What's a reasonable withdrawal rate when living off savings? A look at how various withdrawal rates would have fared based on past market returns provides a useful guide.

Retirement Savings: Choosing a Withdrawal Rate That Is Sustainable

By Philip L. Cooley, Carl M. Hubbard and Daniel T. Walz

Most investors who plan for retirement eventually confront the question of how much money they should plan to withdraw annually from their investment portfolio. The dilemma is that if they withdraw too much, they prematurely exhaust the portfolio, but if they withdraw too little, they unnecessarily lower their standard of living.

Financial planners, counselors, analysts, and writers stand ready to advise investors on their dilemma, but their advice varies greatly, ranging from investing in common stocks and spending the dividend yield (roughly 3%), up to 7%, which allows for the invasion of principal. Highly risk-averse investors would likely gravitate toward the low end of the range because of their concerns about outliving their portfolio. Moreover, the larger the percentage of a retiree's total income provided by the portfolio, the more risk-averse the retiree is likely to be. In addition, some retirees wish to bequeath a large estate to their heirs, which again argues for a low withdrawal rate. In contrast, an aggressive investor without heirs might wish to plan a financial future based on a high withdrawal rate. Because of these highly personal behavioral traits, circumstances, and goals, no single withdrawal rate appears appropriate for every investor.

What, then, can be done to help an investor in planning for a withdrawal rate? The word *planning* is emphasized because of the great uncertainties in the stock and bond markets. Mid-course corrections likely will be required, with the actual dollar amounts withdrawn adjusted downward or upward relative to the plan. The investor needs to keep in mind that selection of a withdrawal rate is not a matter of contract but rather a matter of planning. Thus, the question addressed here is: What is a reasonable withdrawal rate from a portfolio for purposes of planning retirement income? Or stated differently, what withdrawal rate is likely to be sustainable during a specified number of years?

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To help in the selection of a withdrawal rate, the following sections provide information on the historical success of various withdrawal rates from portfolios of stocks and bonds. If a withdrawal rate proves too high based on historical year-to-year returns, then it seems likely that the rate will not be sustainable during future periods. Conversely, historically sustainable withdrawal rates are more likely to have a high probability of success in the future.

Using Historical Experience as a Guide

One approach to examining withdrawal rates is based on present value analysis and historical average rates of return. For example, if a portfolio earns 3.7% per year, the historical average return on U.S. Treasury bills, withdrawals of 6% per year can be maintained for about 26 years before exhausting the portfolio. For a $1 million portfolio, that works out to an annual income of $60,000 for 26 years. Similar exercises can be conducted for portfolios of large-company common stocks and long-term corporate bonds, which have produced annual compound rates of roughly 10.5% and 5.7%, respectively, during the period 1926 to 1995.

This analytical approach provides useful insights, but it ignores the critical short-term variations in rates of return. For an investor withdrawing assets from a portfolio, these short-term variations can have an impact on the ultimate outcome that is not reflected using long-term averages. This impact is especially significant for portfolios of common stocks, since their returns are highly variable.

An alternative approach to understanding withdrawal rates is to examine historical year-to-year experience. A sustainable withdrawal rate (as a percentage of initial portfolio value) is one that does not exhaust a portfolio of stocks and bonds despite the annual dollar withdrawals during a specified number of years (the payout period). The *portfolio success rate*, a useful concept for identifying sustainable withdrawal rates, is measured by the percentage of all past payout periods supported by the portfolio despite annual withdrawals. Presumably, a withdrawal rate

that has worked well over the long-term past is likely to work well in the future.

Our study measured the impact of withdrawal rates on portfolio values using the following approach:

- Annual withdrawal rates ranged from 3% to 12%. This wide range contains withdrawal rates of interest to most investors and will clearly show their impact on the portfolio success rate.
- The payout periods examined were 15 years, 20 years, 25 years, and 30 years. These payout periods are consistent with the life expectancy of most retirees.
- The portfolio allocations examined were: 100% stocks; 75% stocks/25% bonds; 50% stocks/50% bonds; 25% stocks/75% bonds; 100% bonds. The Standard & Poor's 500 index was used to represent stocks, and long-term, high-grade corporate bonds were used to represent bonds. (All stock, bond, and inflation data were from "Stocks, Bonds, Bills, and Inflation, 1996 Yearbook," Ibbotson Associates, 1996).
- The study did not adjust for taxes or transaction costs. An investor's own experience would differ depending on how much of his assets were in tax-deferred accounts, and the extent to which transaction costs could be held to a minimum using low-cost index funds.
- Historical annual return data were used to calculate ending portfolio values after annual dollar withdrawals; the annual dollar withdrawals are based on a first-year withdrawal rate that is a percentage of the initial portfolio value. For instance, for a 100% stock portfolio with a 15-year payout and a 3% initial withdrawal rate, the amount remaining after the payout period was determined at the end of the first 15-year period (1926 to 1940), the second 15-year period (1927 to 1941), etc. The *portfolio success rate* in the study is the percentage of all past payout periods supported by the portfolio (where the ending value exceeds $0). [For those more technically inclined, an illustration of the algorithm used can be found at the *AAII Journal* Web site at www.aaii.com.]

Portfolio Success Rate

The portfolio success rate responds to the variously ex-

Table 1.
Portfolio Success Rates: 1926 to 1995
(Percentage of all past payout periods supported by the portfolio)

	Withdrawal Rate as a % of Initial Portfolio Value:									
Payout Period	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**	**11%**	**12%**
100% Stocks										
15 Years	100	100	98	98	93	91	88	77	63	55
20 Years	100	98	96	94	92	84	73	61	47	43
25 Years	100	98	96	91	87	78	70	50	43	35
30 Years	100	98	95	90	85	78	68	54	49	34
75% Stocks/25% Bonds										
30 Years	100	98	95	90	85	78	68	54	49	34
15 Years	100	100	100	100	96	95	91	79	63	46
20 Years	100	100	100	96	94	88	71	51	41	33
25 Years	100	100	98	96	91	78	57	46	33	26
30 Years	100	100	98	95	88	73	54	46	37	24
50% Stocks/50% Bonds										
15 Years	100	100	100	100	100	98	91	71	50	36
20 Years	100	100	100	100	96	88	61	41	25	10
25 Years	100	100	100	98	96	70	43	22	7	0
30 Years	100	100	100	98	90	51	37	15	0	0
25% Stocks/75% Bonds										
15 Years	100	100	100	100	100	100	91	50	21	14
20 Years	100	100	100	100	100	71	24	12	4	2
25 Years	100	100	100	100	78	22	9	0	0	0
30 Years	100	100	100	100	32	5	0	0	0	0
100% Bonds										
15 Years	100	100	100	100	100	79	43	38	14	7
20 Years	100	100	100	96	47	35	16	6	0	0
25 Years	100	100	98	52	26	7	2	0	0	0
30 Years	100	100	51	27	0	0	0	0	0	0

Note: Numbers rounded to the nearest whole percentage. The number of overlapping 15-year payout periods from 1926 to 1995, inclusively, is 56; 20-year periods, 51; 25-year periods, 46; 30-year periods, 41. Stocks are represented by Standard and Poor's 500 index, and bonds are represented by long-term, high-grade corporates. Data source: Authors' calculations based on data from Ibbotson Associates.

Table 2.
Portfolio Success Rates: 1946 to 1995
(Percentage of all past payout periods supported by the portfolio)

	Withdrawal Rate as a % of Initial Portfolio Value:									
Payout Period	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**	**11%**	**12%**
100% Stocks										
15 Years	100	100	100	100	100	100	97	86	69	64
20 Years	100	100	100	100	100	97	81	61	45	42
25 Years	100	100	100	100	100	88	77	46	42	38
30 Years	100	100	100	100	100	90	76	52	52	38
75% Stocks/25% Bonds										
15 Years	100	100	100	100	100	100	100	86	69	53
20 Years	100	100	100	100	100	97	77	48	42	32
25 Years	100	100	100	100	100	85	54	42	31	27
30 Years	100	100	100	100	100	81	52	48	38	29
50% Stocks/50% Bonds										
15 Years	100	100	100	100	100	100	94	78	56	42
20 Years	100	100	100	100	100	94	61	39	26	13
25 Years	100	100	100	100	100	69	38	19	4	0
30 Years	100	100	100	100	100	48	33	10	0	0
25% Stocks/75% Bonds										
15 Years	100	100	100	100	100	100	89	53	25	17
20 Years	100	100	100	100	100	68	23	13	6	3
25 Years	100	100	100	100	73	15	8	0	0	0
30 Years	100	100	100	100	19	0	0	0	0	0
100% Bonds										
15 Years	100	100	100	100	100	72	39	33	19	11
20 Years	100	100	100	94	42	29	23	10	0	0
25 Years	100	100	96	54	15	12	4	0	0	0
30 Years	100	100	48	10	0	0	0	0	0	0

Note: Numbers rounded to the nearest whole percentage. The number of overlapping 15-year payout periods from 1946 to 1995, inclusively, is 36; 20-year periods, 31; 25-year periods, 26; 30-year periods, 21. Stocks are represented by Standard and Poor's 500 index, and bonds are represented by long-term, high-grade corporates. Data source: Authors' calculations based on data from Ibbotson Associates.

pressed problem of an investor running out of money during the retirement years. If an investor's portfolio outlives the investor's planned payout period, then it is counted a success.

Table 1 presents 200 portfolio success rates resulting from different combinations of 10 withdrawal rates, five portfolio allocations, and four payout periods, all based on annual stock and bond returns from 1926 to 1995. The first entry in the table indicates that a 100% stock portfolio supported 100% of all 15-year periods in which annual withdrawals were made based on an initial withdrawal of 3% of portfolio value. The portfolio success rate drops to 98% for a 5% initial withdrawal rate, reflecting the failure of the all-stock portfolio during one of 56 15-year periods (1929 to 1943). Not surprisingly, as the withdrawal rate rises, the portfolio success rate declines.

Continuing with the all-stock portfolio and holding the withdrawal rate constant shows that portfolio success rate usually declines with increases in the length of the payout period—also not too surprising. Because the portfolio success rate declines with increases in withdrawal rates and usually with increases in payout period, the numbers in Table 1 for the all-stock portfolio generally decline proceeding from the upper-left corner to the lower-right corner. The numbers imply that young retirees who anticipate long payout periods should plan on lower withdrawal rates than their older counterparts.

Table 1 also shows the impact of asset allocation on portfolio success rates: there is a general decline in portfolio success rates caused by increases in the percentage of bonds. In contrast to stocks, bonds provide little upside potential, which causes the portfolio success rate to be small or even zero for bond-dominated portfolios at high withdrawal rates. Because of the benefits of diversification, however, the presence of some bonds in the portfolio increases the portfolio success rate for low to mid-level withdrawal rates. For example, for withdrawal rates of 7% and lower, the 50% stock/50% bond portfolio has higher success rates than the portfolios with greater stock allocations for all payout periods.

If history is any guide for the future, then withdrawal rates of 3% and 4% are extremely unlikely to exhaust any portfolio of stocks and bonds during any of the payout periods shown in Table 1. In those cases, portfolio success seems

close to being assured.

For planning purposes, where should an investor draw the line between acceptable and unacceptable portfolio success rates? The answer will vary from investor to investor, but it seems clear that some investors will choose withdrawal rates exceeding the highly conservative 3% and 4% rates.

The Most Recent 50 Years

The portfolio success rates in the preceding section are derived from 70 years of capital market returns generated from 1926 to 1995. The most recent 50 years, frequently described as the post-war period, includes the years 1946 to 1995. Excluding the 20 years from 1926 to 1945 reveals the impact on portfolio success of excluding capital market returns generated during the Great Depression and World War II.

Table 2 presents portfolio success rates based on the methodology used in Table 1 but with the period of analysis limited to 1946 to 1995. In contrast to the 70-year period, the post-war period generally produces higher success rates for portfolios comprising at least 50% stocks. Bond-dominated portfolios, however, show little or no improvement during the post-war period.

If the most recent 50 years of capital market returns are indicative of the future, then investors with stock-dominated portfolios may be quite aggressive in planning withdrawal rates. For a 15-year payout period, withdrawal rates of 8% or 9% appear reasonably sustainable. Many investors, however, require payout periods of 20 years or longer. In those cases, sustainable withdrawal rates fall to the 7% to 8% level.

Whether portfolio success rates during the most recent 50 years are more relevant than those during the 70-year period is debatable. Restricting the analysis to the most recent 50 years excludes not only the bear market of the 1930s, but also the bull markets of the late 1920s and the early 1940s. The longer period provides a larger distribution of returns, which beneficially represents more possible states of the market. On the other hand, some of the economic conditions prevalent in the 1920s and 1930s bear little resemblance to today or the future. Whether Table 1 or Table 2 is more representative of the future is unknown, but both tables provide a richer view of past experience and perhaps future experience as well.

What About Inflation?

One big risk faced by individuals living off their portfolios is inflation. For example, an investor who plans to withdraw $70,000 per year from a $1 million portfolio of stocks and bonds (a 7% withdrawal rate) is likely to experience a decline in purchasing power; if inflation averages 3% per year, then the purchasing power of the $70,000 will be cut in half by the end of 25 years.

One way to plan for the impact of inflation is to adopt a withdrawal rate smaller than the rate of return on the portfolio; that allows the portfolio value to grow annually. If the withdrawal rate is then applied to the growing portfolio value, the annual amount withdrawn will increase.

The formula to determine this assumes a constant rate of return, which produces a constant growth rate for a given retention rate. But the rate of return on a portfolio of stocks and bonds varies substantially each year. Thus, while the formula may be useful on average, it may produce grossly misleading results in many instances.

A richer understanding of sustainable withdrawal rates in the face of inflation can be obtained by analyzing past rates of return and inflation rates. To counteract the effect of inflation, the dollar withdrawal in a given year must be increased by the inflation rate for that year. Similarly, to counteract the effect of deflation (as occurred in 10 of the past 70 years, especially frequent from 1926 to 1932), the dollar withdrawal in a given year must be decreased by the deflation rate for that year. Thus, portfolio value changes from year to year according to market return; withdrawals change from year to year according to the inflation/deflation rate, which maintains purchasing power of the withdrawals.

Table 3 presents portfolio success rates based on the methodology used in Table 1 but with the addition of withdrawals adjusted for inflation and deflation. Immediately noticeable is the dramatic decline in many of the portfolio success rates, especially for mid-level and high withdrawal rates. Despite the adjustment, however, withdrawal rates of 3% to 4% continue to produce high portfolio success rates for stock-dominated portfolios. Even the 5% withdrawal rate produces reasonably high portfolio success rates for all payout periods, but the 6% and 7% rates perform reasonably well only for short payout periods. All withdrawal rates above 7% perform poorly for all payout periods.

Adjusting withdrawals for inflation substantially reduces near-term withdrawals in favor of much larger ones in later years. Whether such adjustments are justifiable depends on investor preferences. Each investor must judge individually which of the possible patterns of consumption produces the most benefit. Because of health considerations, some investors might prefer a consumption pattern tilted toward the early years of retirement. Others might derive more utility from the increased financial security that postponed consumption produces.

A second issue revolves around the inflation/deflation calculation itself. Table 3 presents portfolio success rates that reflect withdrawals adjusted for changes in the Consumer Price Index (CPI). Many economists believe, however, that inflation as measured by the CPI overstates the actual increase in cost of living by 1.0 to 1.5 percentage points per year. If so, then the portfolio success rates in Table 3 are biased downward, especially those for the longer payout periods. Planning for CPI-adjusted with-

Table 3.
Inflation-Adjusted Portfolio Success Rates: 1926 to 1995
(Percentage of all past payout periods supported by the portfolio after adjusting withdrawals for inflation)

	Withdrawal Rate as a % of Initial Portfolio Value:									
Payout Period	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**	**11%**	**12%**
100% Stocks										
15 Years	100	100	100	91	79	70	63	55	43	34
20 Years	100	100	88	75	63	53	43	33	29	24
25 Years	100	100	87	70	59	46	35	30	26	20
30 Years	100	95	85	68	59	41	34	34	27	15
75% Stocks/25% Bonds										
15 Years	100	100	100	95	82	68	64	46	36	27
20 Years	100	100	90	75	61	51	37	27	20	12
25 Years	100	100	85	65	50	37	30	22	7	2
30 Years	100	98	83	68	49	34	22	7	2	0
50% Stocks/50% Bonds										
15 Years	100	100	100	93	79	64	50	32	23	13
20 Years	100	100	90	75	55	33	22	10	0	0
25 Years	100	100	80	57	37	20	7	0	0	0
30 Years	100	95	76	51	17	5	0	0	0	0
25% Stocks/75% Bonds										
15 Years	100	100	100	89	70	50	32	18	13	7
20 Years	100	100	82	47	31	16	8	4	0	0
25 Years	100	93	48	24	15	4	2	0	0	0
30 Years	100	71	27	20	5	0	0	0	0	0
100% Bonds										
15 Years	100	100	100	71	39	21	18	16	14	9
20 Years	100	90	47	20	14	12	10	2	0	0
25 Years	100	46	17	15	11	2	0	0	0	0
30 Years	80	20	17	12	0	0	0	0	0	0

Note: Numbers rounded to the nearest whole percentage. The number of overlapping 15-year payout periods from 1926 to 1995, inclusively, is 56; 20-year periods, 51; 25-year periods, 46; 30-year periods, 41. Stocks are represented by Standard and Poor's 500 index, and bonds are represented by long-term, high-grade corporates, and inflation (deflation) rates are based on the Consumer Price Index (CPI). Data source: Authors' calculations based on data from Ibbotson Associates.

drawals places great demands on the portfolio and requires the investor to reduce the withdrawal rate, perhaps more than necessary. As a result, the investor may forgo more current consumption for future consumption than is necessary to maintain a given standard of living.

Terminal Value

Portfolio success rates provide useful information for the question "Is my portfolio likely to last as long as I do?" A corollary question is: "What is the likely value of my portfolio after making all of those annual withdrawals during my retirement years?" Portfolio value at the end of a payout period, or terminal value, depends on length of the payout period, portfolio composition, and withdrawal rate.

Reflecting the methodology used in Table 1 for calculating portfolio success rates, Table 4 presents terminal values for a $1,000 portfolio (for a $1 million portfolio, multiply by 1,000) after making annual withdrawals. The terminal values are for portfolios containing both stocks and bonds, which exclude the most extreme allocations; and for payout periods ranging from 15 years to 30 years. Based on all past payout periods from 1926 to 1995, the statistical values in Table 4 for each case include the average, the minimum and maximum terminal values, and the median, which is the midpoint value (half of all values are below, and half are above).

As an example, assume a 75% stock/25% bond portfolio allocation, a 7% withdrawal rate, and a 20-year payout. Table 4 shows that the average terminal value for all 51 20-year periods from 1926 to 1995 is $2,435—in other words, after paying out 7% of the initial portfolio value each year for 20 years, the portfolio has $2,435 remaining, presumably to pass on to heirs. The worst 20-year period would have resulted in a terminal value of $0, while the best 20-year period would have resulted in a terminal value of $7,047. The median, or midpoint of all the results, is $2,076, which is smaller than the average and implies a distribution of terminal values that is skewed upward, which is also suggested by the large maximum value.

For stock-dominated portfolios, the median terminal value generally increases as the payout period grows longer, but so does the frequency of a zero minimum. Investors with longer planning horizons potentially will

Table 4.
Terminal Value of a $1,000 Initial Portfolio After All Annual Withdrawals: 1926 to 1995

	75% Stocks/25% Bonds Withdrawal Rate*:				50% Stocks/50% Bonds Withdrawal Rate*:				25% Stocks/75% Bonds Withdrawal Rate*:			
Payout Period	**4%**	**5%**	**6%**	**7%**	**4%**	**5%**	**6%**	**7%**	**4%**	**5%**	**6%**	**7%**
15 Years												
Average	$2,964	$2,631	$2,297	$1,970	$2,285	$1,992	$1,698	$1,405	$1,755	$1,496	$1,236	$977
Minimum	493	249	5	0	855	615	375	135	969	756	542	327
Median	2,727	2,328	1,909	1,543	2,086	1,770	1,472	1,175	1,422	1,198	951	727
Maximum	6,417	5,919	5,421	4,923	5,554	5,103	4,652	4,202	5,321	4,898	4,474	4,051
20 Years												
Average	4,239	3,628	3,026	2,435	2,954	2,449	1,944	1,443	2,026	1,606	1,185	765
Minimum	536	108	0	0	975	587	199	0	1,019	744	451	110
Median	4,481	3,752	2,914	2,076	2,755	2,291	1,798	1,309	1,505	1,164	824	502
Maximum	9,484	8,672	7,859	7,047	7,512	6,769	6,025	5,282	5,965	5,168	4,422	3,746
25 Years												
Average	6,031	4,995	3,991	3,016	3,815	3,007	2,199	1,416	2,307	1,672	1,036	424
Minimum	785	0	0	0	1,340	655	0	0	1,203	736	269	0
Median	5,574	4,483	3,710	2,636	3,568	2,706	2,058	1,381	1,850	1,325	787	200
Maximum	11,534	10,418	9,301	8,185	8,109	6,624	5,138	3,652	6,795	5,492	4,188	2,997
30 Years												
Average	9,031	7,367	5,779	4,262	5,171	3,936	2,712	1,553	2,645	1,724	803	122
Minimum	1,497	0	0	0	2,151	870	0	0	1,428	729	29	0
Median	8,515	6,868	5,586	3,745	5,171	4,041	2,610	1,251	2,245	1,481	806	0
Maximum	16,893	14,980	13,067	11,245	8,423	7,212	6,001	4,790	5,407	3,451	2,080	1,330

**As a percentage of initial value*
Note: Numbers rounded to the nearest dollar. The number of overlapping 15-year payout periods from 1926 to 1995, inclusively, is 56; 20-year periods, 51; 25-year periods, 46; 30-year periods, 41.

have larger terminal values, but without mid-course reductions in the withdrawal rate, in some cases, they will experience higher frequencies of portfolio failure. And, as the percentage of bonds increases, the median terminal value decreases, but the minimum terminal value increases, and the frequency of zeros is reduced.

Conclusion

What is the appropriate annual withdrawal rate from a portfolio during the retirement years?

It is clear from the results in Tables 1 through 4 that the answer depends on the mix of stocks and bonds in the portfolio, a planned payout period, and on a retiree's degree of risk aversion and preferences for consumption patterns. Nonetheless, there are some general conclusions:

- Early retirees who anticipate long payout periods should plan on lower withdrawal rates.
- The presence of bonds in the portfolio increases the success rate for low to mid-level withdrawal rates. However, the presence of common stocks provides upside potential and holds the promise of higher sustainable withdrawal rates. In other words, the addition of bonds helps increase certainty but at the expense of potentially higher consumption. Most retirees would likely benefit from allocating at least 50% to common stocks.
- Retirees who demand CPI-adjusted withdrawals during their retirement years must accept a substantially reduced withdrawal rate from the initial portfolio. For retirees with significant fixed costs and for those who tend to spend less as they age, CPI-adjustments will likely cause a suboptimal exchange of present consumption for future consumption.
- For stock-dominated portfolios, withdrawal rates of 3% and 4% represent exceedingly conservative behavior. At these rates, retirees who wish to bequeath large estates to their heirs will likely be successful. Ironically, even those retirees who adopt higher withdrawal rates and who have little or no desire to leave large estates may end up doing so if they act reasonably prudent in protecting themselves from prematurely exhausting their portfolio. Table 4 shows large expected terminal values of portfolios under numerous reasonably prudent scenarios that include withdrawal rates greater than 4%.
- For short payout periods (15 years or less), withdrawal rates of 8% or 9% from stock-dominated portfolios appear to be sustainable. Since the life expectancy of most retirees exceeds 15 years, however, these withdrawal rates represent aggressive behavior in most cases. By definition, you have a 50% chance of living beyond your actuarially determined life expectancy, so it is wise to be conservative and add a few years.