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A more dynamic approach to spending for investors in retirement

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Executive summary. Of the many challenges investors face when deciding how to spend from their retirement savings, one of the most important is that of choosing a portfolio spending strategy that best balances investors' two competing goals: (1) maintaining their desired level of current spending; and (2) increasing or preserving their portfolios to support future spending.

This paper reviews two of the most common spending strategies and introduces a third strategy—a hybrid of the two others—that we view as a more dynamic approach. Through a simulation analysis, we highlight the trade-offs of these strategies. We conclude that although adopting an appropriate strategy is important, the key ingredient in a long-term spending plan is flexibility: The more investors can tolerate some short-term fluctuations in spending, the more likely they are to achieve their longer-term investing goals.

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As investors plan for retirement, one of their most difficult tasks is to select a spending strategy that provides them with an ample income stream for their lifetime. What makes this so challenging is that many of the critical factors in the decision are beyond the investor's control and are entirely unpredictable. Investors have no control, for instance, over the returns of the investment markets, the rate of inflation, or the length of their planning horizon (their life expectancy). Yet each of these variables has a significant impact on how much an investor can "safely" withdraw from his or her portfolio to maximize current consumption while preserving the potential to generate future income for the rest of the investor's life, however long.

Many strategies have been devised to help investors deal with these uncertainties, each placing a different emphasis on the competing goals. An investor's assessment of the trade-offs is key to his or her decision. This paper describes two of the most common spending strategies, *dollar amount grown by inflation* and *percentage of portfolio*, while also introducing a third strategy that Vanguard has devised—combining aspects of the two others—that we believe is more dynamic and flexible. This third method, which we call *percentage of portfolio with "ceiling and floor,"*¹ incorporates balance: That is, spending is relatively consistent while remaining responsive to the financial markets' performance, thereby helping to sustain the portfolio.

Broad assumptions of this analysis

The analyses in this paper assume that retirement assets are invested in a diversified portfolio of equities and fixed income holdings (see Appendix 2, on page 10, for details about our Vanguard Capital Markets Model[®] simulation tool), and that a systematic withdrawal strategy is employed to generate income. It's important to note that there are other ways to obtain income from a portfolio. Purchasing an income annuity is one example, and the marketplace continues to introduce other products aiming to provide lifetime income benefits.

Note to readers: We examine here each strategy in its purest form—as though an investor were adhering to it blindly, without making any changes over the investment horizon. In the real world, of course, such a situation could not exist, nor should it. Because circumstances constantly change, investors and their financial counselors need to review portfolio performance and strategy regularly to assess the status of their spending plans. Nonetheless, we believe that examining the strategies in this pure form can help investors evaluate the various factors that need to be weighed.

Important: *The projections or other information generated by Vanguard Capital Markets Model (VCMM) simulations regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Results from the model may vary with each use and over time. In addition, the model may underestimate extreme scenarios that were unobserved in the historical data on which the model is based. For more information on the VCMM, see Appendix 2, on page 10.*

Notes on risk: All investments are subject to risk. There is no guarantee that any particular asset allocation or mix of funds will meet your investment objectives or provide you with a given level of income. Diversification does not ensure a profit or protect against a loss in a declining market.

¹ *Ceiling and floor* refer to a maximum and minimum percentage increase or decrease, respectively, in real spending.

**The three strategies:
10,000 outcomes for each**

Figure 1 provides a high-level rundown of the three spending strategies. To illustrate the trade-offs of the three approaches, we simulated 10,000 potential scenarios for each, using the Vanguard Capital Markets Model to estimate future returns for broad asset classes.² Each scenario generated a cash-flow path based on the following assumptions:

- Time horizon: 35 years.
- Portfolio asset allocation: 35% U.S. stocks/ 15% international stocks/40% U.S. bonds/ 10% international bonds, rebalanced annually.
- Starting balance: \$1 million.
- First-year spending: 4% of the portfolio (i.e., \$40,000).
- No taxes: They are assumed to be paid from the withdrawn amounts.

Figure 1. Spectrum of three spending strategies

Strategy	Method	Key characteristics
1. Dollar amount grown by inflation	Calculate a dollar amount in the first year; adjust it for inflation yearly.	<p> Ignores market performance</p> <p> Provides short-term spending stability.</p> <p> Long-term effect on the portfolio can be unpredictable.</p>
2. Percentage of portfolio with “ceiling and floor”	Withdraw a specific percentage of the portfolio each year subject to upper and lower limits based on the prior year’s spending.	<p> Somewhat responsive to market performance.</p> <p> Spending may fluctuate in the short term but is held within limits.</p> <p> If the markets decline significantly, the portfolio’s principal could fall far enough to require reductions in future spending beyond the “floor.”</p>
3. Percentage of portfolio	Withdraw a specific percentage of the portfolio each year.	<p> Highly responsive to market performance.</p> <p> Spending may fluctuate significantly in the short term.</p> <p> The portfolio is never depleted; however, long-term spending levels depend on both market performance and investment strategy.</p>

Note: See Appendixes 1 and 2, on pages 9 and 10, respectively, for guidelines on withdrawal rates in this analysis as well as details on the VCMM simulation, including return assumptions.

Source: Vanguard.

² See Appendix 2 for details about the VCMM simulation, including return assumptions.

Figure 2 summarizes the resulting statistics for each spending strategy. Investors can use statistics such as these, and the discussion in the paragraphs following, to help evaluate the trade-offs inherent in the strategies.

1. Dollar amount grown by inflation

Under the *dollar amount grown by inflation* strategy, the investor decides on a dollar amount of spending in the initial year of retirement. A percentage of the

portfolio is selected once at the beginning of the withdrawal phase, and that dollar amount is then increased each year to account for the previous year’s inflation. The initial percentage is the investor’s preference and can be based on the withdrawal-rate guidelines in Appendix Figure A-1. To determine the spending amount in each subsequent year, the investor multiplies the prior year’s spending by an inflation factor—typically the change in the Consumer Price Index.

Figure 2. Summary statistics for the three spending strategies

	Spending strategy		
	Dollar amount grown by inflation	Percentage of portfolio with ceiling and floor (assuming 5% ceiling and 2.5% floor)	Percentage of portfolio
Portfolio survival rate (assets not depleted over 35 years)	78%	92%	100%
Real (inflation-adjusted) ending asset balances:			
Maximum	\$100,030,300	\$88,954,400	\$37,035,200
75th	3,162,400	2,220,400	2,156,100
Median	1,153,700	1,068,600	1,226,200
25th	102,400	449,700	700,800
Minimum	0	0	43,900
Real annual spending as a percentage of initial spending:			
Maximum	100%	525%	3,634%
75th	100	198	208
Median	100	114	119
25th	100	66	68
Minimum	0	0	5
Percentage of time real spending drops below initial spending	6%	45%	48%

Important note: This hypothetical illustration does not represent the investment results of any particular portfolio. See Appendixes 1 and 2, respectively, for guidelines on withdrawal rates in this analysis as well as details on the VCMM simulation, including return assumptions.

Source: Vanguard.

This strategy is indifferent to the performance of the capital markets, with the result that investors may accumulate unspent surpluses when markets outperform and face spending shortfalls when markets underperform.³ In either case, the strategy provides short-term spending stability; however, the long-term consequences (positive or negative) can be significant if an investor does not make as-needed adjustments along the way.

For example, in this study's simulation, the portfolio based on the *dollar amount grown by inflation* approach would have survived 78% of the time, meaning that in 2,200 of the 10,000 scenarios the investor would have run out of money within 35 years. Of the three methods, this one presented the highest likelihood of prematurely depleting assets. However, the method resulted in a decrease in real (inflation-adjusted) annual spending only 6% of the time, meaning that 94% of the time the real annual spending from the portfolio met the initial (but adjusted for cumulative inflation over the years) spending target. It is important to note, though, that when real spending did drop, it most likely was the result of a completely depleted portfolio.

2. Percentage of portfolio

As the name implies, the *percentage of portfolio* strategy bases annual spending on a stated proportion of the portfolio's value at the end of the prior year (our scenario used 4%, as noted earlier). As a result, this strategy is strongly linked to the performance of the capital markets. However, because spending levels vary yearly based on investment returns, short-term planning can be problematic, especially if the majority of an investor's spending is nondiscretionary (that is, it represents payments that must be made irrespective of yearly income).

On the other hand, this strategy builds in appropriate adjustments: Spending is automatically cut back on a yearly basis when the markets have been doing poorly, and automatically increases (again, in terms of the yearly allotment) after periods when the markets have done well. Thus, poor investment returns are at least partially offset by reductions in current spending. Such cutbacks help to preserve the portfolio value and thereby sustain future spending. As a result, over the longer term, the *percentage of portfolio* strategy provides for at least some level of annual spending. Although the dollar amount may decrease over time (if market conditions are poor), spending will never drop to zero, because the portfolio is never depleted.

For example, in our simulation of this approach, the portfolio survival rate was 100%, meaning that in all 10,000 paths, the investor had a positive inflation-adjusted ending asset balance after 35 years (as compared with 78% for the *dollar amount grown by inflation* strategy). The trade-off is that the investor's annual income stream fluctuated; 48% of the time the annual income (on a real basis) fell below the initial target (compared with 6% for the *dollar amount grown by inflation* strategy). In addition, as just mentioned, with this strategy the portfolio balance is never depleted, but it can drop substantially, causing a significant reduction in annual spending. In the worst case among our scenarios, real annual spending dropped to 5% of the initial spending amount (that is, 5% of \$40,000, or \$2,000).

3 See Scott, Sharpe, and Watson (2009).

3. Percentage of portfolio with ceiling and floor

To address the pitfalls of the previous two commonly used spending strategies, Vanguard suggests that investors consider using what we see as a more dynamic method: applying a “ceiling” and a “floor” to percentage-based withdrawals. In essence, this strategy is a hybrid of the other two methods.

As in the *percentage of portfolio* strategy, the investor calculates each year’s spending by taking a stated percentage of the prior year-end portfolio balance. The investor then also calculates a ceiling and a floor by applying chosen percentages to the prior year’s spending amount (our scenarios used a 5% ceiling and a 2.5% floor—see also Appendix 3). The investor then compares the three results. If the newly calculated spending amount exceeds the ceiling, the investor limits spending to the ceiling amount; if the calculated spending is below the floor, the investor increases spending to the floor amount.

Although with this method spending will vary from year to year based on what the markets do, it is not allowed to exceed a set range so long as assets remain in the portfolio—a factor that can assist with short-term planning. The strategy allows investors to benefit from good markets by increasing spending, while in less favorable periods it prompts investors to reduce spending, thereby supporting the portfolio’s longevity. By periodically monitoring the portfolio and allowing for some flexibility in annual spending based on recent market performance, investors can improve their likelihood of meeting long-term financial goals.

Keep in mind, however, that although this strategy provides for some reduction in spending in poor markets, it does not preclude the possibility of a substantial decline in the portfolio’s principal, which could require spending to drop below the “floor” and could even result in premature portfolio depletion. In our simulation, 92% of the paths resulted in a positive ending portfolio balance after 35 years. As expected, this 92% value lay between the survival rates for the other two approaches (78% and 100%).

When it comes to real annual spending amounts, we found that applying the ceiling and floor constrained both the upside and the downside. In our simulation, the highest annual spending level reached with this strategy was 525% of the original target; by contrast, the *percentage of portfolio* strategy reached a maximum of 3,634%. On the other hand, the ceiling/floor limits produced fewer scenarios in which annual spending fell below the target level: 45%, compared with 48% for the *percentage of portfolio* strategy. These differences reflect the moderation imposed by the ceiling and floor.

Compared with the *dollar amount grown by inflation* strategy, the ceiling/floor method had a higher maximum-spending scenario (525% of the original target versus 100%), but it also had many more cases in which spending dropped below that target (45% versus 6%). This is because, under the *dollar amount grown by inflation* strategy, inflation-adjusted spending is kept at a constant level, instead of being allowed to rise to a ceiling or held up above a floor.

The most important consideration for the *percentage of portfolio with ceiling and floor* strategy is the selection of the upper and lower percentages that will be applied to the prior year’s spending. The narrower the spread between them, the more similar this strategy is to the *dollar amount grown by inflation* strategy, and the more likely that the portfolio could reach a crisis point at some future time. The wider the difference between the ceiling and floor percentages, the more similar this strategy is to the *percentage of portfolio* strategy. That is because calculated spending reaches the ceiling or floor relatively rarely, leaving the withdrawal percentage as the primary factor in annual spending fluctuations.

To demonstrate this point, we repeated the ceiling/floor simulation analysis with two variations: a 0% ceiling and floor, and a 10% ceiling and floor. As shown in **Figure 3**, the results for those variations are quite similar to the results for the two other strategies shown in Figure 2. This is because the 0% variation—in which inflation-adjusted spending has no room to fluctuate—is essentially the same as the *dollar amount grown by inflation* strategy, and the 10% variation, with its hard-to-reach limits, is quite similar to the *percentage of portfolio* strategy. The outcomes for other ceiling/floor combinations between 0% and 10% would likely fall between these values.

Figure 3. Percentage of portfolio with ceiling and floor: Summary statistics for three variations of ceiling/floor

Strategy			
Ceiling	0.00%	5.00%	10.00%
Floor	0.00	2.50	10.00
Portfolio survival rate	78	92	100
Real (inflation-adjusted) ending asset balances			
Maximum	\$100,030,300	\$88,954,400	\$73,136,800
75th	3,162,400	2,220,400	2,174,500
Median	1,153,700	1,068,600	1,194,400
25th	102,400	449,700	659,000
Minimum	0	0	6,500
Real annual spending as a percentage of initial spending			
Maximum	100%	525%	2,555%
75th	100	198	209
Median	100	114	117
25th	100	66	67
Minimum	0	0	3
Percentage of time real spending drops below initial spending	6	45	47

Important note: This hypothetical illustration does not represent the investment results of any particular portfolio. See Appendixes 1 and 2, respectively, for guidelines on withdrawal rates in this analysis as well as details on the VCMM simulation, including return assumptions.

Source: Vanguard.

Conclusion

Although we believe that investors can usefully analyze these conceptual spending frameworks, we also recognize that most investors determine their annual spending in a less rigid way. Certainly no strategy should be followed blindly; indeed, it is essential for investors to periodically evaluate their income strategies, assess their portfolios, and consider whether alterations are needed. Still, working through calculations such as these on an annual basis can assist investors with their long-term planning as they strive to achieve their financial goals.

In our view, *flexibility* is the one word that best describes a prudent spending strategy. Rigid spending rules cannot eliminate investment volatility; they simply push its consequences into the future. Spending strategies insensitive to returns are risky, in that they assume a portfolio will recover before a crisis point is reached—at which time much more dramatic reductions in spending would be necessary. If a portfolio is to rely on the capital markets for growth, then investors must either accept continuous, relatively smaller changes in spending or else run the risk of having to make abrupt and significantly larger adjustments later. The more investors can tolerate some short-term fluctuations in spending, the more likely they are to achieve their longer-term goals.

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Appendix 1. General guidelines for setting initial withdrawal rates

The desired amount of annual spending is unique to each investor, but several factors are generally worth considering when determining the target level. Investors should try to envision the lifestyle they would like to have during retirement (if there are any bequest goals, these should be included in planning from the start). From there, investors should determine how much annual spending they would need to support the desired lifestyle, recognizing that over the course of retirement their needs are likely to evolve. For example, early in retirement travel and entertainment may be priorities, whereas in later years health and long-term care costs may be more important. Finally, investors should estimate what percentage of their annual spending is nondiscretionary (that is, payments that must be made irrespective of yearly income). This information will help them weigh the trade-offs involved in choosing a spending level appropriate to their circumstances.

For general reference, we calculated initial withdrawal rates that would give a hypothetical portfolio an 85% chance of survival under various circumstances. The tables in Appendix Figure A-1 show these rates for two strategies—*dollar amount grown by inflation* and *percentage of portfolio with ceiling and floor*—based on various asset allocations and time horizons. It’s important to note that income taxes were not part of the calculation; an investor would need to pay any taxes from the withdrawn amounts.

The tables in Figure A-1 provide hypothetical examples, they do not reflect any investor’s particular circumstances, and they must not be taken as advice—but they do illustrate the potential benefit of a flexible approach. The ability to tolerate annual fluctuations in income within a specified range is accompanied by higher withdrawal rates. The ceiling/floor strategy, assuming a 5% ceiling and a 2.5% floor, allows for initial withdrawal rates that are 0.7–1.2 percentage points above those in the inflation-based strategy.

Figure A-1. Initial withdrawal rates providing 85% chance of survival for hypothetical portfolios

a. Dollar amount grown by inflation

Portfolio	Planning horizon			
	10 years	20 years	30 years	40 years
Conservative	9.4%	4.9%	3.5%	2.9%
Moderate	9.6	5.2	3.9	3.3
Aggressive	9.6	5.3	4.0	3.4

b. Percentage of portfolio with ceiling and floor (assuming 5% ceiling and 2.5% floor)

Portfolio	Planning horizon			
	10 years	20 years	30 years	40 years
Conservative	10.5%	6.1%	4.7%	4.1%
Moderate	10.7	6.3	4.9	4.3
Aggressive	10.5	6.2	4.8	4.1

Important notes for Figure A-1a and b:

- The 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.
- Our computer model (the Vanguard Capital Markets Model) and its assumptions are described in Appendix 2.

Source: Vanguard.

Appendix 2. About the Vanguard Capital Markets Model

The Vanguard Capital Markets Model (VCMM) is a proprietary financial simulation tool developed and maintained by Vanguard's Investment Strategy Group. The VCMM uses a statistical analysis of historical data for interest rates, inflation, and other risk factors for global equities, fixed income, and commodity markets to generate forward-looking distributions of expected long-term returns.

The long-term returns for our hypothetical portfolios are based on data for the appropriate market indexes through June 2013. For U.S. bond market returns, we used the Standard & Poor's High Grade Corporate Index from 1926 through 1968; the Citigroup High Grade Index from 1969 through 1972; the Lehman Brothers U.S. Long Credit AA Index from 1973 through 1975; and the Barclays U.S. Aggregate Bond Index thereafter. For U.S. stock market returns, we used the S&P 90 Index from 1926 through March 3, 1957; the S&P 500 Index from March 4, 1957, through 1974; the Dow Jones Wilshire 5000 Index from 1975 through April 22, 2005; and the MSCI US Broad Market Index thereafter. For international stock market returns, we used the MSCI EAFE Index from 1970 through 1988, and a blend of 75% MSCI EAFE Index/25% MSCI Emerging Markets Index thereafter.

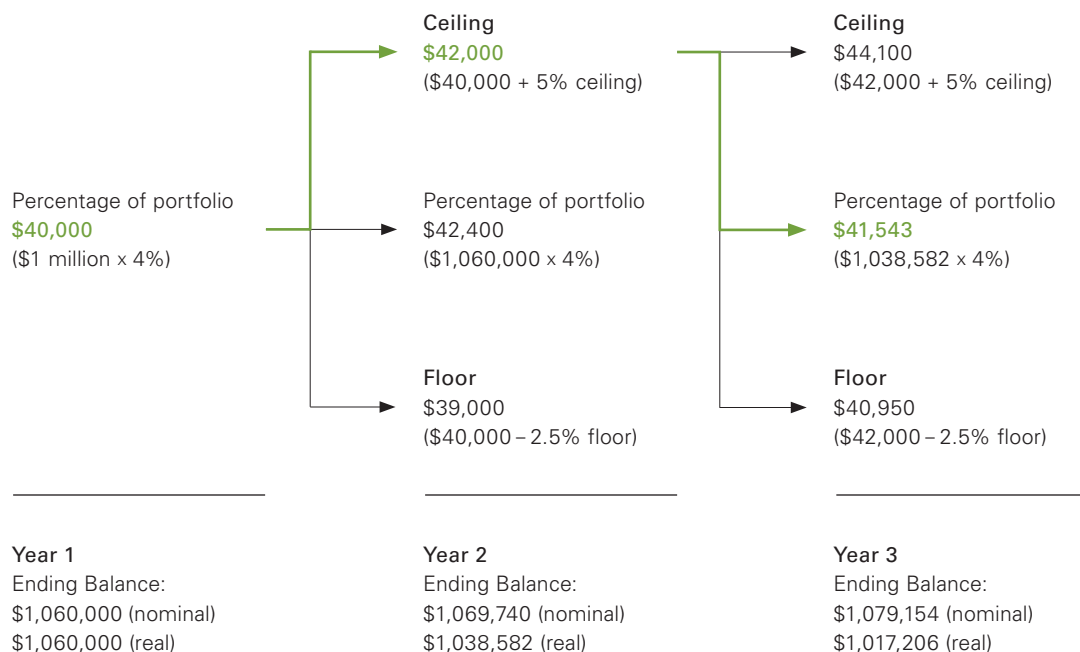
The VCMM is grounded in the empirical view that the returns of various asset classes reflect the compensation investors receive for bearing different types of systematic risk (or beta). Using a long span of historical monthly data, the VCMM estimates a dynamic statistical relationship among

global risk factors and asset returns. Based on these calculations, the model uses regression-based Monte Carlo simulation methods to project relationships in the future. By explicitly accounting for important initial market conditions when generating its return distributions, the VCMM framework departs fundamentally from more basic Monte Carlo simulation techniques found in certain financial software.

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 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.

The VCMM seeks to represent the uncertainty in the forecast by generating a wide range of potential outcomes. It is important to recognize that the VCMM does *not* impose "normality" on the return distributions but, rather, is influenced by the so-called fat tails and skewness in the empirical distribution of modeled asset-class returns. Within the range of outcomes, individual experiences can be quite different, underscoring the varied nature of potential future paths.

Appendix 3. Dynamic spending strategy example: Percentage of portfolio with ceiling and floor



Starting balance	\$1 million
Spending rate	4%
Floor	2.5%
Ceiling	5%
Annual returns	
Year 1	10%
Year 2	5%
Year 3	5%

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

Important note: This hypothetical illustration does not represent the investment results of any particular portfolio. This 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. The green lines are meant to emphasize which of the three calculated amounts would be used as each year's real spending withdrawal.

Source: Vanguard.



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