Making Sense Out of Variable Spending Strategies for Retirees

by

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Abstract

Variable spending strategies can be situated on a continuum between two extremes: spending a constant amount from the portfolio each year without regard for the remaining portfolio balance, and spending a fixed percentage of the remaining portfolio balance. Variable spending strategies seek compromise between these extremes by avoiding too many spending cuts while also protecting against the risk that spending must subsequently fall to uncomfortably low levels. Two basic categories for variable spending rules explored include decision rule methods and actuarial methods. Ten strategies will be compared using a consistent set of portfolio return and fee assumptions, and using an XYZ formula to calibrate initial spending: the client willingly accepts an **X%** probability that spending falls below a threshold of **$Y** (in inflation-adjusted terms) by **year Z** of retirement. Presenting the distribution of spending and wealth outcomes for different strategies in which the initial spending rate is calibrated with the XYZ formula will allow for a more meaningful comparison of strategies. The article provides a framework for identifying appropriate spending strategies based on client preferences.

JEL Codes: C15, D14, G11, G17

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Introduction

Bengen (1994) introduced the concept of the 4% rule for retirement withdrawals. He defined the sustainable spending rate as the percentage of retirement date assets which can be withdrawn, with this amount adjusted for inflation in subsequent years, such that the retirement portfolio is not depleted for at least 30 years. Specifically, Bengen found that a 4% initial spending rate would have been sustainable in the worst-case scenario from US historical data over rolling 30-year periods with a stock allocation of between 50 and 75%.

In an attempt to illustrate the importance of the sequence of investment returns on retirement spending outcomes, which highlighted how it is wrong to base a sustainable spending rate on a fixed average return assumption plugged into a spreadsheet, Bengen reasonably used a number of simplifying assumptions. Among these is the previously-mentioned constant inflation-adjusted spending assumption. It was a simplification to obtain a general guideline about feasible retirement spending.

While the assumption may reflect the preferences of many retirees to smooth their spending as much as possible, real clients can be expected to vary their spending over time. Clients will not play the implied game of chicken by keeping their spending constant as their portfolios plummet toward zero. As well, constant spending from a volatile portfolio is a unique source of sequence of returns risk which can be partially alleviated by reducing spending when the portfolio drops in value.

But how exactly should clients adjust their spending patterns in response to changes in the value of their retirement portfolios? There are countless variations on spending rules which are discussed in outlets ranging from research papers to Internet discussion boards. The purpose of this article is to identify and classify key variable spending strategies, and to develop simple metrics which are able to evaluate and compare the strategies on an equal basis. As will be discussed, the frequently used 'failure rate' metric should not be applied to variable spending rules. Other approaches are needed. The aim here is to assist advisors and their clients in figuring out which sort of variable spending strategy will be most appropriate for their situations. This holistic evaluation is important for a number of reasons.

First, variable spending rules are usually described and evaluated using different data and assumptions, and so if one rule suggests a 6% withdrawal rate while another suggests a 3% withdrawal rate, we cannot necessarily know whether the first rule is really twice as powerful. The differences could just reflect different underlying assumptions, such as higher market returns. We must use the same set of capital market and fee assumptions to properly compare strategies.

We must also worry about where we are situated in the distribution of possible spending and wealth outcomes. There are many tradeoffs involved with building a retirement income strategy and one metric cannot summarize the overall performance of a strategy. Spending more at the start of retirement runs a greater risk for having to spend less later. A more aggressive asset allocation creates greater upside potential for spending growth and legacy, but it also leads to greater downside risk as well. Naturally, regarding legacy, greater spending implies that less assets will remain. Spending can evolve differently depending on the random sequence of market returns, and clients have to decide where to focus their concerns.

The traditional failure rate measure often employed by safe withdrawal rate studies (which calculates the probability of portfolio depletion) cannot be used to compare variable spending strategies. It only tracks portfolio depletion, and different variable strategies may imply different spending levels just prior to wealth depletion. For instance, a 6% variable spending strategy may have caused spending to fall to $20,000 per year in the period leading up to portfolio depletion, while the 3% strategy might have maintained spending at $50,000 until depletion. Failure rates ignore this important distinction since the depletion event is all that matters. This is important because it reflects a general theme in the variable withdrawal rate literature: the more the client is willing to let their spending drop in retirement, the higher is the initial spending rate they may use.

And a related problem is that some variable spending strategies can technically never fail. For instance, when always calculating spending as a percentage of remaining assets, even a 99% withdrawal rate never runs out (though in practice it may be tough to slice up the remaining penny).

Portfolio failure rates also do not reflect a client's entire household balance sheet of assets for income generation. Cutting spending from a portfolio may not be so disastrous for clients who receive plenty of income from other sources such as Social Security, pensions, and income annuities. We should consider how potential spending reductions from a portfolio will impact the overall lifestyle of the client after also incorporating all of their other non-portfolio sources of income. Failure, defined strictly as investment portfolio depletion, is not the whole story.

The failure rate is also an extreme outcome measure which puts weight only on financial wealth depletion. Client spending potential is irrelevant. Clients must find an appropriate personal balance between the aims of spending more and then having to make potentially larger subsequent cutbacks in the event of a long life and a sequence of poor market returns.

By focusing only on the failure rate, clients may end up the bequeathing a large amount of assets and not enjoying their retirements as much as possible.

As an alternative to failure rates, this article suggests comparing the distribution of outcomes for spending and remaining wealth for different strategies, and calibrating their initial spending rates using a customized "XYZ formula" determined by the advisor and client:

XYZ Formula = Client Willingly Accepts an **X%** probability that spending falls below a threshold of **$Y** (in inflation-adjusted terms) by **year Z** of retirement.

For instance, instead of accepting a 10% chance for failure within the first 30 years of retirement, an XYZ rule could be that the client accepts a 10% chance that their spending level falls below an inflation-adjusted $60,000 by the 30th year of retirement. This calculation can incorporate Social Security and other income sources as well, and it provides a way to compare strategies while otherwise dealing with the reality that higher initial spending rates can be justified if spending is subsequently allowed to drop more steeply. The formula provides a controlled anchor for those spending drops, and so when combined with consistent market assumptions and a view of the entire distribution of outcomes, we can compare different variable strategies on an equal footing.

Literature Review

Through a review of existing research on variable spending, we seek to identify and describe key representative variable spending strategies from the countless possibilities, and to classify them into a general taxonomy with two subsets: decision rule methods and actuarial methods.[1] Key examples of each are shown in Table 1.

Though there are exceptions, we can generalize a few important distinctions for these methods. Among these distinctions, decision rule methods frequently share elements of the probability-based school of thought, while advocates of actuarial methods often identify more with the safety-first school (See Pfau and Cooper (2014) for more on these schools of thought).

[1] There is a third category of variable spending strategies based on dynamic programming computational methods. They integrate spending and asset allocation decisions more completely and offer the most sophisticated models. But these methods are beyond the scope of this article. Due to their mathematical complexity, they have not yet become a practical part of the toolkit for advisors. For more on dynamic programming methods, see Irlam (2014) or Irlam and Tomlinson (2014).

Table 1
Variable Spending Strategies in Retirement

Decision Rule Methods	[1] & [2] Bengen's Constant Inflation-Adjusted Spending (1994)
	[3] Bengen's Fixed-Percentage Withdrawals (2001)
	[4] Bengen's Floor-and-Ceiling Withdrawals (2001)
	[5] Guyton and Klinger's Decision Rules (2006)
	[6] David Zolt's Target Percentage Adjustment (2013)
Actuarial Methods	[7] & [8] RMD Spending Rules
	[9] PMT Formula (ex. Waring and Siegel (2015); Steiner (2014); Bogleheads)
	Monte-Carlo PMT Formulas: Frank, Mitchell, and Blanchett Age-Based 3D Model (2011, 2012a, 2012b); Blanchett, Maciej, and Chen Mortality-Updating Constant Probability of Failure (2012); David Blanchett's Simple Formula (2013)
	[10] Annuitize the Floor & Invest for Discretionary

Note: The numbers in brackets reflect the strategies to be simulated and analyzed in this article.

For instance, decision rule methods will demonstrate more willingness to start spending at a higher level than justified by the bond yield curve, with an expectation that future portfolio growth from stocks can be counted upon to justify a higher spending rate now. Meanwhile, with actuarial methods, spending may start at a lower level, and spending will only increase in the event that upside potential has been realized. There is a greater recognition of the notion that stock investments are still risky even after long holding periods, and so efforts to ‘amortize the upside’ through higher spending may backfire on the client.

Related to this, decision rules will generally try to keep spending at a steadier level and only make spending adjustments when deemed essential, while actuarial methods may call for more frequent spending adjustments. At least, actuarial advocates suggest that those seeking smoother spending should use a less volatile portfolio. For actuarial methods, spending volatility is more directly linked to investment volatility, and it is the asset allocation lever which should be used to reduce spending volatility, rather than any other sort of smoothing technique. Any effort to keep spending constant from a volatile portfolio creates greater risk for even greater subsequent spending declines.

Beyond these differing views of market risk, decision rule methods will generally adopt a conservative planning horizon beyond life expectancy (such as 30 or 40 years), while actuarial methods will make decisions based on a dynamically-adjusting time horizon linked to the remaining life expectancy as retirement progresses. Finally, decision rule methods will generally be more comfortable in formulating their spending parameters using historical market data, whereas actuarial methods will be more willing to incorporate updated market return expectations as the spending plan is updated regularly throughout retirement. With this overview, we now consider some specific strategies identified in the literature.

Decision Rule Methods

The first method to be tested, so that it may serve as a baseline for comparison, is the [1] original constant inflation-adjusted withdrawal strategy introduced in Bengen (1994). This basic spending rule is to adjust spending annually for inflation, and to maintain constant inflation-adjusted spending for as long as possible until the portfolio depletes. We also test a variant in which [2] the annual spending adjustments will equal inflation less one percentage point. This allows for a higher initial spending rate, followed by subsequent real spending declines. This variant may appeal to those who do expect their spending to naturally decline with age, as it provides a mechanical way to front-load spending. More generally, any client-specified targeted spending path could be simulated in this way.

The next decision rule is the polar opposite of constant inflation-adjusted spending. Bengen (2001) described it as [3] fixed-percentage withdrawals. This rule calls for users to spend a constant percentage of the remaining portfolio balance in each year of retirement. This rule never depletes the portfolio. Cotton (2014) also formalized how there is no sequence of returns risk with a constant percentage strategy. Intuitively, the lack of sequence risk can be understood as the fact that this strategy provides a clear mechanism for reducing spending after a portfolio decline. As with investing a lump-sum of assets, the specific order of returns makes no difference to the final outcomes realized with this strategy. As such, we can expect the sustainable spending rate to be higher than with constant inflation-adjusted withdrawals. As for disadvantages, spending can become extremely volatile with this strategy, if combined with volatile investments, and it will be difficult for clients to budget in advance.

The fixed percentage and the constant (inflation-adjusted) rules represent the two extremes on a spectrum of possible choices. With Bengen's fixed percentage rule, spending can be very volatile, but the portfolio technically cannot be depleted. Meanwhile, a constant amount does keep spending more predictable as long as assets remain, but the portfolio can be depleted and spending can fall to zero. Neither extreme will be ideal for most clients. The other decision rule methodologies seek to provide a compromise of sorts between these two extremes, by having a mechanism to smooth spending adjustments made in response to market volatility.

Bengen (2001) described [4] floor-and-ceiling withdrawals as one such spending compromise. This method begins by applying the fixed percentage rule, which allows greater spending when markets do well, and which forces spending reductions when markets do poorly. But Bengen also adds hard dollar ceilings and floors on spending. Spending would not be allowed to rise above the ceiling set at 20% higher than the real value of the first year's withdrawal, and spending would not be allowed to fall by more than 15% below the real value of the first year's withdrawal. This keeps spending from drifting too far from its initial levels as a way to smooth spending fluctuations. It is important to recognize that the hard dollar floor on spending imposed by this rule restores the possibility for portfolio depletion. And as emphasized, the failure rate comparison would be less meaningful for this rule if spending is already lower in the period before wealth depletion than with constant inflation-adjusted spending. A willingness to cut spending when markets do poorly does justify a higher initial spending rate, and Bengen determined that this floor-and-ceiling rule increased the historical worst-case initial spending rate by 10%.

The next decision rule approach is actually the source of the naming for this category of methods. The [5] Guyton and Klinger spending decision rules derive from work by Guyton (2004) and Guyton and Klinger (2006). The basic components of these spending rules include a spending adjustment for inflation unless the portfolio had a negative return in the previous year and this year's withdrawal rate (current spending divided by remaining assets) is higher than the initial withdrawal rate at the retirement date. As well, the ‘prosperity rule’ increases spending by 10% in any year that the current withdrawal rate falls to be 20% less than its initial level. The ‘capital preservation rule’ cuts spending by 10% during the first 15 years of retirement if the current withdrawal rate rises to be 20% more than its initial level. With these decision rules, spending can increase faster than inflation when the markets are doing well, and can fall even in nominal terms when the portfolio is losing value.

A final example in the decision rules category is the [6] Target Percentage Adjustment method introduced in Zolt (2013). This method is actually a hybrid between decision rules and actuarial methods, though I classify it as a decision rule method because of the simple spending rule which defines whether spending adjusts for inflation. Given a fixed-return assumption and a 45-year time horizon, Zolt calculates a critical path for how much wealth should remain in each year of retirement. In any year that remaining wealth is higher than the critical number from his calculation, spending adjusts for inflation. However in any year that wealth falls below where it should be as implied by this critical path, no inflation-adjustment is made. Throughout retirement, sometimes spending adjusts for inflation and sometimes it stays fixed. Zolt considered other variants for how much to adjust spending depending on the relationship between wealth and the critical path calculations, and we simulate the version he showed to provide quite favorable results. I use his assumptions to create the critical path, which include a 45-year planning horizon, 3% inflation, and an 8.6% portfolio return.

Actuarial Methods

Actuarial methods are the basis for the other set of dynamic spending rules. These methods generally have clients recalculate their sustainable spending annually based on the remaining portfolio balance, remaining longevity, and expected portfolio returns. In fact, these methods can generally be represented with the Excel PMT function:

PMT(rate,nper,pv,fv,type)

Given an expected return for investments (*rate*), the planning horizon (*nper*), the current size of the financial portfolio (*pv*), the desired amount of remaining wealth at the end of the planning horizon (*fv*), and a value of 1 for *type* if withdrawals are made at the start of the period, this formula provides the sustainable spending amount. If the *rate* is expressed in inflation-adjusted terms, the answer would imply a stronger opportunity to enjoy continued inflation-adjusted spending from this level. As well, *fv* could be a value greater than zero if the client seeks to leave a bequest or to preserve a portion of the portfolio for other purposes.

This calculation could be repeated annually, reflecting changes in *rate*, *nper*, and *pv*, which would then provide clients with a sustainable spending amount for each year. Remaining portfolio assets will clearly change over time, and circumstances may also call for a change in expected market returns. A dynamic measure of remaining life expectancy is also important, as withdrawal rates can increase when the remaining time horizon shortens.

Steiner (2014) suggests that users may smooth spending adjustments relative to the changes implied by this formula. Not all would agree, as Waring and Siegel (2015) suggest that a less volatile asset allocation is a safer way to smooth spending fluctuations. The PMT formula does make clear that market volatility is the main source for spending fluctuations, and the latter argue that clients who seek stable spending should create a less volatile portfolio to be logically consistent with their choices.

A basic form for the actuarial method is to use the Internal Revenue Services' Required Minimum Distribution (RMD) rules as a more general guide for sustainable spending. In an effort to get those benefiting from tax deferral to eventually pay taxes, the RMD rules indicate a by-age percentage which must be withdrawn from tax deferred accounts. Blanchett, Maciej, and Chen (2012) and Sun and Webb (2012) both studied the RMD rule as a spending option and found it to be a reasonable strategy which roughly approximates more sophisticated attempts to optimize spending. The RMD rule contains the actuarial components of spending a percentage of remaining assets which is calibrated to an updating remaining life expectancy, covering the *nper* and *pv* aspects of the PMT formula. Its deficiency is that it does not provide a mechanism for users to adjust the value of *rate* beyond whatever government policy makers initially assumed when developing their RMD framework. I will simulate the [7] straightforward RMD rule, which does not have flexibility to calibrate to an XYZ rule, as well as a [8] modified version of the RMD rule in which I do adjust the RMD spending rates to comply with the parameters of the XYZ rule.

The next simulated method is to use the [9] PMT formula, as suggested by a number of sources. Most recently, Waring and Siegel (2015) call this the 'annually recalculated virtual annuity' (ARVA). Steiner (2014) calls this method the 'actuarial approach.' As well, users at the Bogleheads Forum collectively developed a variant of this approach which they call 'variable percentage withdrawal.' The approach recognizes that the amount someone can spend in each year of retirement can be determined through a simple annuity calculation for a spending rate assuming a fixed portfolio return and remaining time horizon. This calculation can be updated annually for the new portfolio balance, any changes to the expected return, and an adjustment for remaining longevity. But the method does not provide a clear baseline about assumptions for which all users would agree. To show how the method may work in practice, we simulate a variant using the simulated 10-year Treasury rates for the expected returns, and rounding up the life expectancy numbers used in the RMD rule. This is the only other method which is not calibrated to the XYZ formula.

There are also a number of other more sophisticated actuarial methods which incorporate Monte Carlo simulations to calibrate spending based on a specified probability of success or failure. Though these will not be simulated, they are worth mentioning, as they provide more sophisticated versions of the PMT formula. Examples include the age-based, three-dimensional distribution model developed by Frank, Mitchell, and Blanchett (2011, 2012a, 2012b), the ‘mortality-updating constant probability of failure’ withdrawal method of Blanchett, Maciej, and Chen (2012), and the simple formula for retirement withdrawals in Blanchett (2014). The latter allows users to input their preferred asset allocation, expected portfolio returns, level of portfolio fees, remaining life expectancy, and targeted probability of success, in order to obtain a customized withdrawal rate. Though these methods are more sophisticated, the underlying PMT formula remains at the philosophical core of the spending recommendations.

A final method which we will simulate is to partially annuitize with an inflation-adjusted income annuity to cover essentially spending needs and to then spend more aggressively from remaining assets. The annuity payout rate is 3.75%, which matches the inflation-adjusted option available to a 65-year old couple with joint and 100% survivor’s income in early 2015. With the XYZ formula, the client annuitizes enough to cover their minimum $Y floor, and the remainder of spending will be determined with a more aggressive version of the Guyton and Klinger decision rules, which do not have to worry about protecting a floor since that was covered by the annuity.

Methodology

The methodological approach for each spending strategy was explained in the previous section. I simulate these strategies using 10,000 Monte Carlo simulations for stock and bond returns, and the details of the underlying market simulations are provided in the appendix. These simulations reflect the lower bond yields available to retirees today, but they do include a mechanism for interest rates to gradually increase over time, on average. Bond returns are calculated from the simulated interest rates and their changes, and stock returns are calculated by adding a simulated equity premium on top of the simulated interest rates. All strategies will be simulated with the same asset allocations and portfolio returns in order to make the results comparable. Strategies are simulated with annual data, assume withdrawals are made at the start of each year, use annual rebalancing to restore the targeted asset allocation, and deduct a 0.5% fee from remaining portfolio assets at the end of the year. The tax implications for different spending strategies are not otherwise considered.

For each strategy, the initial spending rate is shown, with the assumption that retirement wealth is equal to $100,000. Results are scalable for other wealth amounts. The distribution for spending amounts is also shown for 10, 20, and 30 years into retirement. As well, the distribution of remaining wealth is shown after the 30th year of retirement. A consideration of spending and wealth are both important, as retirees should not be narrowly focused on a singular goal to avoid financial wealth depletion. Financial goals for retirement can essentially be reduced to two competing objectives: to support as much spending as feasible, and to maintain a reserve of financial assets to support risk management objectives such as protecting from expensive health shocks, divorce, unexpected needs of other family members, severe economic downturns, etc., or to otherwise provide a legacy.

In presenting outcomes, the part of the distribution of outcomes which should be highlighted is not completely clear, though retirees will surely wish to consider the implications for when markets and well and when markets do poorly. To demonstrate the range of possibilities, outcomes for spending and remaining wealth will be shown for the 90th percentile (markets do well), 50th percentile (the mid-range outcome in which half can expect to do better and half worse), and the 10th percentile (markets do poorly).

The result tables present outcomes for 10 different spending strategies, eight of which are calibrated using the XYZ rule. Again, this rule is defined as a client allowing for an X% chance that spending will fall below $Y by year Z of retirement. The two strategies not calibrated are the RMD rule and the ARVA rule, as those strategies are strict about how retirement spending should be defined.

Results

Table 2 presents results for an each strategy assuming an asset allocation of 50% stocks and 50% bonds. The XYZ formula applied in this table is that clients accept a 10% chance that spending falls below $1,500 (in inflation-adjusted terms) by year 30 of retirement. This constraint guides initial spending for eight of the 10 strategies. The rule does not otherwise build in a legacy objective, so all wealth is available for spending and any legacy is unintentional and undesirable from a spending perspective.

The first strategy is constant inflation-adjusted spending, which William Bengen popularized as the 4% rule. After incorporating 0.5% administrative fees and the lower interest rates available to clients at the present, the maximum sustainable initial spending rate which meets the requirements of the XYZ rule is 2.85%. For the $100,000 initial portfolio, this supports $2,850 in real spending across the entire distribution of Monte Carlo simulations for as long as wealth remains. At the 10th percentile, after 30 years of retirement, wealth is on the cusp of running out. With $1,790 remaining, the portfolio will be depleted in the 31st year. In the median outcome, almost 80% of the initial wealth remains after 30 years even after adjusting for inflation, and wealth has grown by almost 2.7 times in real terms at the 90th percentile. This strategy does not take advantage of the upside potential from the investment portfolio. On the downside, spending is still maintained at a higher level up until the point of wealth depletion. Wealth does not fall to the $1,500 allowed threshold until wealth is gone, and then a large discrete drop in spending takes place.

Table 2
Sustainable Spending Rates from an Investment Portfolio over 30 years, For a 65-Year Old Couple
Strategies Allowing for a 10% Chance That Spending has fallen below an inflation-adjusted $1,500 in Year 30
Using a 50/50 Portfolio of Stocks and Bonds
Initial Wealth Level = $100,000

Spending Strategy	Initial Spending Rate	Percentile of Distribution	Real Spending in 10 years	Real Spending in 20 years	Real Spending in 30 years	Real Remaining Wealth After 30 Years
Constant Inflation-Adjusted Spending	2.85%	90th	$2,850	$2,850	$2,850	$267,930
		50th	$2,850	$2,850	$2,850	$79,460
		10th	$2,850	$2,850	$2,850	$1,790
Modified Inflation-Adjusted Spending (Inflation - 1%)	3.26%	90th	$2,990	$2,720	$2,470	$260,560
		50th	$2,990	$2,710	$2,450	$77,360
		10th	$2,980	$2,690	$2,430	$1,800
Fixed Percentage	0.00%	90th	$0	$0	$0	$510,840
		50th	$0	$0	$0	$227,410
		10th	$0	$0	$0	$97,950
Bengen's Floor-and-Ceiling Rule	3.29%	90th	$3,950	$3,950	$3,950	$214,980
		50th	$2,850	$2,800	$2,800	$70,890
		10th	$2,800	$2,800	$2,800	$1,710
Guyton and Klinger's Decision Rules	4.95%	90th	$5,450	$5,680	$6,100	$111,420
		50th	$3,880	$3,290	$3,200	$34,520
		10th	$2,650	$1,950	$1,580	$4,390
Zolt Target Percentage Adjustment: No CPI Increase	3.43%	90th	$3,430	$3,430	$3,430	$222,760
		50th	$3,430	$3,430	$3,430	$55,290
		10th	$3,100	$2,330	$1,580	$6,790
Required Minimum Distribution Spending Rule (Modified)	4.01%	90th	$6,350	$8,250	$7,760	$51,650
		50th	$4,070	$4,300	$3,480	$22,990
		10th	$2,680	$2,320	$1,560	$9,900
Required Minimum Distribution Spending Rule	3.23%	90th	$5,550	$8,220	$9,630	$82,190
		50th	$3,560	$4,280	$4,320	$36,590
		10th	$2,340	$2,310	$1,940	$15,760
PMT Formula with 10-Year Treasury Yields and Dynamic Life Expectancy	4.34%	90th	$6,730	$7,190	$5,850	$45,560
		50th	$4,390	$3,860	$2,730	$20,880
		10th	$2,870	$2,130	$1,290	$9,400
Annuitize Floor & Aggressive Discretionary Spending	4.57%	90th	$4,880	$4,920	$5,140	$62,100
		50th	$3,880	$3,490	$3,380	$18,290
		10th	$3,120	$2,680	$2,020	$1,520

Notes: Analysis assumes that withdrawals are made at the start of each year, a 0.5% portfolio administrative fee is deducted at the end of each year, and market return simulations are based on capital market assumptions detailed in the appendix.

The next strategy is similar to the constant spending rule, except that spending will grow at a rate less than the CPI. This provides a mechanical way to increase initial spending, with a built-in adjustment factor that will automatically reduce real spending over time. More generally, any predetermined spending pattern could be tested in a similar way. This rule also does not adjust spending to portfolio performance. The initial spending rate increases by 14% to 3.26%, and then real spending will gradually decline subsequently. Real spending varies slightly across the distribution of outcomes to reflect the differing compounded inflation rates for the different Monte Carlo simulations. As for remaining wealth after 30 years, wealth may still be high except for the worst-case scenarios since the rule does not provide any upward adjustment for good market returns.

The third strategy is to spend a fixed percentage of the remaining portfolio balance. This rule could not be calibrated to the specified XYZ formula and so a spending rate of 0% is shown. This is an exception, and later we shall a case in which the formula will apply. The problem here is that there is no balance point for the XYZ formula. Higher spending rates cause spending to fall below the $1,500 floor too frequently, and lower spending rates cannot get spending above this floor often enough. With no withdrawals, the 30-year remaining wealth numbers indicate the growth of wealth across the distribution for the $100,000 available at the retirement date.

The next strategy is Bengen's floor-and-ceiling rule. This rule shows the synergies which can develop when allowing spending to fluctuate with market returns. The initial spending rate can be increased to 3.29%, which is 15% more than with constant inflation-adjusted spending. Nevertheless, the hard spending floor supports spending at a level close to the same as before in the unlucky part of the distribution, and there is potential for further upside spending. After 30 years, the XYZ rule has calibrated this strategy to be at the precipice of wealth depletion for the 10th percentile in year 30, and at other points in the distribution this strategy has been a little more efficient in spending down wealth. With good market outcomes, wealth can still more than double, though, as the ceiling was not otherwise as high as it could have been when legacy is not an objective.

Next, the Guyton and Klinger decision rules allow initial spending to increase by 74% to 4.95%, relative to the Bengen baseline. The strategy provides greater upside spending potential and median spending remains higher as well, though while still calibrated to the XYZ formula, the 10th percentile spending does fall to be less than with constant inflation-adjusted spending. The strategy is providing greater upside potential with some additional downside risk, though the minimum floor identified by the client is still being protected equally as well as with other spending rules. The strategy is more efficient in spending down wealth, as lower wealth balances remain after 30 years, ensuring that retirees could enjoy much more of their potential spending throughout retirement.

David Zolt’s Target Percentage Adjustment strategy is next, and it allows for a 20% initial spending increase relative to constant inflation-adjusted spending. This strategy does also use wealth more efficiently than the baseline, though there is not a mechanism for spending to increase beyond the initial level when markets are doing well. It should be clear that such increases could be built in if desired, by modifying the spending rule.

Next, we shift to actuarial methods, which are all shown to spend down wealth more efficiently. The first method is a modified version of the required minimum distribution spending rule. The modification is to scale up the spending rate above the RMD rule in order to calibrate the XYZ formula to retirement spending. The modified rule allows for an initial spending rate of 4.01%. With it, the distribution of spending widens, as an increasing percentage of the remaining portfolio is spent each year. At the median and 90th percentile, real spending grows at 10 and 20 years into retirement, and then declines by year 30 as the spending rate becomes increasingly aggressive at higher ages. Real spending continuously declines at the 10th percentile to just above the $1,500 XYZ threshold at year 30. Wealth after 30 years is less across the distribution, implying that this strategy more efficiently spends down wealth.

The next strategy is the traditional RMD rule, which calls for a 3.23% withdrawal rate at age 65, a 3.65% withdrawal rate at 70, and so on. The straightforward RMD rule is not calibrated to the XYZ formula. It is more conservative. At the median and 90th percentiles, spending can be expected to continue growing in real terms throughout retirement. It declines at the 10th percentile, though it is still $1,940 after 30 years, which is above the XYZ threshold applied in other cases.

Application of the PMT formula is next. This rule can be designed many different ways. The version shown implies aggressiveness as remaining life expectancy is used for each year of retirement, and as the nominal (rather than real) 10-year Treasury yield is used each year to calibrate spending. This suggests that the rule will start with higher spending, but that spending will decline throughout retirement, unless upside is realized through the 50/50 portfolio with a higher "expected" return than provided by Treasury yields. Spending could have been more aggressive if such a higher return from an investment portfolio was used in place of the Treasury rate, though this would increase downside risks as well. The initial spending rate is 4.34%, and at the median spending holds relatively constant in real terms at least through the first 10 years of retirement.

The final method is to annuitize the spending floor with an inflation-adjusted SPIA. With a 3.75% payout rate for a joint and 100% survivor's SPIA which adjusts for CPI, a 65-year old couple annuitizing to obtain $1,500 of real income will require 40% of assets. The remaining 60% of the retirement portfolio is then spent down using the Guyton and Klinger decision rules. With these decision rules, spending can be more aggressive than shown earlier in the table because the XYZ formula for remaining assets allows for a floor of $0. Spending can start higher at 4.57% because it is allowed to fall more aggressively when there are poor market outcomes, as the income annuity protects the client's specified spending floor.

To understand better about the point for how the floor in the XYZ formula matters, Table 3 repeats the analysis by applying the XYZ formula with a floor level of $250 instead of $1,500. This allows for a higher initial withdrawal rate, again, because spending is allowed to fall more steeply during retirement. Why might a client be willing to allow for greater declines? Aside from having greater flexibility to reduce spending, this may be an appropriate decision when client risk capacity is greater because more income is available from outside the investment portfolio. A client who is able to cover their basic spending with Social Security and other pensions can view their portfolio withdrawals as being more discretionary in nature.

Table 3
Sustainable Spending Rates from an Investment Portfolio over 30 years, For a 65-Year Old Couple
Strategies Allowing for a 10% Chance That Spending has fallen below an inflation-adjusted $250 in Year 30
Using a 50/50 Portfolio of Stocks and Bonds
Initial Wealth Level = $100,000

Spending Strategy	Initial Spending Rate	Percentile of Distribution	Real Spending in 10 years	Real Spending in 20 years	Real Spending in 30 years	Real Remaining Wealth After 30 Years
Constant Inflation-Adjusted Spending	2.88%	90th	$2,880	$2,880	$2,880	$265,790
		50th	$2,880	$2,880	$2,880	$78,070
		10th	$2,880	$2,880	$2,880	$510
Modified Inflation-Adjusted Spending (Inflation - 1%)	3.30%	90th	$3,030	$2,750	$2,500	$257,920
		50th	$3,020	$2,740	$2,480	$75,660
		10th	$3,010	$2,730	$2,460	$360
Fixed Percentage	12.40%	90th	$6,920	$2,990	$1,290	$9,630
		50th	$4,430	$1,560	$580	$4,280
		10th	$2,920	$840	$260	$1,850
Bengen's Floor-and-Ceiling Rule	3.33%	90th	$4,000	$4,000	$4,000	$212,010
		50th	$2,870	$2,830	$2,830	$69,270
		10th	$2,830	$2,830	$2,610	$500
Guyton and Klinger's Decision Rules	5.36%	90th	$5,820	$5,800	$6,000	$94,380
		50th	$4,050	$3,340	$3,120	$25,990
		10th	$2,760	$1,960	$860	$280
Zolt Target Percentage Adjustment: No CPI Increase	3.86%	90th	$3,860	$3,860	$3,860	$189,880
		50th	$3,860	$3,620	$3,200	$42,180
		10th	$3,170	$2,310	$1,030	$330
Required Minimum Distribution Spending Rule (Modified)	8.30%	90th	$8,270	$5,080	$1,290	$3,460
		50th	$5,300	$2,650	$580	$1,540
		10th	$3,490	$1,430	$260	$660
Required Minimum Distribution Spending Rule	3.23%	90th	$5,550	$8,220	$9,630	$82,190
		50th	$3,560	$4,280	$4,320	$36,590
		10th	$2,340	$2,310	$1,940	$15,760
PMT Formula with 10-Year Treasury Yields and Dynamic Life Expectancy	4.34%	90th	$6,730	$7,190	$5,850	$45,560
		50th	$4,390	$3,860	$2,730	$20,880
		10th	$2,870	$2,130	$1,290	$9,400
Annuitize Floor & Aggressive Discretionary Spending	5.25%	90th	$5,670	$5,660	$5,850	$87,840
		50th	$4,030	$3,370	$3,160	$24,190
		10th	$2,830	$2,090	$810	$260

Notes: Analysis assumes that withdrawals are made at the start of each year, a 0.5% portfolio administrative fee is deducted at the end of each year, and market return simulations are based on capital market assumptions detailed in the appendix.

Modifying the XYZ formula to include a lower floor has caused initial spending rates to increase notably for the Guyton and Klinger decision rules, Zolt's Target Percentage Adjustment, the modified RMD rule, and the floor annuitization strategy. The fixed percentage rule is also able to be calibrated with the lower floor, allowing for a 12.4% withdrawal rate. Because the floor is so low in table 3, this high withdrawal rate is a manifestation of the idea that failure is not possible with a fixed percentage rule. For other spending rules, initial withdrawal rates do not change much, either because the XYZ formula was not applied, or because the mechanical nature of spending changes do not provide a way for spending to be lowered enough in the lead-up to depletion. Small differences can be found when the spending rate could be a little higher since less wealth is needed at the end of year 30 to support the spending floor in the subsequent year.

Conclusions

Choosing a retirement income strategy is complicated by the fact that there is no single number which can summarize all of the characteristics of the strategy. The failure rate is not sufficient. The tables in this article provide 13 numbers to summarize the performance of a strategy, and all 13 numbers are important. These numbers include the initial spending rate, the evolution of real spending over 30 years at different points in the distribution of outcomes, and the distribution of remaining real wealth after 30 years.

How should a client choose a spending method and parameterize the initial spending rate? This article provides a framework to think about the important issues, such as spending flexibility, feelings about upside spending growth vs. downside spending risks and a minimum spending threshold to be protected, desired direction of spending (for instance, whether to decrease spending over time), the appropriate planning horizon, and any legacy goals. With decisions made about these issues, clients can decide on an appropriate XYZ formula and then compare the distributions of spending and wealth created by variable spending rules.

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Appendix on Capital Market Expectations

The capital market expectations is this article connect the historical averages from Robert Shiller's dataset (http://www.econ.yale.edu/~shiller/data.htm) together with the current market values for inflation and interest rates. This makes allowances for the fact that interest rates and inflation are currently far from their historical averages, but it also respects historical averages and does not force returns to remain low for the entire simulation.

Table A1 provides summary statistics for the historical data, which guides the Monte Carlo simulations for investment returns. A Cholesky decomposition is performed on a matrix of the normalized values for the risk premium, bond yields, home prices, bills and inflation. A Monte Carlo simulation is then used to create error terms for these variables, which preserve their contemporaneous correlations with one another. Then the variables are simulated with these errors using models that preserve key characteristics about serial correlation. Though home prices and bills are not used in this analysis, I present the complete model which also takes them into account.

Table A1

Summary Statistics for U.S. Returns and Inflation Data, 1890-2013

				Correlation Coefficients						
	Arithmetic Means	Geometric Means	Standard Deviations	Stocks Returns	Risk Premium	Bond Yields	Bond Returns	Home Prices	Bills	Inflation
Stock Returns	10.7%	9.1%	18.3%	1	0.99	0.04	0.06	0.17	-0.09	0.06
Risk Premium	6.1%	4.4%	18.3%	0.99	1	-0.09	-0.01	0.15	-0.20	0.03
Bond Yields	4.7%	---	2.4%	0.04	-0.09	1	0.52	0.12	0.85	0.22
Bond Returns	4.9%	4.7%	6.7%	0.06	-0.01	0.52	1	-0.06	0.33	-0.09
Home Prices	3.3%	3.0%	7.4%	0.17	0.15	0.12	-0.06	1	0.03	0.37
Bills	4.5%	---	3.0%	-0.09	-0.20	0.85	0.33	0.03	1	0.14
Inflation	2.9%	2.8%	5.4%	0.06	0.03	0.22	-0.09	0.37	0.14	1

Source: Data from Robert Shiller's webpage. The U.S. S&P 500 index represents the stock market, 10-year Treasuries represent the bond index, the Shiller-Case home price index for homes, 6-month Treasuries for bills, and the Consumer Price Index for inflation.

With the correlated error terms, inflation is modeled as a first order autoregressive process starting from 1.58% inflation in 2013 and trending toward its historical average over time with its historical volatility. Bond yields are similarly modeled with a first order autoregression with an initial seed value of 2.12%. Next, home prices and the risk premium are both modeled as random walks around their historical averages and with their historical volatilities. Bond returns are calculated from bond yields and changes in interest rates, assuming a bond mutual fund with equal holdings of past 10-year Treasury issues. Stock returns are calculated as the sum of bond yields and the equity premium over yields. Figure A1 shows the medians for the key variables.

Figure A1
Medians of Simulated Outcomes for Inflation, Bonds, and Stocks