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A rule for all seasons: Vanguard's dynamic approach to retirement spending

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- Global trends have led to an increase in personal accountability for funding retirement resulting in an increased reliance on retirees' personal portfolios. These trends include a continuing shift from defined benefit to defined contribution plans, changes in advice toward goals-based financial planning, and aging populations, compounded by ever-increasing complexity and muted return expectations.
- One of the most important challenges that investors face when deciding how to spend from their retirement savings is that of choosing a portfolio spending strategy that best balances their two, often competing, goals: (1) maintaining their desired level of current spending; and (2) increasing or preserving their portfolios to support future spending and/or bequests.
- This paper reviews two of the most common spending strategies and introduces a third strategy—a hybrid of the other two—which we view as a more dynamic approach. We explore the trade-offs of these strategies.
- Although adopting an appropriate strategy is important, the key ingredient in a long-term spending plan is flexibility. Regardless of the means—a product offering an automated distribution feature or a goals-based spending strategy developed with an advisor—the combination of complexity and consequences underscores the need for, and the value of, skilful guidance.

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Great progress has been made in helping investors in the accumulation phase of the investor life cycle, both in providing solutions for, and educating investors about the importance of, saving, low costs, and disciplined investing (Utkus and Young, 2016). But much work remains on the decumulation phase of retirement planning.

This paper will focus on one aspect of the decumulation phase, albeit one of increasing importance: the need to develop a spending plan from one's personal asset portfolio. Some investors with less complex situations can implement a spending strategy through an automatic withdrawal plan. Or, they can purchase an investment product designed to provide regular distributions from their current portfolios. Others may find that the complexity and potential consequences underscore the need for, and the value of, skilful guidance.

Changes around the globe make this discussion more important than ever. We begin by exploring the convergence of five major trends, then introduce a framework by which retirees can examine the trade-offs involved in implementing strategies that balance their goals with their unique constraints. Given the uncertainty inherent in an endeavour such as retirement—with numerous variables, many of which are out of our control—we examine potential outcomes¹ in a simulated distributional framework using Vanguard's proprietary Vanguard Capital Markets Model[®] (see Appendix II for a further description of the VCMM). Our analysis found that the rewards of careful decision-making and the consequences of missteps put a premium on skilful analysis and, for many investors, the insight of a knowledgeable advisor.

Notes on risk

IMPORTANT: The projections and other information generated by the Vanguard Capital Markets Model (VCMM) regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from the VCMM are derived from 10,000 simulations for each modelled asset class. Simulations are as of December 31, 2015. Results from the model may vary with each use and over time. For more information, see the appendix.

Investments are subject to market risk, including the possible loss of the money you invest. Past performance is no guarantee of future returns. Bond funds are subject to the risk that an issuer will fail to make payments on time, and that bond prices will decline because of rising interest rates or negative perceptions of an issuer's ability to make payments. Investments in stocks issued by non-U.S. companies are subject to risks including country/regional risk, which is the chance that political upheaval, financial troubles, or natural disasters will adversely affect the value of securities issued by companies in foreign countries or regions; and currency risk, which is the chance that the value of a foreign investment, measured in U.S. dollars, will decrease because of unfavourable changes in currency exchange rates. Stocks of companies based in emerging markets are subject to national and regional political and economic risks and to the risk of currency fluctuations. These risks are especially high in emerging markets.

Funds that concentrate on a relatively narrow market sector face the risk of higher share-price volatility. Prices of mid- and small-cap stocks often fluctuate more than those of large-company stocks. U.S. government backing of Treasury or agency securities applies only to the underlying securities and does not prevent share-price fluctuations. Because high-yield bonds are considered speculative, investors should be prepared to assume a substantially greater level of credit risk than with other types of bonds. Diversification does not ensure a profit or protect against a loss in a declining market. *Performance data shown represent past performance, which is not a guarantee of future results. Note that hypothetical illustrations are not exact representations of any particular investment, as you cannot invest directly in an index or fund-group average.*

¹ For purposes of global audiences, this paper assumes asset allocation, except where noted as conservative or aggressive, of 50% global stocks and 50% global bonds, approximating our ideal allocation for the global market portfolio. For calculations of real (inflation-adjusted) figures, we use U.S. inflation assuming equilibrium. For purposes of other home country investors, substituting local inflation would produce materially identical results, again assuming an equilibrium model.

I. The changing global retirement landscape

The retirement industry is changing rapidly. The convergence of five major trends occurring across the globe, at different paces and of differing magnitudes, is leading to a global retirement system that places more importance on using personal assets to meet spending needs. Some of these trends, such as changes in the advice industry, are a result of regulatory action, while others, such as aging populations, are occurring more organically.

1. Demographic changes: In recent years, the populations of most developed nations have been growing older in average age, leading to increasing numbers of retirees (Wallick et al., 2013). This trend is expected to continue for the foreseeable future. But it's not just the increased number of people reaching the age of retirement that's raising the average age, it's also the fact that many are living longer.
2. Increasing complexity: Though many have tried to find one, there's no "silver bullet" to solve the retirement income puzzle (unless you count quality financial advice). The inconvenient reality is that there is no one-size-fits-all strategy. Proper retirement planning should include an evaluation of a suite of tools available, including, but not limited to, investment products, annuities, and advice services. A portfolio spending strategy is one of these tools, and an increasingly important one.
3. Transition toward personal accountability: Broadly speaking, the trend toward reduced reliance on defined benefit (or pension) plans has been ongoing for quite a while now, and has accelerated since the global financial crisis of 2008–2009 (Utkus and Young, 2016). These plans include corporate plans and, to a lesser extent, public plans as well. Regulatory action in many nations—such as compulsory employee/employer contributions in Australia or the end of mandatory annuitization in the United Kingdom—has also led to increasing balances in investment accounts, often without the increased education on what investors should do with them.
4. Evolution of financial advice: In recent years, often by way of regulatory changes, financial advice has become more focused on goals-based financial planning. Whether it is Future of Financial Advice (FoFA) in Australia, Retail Distribution Review (RDR) in the United Kingdom, or Client Relationship Model—Phase 2 (CRM2) in Canada, regulations are forcing the advice industry away from the traditional sales- and commission-based models. This has elevated the importance of fiduciary responsibilities and helped fuel the move to low-cost investing, thus encouraging advisors to offer additional services. Meanwhile, as a result of the three trends mentioned above, more retirees are navigating more complex retirement situations, all while assuming more responsibility for themselves, leading to greater demand for quality advice.
5. Muted return expectations: With interest rates expected to remain low for the foreseeable future and many experts, Vanguard included (see Davis et al., 2015), expecting lower equity returns as well, making informed portfolio spending decisions is more important than ever. Additionally, many retirees who traditionally would have used the natural yield of the portfolio to live on are now forced to make more difficult choices about how to spend from their portfolios (see Schlanger et al., 2016).

In short, these trends make a retiree's personal investment assets more important than ever. Deciding how to use these assets to meet spending needs, while complex, is crucial. Retirees need to develop a strong, cohesive framework for how to approach these decisions.

First things first

The first step in developing a durable spending strategy involves carefully mapping out sources of both income and expenses. When accounting for income, retirees need to examine both the stability and the sustainability of each source. For example, sources such as government-provided social security income and pensions may be more stable and can reasonably be expected to persist throughout retirement, while others, such as income from part-time employment, may be less stable. In terms of expenses, the most important consideration is to separate discretionary spending (e.g., for travel and leisure) from nondiscretionary spending (e.g., for housing and food).

The gap between a retiree's income sources and expenses is the amount he or she needs to supplement from the investment portfolio, generally consisting of both taxable and tax-advantaged accounts. Obviously, if the amount needed from the portfolio is too high, the portfolio will be depleted regardless of the spending rule selected. That said, four primary levers affect how much a retiree can spend from his or her portfolio: the retiree's time horizon or life expectancy; the portfolio's asset allocation; the retiree's annual spending flexibility; and the retiree's degree of certainty that the portfolio won't be depleted before the end of his or her time horizon. **Figure 1** highlights these variables and their effect on portfolio withdrawal rates.

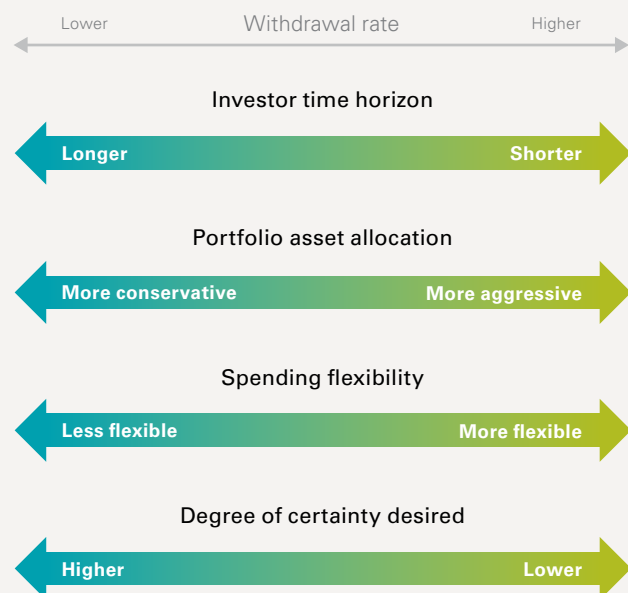
As expected, the longer the retiree's anticipated time horizon, the lower the initial spending rate. Conversely, the shorter the time horizon, the more spending the portfolio is likely to be able to sustain. For example, a 60-year-old investor with a 30-year time horizon can spend less than an 85-year-old investor with a 10-year horizon (as a percentage of the overall portfolio). Similarly, the more conservative the asset allocation, the lower the expected return over the time horizon and, therefore, the lower the spending rate. On the other hand, the more aggressive the asset allocation, the higher the initial spending rate—with one caveat: As the equity percentage approaches 100%, the return volatility will likely increase, and over shorter time horizons may actually increase the chance of prematurely running out of money.

The third lever, spending flexibility, can be defined as the proportion of total expenses that can be attributed to discretionary versus nondiscretionary spending. Simply put, what is the minimum you need "to keep the lights on" after accounting for ongoing income sources such as government-provided payments or other forms of

"guaranteed" income? In general, the greater the proportion of expenses one can eliminate or minimize in any given year, the greater the level of spending flexibility. For example, if leisure and entertainment take up a large portion of each year's expenses, a retiree may be better able to endure a reduction in his or her portfolio-based income. Finally, the fourth lever—the degree of certainty a retiree desires regarding the chance for premature portfolio depletion—can be defined as the "success rate," or the likelihood that the portfolio will last for the investor's entire time horizon or life expectancy. The higher the preferred degree of certainty, the lower the spending rate.

As a general guideline, a prudent initial withdrawal rate for retirees entering retirement (that is, with a time horizon of approximately 30 to 40 years) is 3.0% to 5.0% of their portfolio balance. Typically, the 3.0% would apply to more conservative portfolios, and the 4.0% to 5.0% to more moderate or aggressive portfolios. Clearly, these rules can be broadly applied, and each investor's circumstances are unique, potentially allowing for more or less spending than this general guideline, as discussed later in Section II.

Figure 1. Four levers affecting portfolio withdrawal rates



Source: Vanguard.

II. A framework for retirement spending from a portfolio

It sounds simple, but choosing an appropriate portfolio spending rule that balances a retiree's competing goals, including differentiating wants from needs,² is especially challenging because many critical factors affecting the outcome are beyond a retiree's control, and are often unpredictable. For example, retirees have no control over market returns, the rate of inflation, or the length of their planning horizon (their life expectancy). Yet each of these variables significantly affects how much a retiree can safely withdraw from his or her portfolio to provide for current consumption while preserving the potential to generate future income for the rest of the retiree's life, however long.

Goals-based spending-rule options

A number of spending rules—each emphasizing different goals—have been developed to help retirees deal with changes in their individual circumstances and in the markets. Each rule places a different emphasis on the competing priorities that many retirees are trying to balance: maintaining a relatively consistent level of current spending; and increasing—or preserving—the value of a portfolio to support future spending, bequests, and other goals. The most popular rules are the “dollar

plus inflation” rule—where, at retirement, a retiree chooses the initial dollar amount to spend and then increases that sum by inflation each subsequent year (for example, the “4% spending” rule [Bengen, 1994])—and the “percentage of portfolio” rule, where a retiree spends a fixed percentage of his or her portfolio balance each year. While many people use these rules of thumb, they may not be flexible enough to provide a tailored solution for a retiree's unique circumstances.

Vanguard's dynamic spending strategy: A tailored solution for every retiree

To provide a customized solution for each retiree, we have developed a hybrid of these two rules, which we call the “dynamic spending” strategy. With this rule, annual spending is allowed to fluctuate based on the performance of the markets while at the same time being sensitive to significant fluctuations in spending from year to year. This is accomplished by overlaying an annual ceiling and floor to each year's spending amount. As discussed in more detail below, the outcomes are significantly affected by the selection of the ceiling and floor percentages. This is where retirees, and their advisors, can tailor the strategy to provide the flexibility each retiree needs to meet his or her goals.

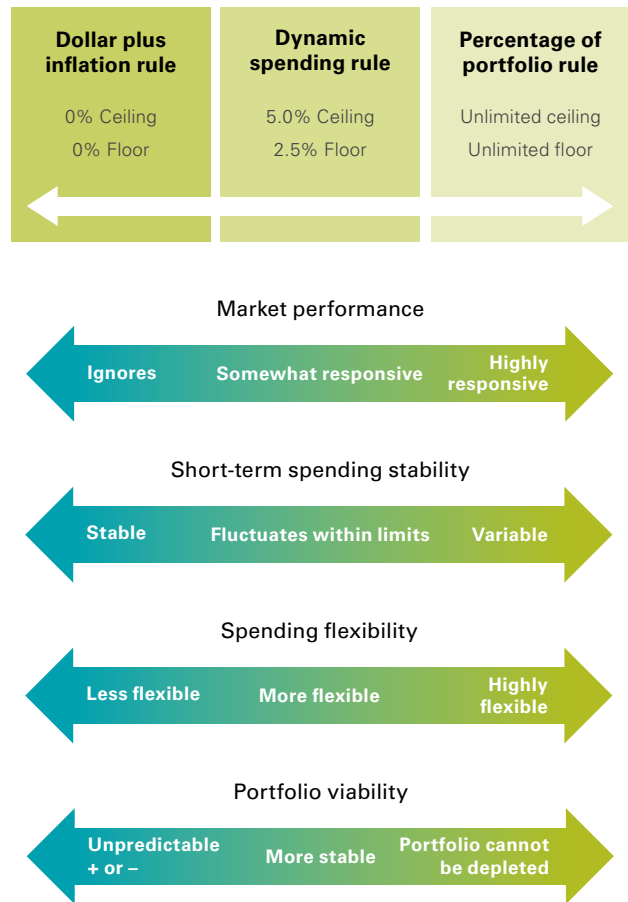
² As part of the planning process, it is important to differentiate between desired versus required spending, which has an impact on this discussion and other portfolio construction decisions (see Bennyhoff and Jaconetti, 2016).

Spectrum of spending rules

We prefer to see these spending rules as a spectrum of choices based on the relative importance a retiree places on each goal, as shown in Figure 2. Thus, at one end of the spectrum is the dollar plus inflation rule, which is essentially the dynamic spending rule with a 0% ceiling and a 0% floor. At the other end of the spectrum is the percentage of portfolio rule, which is essentially the dynamic spending rule with an unlimited ceiling and an unlimited floor. The dynamic spending rule is positioned in the middle of these two rules in terms of potential outcomes.

For a retiree whose primary goal is spending stability, the dollar plus inflation rule (dynamic spending rule with a 0% ceiling and 0% floor) would likely be preferred. Although this rule allows for more stable spending from year to year than the other spending rules we discuss, it comes with the risk of either premature portfolio depletion or lifetime underconsumption. That is because the strategy is exposed to “sequence of returns risk”—that is, it is indifferent to the performance of capital markets. The annual spending amount is automatically increased by inflation regardless of whether the portfolio’s market returns are positive or negative. A significant period of underperformance without an adjustment in spending could mean the retiree runs out of money before the end of the investing time horizon. Conversely, a retiree could miss out on the opportunity to increase spending, if desired, after a significant period of market outperformance. Failure to appropriately tailor spending to market performance could thus mean a retiree either misses out on enjoying retirement to the fullest extent possible or, at the other extreme, overspends and depletes the portfolio too soon.

Figure 2. Spectrum of spending rules



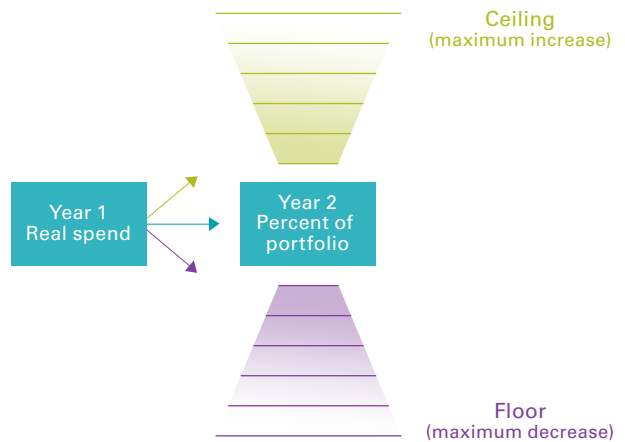
Source: Vanguard.

At the other end of the spectrum, for a retiree whose primary goal is to avoid depleting the portfolio, the percentage of portfolio rule³ (dynamic spending rule with an unlimited ceiling and unlimited floor) would likely be preferred. With this rule, the annual spending amount is a fixed percentage of the portfolio balance so that the annual spending amount is automatically increased or decreased based on the markets' performance; this rule is thus highly responsive to the capital markets. Although the retiree's portfolio will not be depleted (even though the spending amount may be substantially reduced over time), the annual spending amount can fluctuate significantly, which may not be an option for retirees whose nondiscretionary, or fixed, expenses (such as housing or food) are a relatively high proportion of their total expenses. However, for those with very high, if not unlimited, levels of flexibility, this option may be preferred.

As previously mentioned, our dynamic spending rule is a hybrid of these two rules. With this rule, withdrawals are kept within a maximum percentage increase and maximum percentage decrease in real (inflation-adjusted) spending. The rule allows retirees to benefit from good markets by spending a portion of their gains, while weathering bad markets without a significant reduction in spending. Retirees accomplish this by saving some of their upside returns for use on a rainy day when the portfolio otherwise would have required a greater reduction in spending (see Appendix I for an in-depth example of this spending rule).

To implement the dynamic spending strategy, a retiree would first select a spending rate, or the percentage of the portfolio that will be withdrawn in the first year as well as a ceiling and a floor. The ceiling is the maximum amount that you are willing to allow real (inflation-adjusted) spending to increase in any given year, while the floor is the maximum amount you can tolerate for real spending to decrease in a given year. This framework allows retirees to decide how much, if at all, they would like to benefit from good markets by spending a portion of their gains, while also weathering bad markets without a substantial reduction in spending. **Figure 3** may help better visualize this concept.

Figure 3. Mechanics of Vanguard's dynamic spending framework



Source: Vanguard.

Once these values have been determined, a retiree calculates each year's spending by taking the stated percentage of the prior year-end's real portfolio balance. The retiree then calculates a ceiling and a floor by applying the chosen percentages to the previous year's real spending amount, such as a 5% ceiling (increase) and a -2.5% floor (decrease). The results are then compared. If the newly calculated spending amount exceeds the ceiling, the spending amount will be limited to the ceiling amount; if the calculated spending falls below the floor, the spending amount will be increased to the floor amount. With this rule, depending on the ceiling and floor selected, spending can be made relatively consistent while remaining responsive to the financial markets' performance—thereby helping to sustain the portfolio to meet future goals. The following section will address what this may look like in practical terms.

³ For simplicity, we calculate the unlimited combination based on annual ending balances. In practice, it is common to apply three-year smoothing to this strategy, which would generate similar results (directionally) to those presented in this paper; however, the variance would be truncated.

Putting theory into practice: Quantitative analysis of spending rules

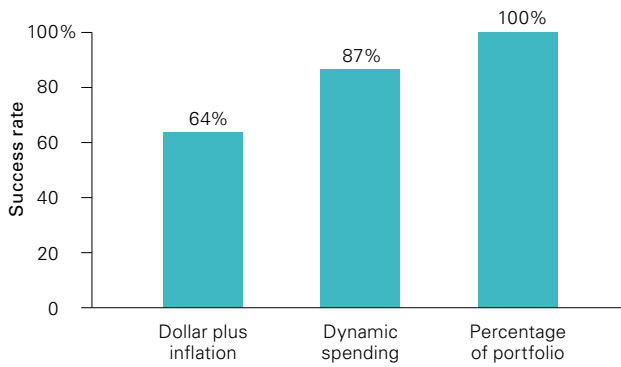
To demonstrate the practical implications of choosing among the three spending rules previously discussed, we used Vanguard's proprietary VCMM to run simulations on several key metrics for retirement spending success. By examining potential outcomes in a distributional framework over a 30-year time horizon, retirees can gain a better understanding of the trade-offs introduced in Figure 2. As Figure 4 illustrates, although the percentage of portfolio rule may have the highest rate of portfolio success and the highest internal rate of return (Figure 4a and 4b), those come with a cost—namely, higher volatility in annual real spending (see Figure 4d). However, by implementing a hybrid approach, a retiree can capture many of the benefits of this approach while significantly reducing the variation in annual spending that could occur as a result of market movements.

We examined the trade-offs mentioned previously in a multiplier framework (that is, a multiple of initial balance or spending amounts over 30 years for each spending rule [Figure 4c and 4d]) so that one could personalize the outcomes to his or her unique circumstances. For example, the dollar plus inflation rule produced real ending balances ranging from 0.0 times the initial amount at the 5th percentile to 4.0 times the initial amount at the 95th percentile (see Figure 4c). In practical terms, this could, for example, correspond to an investor with a starting portfolio balance of \$1 million and a 5% withdrawal rate ending with an account balance somewhere between \$0 and \$4 million 90% of the time. As Figure 4c shows, the two other approaches produced results in a much narrower range.

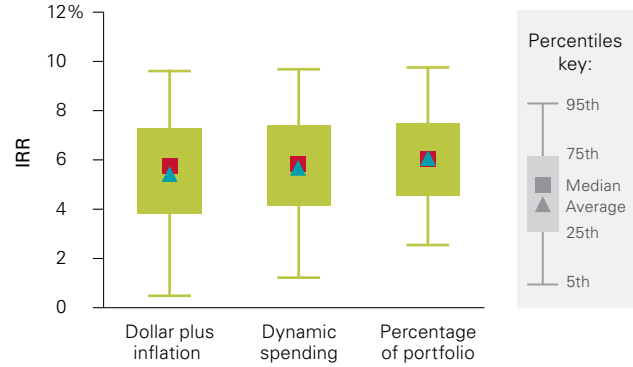
The most important trade-off when discussing a spending method, however, is spending volatility. Our analysis shows that the dollar plus inflation rule produces a real annual spending multiplier of 1.0, unless the portfolio depletes, in which case it falls to zero (see Figure 4d). Continuing the example from the previous paragraph, in theory, this simply means real annual spending of \$50,000 or \$0. In reality, an investor would not let his or her portfolio drop to \$0, but might have to make uncomfortable adjustments along the way. The dollar plus inflation rule is thus strikingly insensitive to market conditions. On the other hand, the percentage of portfolio rule produces real annual spending multipliers ranging from 0.4 to 1.7 at the 5th and 95th percentiles and 0.9 on average, while the dynamic spending rule's multiples range from 0.5 to 1.6 at the 5th and 95th percentiles and average 1.0. It bears repeating that, in this latter example using the dynamic spending approach, a retiree's real spending would never decrease by more than 2.5% or increase by more than 5% in any given year. Use of the percentage of portfolio approach, however, could result in real spending decreasing or increasing by a theoretically unlimited amount (although, in reality, bounded by the portfolio's performance and, hence, that of the financial markets). Ultimately, an investor with endless flexibility would likely choose the percentage of portfolio approach; however, for most retirees, this is simply not practical. In that case, the dynamic spending approach can provide many of the benefits of the percentage of portfolio rule without giving up the relatively consistent level of real annual spending.

Figure 4. Comparison of various spending rules

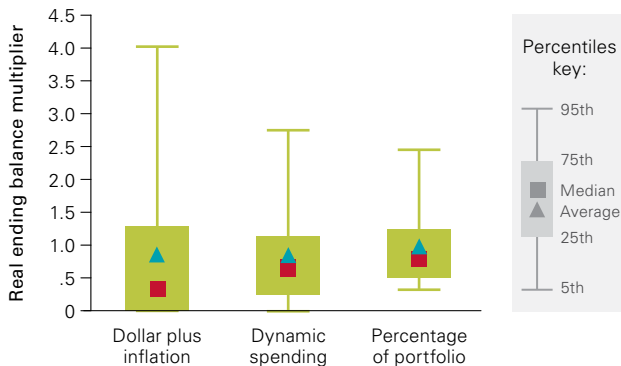
a. Portfolio success rates across spending rules



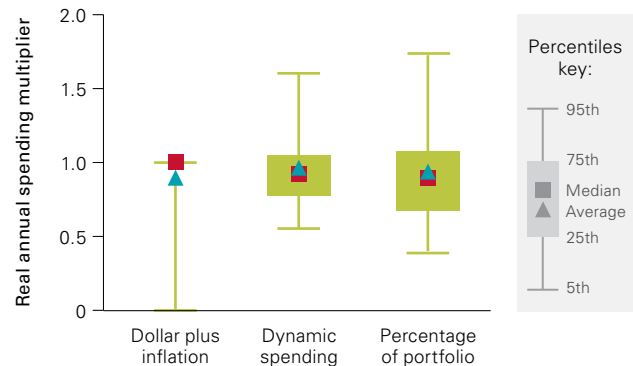
b. Portfolio IRRs across spending rules



c. Real ending balance multipliers across spending rules



d. Real annual spending multipliers across spending rules



Notes: This hypothetical illustration does not represent the investment results of any particular portfolio. All results are based on 10,000 VCMM simulations using each specified spending rule. This analysis assumes portfolios with a starting balance at retirement of \$1 million, with a moderate allocation of 50% global stocks and 50% global bonds, a time horizon of 30 years, and an initial portfolio withdrawal rate of 5%. See Appendix II for a further description of the VCMM. In part 4a, “success rate” is defined as the likelihood that the portfolio will last for the investor’s entire time horizon. In Part 4b, “IRR” is internal rate of return.

Source: Vanguard.

Tailoring the ceiling and floor percentages to meet each retiree’s unique goals

An important point in this discussion is that the outcomes are significantly affected by the selection of the ceiling and floor percentages. This is where retirees, and their advisors, can tailor the ceiling and floor percentages along the spectrum (from a 0% ceiling and 0% floor to an unlimited ceiling and an unlimited floor) to provide the flexibility each retiree needs to meet his or her goals. For illustrative purposes, we used the 5% ceiling and the 2.5% floor as an initial starting point because it provided a portfolio survival rate of 85% over a 30-year time horizon; however, we tested hundreds of ceiling and floor scenarios to determine the impact on portfolios’ success rates.

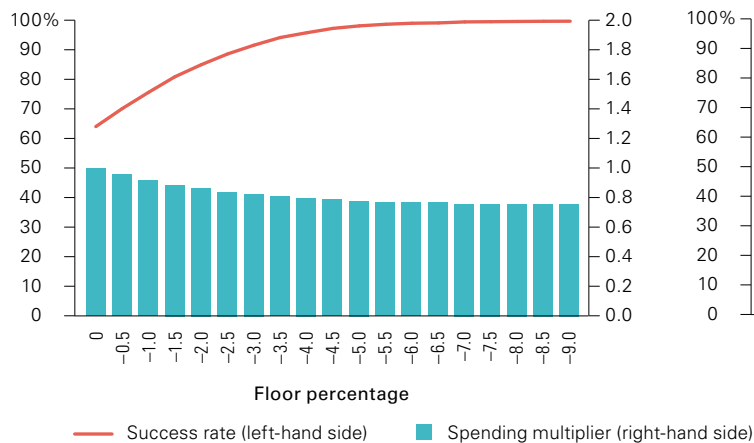
Figure 5 highlights two of the scenarios, each holding one variable constant to isolate the effect of changes in the other. The first scenario (Figure 5a) held the ceiling constant at 0%—meaning any excess returns were reinvested in the portfolio, as opposed to increasing the spending amount—and tested the impact on portfolio

success rates of different floor percentages in –0.5% increments between 0.0% and –9.0% (0.0%, –0.5%, –1.0%, –1.5% . . . –8.5%, –9.0%). The second scenario, Figure 5b, held the floor constant at 0%—meaning spending could not decrease—and tested different ceiling percentages between 0.0% and 9.0% in 0.5% increments.

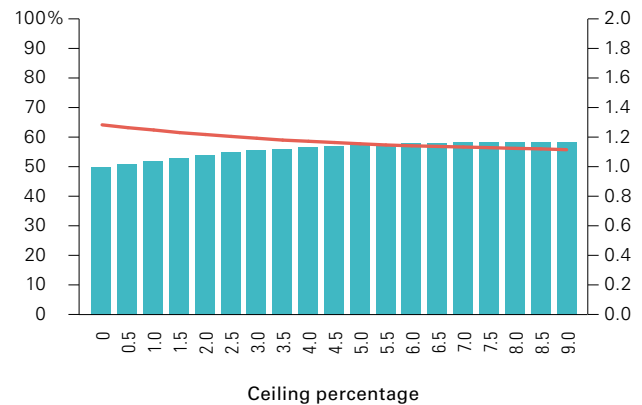
Our analysis found that the more flexibility retirees have in their floor—meaning, the more they can reduce spending when the markets are performing poorly—the higher their success rate—meaning, the less likely they are to deplete their portfolio or be required to significantly reduce their spending before the end of their planning horizon. In fact, retirees’ ability to accept changes in their floor helps their portfolio more than increasing their ceiling hurts it. For example, a ceiling/floor combination of 0% and –1% is about 12 percentage points more successful, as measured by success rate, than a ceiling/floor combination of 0% and 0% (i.e., dollars plus inflation). On the other hand, a ceiling/floor combination of 1% and 0% is about 4 percentage points less successful than a

Figure 5. Dynamic spending floor and ceiling sensitivity

a. Effect of an increase in floor; ceiling constant at 0%



b. Effect of an increase in ceiling; floor constant at 0%



Notes: This hypothetical illustration does not represent the investment results of any particular portfolio. All results are based on 10,000 VCMM simulations using each specified spending rule. This analysis assumes portfolios with a starting balance at retirement of \$1 million, with a moderate allocation of 50% global stocks and 50% global bonds, a time horizon of 30 years, and an “initial portfolio withdrawal rate” of 5%. See Appendix II for further description of the VCMM. Source: Vanguard.

ceiling/floor combination of 0% and 0%. This is shown in Figure 5a, where the absolute slope of the line when keeping the ceiling constant is much steeper than that of the line when keeping the floor constant (Figure 5b).

This concept has implications for retiree withdrawal rates, as shown in Figure 6. The figure charts portfolio withdrawal rates for both a dollar plus inflation rule and a 5.0%/–2.5% ceiling/floor rule using different time horizons and asset allocations, assuming an 85% success rate. As the figure shows, retirees who can incorporate flexibility into their annual spending needs are able to set higher initial portfolio withdrawal rates, which can help put them in a better position to meet their near-term financial goals.

For example, a moderate investor who wants stable inflation-adjusted spending (that is, a 0% ceiling and a 0% floor) with a 30-year time horizon can set an initial portfolio withdrawal rate of 4%, assuming an 85% chance that he or she will not run out of money. If that retiree can cut spending by 2.5% in years when the market is performing poorly, he or she could set the initial portfolio withdrawal rate at 5.1%, which is 1.1 percentage points higher than the previous example.

In short, when choosing a floor and ceiling combination, there are trade-offs between maintaining the desired level of current spending (spending percentage) and

preserving the portfolio to support future spending/goals (success rate). In selecting a floor and ceiling, retirees and their advisors must have a solid understanding of their income and expenses. The more they can tolerate some short-term fluctuations in spending, the more likely they are to achieve their longer-term goals (see the First Things First box on page 4 for more information).

Finally, once a spending strategy and amount have been selected, possible implementation strategies include:

1. Setting up an automatic withdrawal plan from current holdings: For those retirees with all of their assets in one type of account, many financial institutions have the technology to automatically convert retirees' assets into an income stream.
2. Purchasing an investment that is specifically designed to provide regular distributions: Many financial providers offer products that utilize proprietary strategies to offer regular income distributions.
3. Working with an advisor to develop a spending strategy tailored to meet your unique goals: For those with more complex situations such as assets in multiple types of accounts, working with an advisor may be the most appropriate way to implement a spending strategy.

Figure 6. Portfolio initial withdrawal rates (%) for various asset allocations and time horizons

Asset allocation	Dollar plus inflation				5.0% ceiling/2.5% floor			
	Time horizon (years)				Time horizon (years)			
	10.0	20.0	30.0	40.0	10.0	20.0	30.0	40.0
Conservative	9.8	5.1	3.7	3.1	11.0	6.4	5.0	4.4
Moderate	9.7	5.3	4.0	3.4	10.8	6.4	5.1	4.5
Aggressive	9.4	5.3	4.0	3.5	10.4	6.2	4.8	4.3

Notes: Rates are gross of taxes. Any tax is assumed to be paid from the withdrawn amount. Portfolio allocations are: conservative—20% stocks/80% bonds; moderate—50% stocks/50% bonds; aggressive—80% stocks/20% bonds. Withdrawal rates were determined using data from the VCMM. See Appendix II for further description of the VCMM.

Source: Vanguard.

III. Conclusion

Retirees across the globe face a number of challenges. While each country's retirement system is unique, there is a global trend away from the traditional private or public pension system and toward individually funded and managed retirement accounts. At the same time, given expectations of muted returns and possibly volatile markets for the foreseeable future, helping retirees develop a prudent spending strategy is likely to be more important than ever.

Vanguard's dynamic spending framework can help retirees understand where they fall on the spectrum of balancing the competing goals that many face: maintaining a relatively consistent level of current spending; and increasing—or preserving—the value of a portfolio to support other goals. Each strategy comes with its own advantages and disadvantages. But regardless of strategy, the combination of complexity and consequences underscores the need for, and the value of, skilful guidance. Working with a skilful and knowledgeable advisor could spell the difference between a successful retirement—and one that falls short.

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Appendix I. Dynamic spending rule illustration

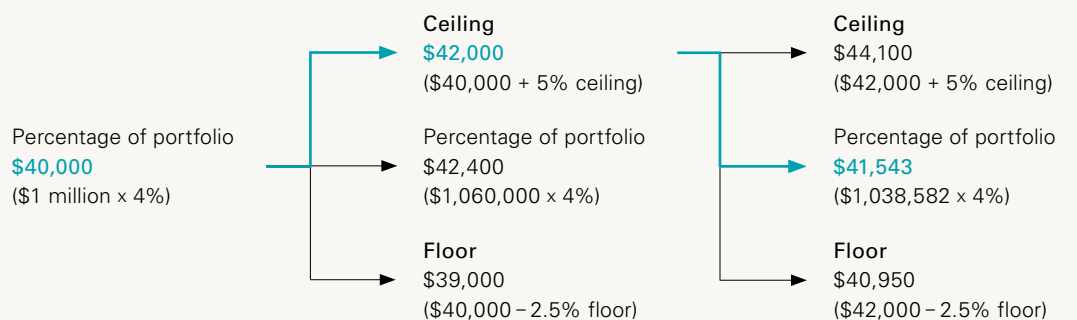
The process is as follows:

1. Calculate each year's spending by taking a stated percentage of the prior year-end's portfolio balance. For example, a retiree with a \$1 million portfolio and an income need of \$40,000 per year would start by taking 4% of the portfolio in year one.
2. Calculate a ceiling and a floor by applying chosen percentages to the prior year's inflation-adjusted spending amount, such as a 5% ceiling and a 2.5% floor. In the example in **Figure A-1**, given a 3% rate of inflation, the ceiling and floor would be calculated as \$42,000 and \$39,000, respectively. The percentage of portfolio amount, after accounting for investment gains and the prior year's spending, would be \$42,400.

3. Compare the results. If the newly calculated spending amount exceeds the ceiling, you limit spending to the ceiling amount; if the calculated spending is below the floor, you increase spending to the floor amount. In the example, since the \$42,400 percentage of portfolio amount exceeds the ceiling of \$42,000, spending would be constrained to the ceiling.

In short, this rule helps retirees maintain income for basic expenses while allowing for more discretionary income if market returns are favourable.

Figure A-1. Dynamic spending strategy example: Percentage of portfolio with ceiling and floor



Year 1
 Ending balance:
 \$1,060,000 (nominal)
 \$1,060,000 (real)

Year 2
 Ending balance:
 \$1,069,740 (nominal)
 \$1,038,582 (real)

Year 3
 Ending balance:
 \$1,079,154 (nominal)
 \$1,017,206 (real)

Starting balance	\$1 million
Spending rate	4%
Floor	2.5%
Ceiling	5%

Annual inflation	3%
Cumulative inflation factor	
Year 1	1.0000
Year 2	1.0300
Year 3	1.0609

Annual returns	
Year 1	10%
Year 2	5%
Year 3	5%

Notes: This hypothetical illustration does not represent the investment results of any particular portfolio. The figure shows a hypothetical three-year example of a spending strategy using the *percentage of portfolio with ceiling and floor* method. Here the Year 2 spending amount is constrained by the ceiling rule, while Year 3's spending amount is constrained by neither the ceiling nor the floor. Aqua lines emphasize which of the three calculated amounts should be used as each year's spending withdrawal.

Source: Vanguard.

Appendix II. About the Vanguard Capital Markets Model

IMPORTANT: The projections or other information generated by the Vanguard Capital Markets Model regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. VCMM results will vary with each use and over time.

The VCMM projections are based on a statistical analysis of historical data. Future returns may behave differently from the historical patterns captured in the VCMM. More important, the VCMM may be underestimating extreme negative scenarios unobserved in the historical period on which the model estimation is based.

The VCMM is a proprietary financial simulation tool developed and maintained by Vanguard's Investment Strategy Group. The model forecasts distributions of future returns for a wide array of broad asset classes. Those asset classes include U.S. and international equity markets, several maturities of the U.S. Treasury and corporate fixed income markets, international fixed income markets, U.S. money markets, commodities, and certain alternative investment strategies. The theoretical and empirical foundation for the Vanguard Capital Markets Model is that the returns of various asset classes reflect

the compensation investors require for bearing different types of systematic risk (beta). At the core of the model are estimates of the dynamic statistical relationship between risk factors and asset returns, obtained from statistical analysis based on available monthly financial and economic data. Using a system of estimated equations, the model then applies a Monte Carlo simulation method to project the estimated interrelationships among risk factors and asset classes as well as uncertainty and randomness over time. The model generates a large set of simulated outcomes for each asset class over several time horizons. Forecasts are obtained by computing measures of central tendency in these simulations. Results produced by the tool will vary with each use and over time.

The primary value of the VCMM is in its application to analyzing potential client portfolios. VCMM asset-class forecasts—comprising distributions of expected returns, volatilities, and correlations—are key to the evaluation of potential downside risks, various risk–return trade-offs, and the diversification benefits of various asset classes. Although central tendencies are generated in any return distribution, Vanguard stresses that focusing on the full range of potential outcomes for the assets considered is the most effective way to use VCMM output.



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