.

Exhibit 1   Comparing Withdrawal Methods: Starting Safe Withdrawal Rate vs. Variability of Annual Withdrawal
for a 50% Stock/50% Bond Allocation
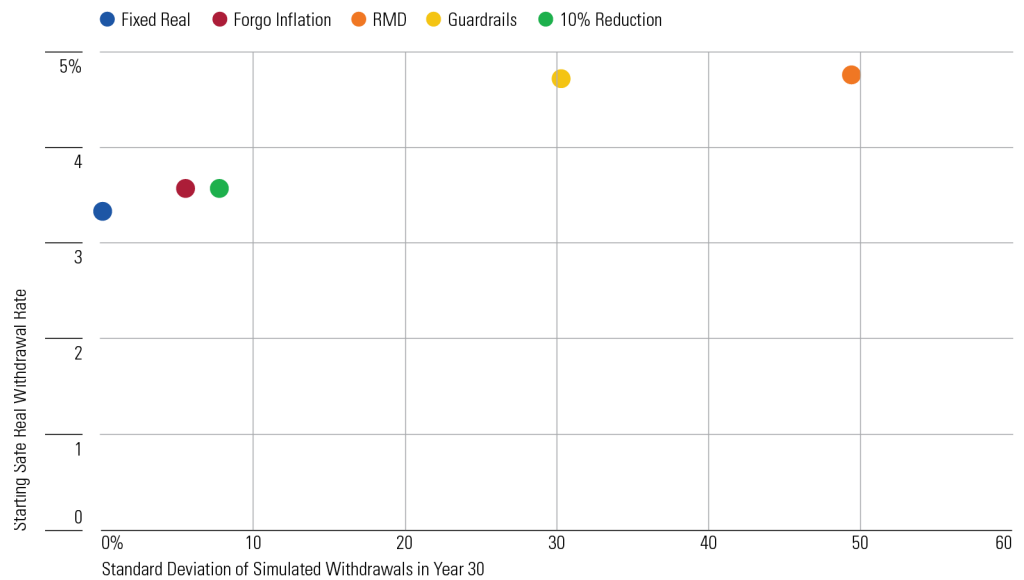
Source: Morningstar Direct. Data as of 12/31/2020.

Exhibit 1 shows the starting safe withdrawal rates of five different withdrawal strategies that we tested
and compares those withdrawal rates with the year-to-year variability of withdrawals under each
strategy. Some methods like the traditional fixed real withdrawal approach, also known as the "Bengen"
method, support lower starting withdrawal rates but boast stable year-to-year withdrawals. Other
methods like the "guardrails" flexible spending approach support higher starting withdrawal rates but
have significant variability in yearly withdrawals because these methods can entail yearly spending
adjustments depending on market conditions. By tethering spending to market conditions, such variable
strategies lead to more efficient portfolio consumption but lower ending balances in many cases.

Section I: Introduction/Research Goals

Setting a retirement withdrawal rate is one of the most studied problems in financial planning, and it's also one of the most important.

That is because personal retirement savings are an increasingly important component of retirees' income streams: Between 1980 and 2008, the percentage of workers participating in defined-benefit (pension) plans dropped nearly in half, from 39% to just 20%. In March 2020, just 3% of workers were covered by a pension plan alone, and another 15% had access to both a pension and defined-contribution (401(k)-style) plan. That trend means that each successive generation of retirees is less likely to have a pension and more likely to be reliant on a combination of Social Security and personal savings to fund in-retirement income needs. The number of Americans over 65 has also grown rapidly: In 2000, people over 65 accounted for 12.4% of the population, and in 2018 they were 16%, according to U.S. Census data. In other words, retirement income is a growing challenge for a growing share of the population.

But determining the optimal amount to take out of a portfolio annually without prematurely depleting one's assets is a question that vexes professional financial advisors and institutions nearly as much as it does individual investors. In this paper, we set out to examine withdrawal rates historically, assessing the withdrawal rates that different asset allocations would have supported in the past. We then turn our gaze forward, using estimates of future stock and bond returns to help determine what withdrawal rate is likely to be supported for people retiring today.

Because our forward-looking withdrawal-rate estimates are low relative to the standard guidance that points to 4% as a safe number for inflation-adjusted withdrawal rates, we assessed several strategies for increasing the portfolio's withdrawal rate. Broadly speaking, such strategies fall into two camps. They either increase the retiree's ability to spend regardless of how the assets are withdrawn, or they improve upon the withdrawal schedule by introducing flexibility. Rather than use a fixed withdrawal amounts that never change, save for adjusting for inflation, the second strategy introduces a flexible approach. The size of the annual withdrawal varies, depending on market conditions. We also explore other non-portfolio strategies that may enable retirees to live on a lower withdrawal rate, including delaying Social Security or considering an annuity to augment retirement income.
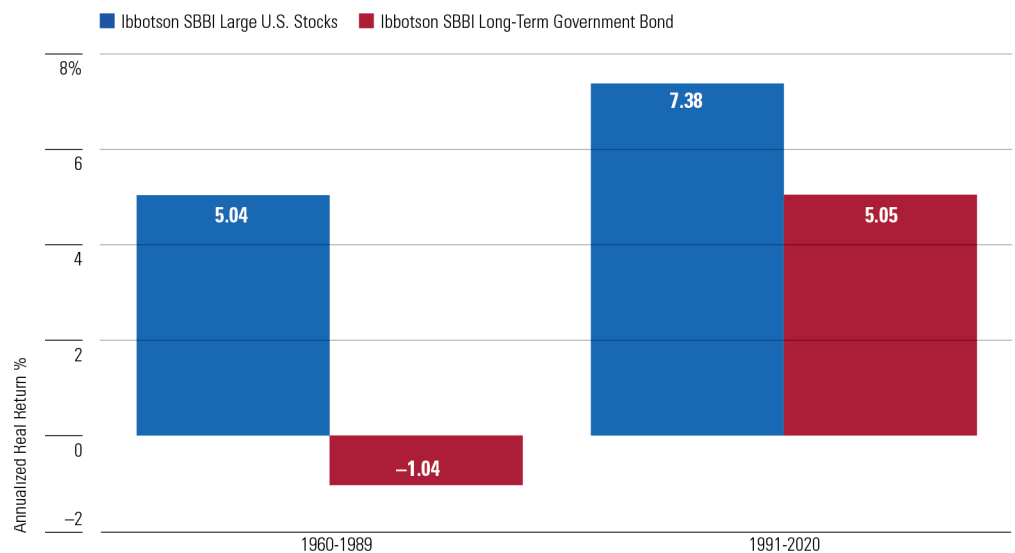
The Withdrawal Rate Problem

Helping pre-retirees and retirees to determine the "right" withdrawal rate for retirement is one of the trickiest jobs in financial planning.

Unlike other financial goals that are either one and done (home purchase) or finite (college), the duration of retirement spending is unknowable. Retirement could last just a few years for the unlucky retiree or 30 or more years for very long-lived people, especially wealthier couples where rates of longevity tend to be much higher than for the general population. With perfect foresight, the optimal withdrawal right for the retiree who dies young would obviously be much higher than would be the case for the retiree with a longer drawdown period. But there is no perfect foresight into longevity.

Compounding the challenge is that it is impossible to know in advance the specific market environment that will prevail during each retiree's time horizon. The past 30 years have been exceptionally strong for both stocks and bonds, supporting a high safe withdrawal rate. But the 30-year period that preceded it was much less robust, especially for bond investors.

Exhibit 2   Real Annualized Stock & Bond Returns, 1960-89 and 1991-2020

Source: Morningstar Direct. Data as of 12/31/2020.

There is also the issue of retirees' spending patterns. While much of the withdrawal rate research (for example, the 4% guideline) is anchored on the premise that retirees seek a fixed real dollar amount from their portfolios annually, research points to a large degree of variability in spending through retirement. Using data from the Consumer Expenditure Survey, financial advisor Ty Bernicke noted that in-retirement spending generally decreases throughout the retirement life cycle. Retirees age 75 and above spent less than those age 65-74, and the 65- to 74-year-olds spent less than those younger than 65. Those downward reductions through time, according to Bernicke's research, more than offset inflation.

That observation led Bernicke to conclude that many retirees are underspending in retirement because their withdrawal rates assume fixed real consumption, when instead consumption patterns are more modest. (Financial planner Michael Stein called the lifestyle phases that underpin that spending trajectory the "go-go," "slow-go," and "no-go" years.)

Research from David Blanchett, now head of retirement research at PGIM and formerly head of retirement research for Morningstar Investment Management, similarly concluded that retirement spending tends to be uneven through retirement. Much like Bernicke's research, Blanchett identified a downward slope in spending from the early to middle/middle-late years of retirement. But Blanchett also noted an uptick in spending toward the end of life, largely attributable to higher healthcare and long-term-care outlays.

Finally, inflation is another wild-card variable in determining the "right" withdrawal rate for retirement. Inflation averaged just 2.5% from 2000-10 and dropped even lower, to just 1.9%, from 2011-20. That provided a helping hand to retirees in that they needed to increase spending only modestly from year to year to maintain their standards of living. But retirees in other eras have not been so lucky. Inflation averaged 7.4% per year in the 1970s and more than 5% per year in the 1980s.

The fact that inflation is also highly personal is an additional complicating factor. In part because of higher inflation in the healthcare sector, along with the fact that older adults spend a higher percentage of their budgets on healthcare than do younger generations, inflation for older adults has historically run higher than the general inflation rate.

Taken together, all of these issues complicate the job of arriving at the "right" withdrawal rate at any given point in time.

Section II: Historical Research

Before delving into the state of retirement income today, it is helpful to look at the research that has been done thus far, which helps underpin our research.

Early Research

Financial planner William Bengen undertook one of the first serious assessments of safe withdrawal rates in 1994. Importantly, Bengen targeted a fixed real withdrawal rate for his simulations. His goal was to identify the starting withdrawal percentage, with that initial dollar amount adjusted thereafter for inflation, that would have supported payouts over previous historical periods, even if the retiree had the misfortune of retiring into the worst conceivable market environment. Incorporating asset-class performance over rolling 30-year periods since 1926, he concluded that a 4% initial portfolio withdrawal rate, with that dollar amount adjusted each year for inflation, was safe for a minimum of 33 years for retirees with 50% in stocks and 50% in intermediate-term Treasuries. With that research, the 4% guideline, or "4% rule," was born.

Researchers Philip Cooley, Carl Hubbard, and Daniel Walz built on Bengen's research in 1998 with their paper "Retirement Savings: Choosing a Withdrawal Rate That Is Sustainable." Dubbed "The Trinity Study," the researchers' work used the same type of historical rolling returns as Bengen's but incorporated different time frames and asset mixes, ranging from 100% equity to 100% fixed income. (In contrast with Bengen's research, which employed Treasury bonds for its fixed-income exposure, the Trinity study assumed high-quality corporate bonds.) The researchers tested varying withdrawal rates on the different asset mixes over rolling historical time periods to determine success rates for each approach. The study generally corroborated Bengen's findings, concluding that a 4% initial withdrawal on a 50% stock/50% bond portfolio exhibited a very high success rate over 30-year periods. Higher withdrawal rates (up to 7% for a 15-year time horizon with a 50% equity portfolio) achieved high success rates over shorter time periods, supporting the notion that older retirees could withdraw more from their portfolios.

Other early research sought to incorporate some of the other factors that can have a meaningful effect on withdrawal rates. In a 2001 article in the *Journal of Financial Planning*, for example, George Pye found that paying a 1% expense ratio for investments translated into a 0.5% reduction in safe withdrawal rates.[1]

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1 Pye, G. 2001. "Adjusting Withdrawal Rates for Taxes and Expenses." Journal of Financial Planning, Vol. 14, No. 4, P. 126.

Subsequent research has suggested that the 4% guideline may not hold up going forward, largely because of today's low bond yields. In a 2013 paper titled, "The 4% Rule Is Not Safe in a Low-Yield World," Michael Finke, Wade Pfau, and David Blanchett concluded that under a fixed real-dollar withdrawal system, the 4% guideline was not likely to be safe over a 30-year time horizon for more conservatively positioned portfolios.

Flexible Approaches

The earliest studies generally focused on the sustainability of fixed real withdrawal amounts (for example, Bengen's 4% initial withdrawal rate with the dollar amount subsequently adjusted for inflation). Yet subsequent studies explored the extent to which varying withdrawals based on market conditions helped improve sustainability and enlarged the lifetime payout.

One of the first examples of this type of research came from Bengen himself in 2001. In a spending method that is sometimes called "The Floor and Ceiling Method," Bengen began with the premise of fixed percentage withdrawals, which tethered the withdrawals to the portfolio balance but put a "ceiling" on high-dollar-amount withdrawals in good years and a "floor" on low-dollar-amount withdrawals in bad ones.

In 2006, in a paper titled "Decision Rules and Maximum Initial Withdrawal Rates," financial planner Jonathan Guyton and computer scientist William Klinger put forth a series of spending rules to help withdrawals conform to current market conditions while similarly putting limitations, or guardrails, around the variability in spending from year to year. (We explore this type of approach later in this paper.) In the Monte Carlo simulations tested in the research, the Guyton-Klinger guardrails approach helped elevate withdrawal rates while also helping ensure a high level of sustainability.

In a similar vein, researchers John Spitzer, Jeffrey Strieter, and Sandeep Singh corroborated the value of flexibility in withdrawals—specifically, reducing them after a weak market. In a paper titled, "Adaptive Withdrawals," the authors found that "adaptive," or flexible, withdrawal rules both improved sustainability and enlarged total withdrawals. Vanguard researchers also examined flexible withdrawal strategies, introducing a system they called the "ceiling and floor" method.

Because some of these variable withdrawal systems can get complicated, subsequent research aimed to simplify the variable approach. David Blanchett, for example, explored the viability of an RMD-based withdrawal approach. In other words, retirees base the withdrawal on their portfolios' value each year but take an ever-larger percentage (based on the IRS tables for expected longevity) as they age. Blanchett concluded that such an approach was a relatively efficient way to drawdown the portfolio. Moreover, an RMD-based approach, by definition, helps ensure that a retiree will never run out.

Relatedly, research from T. Rowe Price examined how employing a Bengen-style fixed real withdrawal strategy, coupled with forgoing inflation adjustments following portfolio losses, can help improve the

sustainability of a fixed real withdrawal system. Such a strategy is simple and helps retirees maintain more stable cash flows than is the case with many of the other flexible withdrawal strategies.

Section III: What History Says About Safe Withdrawal Rates

The natural starting point for establishing a future withdrawal rate is to understand the withdrawal rates that have been safe in the past. By definition, such an exercise is streamlined—the product of a model, rather than of a detailed plan. After all, if the calculations are customized for each individual's circumstance, then the topic cannot be examined in general terms. This paper instead would need to apply to a single investor.

These constraints, as well as the reality that portfolio performances must be represented by indexes rather than real-life investments, mean that one cannot regard historical calculations as providing more than rough guidelines. Nevertheless, they give a general idea of the level of withdrawal rates that retirees were able to receive at different points in time, for different asset allocations. They also indicate the stability of results. Was the recent past a useful guide for newly minted retirees? Or would they have been misled?

The assumptions for the calculations are as follows:

► A 30-year time horizon: This is the standard time period that is used for research on safe withdrawal rates. It is relatively conservative, in that the joint life expectancy for a 65-year-old couple is 24 years. Of course, depending upon their health and age, individual retirees may have shorter or longer expectations. A later section in this paper presents the safe withdrawal rates for alternate time horizons.

► A total return approach to cash flow sourcing: Rather than invest solely for income, thereby holding the portfolio's principal constant, the retiree funds withdrawals through a combination of income and capital consumption. That is, if the portfolio's income equals or exceeds the planned withdrawal amount, then the retiree uses only the income, placing any excess back into the portfolio. If, however, income alone cannot fund the withdrawal amount, then the shortfall is covered by selling the requisite amount of portfolio principal.

► A fixed real withdrawal amount: The annual portfolio withdrawals are adjusted for inflation to maintain a constant real income. That is, assuming a $1 million initial investment, a 4% stated withdrawal rate, and a 3% inflation rate, the portfolio would withdraw $40,000 in Year 1, $41,200 in Year 2, $42,436 in Year 3, and so forth. The difference between nominal and real withdrawal rates is substantial. Assuming

the same 3% inflation assumption, using a nominal 4% withdrawal rate would lead to the initial $40,000 annual withdrawal being repeated each year until the simulation ends in Year 30. Meanwhile, the required real withdrawal amount for Year 30 when using a 3% inflation assumption would be $97,091.

Note that the fixed withdrawal rate doesn't factor in taxes. For example, if the Year 1 withdrawal is $40,000 on a $1 million portfolio and the retiree is in the 22% tax bracket, the aftertax withdrawal would be $31,200.

▶ Monte Carlo simulation: Rather than assess what actually occurred over a time period—as with, say, Bengen's research—this paper simulates potential results, assuming the same market conditions and inflation rate that existed during that time period. For example, from 1950 through 1980, a portfolio that consisted of 50% stocks and 50% fixed-income securities returned an average of 8.20% per year, with an annualized standard deviation of 7.77%. The average rate of inflation was 4.01%. The calculation for the safe withdrawal rate for the 1950-79 time period creates 1,000 hypothetical return patterns that cluster around these averages.

The benefit of such an approach is that the simulations provide 1,000 potential histories rather than the single history that did occur. If the average returns that were received through a time period had occurred in a different order, the safe withdrawal rate would have changed. Or perhaps, the average would have been roughly similar to what was achieved but, because of accidents of history, somewhat higher or lower than what history has recorded. Using simulations permits the model to test such possibilities.

▶ A 90% success rate: If at the conclusion of the time period, every year's scheduled withdrawal has been funded, with at least 900 of the 1,000 trials, then the withdrawal rate is deemed to have passed the test. The final "safe withdrawal" rate for each allocation through each time period is therefore the highest withdrawal rate that achieves at least a 90% success rate.

Note: As is standard with retirement-income research, this approach considers only whether a portfolio can fund its scheduled withdrawals, not its final value. If a portfolio spends its last dollar during Year 30 to meet its withdrawal, with not a penny remaining, then the trial is considered successful. As we shall see, though, this is rarely the case. Although the trials near the 90th percentile create low final values, the ending balance for the median trial—that is, the simulation that creates a final value that lies midway between the best and worst outcomes—is often quite high.

▶ Indexed portfolios: The historic exercise computes Safe Withdrawal Rates for six different asset allocations, over nine different rolling 30-year periods, ranging from 1950-79 to 1990-2019. The allocations consist of:
A) 100% stocks
B) 75% stocks, 25% fixed income
C) 50% stocks, 50% fixed income
D) 25% stocks, 75% fixed income

E) 100% fixed income

F) The mattress

All portfolios except the 100% stock portfolio and the mattress contain a 10% cash position. We used a blend of 75% IA SBBI U.S. Large-Company Stock and 25% IA SBBI U.S. Small-Company Stock for each portfolio's stock position. The bond allocations incorporate a mix of 50% IA SBBI U.S. Intermediate-Term Government Bond, 25% IA SBBI Long-Term Government Bond, and 25% IA SBBI Long-Term Corporate Bond. We also included a 10% cash position (represented by 30-day Treasury bills) in each fixed-income sleeve.

Thus, the 50% stock, 50% fixed-income portfolio consists of:
37.5% U.S. large stock
12.5% U.S. small stock
20% U.S. intermediate-term government bond
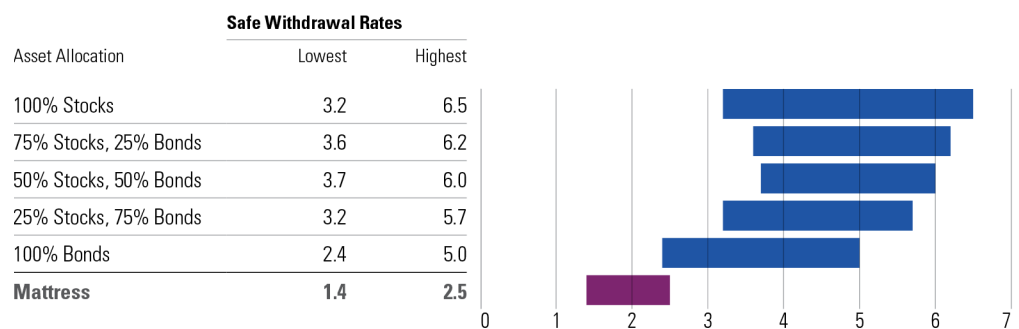10% U.S. long-term government bond
10% U.S. long-term corporate bond
10% U.S. 30-day Treasury bills

Finally, the mattress portfolio consists of money that is stashed under a metaphorical mattress. Unlike the 10% of assets that the invested portfolios place into cash (except, once again, the 100% stock portfolio), the mattress portfolio does not earn interest.

Exhibit 3 shows the safe withdrawal rates for each of the six asset allocations over 13 rolling 30-year time horizons. The first time period begins in January 1930 and concludes in December 1959, while the final time period starts in January 1990 and concludes in December 2019. The calculated withdrawal rate is the highest rate that succeeds for 90% of the trials—that is, a hypothetical investor could make 30 years' worth of withdrawals without running out of money. The high and low end of the range represent the range of sustainable withdrawal rates during the 13 rolling 30-year time horizons tested.

Exhibit 3　Highest and Lowest Starting Safe Withdrawal Rates, by Asset Allocation
(Rolling 30-Year Time Horizon, Starting From 1930 Through 1990, 90% Success Rate)

Asset Allocation	Safe Withdrawal Rates	
	Lowest	Highest
100% Stocks	3.2	6.5
75% Stocks, 25% Bonds	3.6	6.2
50% Stocks, 50% Bonds	3.7	6.0
25% Stocks, 75% Bonds	3.2	5.7
100% Bonds	2.4	5.0
Mattress	**1.4**	**2.5**

Source: Morningstar Direct. Data as of 12/31/2019.

There are a few key takeaway points from these results, as discussed below.

History is an unreliable guide.

The safe 30-year withdrawal rates for the 100% stock portfolio hovered near 6% for investors who retired in 1935, dropped to 4% for those who retired 20 years later, and then increased back to 6% by the mid-1970s. With fixed-income portfolios, the change was even more dramatic. The safe withdrawal rate for the 100% fixed-income portfolio was 2.5% for those who retired during the 1940s, then rose steadily, eventually reaching double that rate.

Because results vary widely depending on the time period, it is clear that today's retirees cannot expect that past withdrawal rates will provide anything more than a very rough estimate of what they can expect in the future. It seems reasonable to assume that the next 30 years will allow a diversified portfolio to achieve something between the upper and lower bounds of what has been experienced over the past three fourths of a century, that is, a safe 30-year withdrawal rate somewhere between 3% and 6%. But pinning down a more precise number requires making some estimates of how future returns might compare with previous levels.

The more stocks (apparently) the better.

For the first part of the analysis, stocks dominated. The 100% stock portfolio reliably outperformed the 75% stock portfolio, which in turn allowed for a higher safe withdrawal rate than the 50% stock portfolio, and so forth. Starting with the 1955-84 time period, the other asset classes caught up, save for the 100% fixed-income portfolio. Even then, though, the 100% stock portfolio matched the alternatives, on average. For real withdrawal rates over 30 years, opting for more stocks has never been a mistake.

Of course, this analysis excludes the considerable doubt that comes with holding such a volatile asset. In hindsight, we know that each equity bear market was followed by a recovery that allowed retirees to continue with their plan. At the time, no such certainty existed. Nor does it in the future. Although stocks have always recovered from their ills during the 70 years covered by this study, that doesn't mean that they inevitably must.

On the other hand, stock portfolios then to have greater ending values. This paper is primarily concerned with assessing how much money retirees can safely withdraw from their portfolios, as opposed to considering capital growth. The goal is supporting a retiree's cost of living, not building a legacy. Nonetheless, if given a choice, nearly everyone would prefer a portfolio that grows its value over time, rather than one that declines because of capital withdrawals. The 100% stock portfolio generally records the highest ending value—often, by a large amount.

The primary reason why safe withdrawal rates have been unstable has not been the effect of economic recessions but instead that of changing inflation rates. Recessions come and go. They hurt equity prices (and sometimes corporate bond performances) in the short run, but over 30 years, they are more than counterbalanced by the gains during the longer periods of economic expansion. However, trends in

inflation can persist for generations, such as the below-average inflation trend we have seen over most of the past 30 years.
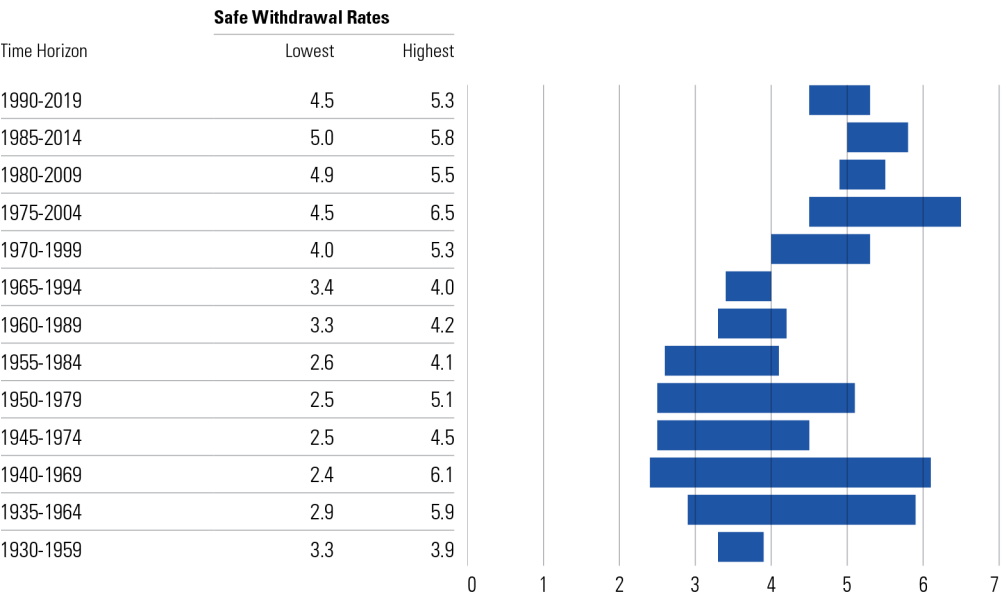
This is important for the relative returns of stocks and bonds because stocks adjust more quickly to changes in inflation than do bonds. When faced with rising costs, companies can raise their prices, which protects their real earnings. In contrast, almost all bonds—save for Treasury Inflation-Protected Securities, or TIPS—offer fixed payments. Consequently, although stock performances have been more volatile than bonds' over the shorter time periods, they have been steadier over long periods.

Looking at stock and fixed-income returns over two consecutive 30-year periods, the first from 1960 through 1989, and the second from 1990 through 2019, helps illustrate this point. During the first period, inflation rose steadily and unexpectedly for more than two decades, before beginning to subside. During the second period, inflation continued to decline, again by more than investors had expected. Stocks effectively ignored the inflation data, posting solid real returns through both eras. However, fixed-income performances varied widely. From 1960 through 1989, the 100% fixed-income portfolio actually lost value before rebounding to a 5% annualized gain during the second.

One way of demonstrating the variability of historic safe withdrawal rates is to measure the range of potential outcomes. Exhibit 4 depicts the outcome of those computations. Typically, the range between the lowest and highest safe withdrawal rates, as measured over the 13 overlapping time periods, is about 2.5 percentage points, while the range for the 100% stock portfolio is moderately higher.

Another view of withdrawal-rate variability, depicted in Exhibit 4, comes from examining the difference between the highest and lowest rates among the five allocations for each time period. Sometimes, the asset-allocation decision isn't critical. In 1980, for example, the best future allocation would have provided a 5.5% withdrawal rate, while the weakest of the five allocations would have sustained a 4.9% payout. Just five years before, though, the best asset allocation made for a 6.5% withdrawal rate, while the weakest selection generated a 4.5% rate—a difference of 2 full percentage points. Strikingly, the highest sustainable withdrawal rates for each of the past five 30-year periods have been well above their historical averages.

Exhibit 4   Highest and Lowest Starting Safe Withdrawal Rates by Time Period and Asset Allocation
(30-Year Time Horizon, 5 Asset Allocations Ranging From 100% Stock to 100% Bond, 90% Success Rate)

	Safe Withdrawal Rates	
Time Horizon	Lowest	Highest
1990-2019	4.5	5.3
1985-2014	5.0	5.8
1980-2009	4.9	5.5
1975-2004	4.5	6.5
1970-1999	4.0	5.3
1965-1994	3.4	4.0
1960-1989	3.3	4.2
1955-1984	2.6	4.1
1950-1979	2.5	5.1
1945-1974	2.5	4.5
1940-1969	2.4	6.1
1935-1964	2.9	5.9
1930-1959	3.3	3.9

Source: Morningstar Direct. Data as of 12/31/2019.

**Safety is illusory once inflation is factored in.**

Examining historical safe withdrawal rates also yields insights into the role that safe assets might play in retirement, as well as their limitations. Stocks and bonds do generate positive returns over time, which has contributed to a higher safe withdrawal rate than one could employ by not investing at all. But converting cash into investments introduces volatility, which both reduces the amount that can be safely withdrawn and creates investor stress. Over a 30-year time period, a retiree could receive an annual payment equal to 3.33% of the original principal simply by putting cash under a mattress and then withdrawing 1/30th of that amount each year. Is it really worth investing in risky assets when the mattress nest egg could generate 3.3% on its own?

Indeed, it is. Initially, that 3.3% safe withdrawal rate looks reasonably attractive. However, it assumes constant, unchanged payments, while the historic safe withdrawal rates that were calculated in the previous section were adjusted for the effects of inflation. Converting the mattress' payouts into real terms dramatically reduces the results. Over all time periods, including the 1930-59 era, which includes the worst of the Great Depression, a portfolio consisting of 50% stocks, 50% fixed-income securities handily outperformed the mattress, as evidenced by Exhibit 5.

True, the mattress enjoyed a 100% success rate, while the investment portfolios had only a 90% success rate. (Later, we shall see how altering the required success rate for the investment portfolios affects their safe withdrawal rates.) However, that apparent 3.3% withdrawal rate proves illusory when translated into real terms. Adjusting the scheduled withdrawals by the rate of inflation reduces the

mattress' safe rate to between 1.4% and 2.5%—far below what the 50/50 portfolio generated, for all time periods. In addition, while most of the 50/50 portfolio trials leave ending values when the 30 years are finished, by definition the mattress is depleted.

Exhibit 5   Highest and Lowest Starting Safe Withdrawal Rates, Mattress vs. Stock/Bond Portfolio
(30-Year Time Horizon, 50% Stock Portfolio, 90% Success Rate)
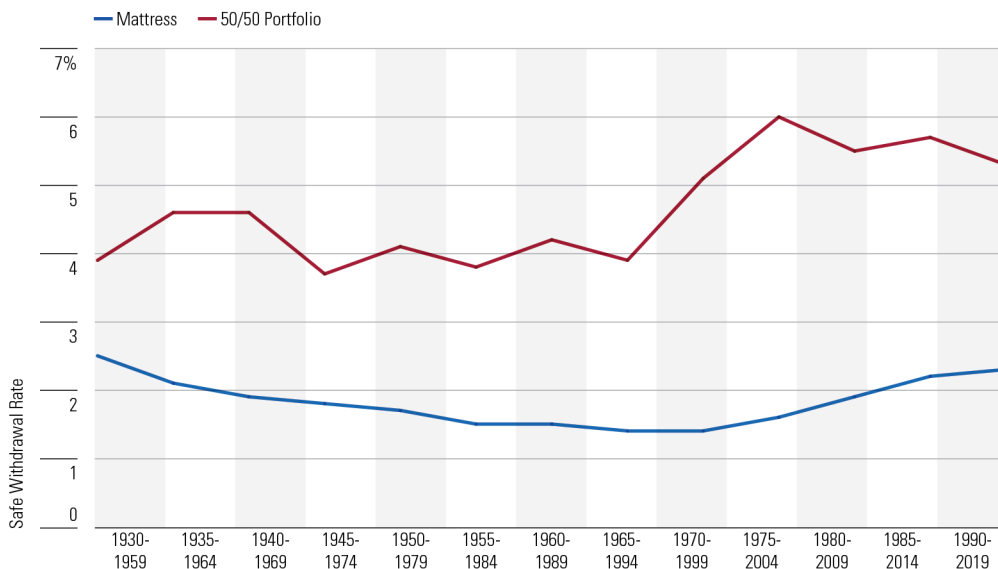
Source: Morningstar Direct. Data as of 12/31/2019.

Another straightforward strategy that is more sensible and less extreme than simply stashing away the assets is to hold bonds. Although fixed-income securities do carry market risk, thereby introducing volatility into the strategy, they are much more stable than equities. In addition, if the fixed-income portfolio features high-quality credits, as do the portfolios we tested in this paper, it is relatively impervious to economic downturns. Indeed, during most recessions, the 100% fixed-income portfolio posts afterinflation gains.

Unfortunately, those benefits are overshadowed by the weakness of fixed-income securities: Over long time periods, they have consistently returned less than equities, usually substantially less. Thus, when measured by safe withdrawal rates over rolling 30-year periods, a 50% stock/50% fixed-income portfolio consistently outperforms a portfolio that consists solely of fixed-income investments. See Exhibit 6. In recent decades, the gap has narrowed because bonds have rallied since 1980, but the lesson remains: Better to have a balanced portfolio than to rely strictly on fixed-income securities.

Because the "right" withdrawal rate for retirement income is wholly dependent on the market and inflationary environments, we will be revisiting this research annually to provide new retirees and their advisors with the tools they need to chart a safe course. In future installments of this research, we plan

to incorporate a more comprehensive look at various annuity types and also factor in how a retiree's percentage of fixed versus discretionary expenses affect withdrawal rates and systems.

to incorporate a more comprehensive look at various annuity types and also factor in how a retiree's percentage of fixed versus discretionary expenses affect withdrawal rates and systems.

Exhibit 6 Highest and Lowest Starting Safe Withdrawal Rates, Bonds vs. Stock/Bond Portfolio
(30-Year Time Horizon, 50% Stock Portfolio, 90% Success Rate)
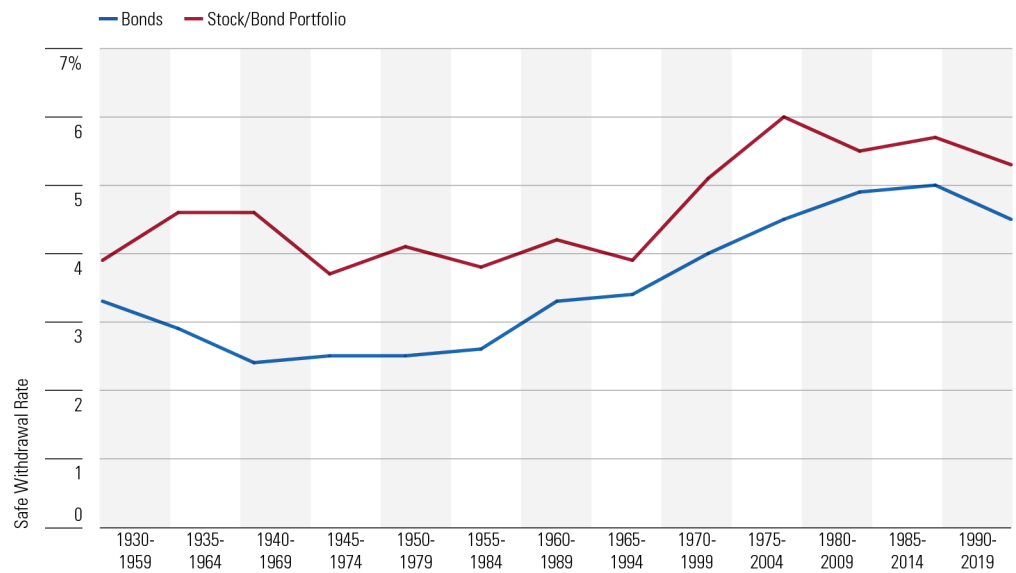
Source: Morningstar Direct. Data as of 12/31/2019.

More stocks equate to more uncertain outcomes.

This paper's primary focus is safe withdrawal rates: Understanding what rates could have been achieved in the past, which rates might be safe in the future, and strategies that investors could use to improve their results. However, the level of sustainable withdrawal rates is only one measure of portfolio performance. Three additional measures are:

► Ending values: What the portfolio is worth at the conclusion of the time period
► Portfolio volatility: The variance that the portfolio endures along the way
► Tail risk: The possibility that "failed" trials will be disastrous, rather than merely bad

Addressing these topics in detail lies beyond the scope of this paper, but they do deserve mention. Broadly speaking, the greater the portfolio's equity position, the higher are its likely ending values, portfolio volatility, and tail risk. Conversely, portfolios that consist mostly of fixed-income securities will generally have relatively low ending values, portfolio volatility, and tail risk.

The exhibit below illustrates the first of these principles. For each of the 13 rolling 30-year time periods, the chart shows the median ending value for the 50/50 stock/fixed-income portfolio compared against the median ending value for the 100% fixed-income portfolio. In each case, we calculated the ending values based on the highest safe withdrawal rate for that allocation over that time period. In other words, as we have already seen, each of the 50/50 portfolios allowed for larger annual distributions than did the fixed-income portfolios.

They also left higher ending values. The median ending value for the 50/50 portfolio consistently lands far above that of the fixed-income portfolio. Thus, when measured either by the amount of cash distributed by the portfolio or by its median ending value, owning a mix of stocks and bonds has reliably been the better approach compared with only owning bonds. Admittedly, investors must weigh these benefits against the drawbacks of greater portfolio volatility and higher tail risk.

Exhibit 7 Considering Legacies: Bonds vs. Stock/Bond Portfolio
(30-Year Time Horizon, 50% Stock Portfolio, 90% Success Rate, Median Final Value in USD Thousands)
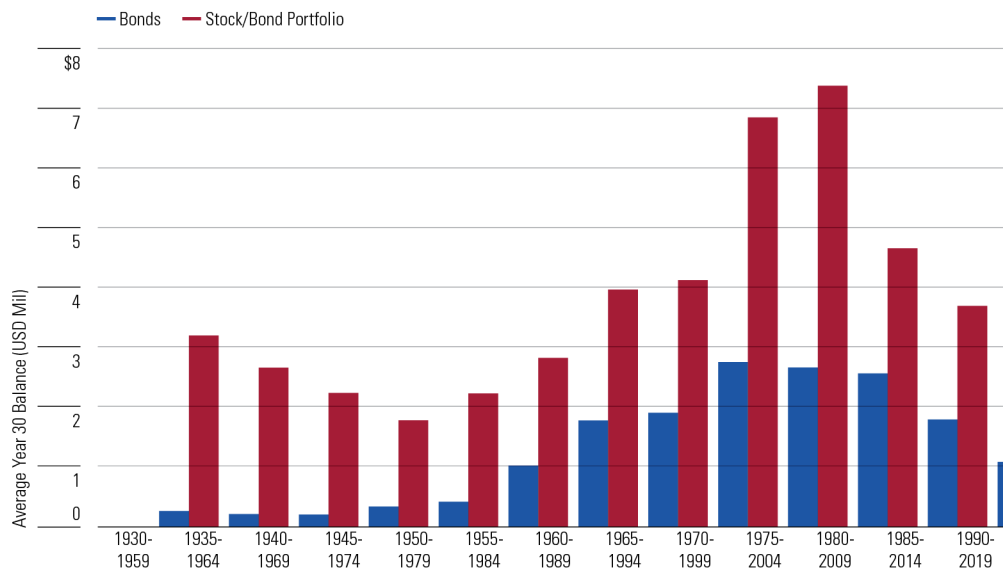
Source: Morningstar Direct. Data as of 12/31/2019.

Section IV: What Is a Safe Withdrawal Rate for the Future?

Understanding the past is a necessary but insufficient condition for anticipating the future. History has shown that, for retirees seeking safe withdrawal amounts over 30-year periods, balanced (or all-equity) portfolios have consistently outperformed those consisting of cash or bonds. The level of safe withdrawal rates has ranged from about 3.5% on the low end to 6% on the high end. Those seem to be reasonably reliable starting assumptions.

After those items, history's lessons become less clear. In particular, as previously demonstrated, one period's results cannot be used to predict those of the next period. Bond yields change, stock valuations shift, and inflation rates rise and fall. Each has a strong effect on both portfolio performance and on the required withdrawal amounts. What should investors expect from stocks, bonds, and inflation in the future? Many investment firms, including Morningstar Investment Management, provide forecasts of asset-class returns, standard deviations, and inflation. Of course, such estimates are merely that—educated guesses about future events. No organization can claim anything more than partial accuracy for its investment predictions.

Nonetheless, forecasts that incorporate current conditions are likely to be more useful than those that rely solely on the past. Three items distinguish today's market landscape. First, bond yields are low—as low as they have been throughout the past 70 years. Second, stock valuations are high—as high as they have been throughout the past 70 years. Third, inflation is low—rising at the time that this paper is written but, nevertheless, over the past several years as low as it has been over the past 70 years.

The first two factors reduce expected withdrawal rates. The third factor, that of low inflation, improves the result. The overall effect is to depress feasible withdrawal rates, but it is worth noting that the low inflation helps to keep the decline in check while the third increases them.

Fixed-income yields strongly suggest caution, because starting bond yields explain a large portion of future fixed-income returns. Generally speaking, sustainable withdrawal rates have been higher for recent generations than for the post-World War II generation. This has occurred largely because bond yields were low in 1950, then high in 1980. Today, they are once again low.

Less directly, equity returns could also revert to lower levels than we have seen in recent decades. This is less certain than with fixed-income returns. Bonds will either continue to deliver relatively low yields and therefore relatively low total returns, or their yields will rise, which will eventually help their returns but at the cost of sacrificing current performance. Either way, they are highly unlikely to enjoy strong gains over the next 30 years. With equities, the math is hazier. High valuations, as measured by price/earnings or price/book ratios (or the more sophisticated Shiller, or CAPE, P/E), suggest that their returns will revert to the mean. But such a result is not inevitable. Valuations could remain steep; corporate profits could exceed expectations; and inflation could remain subdued, thereby supporting investor optimism.

Nonetheless, it is prudent to assume that equities over the next three decades will not be able to match the unusually high returns that they have posted over the past 40 years.

Somewhat counterbalancing these concerns is the good news about inflation. Over the past century, the U.S. inflation rate has never before been this low for this long. Nor has it been so stable. Previously, periods of low inflation were punctuated by spikes—or even bouts of deflation. Yet since the early '90s, inflation has almost always been under 5%, while gradually trending downward. Should the inflation rate remain steadily low, as the bond market anticipates, sustainable withdrawal rates should be higher.

Projecting future results permits the use of more varied portfolios than when assessing past performances. The data limitations have been eliminated. Consequently, unlike with the historic portfolios, which held only U.S. assets, the forward-looking portfolios contain foreign securities. They also incorporate separate estimates for growth- and value-style equities.

As before, we formed the portfolios by combining the same underlying combinations of equities and fixed income securities. The percentage placed in each of the two asset classes varies according to the portfolio's asset allocation, but within each asset class, the mix of subasset classes is constant. As before, each portfolio holds a 10% cash position, except for the 100% stock portfolio.

Below are the annual return and standard deviation forecasts, provided by Morningstar Investment Services, for the 30-year performances of each of the eight subasset classes, along with their portfolio weightings. (The returns are arithmetic averages, rather than the geometric averages that are customarily cited for investment performance. Arithmetic averages are required because the model used for this paper that simulates investment performances requires arithmetic returns for its inputs.) Also included is the expected annual rate of inflation, which is 2.21%.

Exhibit 8 Projected Asset Class and Portfolio Returns

Broad Asset Class	Asset Class	Portfolio Weighting %		Expected Return % *(Arithmetic)*	Standard Deviation % *(Annual)*
Equity	Large Growth U.S. Stocks		30	6.25	18.23
	Large Value U.S. Stocks		30	7.97	15.82
	Small Growth U.S. Stocks		10	10.17	25.24
	Small Value U.S. Stocks		10	10.53	20.72
	Foreign Stocks		20	8.41	18.25
Bond	U.S. Investment-Grade Bond		80	2.68	5.41
	Foreign Bond		20	2.81	9.08
Cash	U.S. Treasury Bill			1.43	1.73

	Portfolio Weighting %			Expected Return %	Standard Deviation %
Asset Class	Equity	Bond	Cash	*(Arithmetic)*	*(Arithmetic)*
Equity Portfolio	**100**	**0**	**0**	**8.01**	**17.00**
90% Equity	90	0	10	7.35	15.31
80% Equity	80	10	10	6.82	13.61
70% Equity	70	20	10	6.29	11.95
60% Equity	60	30	10	5.76	10.33
50% Equity	50	40	10	5.23	8.79
40% Equity	40	50	10	4.70	7.38
30% Equity	30	60	10	4.17	6.17
20% Equity	20	70	10	3.64	5.31
10% Equity	10	80	10	3.11	5.00
Bond Portfolio	**0**	**90**	**10**	**2.58**	**5.32**
Inflation				**2.21**	

Source: Morningstar Direct. Data as of 12/31/2020.

Exhibit 9 shows the safe withdrawal rates based on these projections. It depicts 11 asset allocations, ranging from 100% stocks to 0% stocks. In addition to the standard 30-year time horizon, it also provides the safe withdrawal rates for other time periods, ranging from 10 to 40 years. The required success rate for all calculations is 90%.

Exhibit 9 Projected Starting Safe Withdrawal Rates, by Asset Allocation and Time Horizon

Equity Weighting %	10 Years	15 Years	20 Years	25 Years	30 Years	35 Years	40 Years
100	8.3	5.6	4.3	3.5	2.9	2.7	2.5
90	8.6	5.7	4.4	3.6	3.0	2.8	2.6
80	8.8	5.9	4.6	3.7	3.1	2.9	2.6
70	9.1	6.1	4.7	3.9	3.2	3.0	2.7
60	9.3	6.2	4.8	3.9	3.3	3.0	2.8
50	9.5	6.4	4.9	4.0	3.3	3.0	2.8
40	9.6	6.5	4.9	4.0	3.3	3.0	2.7
30	9.7	6.5	4.9	4.0	3.3	3.0	2.7
20	9.7	6.3	4.8	3.9	3.2	2.8	2.5
10	9.5	6.3	4.7	3.7	3.0	2.7	2.3
0	9.5	6.1	4.4	3.4	2.7	2.3	2.0

Source: Morningstar Direct. Data as of 12/31/2020.

Two items, in particular, deserve discussion.

First, the projected safe withdrawal rates are well below what historically has been realized. Whereas during all previous time periods, balanced portfolios achieved withdrawal rates of at least 4%, save for 1930 through 1959 the projected safe withdrawal rates peak at 3.3% for a 50/50 portfolio over a 30-year time horizon. Assuming that both stock and bond returns are lower than they have been in the past, newly minted retirees cannot safely withdraw 4% of their initial portfolio balance each year, while adjusting for the effect of inflation.

This warning comes with several caveats. To start, the calculations use a 30-year time horizon, along with the assumption that annual withdrawal amounts will adjust fully to increases in inflation. In reality, most retirees have a shorter time horizon than 30 years and may not need to fully keep pace with inflation. (Most retirees spend less, in real terms, during the later stages of their retirements, though uninsured long-term-care costs are a wild card in some retirees' plans.)

Also, because this paper defines success as surviving 90% of simulation trials, higher withdrawal rates do not necessarily fail. For example, although this paper reports a safe withdrawal rate of 3.4% for a 50% stock/50% fixed-income portfolio, a withdrawal rate of 4.0% would also succeed in the majority of our simulations. According to the model, the 4.0% withdrawal rate would survive the full time period, while making all scheduled payments, on 74% of occasions.

Second, although retirees in the past have frequently been best served by owning as many equities as possible, the projections suggest a more conservative approach. The highest safe withdrawal rates come from portfolios that hold 30% to 60% stock positions. This occurs not because fixed-income securities are expected to perform particularly well but instead because of stocks' volatility. When equities post gains that exceed 10% annually, their returns overcome their extra risks. However, at an annual arithmetical average of 8.01%, which is the projection for the 100% stocks portfolio, equities' volatility becomes dangerous.

Section V: How Flexible Withdrawal Strategies Can Help

The preceding research demonstrates that retirees who are wedded to taking a fixed real withdrawal amount from year to year—an approach like the one that Bengen employed with the 4% guideline—will probably have to settle for a lower starting withdrawal percentage if they want to lock in a 90% probability that their portfolios will last over a 30-year time horizon. At higher starting withdrawal rates, the confluence of low bond yields and high equity valuations relative to historic norms suggests a lower probability of success for the static method for new retirees today.

The question is: Can a more flexible withdrawal strategy help wring out a higher income stream while maintaining a high probability of success? (As before, we are defining "success" as ensuring that a portfolio lasts under the withdrawal regimen over a 30-year period in 90% of Monte Carlo simulations.) In other words, if retirees are willing to change their withdrawal amounts from year to year—taking lower withdrawals in weak market environments and higher ones in very strong ones—will that support higher lifetime withdrawals?

Prior research clearly indicates that more-flexible strategies can indeed be effective in that context. (We explored some of these strategies in Section II of this paper.) Flexible strategies are effective because they help ensure that retirees don't overspend in periods of portfolio/market weakness while giving them a raise in strong portfolio/market environments. Adjusting withdrawal rates based on portfolio performance can also help ensure that retirees consumes their portfolios efficiently: For retirees with no interest in leaving a legacy, for example, but instead aiming to consume their entire portfolios during their own lifetimes, flexible strategies provide opportunities for course corrections. Moreover, it is worth noting that, for nearly all retirees, portfolio withdrawals will compose just a portion of the household's cash flow needs: Income from Social Security, a pension(s), and/or an annuity will supply some or even most of the household's spending. As a result, changes in portfolio spending imposed by a flexible system will affect only a portion of the retiree's cash flows. Additionally, taking a lower withdrawal in a down market is apt to lead to a lower tax bill in that year, particularly if at least a portion of the withdrawals are coming from tax-deferred accounts. Those tax savings will partially offset the reduced withdrawal amounts, meaning that the net spending reduction is also reduced.

Yet as much as flexible strategies may help lift a retiree's lifetime portfolio payout versus fixed real withdrawals, variable strategies do entail trade-offs—specifically, the tension between a higher lifetime withdrawal rate afforded by periodic withdrawal adjustments and the volatility those adjustments create in the retiree's cash flows. While most variable withdrawal strategies do help enlarge retirees' lifetime

payouts, they may also subject retirees to big swings in their standards of living and may be unacceptable for some retirees for that reason.

For example, taking a fixed percentage withdrawal perfectly solves the problem of not running out of money, but it does so at the expense of the retiree's standard of living being buffeted around from year to year. At the opposite extreme, a fixed real withdrawal system nicely addresses a retiree's desire to have stable portfolio cash flows, much like a paycheck in retirement. But taking fixed real withdrawals is inefficient in terms of tying consumption to the actual portfolio value. If the starting withdrawal is too low and the portfolio outperforms expectations, the retiree will leave behind a large sum, which may not be a goal. If the initial withdrawal is too high, the retiree will consume too much too early and risk running out prematurely and/or having to engage in dramatic belt-tightening later in life.

To help home in on how flexible strategies balance lifetime income and sustainability considerations alongside quality of life/cash flow volatility considerations, we tested some of the most widely used flexible strategies. We benchmarked them against a system of fixed real withdrawals.

We tested the following:

► Method 1: Forgoing inflation adjustments. This is a fixed real withdrawal strategy but with a twist. Whereas the standard 4%-style guideline entails annual adjustments (usually upward) to reflect inflation, this method involves forgoing those upward adjustments following years in which the portfolio has declined in value.
► Method 2: Required minimum distributions. This is the same framework that underpins required minimum distributions from tax-deferred accounts like IRAs. In its simplest form, this method is portfolio value divided by life expectancy. As such, this strategy is fully optimized from a portfolio sustainability standpoint because it incorporates these two key factors on an ongoing basis. However, it also leads to highly variable cash flows: Even though a retiree is able to increase withdrawals over time to account for ever-shortening life expectancy, changes in the portfolio's value can lead to big swings in annual withdrawal amounts.
► Method 3: Guardrails method. This method, developed by financial planner Jonathan Guyton and computer scientist William Klinger, aims to incorporate some variability based on market performance, but sets an upper boundary on how much comes out in good markets and a lower boundary around withdrawals in down markets.
► Method 4: 10% reductions following losses. This method uses a fixed real withdrawal system as its baseline but adjusts withdrawals downward by 10% in the year following a year in which the portfolio has declined in value. Once the portfolio generates a positive return again, withdrawals go back to where they were prior to the downward adjustments.

For each strategy, we use stochastic (Monte Carlo) modeling to test how successful withdrawal systems—meaning that a given system ensured that a retiree did not run out of money in 90% of trials over 30-year time horizons—fared on a few key metrics. We employed a 50% equity/50% bond portfolio as the baseline but also looked at other asset allocations.

The metrics were as follows:

Starting Safe Withdrawal Rate: What starting withdrawal rate would have been supported for 30-year periods with a 90% probability of success (with "success" defined as a positive account balance at the end of the 30-year horizon)?

Lifetime Portfolio Withdrawal Rate (Internal Rate of Return): What was the average lifetime withdrawal amount, factoring in any upward or downward adjustments that the flexible strategy entailed, that would have been supported for 30-year periods with a 90% probability of success? We calculate this as the average of the average annual withdrawals (discounted back to the present) of the 1,000 simulated trials.

Year 30 Cash Flow Standard Deviation: To what extent did withdrawals vary on a year-to-year basis? To approximate this variance, we examine the standard deviation of the withdrawals that takes place in year 30 across the 1,000 simulated trials. The higher the standard deviation, the greater potential variation in spending across the retirement horizon.

Average Ending Value at Year 30: What was the average amount left over in 30-year periods? To arrive at this figure, we average the balance that is left at the end of the 30-year trial for all 1,000 simulations. This yields a sense of how much margin for error the withdrawal method leaves, on average.

Comparing the Methods: Big Picture

As explained further in the detailed sections that follow, each method entails its own set of trade-offs. Here, we offer big-picture observations for each method based on the four metrics we analyzed — starting safe withdrawal rates, lifetime portfolio withdrawal rates, year 30 cash flow standard deviation, and average ending value at year 30.

Starting Safe Withdrawal Rate

Each flexible spending method supported a higher initial safe withdrawal rate than the fixed real withdrawal method. But the RMD and guardrails methods supported the highest starting safe withdrawal rates. This reflects the nature of these approaches, which can support higher initial withdrawals by making potentially significant year-to-year adjustments to dollar withdrawals, including throttling spending at inopportune times. With the exception of RMD, starting safe withdrawal rates are highest in balanced allocations like 50% stocks/50% bonds and tended to be lowest in less-diversified allocations like 100% stocks.

Exhibit 10 Starting Safe Withdrawal Rate, by Withdrawal Method and Equity Allocation
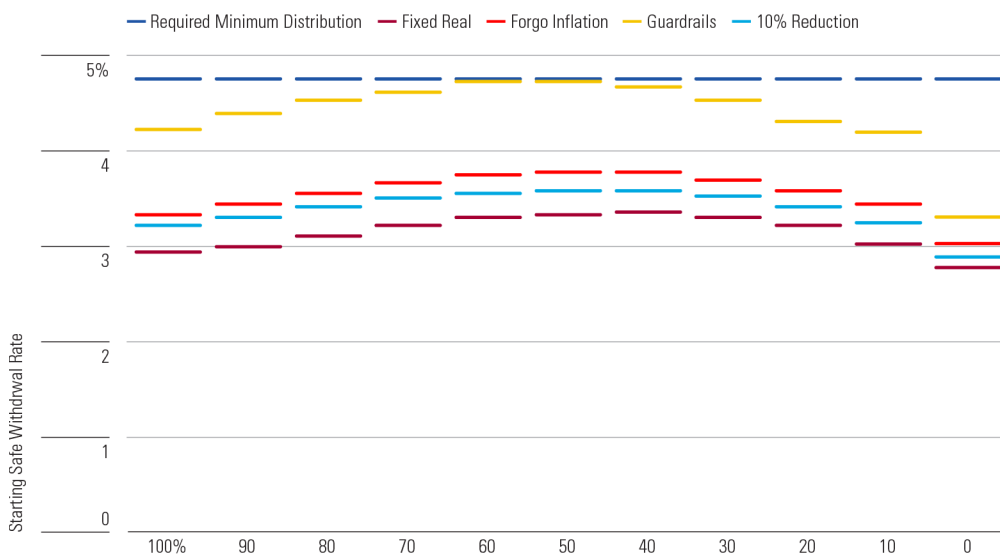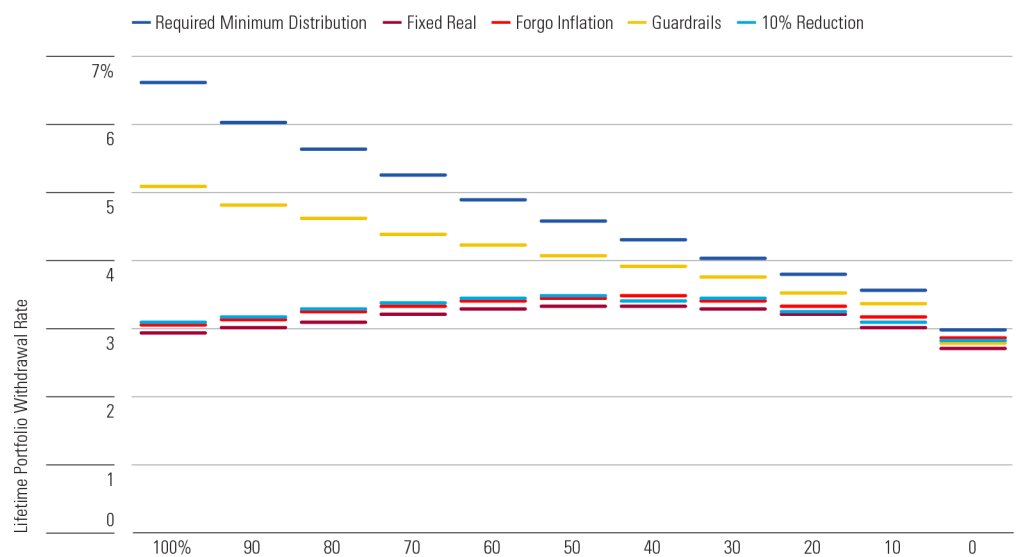

Source: Morningstar Direct. Data as of 12/31/2020.

Lifetime Withdrawal Rate

Each flexible spending approach also boasted a higher lifetime withdrawal rate than the fixed real withdrawal method across the asset-allocation range. The RMD and guardrails methods supported the highest withdrawal rates by this measure, while the forgo-inflation and 10%-reduction methods offered scarcely more income than the baseline fixed real withdrawal approach did. It is also notable that equity-heavy allocations under the RMD and guardrail methods supported higher lifetime withdrawal rates than bond-heavy allocations. That is because the portfolios with higher equity allocations provided larger "raises" in annual withdrawals following good years, thereby enlarging lifetime withdrawal amounts.

Exhibit 11 Lifetime Portfolio Withdrawal Rate, by Withdrawal Method and Equity Allocation
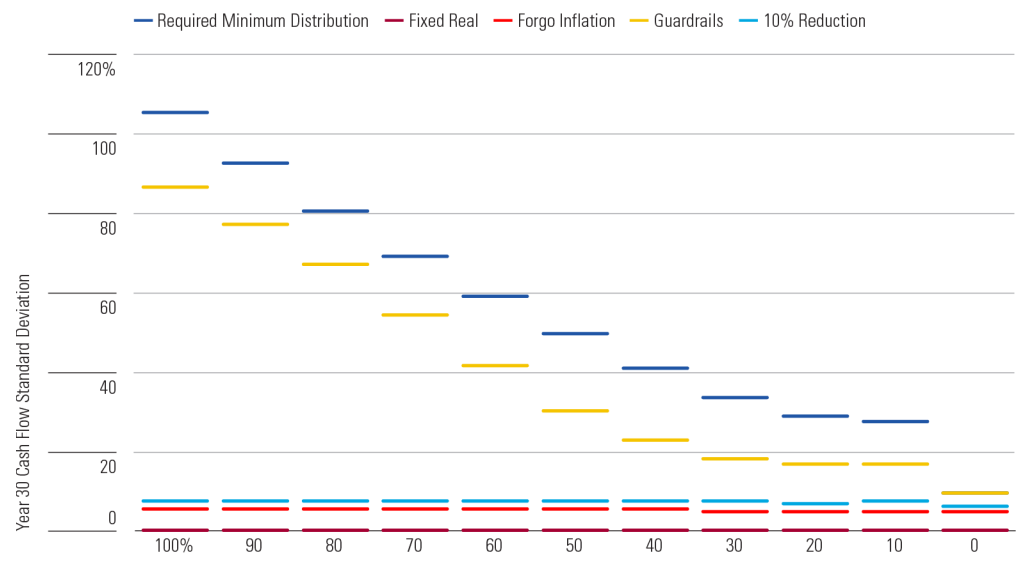

Source: Morningstar Direct. Data as of 12/31/2020.

Year 30 Cash Flow Standard Deviation

It is here that we can see some of the trade-offs that flexible spending approaches like the RMD and guardrails methods impose, especially compared with the baseline fixed real withdrawal method. Namely, there is much more year-to-year variability in the dollar value of withdrawals under these methods; this is the natural byproduct of their rules, which can dictate higher or lower spending under certain circumstances. Thus, a retiree enticed by these methods' potentially higher starting and lifetime withdrawal rates must also reckon with the uncertainty they can involve, including the need to significantly adjust year-to-year spending. By contrast, the forgo-inflation and 10%-reduction methods entail relatively little year-to-year spending change, making them more useful to those retirees who prize stability and predictability.

Exhibit 12 Year 30 Cash Flow Standard Deviation, by Withdrawal Method and Equity Allocation
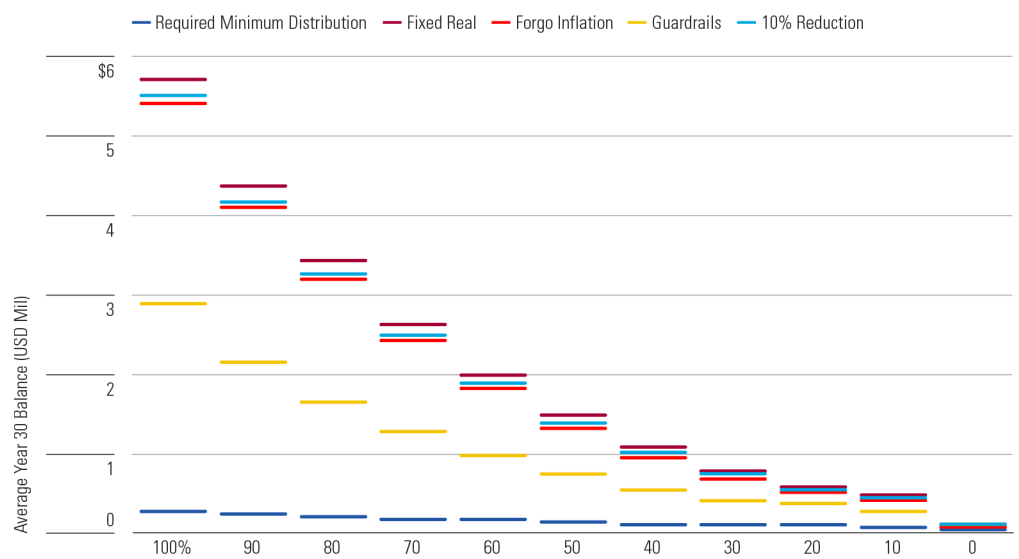

Source: Morningstar Direct. Data as of 12/31/2020.

Average Ending Value at Year 30

Among the flexible withdrawal methods, the forgo-inflation and 10%-reduction methods yielded the highest average ending values at the end of the 30-year retirement horizon in our analysis, far exceeding those of the RMD and guardrails methods, though more or less in line with the baseline fixed real withdrawal method's. The RMD method is designed to spend ratably based on life expectancy, meaning that it will spend down most of the retirement capital by design, thus explaining why it had the lowest average ending values. The guardrails approach splits the difference between a more aggressive, freer-spending method like RMD and thriftier methods like forgo-inflation and 10% reduction, which curtail but never increase spending.

Exhibit 13 Average Ending Value at Year 30, by Withdrawal Method and Equity Allocation

Source: Morningstar Direct. Data as of 12/31/2020.

Exhibit 14 summarizes each method across the four metrics for a 50% stock/50% bond portfolio.

Exhibit 14 Flexible Withdrawal Rate Summary

Method	Starting Safe Withdrawal Rate	Lifetime Withdrawal Rate	Year 30 Cash Flow Standard Deviation %	Median Year 30 Ending Value ($ millions)
Base Case–No Flexibility	3.33	3.33	0	1.08
Forgoing Inflation Adjustment	3.76	3.45	5	1.33
RMD	N/A	4.60	49	0.13
Guardrails Method	4.72	4.07	30	0.74
Spending Reduction Following Losing Years	3.57	3.42	8	1.4

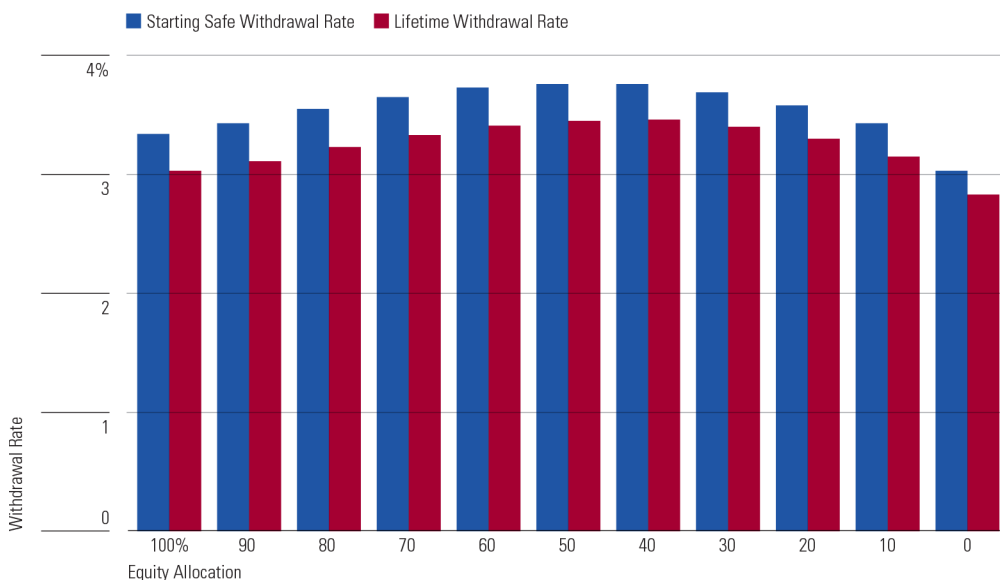Source: Morningstar Direct. Data as of 12/31/2020.

(For the data underpinning this exhibit and the preceding charts, see the Appendix section of this study.)

Method 1: Forgoing Inflation Adjustments

Methodology: This method begins with a 4%-style withdrawal system—fixed real withdrawals throughout a 30-year time horizon. However, in an effort to preserve assets following down markets, the retiree skips the inflation adjustment in the year following a year in which the portfolio has declined in value. T. Rowe Price has frequently referenced this strategy as being both simple and not terribly invasive from a quality-of-life standpoint. To the extent that economic weakness has precipitated the portfolio losses, when inflation is also often low, freezing the paycheck at the prior year's amount seems unlikely to create major disruptions in the retiree's quality of life. On the other hand, to the extent that the market weakness was driven by higher inflation, forgoing inflation adjustments would obviously be more painful.

Starting Safe Withdrawal Rate: Simply forgoing inflation adjustments following losing years enabled this approach to deliver a slightly higher starting safe withdrawal percentage than fixed real withdrawals. A 50% equity/50% bond portfolio maintained with this approach would support a 3.76% starting withdrawal. By contrast, the fixed real dollar approach was safe for a 50% equity/50% bond portfolio with a slightly lower initial withdrawal rate of 3.33%. Indeed, the simple tweak of forgoing inflation adjustments helped deliver a higher withdrawal rate for every asset allocation than would be the case for investors employing fixed real withdrawals. Withdrawals under this system were also higher than was the case for Method 4 (10% reductions following losses). However, both the RMD method and the guardrails method delivered lifetime withdrawal rates that were meaningfully higher.

Lifetime Portfolio Withdrawal Rate: The same patterns persisted for lifetime withdrawal rates. Forgoing inflation adjustments helped deliver a lift in lifetime payouts relative to the lifetime payout of a fixed real withdrawal system, and it also delivered higher lifetime payouts than Method 4. However, this strategy delivered lower lifetime withdrawal rates than the RMD method or the guardrails method.

Exhibit 15 Forgo Inflation Method: Starting and Lifetime Withdrawal Rates, by Equity Allocation

Source: Morningstar Direct. Data as of 12/31/2020.

Year 30 Cash Flow Standard Deviation: Of the methods we tested, this one was the closest to fixed real withdrawals from the standpoint of cash-flow predictability, meaning that the retirees' paychecks under this system were generally exceptionally stable.

Average Ending Value at Year 30: This method delivered a slightly higher ending average value than a fixed real dollar withdrawal approach. And because the approach entails the retiree periodically taking downward adjustments but never upward ones in good markets, the ending value was also better than the guardrails approach, which entails upward and downward adjustments.

Conclusion: For retirees who are seeking a "paycheck equivalent" approach that is likely to support a slightly higher starting and lifetime withdrawal percentage than a simple system of fixed real withdrawals, this simple strategy looks like a decent starting point. While lifetime withdrawals under this system were lower than some of the other flexible strategies we tested, they were higher than a pure fixed real dollar approach. Moreover, there was much less variability in the retiree's cash flows than with some of the other flexible strategies we tested. And because stock and bond returns are positive more often than not, the retiree's spending kept up with inflation roughly two thirds of the time. (Not surprisingly, the safer asset allocations led to fewer years in which the portfolio declined in value, necessitating a freeze on the inflation adjustment, but the trade-off is that the safer portfolio mixes require a lower starting withdrawal percentage.)

Method 2: Required Minimum Distributions

Methodology: This method is simply life expectancy divided by portfolio value as of the preceding year-end. For life expectancy, we used the IRS' Single Life Expectancy Table and assumed a 30-year retirement time horizon from ages 65 to 95. This method is inherently "safe" in that it is designed to ensure that a retiree would never deplete his or her portfolio—the withdrawal amount is always a percentage of the remaining balance. Moreover, it nicely updates to factor in two key variables—remaining life expectancy and remaining portfolio value. But by the same token, the fact that the portfolio updates annually to reflect the portfolio's prior-year performance adds substantial volatility to cash flows.

Starting Safe Withdrawal Rate: An RMD-style system supported the highest starting withdrawal rate of any approach we tested. Assuming a 21-year life expectancy at the beginning of our assumed horizon, that translated to a 4.76% starting safe withdrawal (1/21 = 4.76%) rate at every asset allocation.

Lifetime Portfolio Withdrawal Rate: Because it factors in both portfolio value and life expectancy, an RMD-style system is incredibly efficient from the standpoint of maximizing lifetime payouts. Because RMDs entail withdrawing a certain percentage of savings each year (that percentage approximating 1 divided by the retiree's life expectancy at that point), it means the retiree will never run out of capital and, thus, it always succeeds. Although the starting withdrawal rate was the same across these different allocations, the lifetime withdrawal rate did differ across them because the path of returns varied across the simulations we ran for each allocation. For instance, the lifetime withdrawal rate ranged from around 3% (the mattress) to more than 6.6% (the 100% equity allocation), with the 50% stock/50% bond portfolio allowing for a 4.6% lifetime withdrawal. The higher equity allocations provided for larger "raises" following good years and enlarged lifetime payouts. This was the highest of any of the methods we tested. The trade-off, however, is that lifetime cash flows were substantially more volatile and provide limited opportunities for retirees to leave a bequest. (That may be fine with some retirees, less fine with others.)

Exhibit 16 RMD Method: Starting and Lifetime Withdrawal Rates, by Equity Allocation
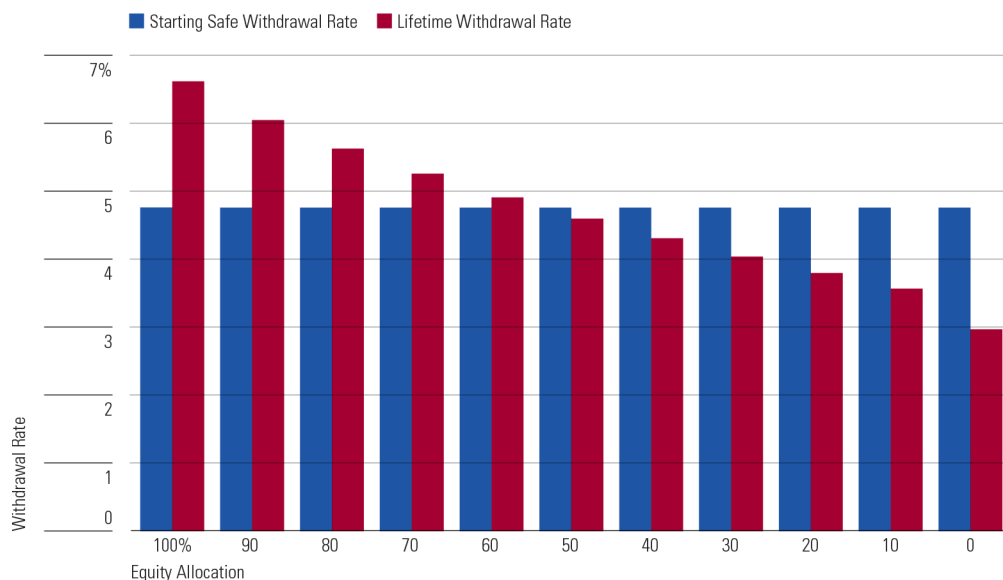
Source: Morningstar Direct. Data as of 12/31/2020.

Year 30 Cash Flow Standard Deviation: The RMD method's efficient approach to portfolio consumption comes at the expense of consistency in retiree cash flows. Indeed, the RMD method led to the greatest variability in year-to-year cash flows of any of the withdrawal methods we tested. Not surprisingly, the portfolios with higher equity allocations—and therefore more variability in year-to-year results that in turn determine each year's withdrawals—had much higher cash flow volatility than was the case for more bond-heavy allocations. Moreover, RMD-based withdrawals do not do a very good job of helping spending keep up with inflation. A retiree with a balanced portfolio using the RMD method would see withdrawals fail to keep up with inflation about half the time; retirees with more conservatively positioned portfolios would lose out to inflation two thirds or more of the time.

Average Ending Value at Year 30: By definition, the RMD method tightly aligns the retiree's spending with the portfolio value. As a result, ending values were lower, on average, with this strategy than any of the other approaches.

Conclusion: The RMD method is simple and efficient but may not very livable, especially for retirees with balanced portfolios or even higher equity allocations. Not only do retirees using this method need to contend with extreme fluctuations in their spending, but balances also are ultra-low later in life, at a time when retiree expenses often increase because of high out-of-pocket healthcare costs. Importantly, using a single life expectancy RMD table to guide withdrawals, as we did in our test, could also lead some retirees to overwithdraw because it uses average life expectancies. Retirees who have much longer-than-average life expectancies and/or younger spouses will want to be more conservative.

Method 3: Guardrails Method

Methodology: Originally developed by financial planner Jonathan Guyton and computer scientist William Klinger, the guardrails method sets an initial withdrawal percentage, then adjusts subsequent withdrawals annually based on portfolio performance and what the new withdrawal percentage looks like relative to starting withdrawal percentage. The guardrails help ensure the retiree takes a sufficient — but not overly high — raise in upward-trending markets while taking a downward adjustment — but not an overly radical one — in downward-trending ones.

In upward-trending markets, the portfolio withdrawal amount is adjusted for inflation, as with the basic 4% guideline. In addition, the guardrails kick in to ensure that the withdrawal percentage is not too low relative to the starting percentage and that the retiree receives a "raise" commensurate with the portfolio's gains. In years in which the portfolio performs well and the new withdrawal percentage (adjusted for inflation) falls below 20% of its initial level, the withdrawal increases by the inflation adjustment plus another 10%. To use a simple example, let's say the starting withdrawal percentage was 4% of $1 million, or $40,000. If the portfolio increased to $1.4 million at the beginning of year 2, the retiree could automatically take $40,000 plus an inflation adjustment — $41,200, based on a 3% inflation rate. One would then divide that amount by the current balance — $1.4 million — to test for the percentage. $41,200 is just 2.9% of $1.4 million. That is 27% less than the starting percentage of 4%, meaning that the retiree gets an upward adjustment of 10% — to $45,320 (the $41,200 plus an additional 10% — $4,120.)

The guardrails kick in during down markets, too, to help ensure that the new withdrawal percentage is not too high. Specifically, the retiree cuts spending by 10% if the new withdrawal rate (adjusted for inflation) is 20% higher than its initial level. For example, let's say the retiree taking out 4% ($40,000) of the $1 million portfolio in year 1 hits a weak market in year 2; the portfolio slides to just $700,000 at the beginning of year 2. The year 2 withdrawal would be $41,200 on a pretest basis. But because $41,200 on $700,000 is 5.9% — more than 20% higher than the initial 4% — the retiree would need to reduce the $41,200 by 10% — to $37,080.

Importantly, Guyton-Klinger doesn't impose the cutback rules (following portfolio declines) in the final 15 years of retirement, to address the fact that weak returns are especially dangerous early in retirement and less so later on. Guyton-Klinger also includes some portfolio-management rules related to the spending of various assets — for example, if the equity allocation exceeds its target allocation because of strong performance, the excess equity exposure is sold and added to cash. For the purpose of this exercise, we focused exclusively on changes to the withdrawal rate rather than including the portfolio-management rules.

Starting Safe Withdrawal Rate: For retirees with balanced portfolios, the Guyton-Klinger "guardrails" approach delivered some of the highest safe withdrawal percentages of any of the withdrawal methods we tested. For a 50% equity/50% bond portfolio, the average safe starting withdrawal rate was 4.72%. That was meaningfully higher than fixed real withdrawals, Method 1, or Method 4.

Exhibit 17 Guardrails Method: Starting and Lifetime Withdrawal Rates, by Equity Allocation
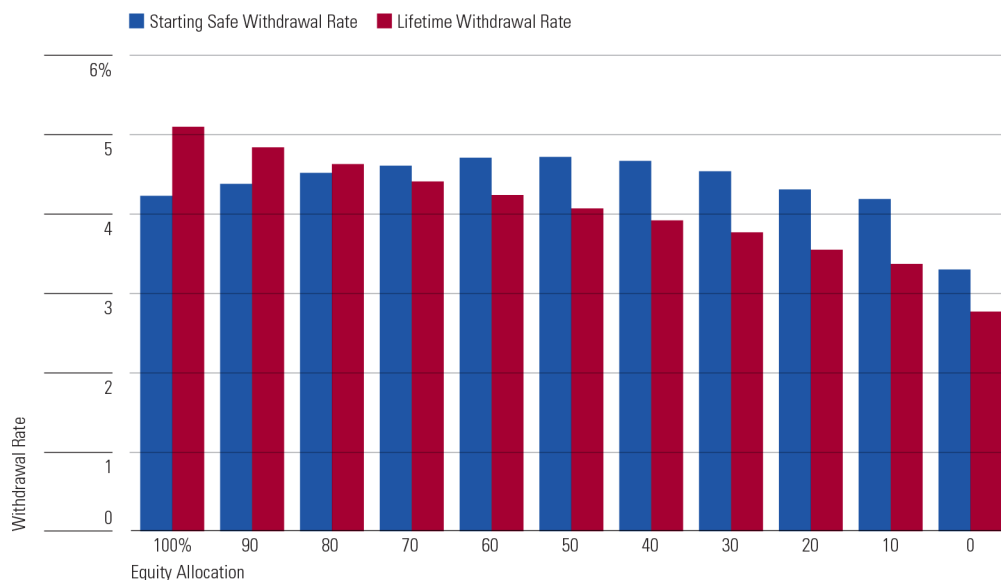
Source: Morningstar Direct. Data as of 12/31/2020.

Lifetime Portfolio Withdrawal Rate: Guardrails' lifetime withdrawal rate was also among the highest we tested—4.1% for a 50% equity/50% bond portfolio and nearly 5% for the highest equity allocations. That is because the course corrections help ensure that the retiree does not withdraw too much (or too little) following market rallies and sell-offs. The lifetime withdrawal rate of this method was a bit lower than the RMD method but substantially higher than this report's other withdrawal methods.

Year 30 Cash Flow Standard Deviation: The "guardrails" approach, which puts boundaries on withdrawals in good and bad markets, also helped stabilize cash flows on a year-to-year-basis. The standard deviation of year-to-year withdrawals for a 50% equity/50% bond portfolio was appreciably lower than was the case for the RMD method. However, it was quite a bit higher than was the case for Method 1 (and Method 4, discussed below. While the guardrails help reduce the variability in cash flows from year to year, portfolios with higher-equity allocations tended to have bigger swings in annual cash flows than more-conservative portfolios.

Average Ending Value at Year 30: The guardrails approach was among the most efficient we tested, meaning that periodic course corrections help the retiree consume more of the portfolio in up markets but not too much in bad ones. The trade-off of that efficiency, however, is that the average ending balance was lower than fixed real withdrawals, as well as Methods 1 or 4. That is intuitive, in that those methods entail many fewer adjustments to match withdrawals to portfolio performance. Thus, this type of system would tend to be most appropriate for retirees who prioritize maximizing spending as opposed to leaving a bequest to family or charity.

Conclusion: For retirees aiming to wring more from their portfolios without radical adjustments to their standards of living, the guardrails system strikes a pleasing balance. While cash flow volatility is certainly higher than with a fixed real withdrawal approach, Method 1 (or Method 4 it is substantially lower than the RMD method. Because the approach resulted in smaller amounts left over than most of the other strategies (only the RMD method had a lower average ending value), it will tend to be less suitable for retirees with a strong bequest motive. Finally, like all of the variable systems, the guardrails system requires ongoing calibration of the withdrawal amount; in contrast with a fixed real withdrawal system, it is not "set it and forget it."

Method 4: 10% Reductions Following Losses

Methodology: This method employs a baseline of fixed real withdrawals, similar to the original Bengen approach, but makes 10% downward adjustments in years following losing years. For example, if the initial withdrawal is $40,000 on a $1 million portfolio in year 1 and the portfolio drops to $700,000 at the beginning of year 2, the year 2 withdrawal would be $36,000. The "guardrails" approach, as well as variations on it like Vanguard's "ceiling and floor" method, can get complicated, so the goal of stress-testing this method was to check whether an ultra-simple downward adjustment would help improve lifetime withdrawals in a similar fashion.

Starting Safe Withdrawal Rate: For 50% stock/50% bond portfolios, this approach delivered a slightly higher starting safe withdrawal rate (3.57%). That was higher than the starting safe withdrawal percentage on a 50% stock/50% bond portfolio (3.33%) but substantially lower than the RMD or guardrails methods. The other simple flexible method that we tested—forgoing the inflation adjustment following a down market—delivered a slightly higher starting safe withdrawal rate with less cash flow volatility.

Exhibit 18 10% Reduction Method: Starting and Lifetime Withdrawal Rates, by Equity Allocation

■ Starting Safe Withdrawal Rate   ■ Lifetime Withdrawal Rate
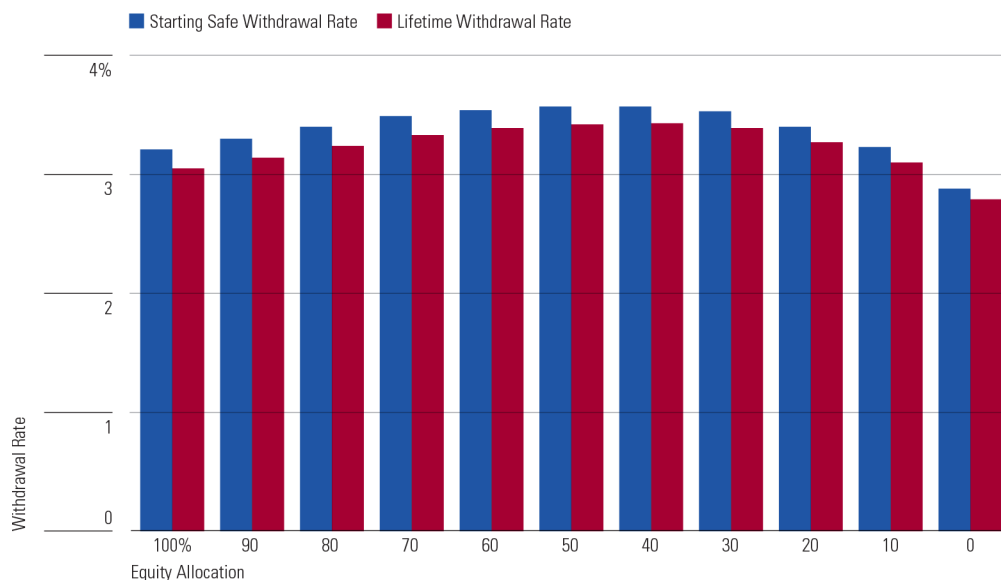
Source: Morningstar Direct. Data as of 12/31/2020.

Lifetime Portfolio Withdrawal Rate: This approach delivered a lift to the lifetime withdrawal rate relative to a system of fixed real withdrawals. Lifetime withdrawals with this method were roughly in line with lifetime withdrawals from Method 1 which makes sense given that both are fairly simple systems for adjusting payouts. The lifetime withdrawal rate was appreciably lower than the RMD or guardrails methods, however.

Year 30 Cash Flow Standard Deviation: From the standpoint of limiting cash flow volatility, this approach looked much better than the RMD or guardrails methods, but it was a bit more volatile than Method 1, forgoing inflation adjustments following losing years. The cash flow volatility for this approach looked worse for more-aggressive asset allocations. That is because holding more in equities led to frequent 10% haircuts and also because, following a downward adjustment, the withdrawal amount would "snap back" to what it was before the downward adjustments.

Average Ending Value at Year 30: This approach led to higher average ending values than was the case for any of the other methods we tested, save for the fixed real withdrawal (original Bengen) method. That makes sense because it entails more frequent and more punitive downward adjustments following losses than Method 1, which helps ensure that funds are left over in a large percentage of scenarios.

Conclusion: While this approach is simple and easy to implement, it underperforms the other simple strategy we tested, forgoing inflation adjustments, on safe withdrawal rates. However, it does lead to larger ending values, on average. As such, it may be appropriate for retirees in search of a simple system

that delivers a higher withdrawal percentage than a fixed real withdrawal system while also incorporating bequests or building in a buffer for a longer-than-expected life span.

Takeaways

Our research finds that a guardrails-type system—flexible withdrawals with parameters, or guardrails, around how high or low withdrawals can go in a given year—does the best job of enlarging payouts in a safe and livable way. Meanwhile, a simple fixed real withdrawal system that forgoes inflation adjustments following a losing year does a decent job of enlarging lifetime withdrawals versus a fixed real withdrawal system and does so without a lot of cash flow volatility on a year-to-year basis. It is also straightforward and simple for individual investors to implement.

Section VI: Identifying the Right Withdrawal Method

The preceding section demonstrates that flexible withdrawal systems have the potential to raise withdrawals relative to a traditional fixed real withdrawal method. But investors contemplating such systems are balancing competing forces: While flexible systems may elevate withdrawals over a retiree's life cycle, they can also lead to undesirable volatility in household cash flows. In short, they may not be very livable.

Some of the withdrawal methods discussed in the preceding section aim to fall somewhere between those two extremes. They incorporate the finding that varying withdrawals based on market conditions and portfolio performance greatly improves sustainability but aim to smooth withdrawals to help improve livability. For example, the guardrails method discussed earlier adjusts withdrawals to accommodate changes in portfolio value but does so only within certain parameters. The method of forgoing inflation adjustments after portfolio losses but otherwise adhering to fixed real withdrawals further smooths cash flows but leads to only a modest improvement in safe portfolio withdrawals.

In the end, the "right" withdrawal method is highly dependent on the retiree's personal situation: level of wealth, stability of pre-retirement income, and desire for certainty about not running out of money, among other factors. Here are some of the key considerations to bear in mind when determining the appropriate withdrawal system.

Age/Remaining Life Expectancy
Younger: More-Flexible Withdrawals
Older: Less-Flexible Withdrawals

One of the key risks for retirement is sequence of return risk, which is the risk of encountering a weak market environment in the early part of retirement, when the portfolio is at its highest level. It is less of a risk factor if a retiree encounters such a market environment later in retirement, after making it through the danger zone of the first 10 to 15 years, with the portfolio needing to last for a shorter period of time. For that reason, a variable withdrawal system will tend to be most appropriate for new retirees and may be less necessary for people who have been retired for many years. Indeed, the Guyton-Klinger guardrails method relaxes its withdrawal rules after the first 15 years. That argues for new retirees varying their withdrawals, whereas older retirees will need to worry less about tethering their withdrawals to their portfolios' performance.

Market Environment

High Equity Valuations and/or Low Bond Yields: More-Flexible Withdrawals
Low Equity Valuations and/or High Bond Yields: Less-Flexible Withdrawals

In a related vein, expectations of market returns can also influence whether a retiree employs a variable strategy or opts for fixed real dollar withdrawals. A fixed real dollar method is not inherently problematic if a retiree embarks on retirement in a period of low bond yields and/or high equity valuations. But if these factors also lead to lower market returns, the starting withdrawal amount that is then inflation-adjusted throughout retirement might need to be uncomfortably low. Employing a flexible withdrawal system helps address the above-mentioned sequence of return risk while also allowing for the possibility of higher withdrawals during times when the market environment is more rewarding.

Level of Wealth

More Wealth: More-Flexible Withdrawals
Less Wealth: Less-Flexible Withdrawals

A key factor in whether a given withdrawal system is "livable" is a retiree's level of wealth and the extent to which changes in the withdrawal rate might be a small nuisance or begin to have a significant impact on the retiree's quality of life. It is a good bet (though by no means a certainty) that a 25% reduction in spending would have a bigger negative impact on the quality of life for the retiree who goes to $45,000 from $60,000 than it would for the retiree who needs to drop to $150,000 from $200,000. Because the dollar amounts are so much smaller, there is not as much room to cut nondiscretionary expenses.

Coverage for Fixed Expenses From Nonportfolio Income Sources

More Coverage: More-Flexible Withdrawals
Less Coverage: Less-Flexible Withdrawals

In a related vein, the extent to which a retiree is meeting basic living expenses—housing, food, utilities, and healthcare, for example—from nonportfolio sources is also a factor. The retiree who covers most such expenses using income from sources like Social Security, a pension, rental income, or an annuity will be better situated to absorb variations in portfolio cash flows than would the one who is relying more heavily on the portfolio to cover basic needs.

Variability of Income While Working

More-Variable Income Stream: More-Flexible Withdrawals
More-Stable Income Stream: Less-Flexible Withdrawals

The retiree's own earnings pattern while working is also apt to influence one's comfort level with varying portfolio withdrawals based on performance. The retiree who experienced very stable cash flows from work—for example, a teacher whose income received an automatic inflation adjustment—may be less comfortable with portfolio cash flows that vary from year to year. Meanwhile, retirees who

experienced lumpy income streams while working—commissioned salespeople or business owners, for example—might be more willing to vary their cash flows in retirement, too. (Of course, it is perfectly plausible they may prefer more-stable cash flows, too.)

Desire to Maximize Lifetime Spending

Strong Desire to Maximize Lifetime Spending: More-Flexible Withdrawals
Less Desire to Maximize Lifetime Spending: Less-Flexible Withdrawals

While a system of fixed real withdrawals runs the risk of premature asset depletion if the initial withdrawal amount is too high, it also runs the risk of underspending if the initial withdrawal rate is too low and/or the market performs well over the retiree's time horizon. Retirees who employ flexible withdrawal systems, by contrast, will be able to employ course corrections on an ongoing basis, thereby deriving greater utility from their portfolios during their own lifetimes. Variable strategies inherently court less of a risk of inadvertently leaving substantial assets behind.

Bequest Motive

Strong Bequest Motive: Less-Flexible Withdrawals
No/Weak Bequest Motive: More-Flexible Withdrawals

Our research demonstrates that a fixed real withdrawal system tended to lead to higher ending balances than did more flexible systems like the guardrails and RMD methods. (Exhibit 13 illustrates the ending balances for the various withdrawal systems and asset allocations that we tested.) That is because flexible methods give retirees a "raise" when their portfolios have done well, meaning that they consume more of their portfolios on an ongoing basis than is the case with a fixed real withdrawal system. However, it is worth noting that retirees using any of the withdrawal systems could ensure a bequest by segregating the bequest assets from spendable assets. That two-part system would allow the retiree to maximize lifetime withdrawals while also ensuring that the bequest assets remain untouched.

Desired Certainty About Not Running Out

Very Concerned About Running Out/Running Short: More-Flexible Withdrawals
More Tolerant of the Possibility of Running Out/Running Short: Less-Flexible Withdrawals

Variable strategies tend to be more appropriate for retirees who would like to minimize the risk of ever running out of funds. Whereas retirees who take fixed real dollar withdrawals run the risk of premature asset depletion if the initial withdrawal is too high and/or the portfolio performance is poor, retirees employing variable strategies can better adjust their withdrawal systems along the way to ensure that they do not run out.

Willingness to Conduct Ongoing Maintenance

Willing to Conduct Ongoing Maintenance: More-Flexible Withdrawals

Not Willing to Conduct Ongoing Maintenance: Fixed Real Withdrawals

All of the variable strategies outlined in Section V entail some level of ongoing maintenance to recalibrate the annual withdrawal amount. By contrast, a system of fixed real withdrawals allows a retiree to set and forget the withdrawal amount.

Section VII: Additional Portfolio-Level Strategies for Maximizing Retirement Income

This paper suggests that, for retirees who seek a fixed real payout from their portfolios along the lines of the 4% guideline, an initial withdrawal in the mid-3% range is a good starting point. Alternatively, retirees who are not wedded to fixed real withdrawals could employ a variable withdrawal system; we discussed the pros and cons of several such strategies in Section V.

In addition, retirees can consider layering on additional strategies to help improve the health of their retirement decumulation plans. These strategies fall into one of two groups. The first category of strategies may help to enlarge a portfolio's payout—tax-efficient portfolio management and drawdown strategies, for example, or being willing to live with a lower probability of success than the 90% in our simulations. The second category, discussed in Section VIII, involves reducing demands on the portfolio by employing nonportfolio strategies: reducing spending and/or enlarging cash flows from nonportfolio sources such as Social Security or a pension.

Retirees can pick and choose which of these approaches—or combination of them—makes the most sense in their own situations.

Strategy 1: Limit Tax Costs
Retirees can exercise a level of control over the tax management of their portfolios to potentially reduce the tax drag and enlarge their take-home payouts. (Note that the aforementioned reference points for safe starting withdrawal rates do not factor in taxes, meaning that aftertax withdrawals will invariably be lower for withdrawals from tax-deferred and taxable accounts.) They can do so in a few key ways.

First, on an ongoing basis, they can situate tax-efficient assets in their taxable accounts and less tax-efficient ones in tax-sheltered accounts. For equity exposure within taxable accounts, broad-market exchange-traded funds fit the bill, while municipal bonds provide tax-efficient fixed-income exposure, especially for higher-income investors. Meanwhile, assets that generate a (relatively) high level of ordinary income are best situated in tax-sheltered accounts.

The pre-retirement, pre-RMD years are also an ideal time to utilize strategies to reduce in-retirement tax bills. That involves funding Roth accounts during the accumulation phase and considering conversions of traditional tax-deferred assets to Roth on an ongoing basis. Doing so reduces the amount of the retiree's balance that is subject to RMDs and in turn reduces the taxes due during retirement. (Roth

assets are not subject to RMDs, and distributions are tax-free provided the retiree is age 59-1/2 and has met the "five-year rule.") The post-retirement, pre-RMD years can be a particularly opportune time to convert traditional IRA assets to Roth and/or accelerate withdrawals from tax-deferred accounts. That is because taxable income will likely be lower during this window given that earned income is not in the picture and RMDs have not commenced yet. Finally, retirees would do well to create a tax-efficient drawdown strategy as a means of reducing the drag of taxes on their portfolio withdrawals. In other words, which accounts should be tapped first, and which should be spent later on or even set aside for heirs? The optimal withdrawal sequence will depend on the retiree's own situation, as well as the percentage of a portfolio a retiree has in each of the three major account types: traditional tax-deferred, taxable, and Roth. The overarching concept is to spend through the least tax-friendly accounts first, while leaving in place as long as possible those assets with the lowest tax bill attached to them.

The conventional withdrawal sequencing guidelines call for taking withdrawals from RMD-subject accounts first (to the extent that RMDs apply), followed by taxable accounts and tax-deferred. Roth accounts bring up the rear because qualified withdrawals from them will skirt taxation altogether. Retirees who expect to leave behind sizable sums for their heirs may be best off preserving taxable accounts, however, in that, under current tax laws, such assets receive a step-up in the cost basis to the asset's price at the decedent's date of death. In other situations, retirees may wish to accelerate withdrawals from taxable accounts with unrealized appreciation, the better to spread out the impact of taxable capital gains.

Strategy 2: Limit Fees
Another way to enlarge take-home portfolio payouts is to reduce the drag of fees on the portfolio. These fees tend to fall into two key categories in retirement: fees associated with the specific holdings and the buying and selling thereof, such as expense ratios and brokerage commissions, and advisory fees.

Focusing on low-cost investment products is pretty much risk-free: Morningstar's research has consistently found a close correlation between lower-expense investment products (funds, ETFs) and better performance versus peers. (Of course, a retiree swapping into lower-cost funds in a taxable account will have to weigh the tax consequences of doing so.) Today's low- and no-commission brokerage environment also makes it easy to dodge trading costs.

What is trickier, however, is balancing the drag of advisor fees alongside the value the advisor brings in other areas, including some of the strategies noted above. Moreover, an advisor can often provide the counsel to keep the retiree with the plan in periods of market duress, while also serving as a safeguard in case the retiree experiences cognitive decline.

Strategy 3: Employ Valuation-Centric Withdrawal Sourcing
Perhaps more controversially, retirees may also be able to boost their portfolios' lifetime payouts by taking a valuation-conscious approach to sourcing withdrawals. Rather than pulling withdrawals pro rata from each of their holdings or relying on income distributions, such a system would rely on rebalancing at the asset-class and intra-asset-class level to source cash flows. In 2021, for example, a

retiree using such a system would likely be pulling from appreciated equity assets—specifically U.S. growth-oriented equity assets—to source cash flow needs for the next few years. In less favorable equity markets, a retiree could rely on cash and/or a combination of income distributions and sell bond holdings to meet cash flow needs. Such a strategy simultaneously provides for cash flows without stretching for yield while also removing risk from the portfolio on an ongoing basis by selling appreciated securities. Holding more-discrete building blocks in the portfolio—for example, growth-style equity investments as well as value, and both developed- and emerging-markets holdings for international equities—will provide more opportunities for such rebalancing opportunities than total market index funds would afford.

Strategy 4: Tolerate a Lower Success Rate
An additional lever to enlarge a portfolio's lifetime withdrawals is to employ a lower success rate—in other words, tolerate a higher likelihood of running out of money before 30 years has elapsed than the 90% success rate we employed in our tests. Some may find that approach too conservative. They may wish to withdraw at a higher rate during the early years of their retirement, with the understanding that, under most possible futures, their assets will survive even the higher withdrawal rate. Also, if the financial markets perform badly during the early part of retirement, a retiree can always adjust by reducing the withdrawal amounts.

The next chart illustrates how the safe withdrawal rates change along with the targeted success ratio. Each bar represents the highest safe withdrawal rate for the 50% stock portfolio over a 30-year time horizon. For example, as previously stated, the safe withdrawal rate for the default success rate of 90% is 3.3%, while the withdrawal rate assuming the lower hurdle of an 80% success rate is 3.9%.

Exhibit 19 Tolerating a Lower Success Rate (50% Stock Portfolio, 30-Year Time Horizon)

Target Success Rate %	Starting Safe Withdrawal Rate
100	1.9
99	2.5
95	3.1
90	3.3
85	3.7
80	3.9
50	4.7
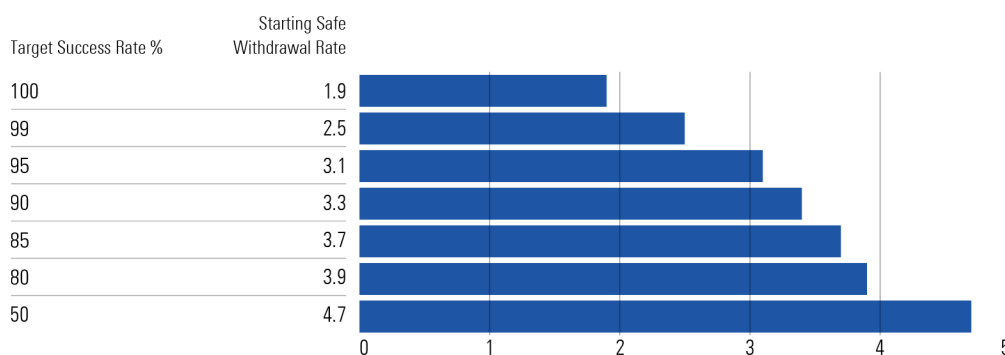
Source: Morningstar Direct. Data as of 12/31/2020.

Targeting an ironclad withdrawal rate is inadvisable. In the worst of the 1,000 simulations, the retiree could only spend an inflation-adjusted 1.9% per year over the 30-year time horizon. Clearly, retirees who plan for such an outcome—a result that, according to the model, would only occur once out of every

1,000 possible futures—would very likely be underspending by a very large amount. Such an approach could suffice for the highly wealthy or for those who have very modest spending desires, but it would be inappropriate for the vast majority of retirees. Better to spend more and then adjust as required should investments perform badly.

This paper assumes that a 90% success rate is the sweet spot – conservative enough to succeed on nine occasions out of 10 but not so conservative that it unduly squeezes the initial withdrawal rate. However, it is certainly reasonable to choose a success rate that is lower than 90%. After all, according to the model, the 80% success rate will suffice to fund the scheduled fixed withdrawals four times out of five. Or, to put the matter another way, four times out of five the retiree will reach the end of the 30-year time period with excess assets.
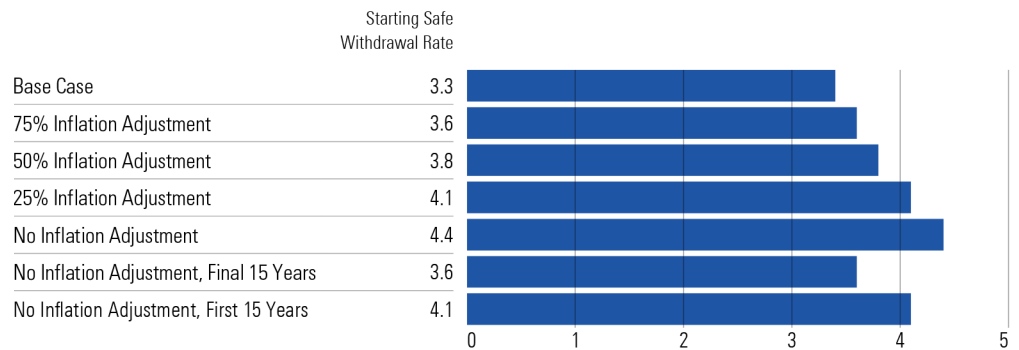
Finally, it should be noted that, while a 50% success rate appears to be unduly low, that was the standard for financial plans until relatively recently. Prior to the development of the personal computer and Monte Carlo simulation programs, which have permitted the creation of customized plans that use simulations, professional advisors routinely constructed plans that assumed fixed investment returns without considering the possibility of alternate outcomes. Implicitly, such plans targeted the median result, meaning that that assumed a 50% success ratio. They did not state the fact in so many words, but that was effectively how they operated.

Strategy 5: Skip Full Inflation Adjustments on Withdrawals
This paper assumes that retirees seek constant real income, meaning withdrawals that are fully adjusted for changes in inflation. That is the convention of retirement research; almost all studies adopt that approach. However, in reality, most retirees do not adjust fully for inflation. They hold cash and bonds that pay nominal yields (unless they have Treasury Inflation-Protected Securities), and if they purchase a fixed annuity, it almost always makes nominal rather than real distributions. Social Security payments are adjusted for cost-of-living increases but generally not the income from a retiree's investments.

Effectively, this habit increases the initial withdrawal rate that is safe. If retirees will spend less from the investment pool over time, because their scheduled withdrawals will not fully keep pace with inflation, then they can withdraw more from the portfolio during the early years of retirement. To be sure, this apparent increase in their withdrawal rate is a mirage—they take more now, then settle for less later, as inflation erodes their purchasing power. But the approach makes intuitive sense. Most retiree have higher spending needs during the first decade after they retire, not during the third. Also, most will not survive the full 30 years.

The following chart demonstrates how the 3.3% withdrawal rate from the 50% stock portfolio is affected by various inflation-adjustment tactics. The first four figures show how the withdrawal rate changes when the retiree does not adjust fully for inflation's changes, while the final result illustrates what happens when the retiree does not adjust for inflation at all.

Exhibit 20 Letting Inflation Run (50% Stock Portfolio, 30-Year Time Horizon)

	Starting Safe Withdrawal Rate	
Base Case	3.3	
75% Inflation Adjustment	3.6	
50% Inflation Adjustment	3.8	
25% Inflation Adjustment	4.1	
No Inflation Adjustment	4.4	
No Inflation Adjustment, Final 15 Years	3.6	
No Inflation Adjustment, First 15 Years	4.1	

Source: Morningstar Direct. Data as of 12/31/2020.

Roughly speaking, each 25% reduction in inflation adjustment increases the safe withdrawal rate for the 50% stock portfolio by about 0.25 percentage points. Thus, eliminating the inflation adjustment entirely raises the safe withdrawal rate to 4.4% annually from 3.3%. Once again, it should be emphasized that this strategy neither turns water into wine nor squeezes blood from a turnip. The percentage increases but the amount of money that is removed from the portfolio over the 30-year period, when discounted by the inflation rate, does not. The effect is to permit more spending early in the retirement and less during the later period.

Another approach is to adjust fully for inflation but for only part of the retirement period. For example, one could increase the withdrawals by the amount of inflation during the first 15 years of retirement, then cease doing so during the second 15 years. Or, one could attempt the reverse. Many possibilities exist. The preceding chart presents only those two tactics in order to establish a sense of their effects. The lesson is straightforward: Forgoing the inflation adjustment is much more effective when done during the early stages of retirement than during the later stages. Unfortunately, this pattern is the opposite of what most retirees desire as the "go-go years" are often the highest-spending years.

Strategy 6: Improve Investment Performance
The easiest path to a higher withdrawal rate during retirement is to invest one's way to success, by achieving higher portfolio returns, reducing portfolio volatility, or encountering less inflation. These items, of course, are easier said than done. Retirees can do nothing whatsoever about inflation rates, and, while they can improve their portfolio odds by investing soundly and keeping their costs low, they have no control over the direction of the financial markets.

Nevertheless, it is instructive to see the effect of better investment performance—to understand how much that improves retirees' spending abilities when compared with the three previous strategies. The following chart shows how the safe withdrawal rates for the 50% stock portfolio change as portfolio returns increase and/or standard deviation declines. There are nine combinations, which feature three levels of higher returns and three levels of standard deviation.

Exhibit 21 How Return, Volatility Assumptions Affect Starting Safe Withdrawal Rates

	Change in Standard Deviation			
	0.0	-0.5	-1.0	-1.5
Change in Return %	**Starting Safe Withdrawal Rate %**			
0.0	3.3	3.4	3.5	3.6
0.5	3.5	3.6	3.7	3.8
1.0	3.7	3.8	3.9	4.0
1.5	3.9	4.0	4.1	4.2

Source: Morningstar Direct. Data as of 12/31/2020.

Unsurprisingly, adding 1 percentage point of return improves the feasible withdrawal rate more than does reducing standard deviation by a single point. The average rate of investment return, along with the inflation rate, has the greatest effect on the portfolio's ability to maintain withdrawals. However, the benefit from reducing volatility is not negligible. The smaller a portfolio's fluctuations, the less likely that a retiree will endanger the portfolio's survivability by withdrawal after a severe downturn, when asset values are low.

While the period from 2010-19 featured very strong investment returns with low volatility, banking on a repeat seems risky. Instead, the best avenue for investors to enlarge their take-home returns appears to be by reducing the temptation to trade, as evidenced by Morningstar's annual Mind the Gap study. It should also be noted that, even as higher future returns have the potential to increase safe withdrawal rates, lower returns can reduce them. A retiree who employs a too costly portfolio or one that is improperly diversified will need to settle for a lower safe withdrawal rate than resulted from our simulations.

Section VIII: Nonportfolio Strategies for Maximizing Retirement Income

In the preceding section, we examined some of the key strategies that retirees might employ to enlarge their lifetime portfolio payouts once they have arrived at the right withdrawal system given their situation. But there is another, arguably more impactful set of strategies that relate to reducing the demands the retiree places on the portfolio. None provide free lunches; they all involve trade-offs. Also important is the size of their effects. Does the method increase the withdrawal rate by a large amount, or is the benefit only moderate? Ultimately, the right combination of strategies will depend on the retiree's own income sources, lifestyle considerations, willingness to take risk in the plan, and so on.

Strategy 1: Delay Retirement

The simplest way to achieve a higher withdrawal rate is to work longer and retire later. This helps in two ways. First, the retiree's time horizon is reduced because each year worked leads to one year less in retirement. Second, the retiree has more years to increase the size of the portfolio, both by making additional contributions to the investment pool and by having a longer compounding period. While retirement "end dates" are not within retirees' control, the start dates may be, and the payoff of delaying may be attractive.

Exhibit 20 depicts the withdrawal rate pickup associated with delaying retirement by one to five years. While our base case (assuming fixed real withdrawals over a 30-year time horizon) suggests that a 3.3% withdrawal rate is safe from a 50% equity/50% bond portfolio, the retiree who delays one year can spend 3.5%. The one who delays a full five years can spend more than 4%.

The following chart is conservatively created, in that it does not simulate the effect of additional retirement contributions, which lies outside the scope of the model. However, it does illustrate the twin effects of 1) shortening the retirement time horizon and 2) lengthening the pre-retirement investment period. For example, with the result that reads "3 Years," the retiree works three additional years. During that period, the investment pool not only does not make distributions but also grows (or, if the market returns are poor, shrinks) for an additional three years. The adjusted investment amount is then used to fund withdrawals for a 27-year retirement period.

Exhibit 22 Delaying Retirement (50% Equity Portfolio, 30-Year Time Horizon)

Starting Safe Withdrawal Rate

Base Case	3.3
1 Year	3.5
2 Years	3.7
3 Years	3.8
4 Years	4.0
5 Years	4.1
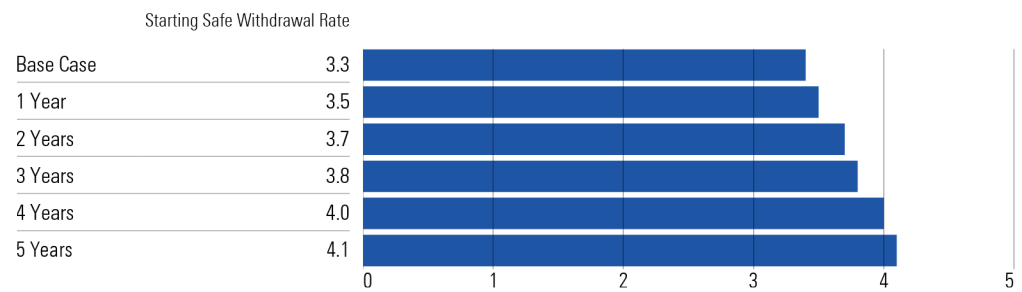
Source: Morningstar Direct. Data as of 12/31/2020.

With these assumptions, each year of additional work increases the safe withdrawal rate by about 0.14 percentage points. That is, by deferring the retirement date by five years, the retiree adds 0.7 percentage points to the base case for the 50% stock portfolio, increasing it to 4.1% from 3.4%. Again, this amount does not include the effect of additional retirement contributions. If the retiree contributed aggressively during those extra working years, the withdrawal rate would be that much higher.

Moreover, there are additional financial and nonfinancial benefits associated with delaying retirement. By holding off on retirement and continuing to work, a retiree can take advantage of additional retirement-account contributions and opportunities for tax-deferred compounding. Delaying Social Security, which delivers benefits that we will discuss below, is another side benefit of deferring the retirement date.

Retirement researchers have also explored the connection between continuing to work later in life and higher levels of happiness and even longevity. Numerous studies have found that people who continue to work later in life report higher levels of happiness and satisfaction, in large part because work can provide a sense of purpose and opportunities for social interactions. The data on the connection between working longer and longevity is less conclusive. While the research does seem to suggest that there is a relationship, it can be difficult to say whether people who worked later in life and lived a long time did so because they were healthier to begin with or because working contributed to their longevity somehow.

Strategy 2: Calibrate/Reduce Expenses

Just as reducing the duration of retirement is one way to make a save in the face of what could be an inhospitable market environment for retirees over the next few decades, so is reducing actual expenses. Many retirement-planning programs rely on income-replacement rates to help calibrate anticipated spending in retirement—for example, an 80% income-replacement rate is a commonly cited benchmark. However, a more finely tuned approach that factors in expected changes in spending in retirement may be warranted and may help reduce estimated income needs.

The following are some of the key factors that may influence retirement spending and allow for downward adjustments in retirement relative to working income.

► Level of wealth

While 75% to 80% is often considered a reasonable rule of thumb for income replacement—the amount of current (working) income that a retiree will need in retirement—actual income replacement rates can vary widely. Blanchett demonstrated that there can be huge variations in income-replacement rates among retirees depending on their levels of pre-retirement income. Based on Blanchett's findings, higher-income, higher-saving households may well need just 60% (or even less) of their pre-retirement income during retirement, while lower-earning, lower-saving households may need closer to 90%.

► Age/changes in spending over the life cycle

As noted in Section II, research also points to how retiree spending changes dramatically over the retirement life cycle. That suggests that targeting a static real dollar withdrawal, as in the original Bengen approach, is an inherently flawed approach in that it does not factor in how retirees actually spend.

In the book "The Prosperous Retirement," financial planner Michael Stein described retirement spending as falling into three key phases: "go-go," "slow-go," and "no-go." The go-go years relate to the early retirement years—for example, the age of 65 through 75—when new retirees may pursue travel or purchase second homes, take on expensive new hobbies like golf, or extend aid to adult children for weddings or home purchases. In the "slow-go" years—typically the mid-70s to early/mid-80s--retirees have often scaled back their spending overall. The "no-go" years relate to the later retirement years, when spending declines more significantly as retirees travel and socialize less, often because of health issues. Financial planner Bernicke identified a similar pattern in his research.

Research from Blanchett identified a similar pattern—but with a twist. Blanchett found that retiree spending did indeed tend to decline throughout much of retirement for many older adults but that it began to trend up in the later retirement years. The culprit: higher out-of-pocket healthcare and long-term-care costs.

The tricky part is whether and how to incorporate aggregate retiree healthcare spending trends into an individual retiree's spending plan. Just because the typical retiree's spending declines through the middle years of retirement does not mean that it will for each and every retiree. Thus, a withdrawal plan that assumes a reduction in spending in the middle years of retirement runs the risk that the retiree may still be going strong at that life stage. From that standpoint, employing an age-based spending plan may introduce unwelcome spending cutbacks.

► Healthcare and long-term-care coverage

The finding that retiree spending often trends up in the later years of retirement because of healthcare-related spending provides more of an opportunity to tailor withdrawals to a retiree's actual situation. Specifically, retirees with ironclad healthcare and long-term-care plans that cover most out-of-pocket expenses wouldn't need to incorporate higher spending later in life. For them, the risk of a negative healthcare spending shock is simply much less than is the case for the broad population of older adults.

For retirees whose insurance coverage allows for more out-of-pocket expenditures and/or those who do not have long-term-care insurance, however, it is reasonable to expect that spending could well trend up later in life. For retirees who are self-funding long-term care, it makes sense to segregate the long-term-care assets from spendable assets—for example, holding two years' worth of long-term-care expenses in a separate "bucket." (Two years is a typical duration for a long-term care need.)

Strategy 3: Maximize Social Security

Social Security provides a lifetime stream of income that is unaffected by market conditions. Moreover, the program provides an annual inflation adjustment to that income based on the Consumer Price Index. Those characteristics explain why retirement experts often describe Social Security as the perfect annuity, and why maximizing benefits from the program is so crucial.

Older adults can claim benefits at any time between age 62 and age 70, with benefits increasing for each year of delay. While the increased benefit from delayed Social Security filing is not always as great as is touted and some retirees are indeed wise to claim earlier, delayed filing will still make sense in many situations, especially older adults who have longevity on their side. (Note that there is a high correlation between wealth and longevity in the United States.) Moreover, married couples with different anticipated retirement dates and earnings records may find that claiming benefits at different times makes sense as a means of enlarging the couple's lifetime payout from the program.

Strategy 4: Maximize Pension Payments

Pensions have been fading away for several decades. But for those retirees lucky enough to have one, they feature some of the same attractions of Social Security: guaranteed lifetime income that does not depend on market performance.

A key fork in the road for people with pensions is whether to take the benefit as a lump sum or an annuity. While the annuity option can be attractive because it provides a retiree with a baseline of lifetime income without market risk, the health of the pension is an important consideration as well. Many pensions have come under stress in recent years, in part because of the very low-yield environment. In addition, those opting for the annuity option with a pension will typically have to choose between a higher payout that lasts for their lifetime alone or a survivor benefit. There may also be the option to choose a higher payout over a specific period or a lower lifetime benefit. For people with well-funded pensions and longevity on their side, opting for the lifetime annuity option can be an attractive way to reduce demands on the portfolio.

Strategy 5: Annuitize

If the combination of Social Security plus any pension income does not cover a retiree's basic in-retirement living expenses, obtaining additional lifetime income through an annuity may be appropriate. Again, the goal is to increase income from nonportfolio sources so as to reduce cash flow demands on the portfolio.

Of course, annuities are a big basket that encompasses minimalist lifetime income products alongside more complicated, costly ones. The academic literature indicates that adding a very simple, low-cost income annuity, either immediate or deferred, can help improve the longevity of a retirement plan.

For retirees concerned about outliving their assets with a too-high withdrawal rate, a deferred income annuity can be a particularly elegant solution. In contrast with an immediate income annuity, sometimes called a *single-premium immediate annuity*, which begins paying a stream of income immediately, a deferred annuity begins paying out at some later date. For example, an individual might purchase an annuity at age 65, but it would not begin paying out until age 85. Such a product would potentially allow retirees to take a higher portfolio withdrawal rate because they are doing so over a shorter time horizon. And assuming the annuity payout is high enough, such a product would also provide piece of mind in that the withdrawal system is developed for a knowable time horizon—say, 20 years—and the annuity payments pick up after that. There are tax advantages associated with a certain type of deferred annuity, too. Retirees opting for what is called a *qualified longevity annuity contract,* or QLAC, can purchase it with traditional tax-deferred assets, thereby reducing the amount of the portfolio that will eventually be subject to required minimum distributions. In 2021, the maximum allowable QLAC amount is $135,000 or 25% of a tax-deferred account balance, whichever is less.

Strategy 6: Tap Additional Nonportfolio Cash Flow Sources
Finally, some retirees may also be able to lean on other nonportfolio sources of income. In this idiosyncratic category of cash flow sources are income from working as well as income from passive nonportfolio sources, such as property rentals or royalties. Additional nonportfolio cash flow sources may include cash values on life insurance as well as reverse mortgages. Retirement researcher Pfau calls these "buffer assets," meaning that they are most advantageous in periods when pulling from a portfolio is a bad idea because the holdings are depressed.

Section IX: Putting It All Together

As the preceding discussion demonstrates, the current era of ultra-low yields necessitates a thoughtful, coordinated approach to retirement decumulation. The following process incorporates the key elements discussed in the preceding.

Step 1: Set retirement date.
As noted in Section VIII, the start and length of retirement is one of the most impactful factors in retirement decision-making. Delaying retirement by even a few years can deliver powerful benefits from the standpoint of portfolio longevity: It allows for a higher starting withdrawal percentage; it may allow the pre-retiree to make additional retirement-plan contributions and benefit from additional compounding, some of it tax-deferred; and it will make it easier to delay the Social Security filing date. The converse is also true: Early retirement necessitates a lower withdrawal rate, reduces opportunities for tax-deferred savings, and may put delayed Social Security filing out of reach.

It is also important to note that from a practical standpoint, many retirees blend working with retirement, and that can have implications for planning. A retiree who works part-time may be able to limit her portfolio withdrawals in those years and also delay Social Security filing, for example. In a similar vein, a worker may decide to continue working full-time until age 70 but stop making additional retirement-plan contributions during those years, the better to enjoy extensive travel. The greater good in this situation is delaying retirement and Social Security filing, not additional contributions later in life.

Step 2: Calculate in-retirement cash flow needs.
If retirement is close at hand, rough rules of thumb about income-replacement rates are not sufficient: a more customized view of income-replacement needs is important. A major swing factor is pre-retirement savings rate: Retirees who were heavy savers during their working years may be able to get by on 75% or even less than their working income simply because they were steering such a large share of their portfolios to savings. Retirees who are pre-Medicare but out of the workforce may have hefty healthcare expenses to contend with in their early retirement years, while those who are planning to downsize or relocate to a lower-cost part of the country may see their in-retirement expenses drop significantly. Retirees who are expecting major variations in annual spending because of lifestyle changes may want to create a spreadsheet depicting year-to-year variations.

Step 3: Assess cash flow from nonportfolio income sources to meet fixed expenses.

Armed with an estimate of annual spending, the next job is to align fixed expenditures (housing, healthcare, taxes, food, and utilities) with preset sources of income such as Social Security or a pension. Ideally those income sources could be calibrated to cover fixed costs, leaving portfolio withdrawals to cover discretionary expenditures where the retiree is able to tolerate higher level of variability (that is, a flexible approach to withdrawals). Here is another area where delaying retirement can be beneficial: Starting Social Security and/or annuitizing at older ages enlarges lifetime payouts.

Step 4: Calibrate withdrawal percentage and system.

Subtracting annual nonportfolio income (Step 2) from estimated cash flow needs (Step 1) yields an approximate year 1 withdrawal amount. That amount can be divided by the anticipated portfolio balance in year 1 of retirement to arrive at a starting withdrawal percentage. If that amount is at the high end of the safe withdrawal rates we discussed in Section IV (the mid-3% range for a balanced portfolio), that argues for a flexible approach to withdrawals as well as some of the strategies discussed in Sections VII and VIII. If, on the other hand, that withdrawal percentage is comfortably at 3.5% or lower, a fixed real withdrawal system is more defensible.

Step 5: Identify withdrawal sequence (account type) and system for sourcing.

Assuming the retiree has multiple tax siloes to draw upon (tax-deferred, Roth, and taxable), the next step is to establish a framework for those withdrawals, taking into account the retiree's variations in annual spending and anticipated tax picture on a year-to-year basis through retirement. The following framework is often a starting point for tax-efficient withdrawal sequencing: required minimum distributions from tax-deferred accounts (to the extent that they apply), taxable withdrawals, followed by tax-deferred withdrawals. Roth accounts bring up the rear because they tend to be the least costly accounts to hold, from a tax standpoint, and the most advantageous for heirs to inherit.

In a similar vein, it is worth establishing a policy about how the retiree will source portfolio withdrawals. An income-centric approach is largely untenable given today's low yields, leaving open two other options. The first is a pure total return approach, whereby any income distributions are reinvested back into the portfolio and rebalancing proceeds supply all needed cash flows. The big advantage of this approach is that it allows for ongoing portfolio optimization via rebalancing; the downside is that rebalancing proceeds can be lumpy or nonexistent in bad market years. That argues for retirees to employ an ongoing cash component to source cash flows in those years. The second option is a hybrid income/total return approach, whereby the retiree spends organically generated income distributions then uses rebalancing proceeds to make up any additional cash flow needs. The big benefit is that spending income may provide the retiree with peace of mind, but such a strategy would not allow for the extensive rebalancing/portfolio optimization benefits afforded by the pure total return approach.

Step 6: Asset allocate appropriately given amount and source of spending.

Once the cash flow sourcing (account withdrawal sequence and withdrawal system) has been identified, the next step is to identify an appropriate portfolio mix to support those withdrawals. Sections V-VII cover the interplay between withdrawal rates and asset allocation. In addition to establishing the total

portfolio's asset-allocation policy, it is worth thinking through how the subportfolios' asset allocations will support those withdrawals. Those accounts that will come earlier in the distribution queue (for example, RMDs and taxable withdrawals) should generally be more conservatively positioned than those that will come later (for example, Roth).

Future Research

We will be updating this research annually to incorporate changing market conditions: return expectations for the major asset classes as well as inflation. We will also be exploring additional strategies for enlarging lifetime withdrawals and better aligning them with retirees' own spending needs. While our safe initial starting withdrawal rate is fairly low today—just a 3.3%-3.4% initial withdrawal rate for balanced portfolios—retirees who are willing to depart from a fixed real withdrawal system should be able to obtain a higher level of cash flows from their portfolios. Ⅲ

Editor's Note: Ex. 1, 8, and 14 have been corrected in this version.

Appendix

Exhibit A1 Starting Safe Withdrawal Rate, by Withdrawal Method and Equity Allocation

Equity Weighting %	Fixed Real %	Forgo Inflation %	RMD %	Guardrails %	10% Reduction
100	2.93	3.34	4.76	4.23	3.21
90	2.99	3.43	4.76	4.38	3.30
80	3.10	3.55	4.76	4.52	3.40
70	3.22	3.65	4.76	4.61	3.49
60	3.29	3.73	4.76	4.71	3.54
50	3.33	3.76	4.76	4.72	3.57
40	3.34	3.76	4.76	4.67	3.57
30	3.30	3.69	4.76	4.54	3.53
20	3.20	3.58	4.76	4.31	3.40
10	3.02	3.43	4.76	4.19	3.23
0	2.76	3.03	4.76	3.30	2.88

Source: Morningstar Direct. Data as of 12/31/2020.

Exhibit A2 Lifetime Withdrawal Rate, by Withdrawal Method and Equity Allocation

Equity Weighting %	Fixed Real %	Forgo Inflation %	RMD %	Guardrails %	10% Reduction
100	2.93	3.03	6.62	5.10	3.05
90	2.99	3.11	6.05	4.84	3.14
80	3.10	3.23	5.63	4.63	3.24
70	3.22	3.33	5.26	4.41	3.33
60	3.29	3.41	4.91	4.24	3.39
50	3.33	3.45	4.60	4.07	3.42
40	3.34	3.46	4.31	3.92	3.43
30	3.30	3.40	4.04	3.77	3.39
20	3.20	3.30	3.80	3.55	3.27
10	3.02	3.15	3.57	3.37	3.10
0	2.76	2.83	2.97	2.77	2.79

Source: Morningstar Direct. Data as of 12/31/2020.

Exhibit A3 Year 30 Cash Flow Standard Deviation, by Withdrawal Method and Equity Allocation

Equity Weighting %	Fixed Real %	Forgo Inflation %	RMD %	Guardrails %	10% Reduction
100	0.0	5.7	105.0	86.3	8.5
90	0.0	5.7	92.5	77.3	8.5
80	0.0	5.6	80.5	66.7	8.3
70	0.0	5.6	69.3	54.4	8.2
60	0.0	5.5	58.9	41.8	8.0
50	0.0	5.5	49.4	30.2	7.7
40	0.0	5.5	41.0	22.7	7.6
30	0.0	5.4	34.1	18.7	7.5
20	0.0	5.4	29.2	17.2	7.2
10	0.0	5.5	27.6	17.6	7.7
0	0.0	5.0	9.5	14.8	6.3

Source: Morningstar Direct. Data as of 12/31/2020.

Exhibit A4 Average Ending Value at Year 30, by Withdrawal Method and Equity Allocation

Equity Weighting %	Fixed Real $	Forgo Inflation $	RMD $	Guardrails $	10% Reduction $
100	5,687,026	5,409,315	281,881	2,903,475	5,489,225
90	4,382,846	4,113,988	234,129	2,136,093	4,171,994
80	3,432,883	3,186,714	201,477	1,651,370	3,252,630
70	2,620,082	2,425,700	173,287	1,291,017	2,487,524
60	1,987,899	1,807,553	148,971	976,285	1,884,536
50	1,485,706	1,331,480	128,014	736,490	1,396,213
40	1,091,312	959,049	109,959	544,066	1,014,371
30	801,621	699,200	94,406	399,841	725,490
20	604,081	514,526	81,007	328,880	551,140
10	493,796	400,902	69,459	250,806	442,245
0	109,026	75,133	42,473	124,252	91,928

Source: Morningstar Direct. Data as of 12/31/2020.

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