A Choice of Risks When Spending in Retirement

Optimizing the Plan for each Retiree

Abstract

A rolling period historical analysis is presented to compare two possible spending strategies using three distinct ending value goals (Don't Go Broke, Maintain Original Value, Maintain Buying Power). Only a 30-year investment horizon is considered. Data from 1926 to 2001 allows testing of 47 actual historical periods (1926-1955, 1927-1956, …, 1972-2001). Small changes in portfolio composition and initial spending can have big impacts on the ending value of the retirement account. In building optimized portfolios, the simulated annealing technique used in this study never produced a portfolio containing less than 50% Large Cap Stocks, and often found the portfolio consisting of 100% Large Cap Stocks to be optimal. In choosing a strategy for spending (either Spend to Maintain Standard of Living or Spend Percentage of Account Value) the retiree is also choosing the type of risk he is willing to face, either the risk of running out of money, or the risk of a declining standard of living.

Credits

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Table of Contents

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What is the worse retirement scenario, running out of money or lowering one's standard of living? Given the choice, most people would probably choose to lower standard of living. Yet, most studies assume the retiree will blindly spend at a pace to maintain standard of living, with no regard to how the markets are actually performing.

The assumption that the retiree will continue to spend at a pace to maintain standard of living, regardless of market performance, helps simplify the analysis. Unfortunately, it has little basis in reality. Most retirees, if hit with a substantial drop in account value, will sacrifice their standard of living and choose instead to spend less, with the hope that doing so will stretch their savings a few more years.

An alternative to the spend-til-its-gone approach is a strategy in which the retiree spends a fixed percentage of the value of the account each year. This second approach effectively changes the type of risk the retiree faces - Instead of risking insolvency, the retiree risks reduced standards of living. This paper compares these two spending strategies to see if there are cases or investor mindsets that are better suited for one approach over the other.

The paper is divided into two main sections: Methodology and Results. The Methodology section is rather lengthy, as there is much to explain in order to understand the results. Readers who are familiar with studies of this kind are encouraged to go directly to the Results section, coming back to the Methodology section as needed for clarification.

Methodology

A rolling period analysis of historical data is used to determine maximum sustainable spending rates and asset allocations capable of achieving those rates for each of three ending value goals and two spending strategies. The investment horizon studied is a 30-year time frame, which is appropriate for someone retiring at 65 years of age.

Ibbotson data from the 2002 SBBI Yearbook is used for the following market indexes:

Code	Index
L	Large Cap Stocks
CB	Corporate Bonds
IG	Intermediate-term Government Bonds
LG	Long-term Government Bonds
T	US T-Bills

The Ibbotson data runs from 1926 to 2001. In the analysis, every 30-year time frame is considered for every case, for thousands of possible portfolios. In each case, the first time frame considered runs from 1926 to 1955, the second from 1927 to 1956, and so on, with the last time frame from 1972 to 2001. In all, 47 time frames are considered.

Note: The Ibbotson Small Cap Index was not included in the analysis because, when it is included, it dominates all other asset classes, and becomes the major player in optimized portfolios. You would be very hard pressed to find an investment professional who would recommend 100% stocks for a new retiree, much less 100% small cap stocks. There has been much debate as to whether small cap stocks outperform large cap stocks or vice versa. We have skirted the issue by omitting small cap stocks from the analysis.

For each of these time frames, the proposed portfolio and spending strategy are run to approximate as closely as possible what would have actually happened had the retiree lived through that particular time frame. If, at the end of the 30-year time frame, the value of the account is greater than or equal to the ending value goal, then that time frame is marked as a successful observation. Otherwise it is marked as a failure. The total number of successful observations divided by 47 (the number of 30-year time frames) is the historical success rate.

So, given 1) a specific asset allocation, 2) a spending strategy (including the initial withdrawal amount) and 3) an ending value goal, one can determine the historical success rate of the strategy, which indicates the historical likelihood that an investor would have reached the goal. While there is no guarantee for the future, it is believed that higher historical success rates indicate higher probabilities of future success, and so higher success rates are preferable to lower ones.

Turning the above equation around, and using some new, high-powered optimization software from J&J Financial named WAT$, it is possible to find optimal asset allocations given a 1) spending strategy, 2) desired historical success rate and 3) ending value goal. In this paper, those three parameters are varied so that outcomes can be compared for investors of differing 1) spending requirements, 2) levels of aggressiveness in terms of historical success rates and 3) ending value goals.

Spending Strategies

The spending strategy is at the heart of this paper. Two possibilities are considered here: 1) The retiree can spend at a pace to maintain standard of living or 2) The retiree can spend a fixed percentage of the value of the account each year.

In the first case, the retiree withdraws some percentage of the value of the account the first year, and then adjusts subsequent year withdrawals by prior year withdrawals adjusted up or down by prior year inflation rates. In this way, the retiree's standard of living is maintained throughout the time frame.

The danger of this approach is that the retiree may run out of money before the 30 years are finished. In fact, in all success rate levels except 100%, the retiree does run out of money in at least some of the time frames. In the 90% success rate level, for example, the

initial withdrawal amount and asset allocation are chosen in a way that maximizes the initial withdrawal amount, and allows the account to survive in all but 4 of the 30-year time frames. At the 50% success rate level, which is indeed very aggressive, the initial withdrawal amount and asset allocation allow the account to survive in only 24 of the 47 30-year periods.

One statistical quibble must be made about this approach. In the time frames where the retiree runs out of money, the analysis continues to record withdrawals against the account, even though the account is empty. The purpose of this is to have some measure of the degree by which the strategy runs short. One consequence of this deficit spending is that average ending values are reduced, sometimes by a considerable amount, because large negative values (rather than zero) often occur for ending values in the more aggressive portfolios.

In the second spending strategy, each year's withdrawal amount is a percentage of the value of the account at the start of the year. For example, if the withdrawal rate is 6%, the first year withdrawal amount is $60,000 (assuming an initial account value of $1 million). In subsequent years the withdrawal amount remains 6% of the account. If, for example, the account value is $900,000 at the start of year 2, then the amount withdrawn in year 2 is $54,000. Using this approach, there is no danger of running out of money, but there is a very real possibility that the retiree will not be able to maintain standard of living.

Note: One way to see that withdrawing a fixed percentage of account value will never go broke is to think about all the numbers between 0 and 1. You can repeatedly split numbers in half (1/2, 1/4, 1/8, 1/16, 1/32, etc.) forever and never get to 0. Likewise, if you always withdraw 50% of an account for spending, the account value will never drop below zero.

The choice of spending strategy is one of the more important choices the retiree faces. If the greater fear is that standard of living will diminish, then the plan should embrace this, and should be designed in a way that withdrawals can be sustained in the face of changing inflation rates. On the other hand, if the greater fear is that of going broke, then the method of withdrawing a fixed percentage of what is available is the better planning method. In either case, the choice of spending strategy is useful only to the point that it helps plan the next several years of withdrawals, as specific circumstances and needs will no doubt require adjustments to the plan.

Historical Success Rates

In this paper four success rate levels are considered: 100%, 90%, 75% and 50%. These success rates were chosen because they represent a wide spectrum of investor mindsets, from the very conservative (100% success rate) to the very aggressive (50% success rate).

The 100% success rate level means the spending strategy has, historically, been successful in every 30-year period since 1926. This does not mean the strategy will be successful in the future, but it does suggest there is a good chance of success.

The question for the retiree is, How certain do you need to be that your retirement plan will achieve your spending needs and ending value goal? One possibility is to start with a plan that has, say, a 75% historical success rate, with the understanding that the plan requires review and revision on a periodic (say, annual) basis. The 75% level is proposed as a reasonable starting point because it allows higher spending levels up front while retaining a high likelihood of success of reaching the ending value goal. At the same time, it is not so aggressive as to take the retiree to a point of no return, provided the proper review and revisions are performed early and often.

Ending Value Goals

The final parameter analyzed in this study is the ending value goal for the account. Three possible ending value goals are considered, as listed below.

Ending Value Goal	Description
Don't Go Broke	If, at the end of a 30-year time frame, the account is out of money, that time frame is counted as a failure. Otherwise the time frame is counted as a success.
Maintain Original Value	If, at the end of a 30-year time frame, the account value is less than one million dollars, that time frame is counted as a failure. Otherwise the time frame is counted as a success.
Maintain Buying Power	For each 30-year time frame, the effects of actual inflation rates during those 30 years are used to determine the inflation-adjusted value of one million dollars. On average, the inflation-adjusted value of one million dollars, over 30 years, is $3.3 million dollars. The low time frame was 1926-1955 in which the inflation-adjusted value is $1.5 million; The high time frame was 1966-1995 in which the inflation-adjusted value was $4.8 million. To be counted as a success, the ending value of the account must be at least equal to the inflation-adjusted value of the original one million dollars, for that particular time frame.

In the Results section below, data is grouped by ending value goal. This places the two spending strategies near each other for each ending value goal, making it easy to see how the two strategies compare for differing ending value goals.

Basic Assumptions

The following parameters of the study are straightforward and require no further explanation:

- The initial value of the account is one million dollars.
- The investment horizon is 30 years. Shorter time frames would likely call for more conservative portfolios.

- Withdrawals occur at the start of the year.
- Any combination of the Ibbotson indexes can be used for the portfolio.
- The portfolio used is an optimal portfolio, as calculated by WAT$ (see Portfolio Composition below).
- The asset allocation of the portfolio is rebalanced each year during the time frame to keep the weightings of the assets consistent over the time frame.
- The following real-world variables are not considered in this study: income taxes, IRS-required withdrawal amounts and account management fees. For these and other considerations a retiree should either self-educate or consult with a retirement specialist.
- Finally, the retiree will not deviate from the spending strategy.
    - In the case where the strategy is to maintain standard of living, each year's withdrawal is equal to the prior year's withdrawal as adjusted by the prior year's actual inflation rate (as measured by the Ibbotson inflation index). In this strategy, the retiree maintains standard of living in spite of account value, even if it means the account is emptied.
    - In the case where the strategy is to spend a fixed percentage of the value of the account, the percent itself does not vary over time, but the actual amount withdrawn varies in lockstep with the value of the account.

Portfolio Composition

The asset allocations used in this study were not chosen ahead of time. Instead, the simulated annealing algorithm in the WAT$ Black Box program was used to find historically optimal portfolios.

To determine optimal allocations, WAT$ takes as inputs 1) the assets to be considered for the portfolio (without weightings), 2) the desired historical success rate, 3) the spending strategy (not including the initial withdrawal amount) and 4) the ending value goal. As output, WAT$ provides the maximum sustainable spending rate (in terms of the initial withdrawal amount) and an asset allocation capable of achieving the ending value goal in enough observations as to reach the desired success rate. An example helps to illustrate.

As is the case in this paper, suppose the retiree can choose from the five Ibbotson indexes listed above (L, CB, IG, LG and T). Also suppose the retiree's ending value goal is to not run out of money before the 30-year horizon is finished. The target success rate is 90%, which means the strategy can have up to 4 failures historically (43 / 47 = 91.5%). Finally, the retiree seeks to spend at a pace to maintain standard of living.

With these inputs, WAT$ finds the maximum sustainable withdrawal rate (the amount that can be withdrawn the first year) to be 4.5% of the initial value of the account (see Table 1). One portfolio capable of achieving that rate consists of 72.5% Large Cap Stocks, 21% Intermediate-term Government Bonds and 6.5% US T-Bills. With an initial withdrawal of 4.5% ($45,000 from an account worth $1 million), and with subsequent withdrawals to maintain standard of living, the retiree would have remained solvent in 43 of the 47 time frames. In 4 of the time frames the retiree would have run out of money. On average, the retiree would have spent a total of $2.5 million over the 30-year time

frame, with the average ending value being $3.8 million. In the worst-case, which occurred from 1969 to 1998, the retiree would have run out of money in the 23rd year.

Worst-Case Scenarios

The criteria for what constitutes a worst-case scenario depend on the spending strategy. When the strategy is to maintain standard of living, the retiree runs the risk of running out of money. In the cases below, when the spending strategy is to maintain standard of living, the worst-case is the time frame when the retiree runs out of money in the fewest number of years.

Alternatively, when the strategy is to spend a percentage of each year's account value, the worst-case scenario is the time frame when the value of the account drops the most dramatically, and hence purchasing power is diminished to the greatest extent. In those cases, the worst-case is listed as the value of the account at the end of the time frame.

Results

The results are divided into three sections based on ending value goal. The first ending value goal presented is the one of not running out of money before the 30-year time frame is finished.

Ending Value Goal: Don't Go Broke

The "Don't Go Broke, Spend Percentage of Account Value" scenario is not shown because it does not make sense. As mentioned earlier, if the withdrawal amount is always a fixed percentage of the value of an account, the account will never, theoretically, run completely down to zero.

For completeness, and to summarize many of the other studies on this topic, the "Don't Go Broke, Spend to Maintain Standard of Living" scenario is shown in Table 1. The results here are not surprising. As the need for historical success increases, the ability to withdraw from the account decreases.

At the 50% success rate, for example, the highest sustainable withdrawal rate is 6.8%, or $68,000 the first year. To achieve this level of spending with 50% success rate the retiree invested in 100% Large Cap Stocks for the entire 30 year time frame. With these parameters, historically, the retiree would have failed in 23 of the 47 time frames. The worst failure occurred from 1929 to 1958. In that time frame, the retiree ran out of money in 1940, just 12 years into retirement.

Why 100% Large Cap Stocks? The WAT$ program finds the portfolio that can achieve the ending value goal (in this case, Don't Go Broke), with the desired success rate (50% of the time in this example) and with the maximum sustainable withdrawal rate. Looking at all the 30-year periods from 1926 to 2001, in 24 of the 47 30-year periods, a retiree invested 100% in Large Cap Stocks could have withdrawn 6.8% of the value of the account the first year, then maintained standard of living for the remaining 29 years,

without running out of money before the end of the time frame. All other portfolios that were tested failed to achieve a 50% success rate given these same parameters.

Table 1 - Don't Go Broke, Spend to Maintain Standard of Living

HSR	MSR	AVG Spent	AVG EV	Allocation	Worst TF	Overdrawn in … yrs
50%	6.80	$3.7	$2.2	100% L	1929-1958	12
75%	4.91	$2.7	$3.2	75% L, 25% IG	1969-1998	20
90%	4.50	$2.5	$3.8	72.5% L, 21% IG, 6.5% T	1969-1998	23
100%	4.03	$2.2	$2.7	50% L, 50% IG	1966-1995	31

See the section at the end of this paper entitled Abbreviations for the meanings of column headings.

Is a portfolio consisting of 100% Large Cap Stocks a reasonable portfolio for a new retiree? That's a very good question. Most investment professionals would not make such a bold recommendation, as, at first glance, it seems far too aggressive, even bordering on the reckless. Nevertheless, in many instances in this study, that exact portfolio turns out to be the optimal portfolio, particularly when the spending strategy is to spend a percentage of account value rather than to maintain standard of living.

Returning to Table 1, it is perhaps surprising that the most conservative portfolio in the group consists of 50% Large Cap Stocks and 50% Intermediate-term Government Bonds. This portfolio is in fact the most conservative portfolio of any optimized portfolio in this study. The idea that the retiree should be, at a minimum, 50% in equities is in itself somewhat surprising.

Another surprising outcome of all the cases is that Corporate Bonds and Long-term Government Bonds do not factor into any of the optimized portfolios, not in Table 1 or in any of the tables. Also, US T-Bills only appears in one portfolio, the 90% success rate portfolio of Table 1, and then only at an allocation of 6.5%. Far and away, Large Cap Stocks dominate the list of optimized portfolios, with Intermediate-term Government Bonds playing a complementary role in less than half of the optimized portfolios.

Ending Value Goal: Maintain Original Value

In this section the results become more interesting. With the goal to end the 30 years with one million dollars still in the account (not adjusting for inflation), both spending strategies can be run to determine which might be preferable.

In Table 2, the retiree is looking to spend at a rate to maintain standard of living with each year's withdrawal, while at the same time, end the 30 years with $1 million still in the account. Not surprisingly, compared to the "Don't Go Broke" goal in Table 1, the retiree in the present case must lower his initial withdrawal amount in order to have some money left in the account at the end of the time frame. What is surprising, perhaps, is the modest degree by which the retiree needs to lower the initial withdrawal amount to achieve the higher ending value goal.

Table 2 – Maintain Original Value, Spend to Maintain Standard of Living

HSR	MSR	AVG Spent	AVG EV	Allocation	Worst TF	Overdrawn in … yrs
50%	6.52	$3.6	$2.7	99% L, 1% IG	1969-1998	13
75%	4.66	$2.6	$3.3	70% L, 30% IG	1969-1998	22
90%	4.18	$2.3	$4.3	68% L, 32% IG	1966-1995	28
100%	3.80	$2.1	$4.3	60% L, 40% IG	1966-1995	n/a

See the section at the end of this paper entitled Abbreviations for the meanings of column headings.

Consider the 100% success rate rows from Tables 1 and 2. In Table 1, the maximum sustainable withdrawal rate is 4.03%, a scant 6% higher than the 3.80% MSR from Table 2. What is the payoff, in terms of ending value, for this lower initial withdrawal? Remarkably, the average ending value in Table 2 is 59% greater than in Table 1, $4.3 million versus $2.7 million. Stated another way, the retiree who sacrifices $2,300 of spending money in year 1 ends up with, on average, $1.6 million dollars more in the account at the end of the 30-year horizon! Over the 30 years, the second retiree spends about $100,000 less than the first retiree, yet has a surplus in the account of $1.6 million.

What accounts for this huge difference in ending values? Three things:

1. The $2,300 left in the account in year 1 is able to compound for 30 years, resulting in a surplus of about $30,000, on average, at the end of 30 years.

2. Each year after the first year, the second retiree withdraws between $2,000 and $4,000 less than the first retiree. This extra money in the account also grows for the second retiree, although for not as long as the original $2,300.

3. Most importantly, the optimal portfolio for the second retiree is 10% heavier in Large Cap Stocks, being composed of 60% L/40% IG as compared to 50% L/50% IG for the first retiree.

While the first two factors account for about $600,000 difference in ending values, the change to the more aggressive portfolio accounts for about $1 million of the difference. The shifting of 10% of the portfolio from Intermediate-term Government Bonds to Large Cap Stocks has the net effect, on average, of re-claiming the entire amount of the original investment. The point is clear: Relatively minor changes in portfolio aggressiveness and spending strategies can result in significant differences in ending values.

Up to now the discussion has only considered the spending strategy whereby the retiree spends in such a way as to maintain standard of living throughout the 30-year retirement horizon. In Table 3, however, we consider an alternative spending strategy, namely, that of withdrawing a fixed percentage of the value of the account each year.

Table 3 – Maintain Original Value, Spend Percentage of Account Value

HSR	MSR	AVG Spent	AVG EV	Allocation	Worst TF	Worst EV
50%	9.76	$3.1	$1.2	100% L	1929-1958	$0.53
75%	9.21	$3.2	$1.4	100% L	1929-1958	$0.63
90%	8.63	$3.3	$1.7	100% L	1929-1958	$0.77
100%	7.81	$3.5	$2.2	100% L	1929-1958	$1.0

See the section at the end of this paper entitled Abbreviations for the meanings of column headings.

As discussed earlier, this spending strategy replaces one risk with another. In particular, the retiree no longer risks running out of money, but instead risks a diminishing standard of living.

In comparing Table 3 to Table 2, some points immediately stand out:

1. The maximum sustainable withdrawal rate is substantially higher, climbing (in the 100% MSR case) from 3.8% in Table 2 to 7.81% in Table 3. In planning to spend a percentage of account value (rather than planning to maintain standard of living) the retiree can spend substantially more in the early years of retirement and still feel it reasonable that the ending value goal will be reached.

2. The total amount spent is, on average, higher in Table 3 than in Table 2 for all success rates except the 50% HSR.

3. The ending value is, on average, about half in Table 3 what it is in Table 2. This makes sense—spend less now and have more later, or spend more now and have less later.

4. The optimal allocation for all portfolios in Table 3 consists of 100% Large Cap Stocks. It is a bit surprising that, even in the 100% HSR case, the portfolio consisting of 100% Large Cap Stocks is the optimal portfolio, allowing the highest MSR, and able to end the time frame with a minimum of $1 million in the account, even in the worst case.

More needs to be said about point 3. As is the case with many things in life, a sacrifice early on often leads to rewards down the road. The question for the retiree is, When do you think you will want to (or need to) spend the most money, now or later? Some will prefer to spend more early in retirement, when their health and energy level allows them to travel and be active. Others will feel they should save as much as possible, either for that rainy day or for their heirs. The choice of spending strategy and asset allocation must be made with the retiree's personal goals (both immediate and long-term) in mind.

Ending Value Goal: Maintain Buying Power

In this section the retiree's goal is to end the 30 years with the buying power of one million dollars still in the account. Compared to the two prior ending value goals, this goal of maintaining buying power places an increased demand on the ending value, and naturally requires reduced spending and more aggressive portfolios.

Table 4 considers the case in which the retiree seeks to spend at a pace to maintain standard of living, while at the same time leaving enough in the account so as to maintain the buying power of the original million dollars. This is asking a great deal of a retirement account, with the effects being considerably lower spending rates.

Table 4 – Maintain Buying Power, Spend to Maintain Standard of Living

HSR	MSR	AVG Spent	AVG EV	Allocation	Worst TF	Overdrawn in … yrs
50%	5.91	$3.2	$4.1	100% L	1969-1998	14
75%	4.16	$2.3	$9.2	100% L	1929-1958	23
90%	3.43	$1.9	$10.2	91% L, 9% IG	1929-1958	*
100%	2.98	$1.6	$13.7	100% L	1929-1958	**

See the section at the end of this paper entitled Abbreviations for the meanings of column headings.
** Worst ending value was $1.7 million.*
*** Worst ending value was $2.4 million.*

First and foremost, the numbers that stand out in the above table are the average ending values. In the case of 100% historical success, the average ending value is $13.7 million. Compare that with an average ending value of $4.3 million in Table 2. The difference in ending value results from three factors:

1) The initial withdrawal is $8,200 less in Table 4 as compared to Table 2. This money remains in the account and compounds for 30 years, resulting in a surplus of about $200,000, on average, at the end of 30 years.

2) Each year after the first year, the retiree in Table 4 withdraws between $8,000 and $20,000 less than the retiree in Table 2. This extra money remains in the account and compounds, although for not as long as the original $8,200.

3) Most importantly, the retiree in Table 4 uses a more aggressive portfolio. In Table 4, the portfolio consists of 100% Large Cap Stocks. Compare that with the 60% L/40% IG mix from Table 2.

While the first two factors account for about $2.1 million difference in ending values, the change to the more aggressive portfolio accounts for about $7.3 million of the difference. This points to the huge importance of asset allocation when designing the retirement plan. Clearly, not every retiree would be comfortable putting 100% of their retirement savings in a Large Cap Index vehicle. In fact, very few would be comfortable with such a strategy. Yet, historically, this has produced the best results.

The reason the more aggressive portfolios are optimal in this study is mostly a result of the length of the investment horizon, namely, 30 years. Shorter horizons, such as 15 or 20 years, would surely call for more conservative portfolios. Yet, the point must be made: Retirees with very long investment horizons should seriously consider the more aggressive portfolios. Once that decision is made, the difficult part becomes staying aggressive, even when stocks are being hit hard as they are today. If the retiree loses the conviction to stay aggressive, the result may be that of riding through some tough times for stocks, only to shift to a more conservative portfolio just as stocks are recovering. That would indeed be problematic.

Our final table of results, Table 5, shows the maximum sustainable spending rates in the case where the spending strategy is to spend a percentage of account value each year, and the ending value goal is to leave enough in the account so as to maintain the buying power of the original million dollars. As with Table 4, the goal of ending the 30 years with the buying power of the original $1 million intact places a heavy burden on the account. Consequently, spending rates fall.

Table 5 – Maintain Buying Power, Spend Percentage of Account Value

HSR	MSR	AVG Spent	AVG EV	Allocation	Worst TF	Worst EV
50%	6.45	$3.7	$3.4	100% L	1929-1958	$1.6
75%	5.06	$3.8	$5.3	100% L	1929-1958	$2.4
90%	4.55	$3.8	$6.3	100% L	1929-1958	$2.8
100%	4.16	$3.7	$7.1	100% L	1929-1958	$3.2

See the section at the end of this paper entitled Abbreviations for the meanings of column headings.

The same points that apply when comparing Tables 2 and 3 apply now. Summarized, those points were that the standard-of-living approach require lower initial withdrawal amounts, and provide lower overall withdrawal totals, but compensate the retiree with higher ending account values, sometimes substantially higher.

Also, it must emphasized, that for the 50 and 75% HSR levels, the standard-of-living approach has time frames in which the account becomes insolvent before the 30 years are up (in the 14th year in the case of 50% HSR, in the 23rd in the case of 75% HSR). The point is that the standard-of-living approach runs the risk of running out of money before the time frame is up, a risk the percentage-of-value approach does not have. In exchange, the percentage-of-value approach risks a reduction in standard of living, whereas the standard-of-living approach, by definition, does not.

There is an interesting phenomenon in the average amount spent by each of the HSRs in Table 5. The average amount spent, regardless of initial withdrawal amount and historical success rate, is between $3.7 and $3.8 million. The explanation for this is that the retirees who withdrew less in the beginning are rewarded with greater account values later, and hence increasing withdrawal amounts as the time frame progresses.

Also interesting is the amount by which the ending values vary, from a low of $3.4 million (when the initial withdrawal percentage is 6.45%) to a high of $7.1 million (when the initial percentage is 4.16%). The retiree who can sacrifice up front, by spending a lower percentage of initial account value, might be able to spend just as much over the 30 years, with the advantage that the ending value might be significantly greater than that of the retiree who spends more up front.

Final Remarks

First and foremost, the author wishes to make clear that this paper is not intended as advice. While history is interesting, and often educational, it is not predictable. Strategies that have worked 100% of the time historically may not work during a current or future 30-year time frame. Please seek the counsel of a retirement specialist before choosing a retirement portfolio or spending policy.

Regarding spending strategies, there is no clear right or wrong strategy. Some retirees will want to plan in terms of spending to maintain standard of living, some in terms of a fixed percentage of what is available in the account. The advantages of the standard-of-living approach are that 1) the retiree's withdrawal amounts are more predictable, 2) ending account values are generally higher and 3) there is no risk that standard of living will decline. The advantages of the percentage-of-value approach are 1) higher initial withdrawals, 2) greater total withdrawals over the time frame and 3) virtually no risk of running completely out of money before the time frame is up.

Regarding portfolio composition, when the investment horizon is long, as it was in this study (30 years), the retiree should consider adding stocks to the portfolio, perhaps in the range of 50% or more. Such a high reliance on stocks would keep some retirees awake at night, worrying they will lose a large percentage of their nest egg in a single, cataclysmic event. Clearly, the idea of a stock-heavy portfolio is not right for everyone. If, however, the retiree believes the stock market will always recover from such events, and if the retiree is willing and able to weather the tough times, then a portfolio heavy in stocks might be the best one.

Much research remains to be done on this subject. One idea for future research is to include other asset classes, such as real estate and foreign investments, into the equation. Another idea is to test more complex spending strategies. For example, a cash holding account could be set up to hold an amount of cash equal to the expected spending needs of some period of time (maybe 3 months to 5 years). The retiree would then move funds from the investment account to the cash account when desired, offering an opportunity and possibility for the retiree to time the market.

Another future research topic is the study of investment horizons other than 30 years. Shorter time frames would likely require lower withdrawal rates and more conservative portfolios. An interesting study would be to run the same analysis as employed in this paper for time frames of, say, 10, 20 and 40 years.

A research paper of this kind cannot hope to answer every retirement question for every retiree. Some very important parameters, such as income taxes and account fees, were not even considered. Again, the author recommends the retiree either self-educate about retirement issues or obtain the services of a retirement specialist.

Abbreviations

To shorten the printed text, and to make formatting of tables easier, the following abbreviations have been used:

Abbreviation	Term	Explanation
HSR	Historical success rate	There are 47 30-year time frames from 1926 to 2001. They are 1926 to 1955, 1927 to 1956, …, 1972 to 2001. Each strategy is run for each time frame. When the goal is reached at the end of the 30 years, that time frame is marked as a success. The number of successes divided by the number of time frames (47 in this case) is the historical success rate.
MSR	Maximum sustainable spending rate	The maximum amount of money that can be withdrawn the first year, as a percentage of account value, such that, given the spending strategy and asset allocation, the retiree achieves the ending value goal in enough time frames so as to achieve the desired HSR.
EV	Ending Value	The value of the account at the end of the 30-year time frame.
TF	Time frame	A specific 30-year period. For example, 1926-1955 is the first time frame in every case; 1972-2001 is the last time frame. There are 47 30-year time frames from 1926 to 2001.
AVG	Average	Average amount of money spent (AVG Spent) for all time frames and average ending value (AVG EV) for all time frames. Both of these values are shown in millions in the tables.
L	Large Cap Stocks	Indexes from Ibbotson and Associates.
IG	Intermediate-term Government Bonds	
LG	Long-term Government Bonds	
CB	Corporate Bonds	
T	US T-Bills	