Optimum Withdrawals from An Asset Pool

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This paper examines and defines maximum initial percentage cash withdrawals from asset pools that have structured time horizons, desired ending value of the portfolios, various portfolio asset allocation parameters and a specific confidence level of success.

In this analysis we examine two withdrawal methodologies: (1) maintaining a fixed annual cash flow and (2) adjusting each subsequent year by the prior period's inflation rate. Finally, we examine three ending values of the asset pool. In addition, we strive to define the worst-case scenario in which the asset pool falls to zero, a scenario that maintains its original value and a scenario where the asset pool is increased (by the underlying inflation rate).

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A problem often experienced by planners and retirees, and sometimes by institutions, is the issue of calculating optimum cash outflows from retirement plans, self-insurance programs, defined benefit plans or endowments. The current standard is to assume values for the variables (rate of return of the assets, inflation or increased valuation rates, an assumed withdrawal rate) and determine through calculations if all the assumptions will work. If the original assumptions aren't financially practical, then either the withdrawal will be adjusted downward, the expectant inflation rate will be adjusted, or the rate of return of the assets will be adjusted. A series of adjustments persist until all the parameters are met. We refer to these values as "average assumed values."

In reality, withdrawals from an investment fund rarely behave in a "normal" average fashion. The ongoing cash flows, usually increasing each year by some inflating factor, coupled with changing market value fluctuations, create an overall portfolio situation that is difficult to solve by the use of "average values." To begin to understand how the process works, we need to start with the concept of internal rates of return, or as they are sometimes referred to, dollar-weighted rates of return. Ultimately, the final value of the assets is a function of the cash flows on the ever-changing value of the asset pool. The impact of this analysis is that in any number of situations, the "average rate of return" analysis will give one a signal of safety; however, in the real world, varying asset values and changing cash flows will prove to be inadequate. In other words, the asset pool will run out of money too soon or may not keep up with inflation. In our analysis, we do not use internal rates of return directly, as we have no idea what they will be until after the fact. The internal rate of return is a by-product of the final answer and is only calculated on a year-by-year basis.

Five Common Variables

In the study, we assume that optimum portfolio cash flows are indeed affected by five common variables. Our findings concluded that these variables not only have an impact on the life of the funding, but also on (1) the timing of the withdrawals and (2) the determination of "optimum" withdrawal amounts. With respect to the optimum withdrawal amount, we are trying to identify the largest percentage that can be withdrawn from a fund at the plan's inception. Once this is established, the focus then is whether the goal of the plan is to keep up with inflation, keep the principal constant or spend it down to zero. The variables that will set these parameters and, in turn, govern the life of the fund, are as follows:

- Amount of annual withdrawals
- Time horizon
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- Desired ending value of the portfolio
- Portfolio asset allocation
- Desired level of assurance

In the study, we have held the last four variables constant. The focus then is to solve for the amount of annual withdrawals. This amount will be determined as to the first year of withdrawals, with the subsequent cash flows determined by each of the other variables we have held constant.

As you might imagine, each variable has the ability to independently affect the success of the plan and should be considered within a portfolio context. Each factor could provide for multiple scenario analyses, including the construction of an asset allocation, or an efficient frontier. As with any portfolio construction, there is a multitude of strategies available for developing the allocation in order to fund withdrawals from an account. The common methods of calculating these cash disbursements generally fall into four categories:

1. Withdraw a constant dollar amount each year
2. Increase each successive period's withdrawal by a fixed amount
3. Increase each successive period's withdrawal by an inflation (deflation) factor
4. Withdraw a fixed percentage based on each year's asset market value

The appeal of constant dollar withdrawals is simplicity, with constant withdrawals conservative and predictable. The weakness, however, is that there is no attempt to maintain buying power, making this approach unsuitable for most applications.

A less conservative approach is to increase each successive period's withdrawal by a fixed amount. This is again a very predictable system and allows for quick calculations of future withdrawals. As with constant-dollar approaches, the issue here is that the periodic cash flows generally do not keep up with inflation.

The one approach we see most often cited in studies is increasing each year's withdrawal amount by the preceding year's inflation (deflation) index. While the downside is a lack of predictability (due to changing indices), this approach does provide for maintaining constant purchasing power.

Where the prior three approaches ignore the performances of the underlying fund, withdrawals based on a fixed percentage of the asset market value incorporate this growth (loss) in the account. The primary advantage of such an approach is the concept that an asset pool will never go broke, at least not completely. For example, if you withdraw ten percent from $100, you spend $10 and leave $90 in the asset pool. Subsequently, in the following year, if you spend another ten percent (and the size of the asset pool is unchanged) you spend $9 and leave $81. If the asset pool never varies in returns, you would be able to withdraw funds for many years to come, although the magnitudes of the withdrawals will continually shrink. Thus, the approach of spending a fixed percentage of each year's asset pool value trades one type of risk for another—liquidity versus market risk.

Incorporate Cash-Flow Requirements

In reality, one generally can specify the time frame for a plan withdrawal. This horizon then allows the plan trustee to incorporate the cash-flow requirements into the plan itself. As we mentioned, one plan goal may be to withdraw funds until the plan is depleted at a specified time, or leave some remaining funds for future endeavors. A corporate or nonprofit spending policy probably would want to provide for some remaining liquidity and possibly even want to increase the fund's ending value. Assuming this time frame is known, we can now solve for an initial amount to begin the withdrawal. In Tables 2 through 7, we show that the methods used to dictate final portfolio values do significantly affect the spending amount over time.

For the sake of simplicity, if we assume a particular withdrawal rate, there will be three basic methods for analyzing the final portfolio, which again encompasses the basic parameters of the spending policy:

1. Allowing the corpus to go to zero, or essentially depleting all assets. This is what a retiree would most likely want to explore. The problem is estimating the correct time frame.
2. Establishing withdrawals such that the corpus does not lose its principal value at the end of the time frame. This would be like a bond purchase that matures in, say, 20 years. You would receive the bond coupon for 20 years and then the bond would be redeemed at par value. One twist to this strategy would be to try to increase your coupon at a predetermined rate, or maybe at the inflation rate.
3. Withdrawing from the corpus while allowing it to increase at the predetermined rate (normally inflation) so that a positive fund value would be available at the end of the funding period. This is the best of all worlds, but as you will see, the amount of funding or spending goes down dramatically over other strategies.

Undoubtedly, one of the more critical determinants affecting the withdrawal plan is the asset allocation decision. However, there are several allocation strategies that may be adapted to each client’s needs. While we have created a number of unique alternative allocations, most may not achieve the plan objective. These individualized asset allocations are touched on in the accompanying tables. In this paper, we have focused on presenting scenarios where there was the highest degree of assurance that the chosen asset allocation achieved the maximum initial spending amount while still demanding success for all tested time frames. Granted, previous performances will not guarantee future returns of a portfolio, but by testing all possible return outcomes for a given allocation, we increase our level of confidence regarding the outcome. If, for instance, we test the past 54 overlapping 20-year periods and they all pass, then there is a high confidence level that the same allocation for the next 20-year periods will continue to provide positive results.

In completing this analysis, we have relied on the Ibbotson Associates data for large capitalized stocks (large-cap), small capitalized stocks (small-cap) and intermediate government bonds (IG) from 1926–1998 (Appendix 1). The study used intermediate government bonds as the only fixed-income vehicle because past studies have shown that this entity offered the best fixed income vehicle for most applications within the fixed income vehicles available in the Ibbotson Associates 1926–1998 study. In each example found in Tables 1–6, rolling time periods of 10, 15, 20, 25 and 30 years are indicated in the charts. These rolling periods are observed for the time frames beginning in 1926 and ending in 1998. During this time frame, we identified 64 individual 10-year time periods; 59 individual 15-year time periods; 54 individual 20-year time periods; 49 individual 25-year time periods and 44 individual 30-year time periods.

Throughout the study, we also have held two assumptions constant: namely, the performances of the assets are measured by total return only (that is, income and capital appreciation of the assets are combined) and there are no tax implications within the model. The former assumption is due to the massive amount of historical total return data that would require dissecting, while the latter assumption recognizes that multiple tax scenarios exist for individuals or institutions. These are certainly issues that would require a more detailed analysis depending on the situation. One final comment regarding these studies is the assumption that all portfolios are rebalanced annually.

TABLE 1

Portfolio Ending Market Value Will Be Greater Than Zero Based On...

History of Large Caps: 1926–1998, Fixed Amount Each Year

Years	100% L	75% L, 25% IG	50% L, 50% IG	25% L, 75% IG	100% IG
10	6.18	7.79	9.39	10.89	10.62
15	4.52	5.77	6.99	8.06	7.34
20	3.92	4.96	5.92	6.70	5.78
25	3.65	4.56	5.35	5.90	4.89
30	3.55	4.39	5.06	5.42	4.30

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TABLE 2

Portfolio Ending Market Value Will Be Equal To or Greater Than Original Corpus Based On...

History of Large Caps: 1926–1998, Fixed Amount Each Year

Years	100% L	75% L, 25% IG	50% L, 50% IG	25% L, 75% IG	100% IG
10	–0.57	1.09	2.56	3.16	1.24
15	0.41	1.62	2.69	3.52	1.43
20	1.79	2.61	3.25	3.60	1.58
25	2.78	3.44	3.85	3.84	2.02
30	3.24	3.91	4.27	4.09	2.09

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TABLE 3

Portfolio Ending Market Value Will Be Equal To or Greater Than Inflation-Adjusted Original Corpus Based On...

History of Large Caps: 1926–1998, Fixed Amount Each Year

Years	100% L	75% L, 25% IG	50% L, 50% IG	25% L, 75% IG	100% IG
10	–6.00	–3.81	–2.54	–3.01	–5.52
15	–0.83	–0.56	–0.56	–1.17	–3.81
20	0.93	1.10	0.67	–0.01	–3.16
25	2.28	2.79	2.79	1.47	–1.58
30	3.03	3.58	3.73	2.14	–1.74

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Understanding the Process

To understand the process, begin with Table 1. If you follow across the row along the 20-year time frame, the table indicates a withdrawal strategy based on maintaining a market value greater than zero. In this example, a portfolio of 100 percent large cap stocks would allow you to withdraw 3.92 percent a year over a 20-year time frame, or $39,200 based on a fund of $1 million. Given the data in the table, if the fund contained 25 percent large cap and 75 percent intermediate government bonds, the withdrawals can increase to 6.7 percent, or $67,000, based on the same portfolio size.

Tables 2 and 3 provide the same initial withdrawal percentages as Table 1, although the ultimate goal of the portfolio is different. Table 1 requires that the final market value be above zero, Table 2 requires that the final market value would be equal or greater than the original asset value while Table 3 requires that the final market value be equal or greater than the inflation-adjusted original value.

Meanwhile, the guidance under Table 1 indicates the asset allocation necessary to draw down a portfolio, maintaining the final balance at a value above zero. The numbers in each sequence indicate the maximum withdrawal percentage from the first year that will have given the highest probability of success. Negative numbers indicate that there is no possibility of being absolutely successful for any withdrawal amount. The negative amount illustrated in Table 3 indicates the initial amount of money, as a percentage of the portfolio, that would have to be borrowed in order to be even with the ending asset value. The negative number would escalate according to its proposed change in value (constant or increased by inflation).

TABLE 4

Portfolio Ending Market Value Will Be Greater Than Zero Based On…

History of Large Caps: 1926–1998, Withdrawal Increases by Inflation Every Year

Years	50% L, 50% S	37.5% L, 37.5% S, 25% IG	25% L, 25% S, 50% IG	12.5% L, 12.5% S, 75% IG
10	5.82	7.69	8.63	8.62
15	4.38	5.61	6.08	6.22
20	3.93	4.85	5.14	5.09
25	3.67	4.43	4.64	4.43
30	3.55	4.21	4.36	3.94

Source: Calculated by Jaye C. Jarrett & Co. using data presented in *Stocks, Bonds, Bills and Inflation® 1999 Yearbook*,

TABLE 5

Portfolio Ending Market Value Will Be Equal To or Greater Than Inflation-Adjusted Original Corpus Based On…

History of Large Caps: 1926–1998, Withdrawal Increases by Inflation Every Year

Years	50% L, 50% S	37.5% L, 37.5% S, 25% IG	25% L, 25% S, 50% IG	12.5% L, 12.5% S, 75% IG
10	−3.62	−1.77	−0.69	−0.70
15	1.16	1.96	1.69	0.48
20	1.94	2.67	2.65	1.29
25	2.63	3.16	3.16	1.92
30	3.17	3.56	3.31	1.59

Source: Calculated by Jaye C. Jarrett & Co. using data presented in *Stocks, Bonds, Bills and Inflation® 1999 Yearbook*,

TABLE 6

Portfolio Ending Market Value Will Be Equal To or Greater Than Original Corpus Based On…

History of Large Caps: 1926–1998, Withdrawal Increases by Inflation Every Year

Years	50% L, 50% S	37.5% L, 37.5% S, 25% IG	25% L, 25% S, 50% IG	12.5% L, 12.5% S, 75% IG
10	−1.43	0.98	3.07	3.24
15	1.22	2.76	4.06	3.25
20	2.52	3.72	4.41	3.33
25	3.01	4.07	4.28	3.28
30	3.32	4.07	4.17	3.17

Source: Calculated by Jaye C. Jarrett & Co. using data presented in *Stocks, Bonds, Bills and Inflation® 1999 Yearbook*,

APPENDIX 1

Annual Market Indices from Ibbotson Associates, Inc. 1998 Yearbook

SBBI Data Series	Series Construction	Index Components	Approximate Maturity
1. Large company stocks (L)	S&P 500 Composite with dividends reinvested (S&P 500, 1957–present S&P 90, 1926–1956)	Total return, Income return, Capital appreciation return	N/A
2. Small-company stocks (S)	Fifth capitalization quintile of stocks on the NYSE for 1926-1982. Performance of the Dimensional Fund Advisors (DFA) Small Company Fund 1982–Present.	Total return	N/A
3. Long-term corporate bonds	Salomon Brothers Long-Term High Grade Corporate Bond Index	Total return	20 years
4. Long-term government bonds	A-One Bond Portfolio	Total return, Income return, Capital appreciate return yield	20 years
5. Intermediate-term government bonds (IG)	A-One Bond Portfolio	Total return, Income return, Capital appreciation return yield	5 years
6. U.S. Treasury bills	A One Bill Portfolio	Total return	30 days
7. Consumer Price Index	CPI—all urban consumers, not seasonally adjusted	Inflation rate	N/A

Adjust the Withdrawal Rate

Tables 4, 5 and 6 enable the spending policy to adjust the withdrawal amounts by the prevailing inflation rate for the periods, while achieving the stated goals for the ending corpus. Again, look at the row covering a 20-year time frame under large-and small-cap portfolios, Table 4. If the goal of the fund is to maintain a policy that will endow a program for a 20-year period while ensuring the portfolio does not go broke, we can calculate the initial payment based on the asset allocation. For example, if the asset allocation is split equally between large-and small-cap stocks, the initial withdrawal will be 3.93 percent, or $39,300 on a $1 million fund. Each successive year, the amount is increased (decreased) by the inflation index (consumer price index) based on the previous year's rate. Assuming a goal of adjusting both the withdrawal amount and the remaining corpus by inflation, we again can determine the initial withdrawal rate based on the asset allocation. In studying Table 5, if the assets are structured the same—50/50 large-and small-cap stocks—for a 20-year endowment life, the initial percentage withdrawal would be 1.94 percent. Again, the subsequent payments are adjusted for inflation while the corpus is growing by the same inflation rate for the life of the portfolio. Table 6 illustrates the maximum withdrawals available, assuming a goal is to end with a portfolio market value at least equal to the original corpus.

The advantage of this type of evaluation is that you are not restricted to indices to make your analysis. Any portfolio of stocks, mutual funds or other financial assets that have a history of returns can be analyzed. Obviously, the longer the historical time frame available for analysis, the more confident we become with the results. As an example, if we assume fixed amount withdrawal and no concern for the ending principal valuation, withdrawal amounts will increase over shorter time frames. The most stringent withdrawal rule (increase by inflation) and the most stringent final corpus disposition (increase by inflation) produce a withdrawal percentage that increases for longer-period expectations. This, of course, is a great plus for long-term organizations with long-term spending policies that want to increase their spending in the future and also increase the value of the corpus they are spending. One problem, though, is that a spending policy requiring increased funding, along with an increasing corpus value, gets its spending amount decreased for a shorter time frame (see Tables 3, 5 and 6).

Interesting Observations

Given the analytical tools at one's disposal, there are some interesting observations that can be gathered from the accompanying tables.

1. The results presented in Tables 1 through 6 represent a high level of confidence regarding the withdrawal

and final corpus value based on the worst-case possibilities over the time frames inspected.

2. If we wish to create a portfolio and withdrawal plan with a lesser assurance of success (say, 85 percent success probability), these values can be calculated and offer the opportunity to weigh the risk of increasing the withdrawal rate. A successful retirement/spending policy requires
   a. A thorough understanding of the asset allocation
   b. Annual rebalancing and re-examination of investment objectives and risk tolerance

We have provided no data that uses "assumed" rates of return on the assets or that even uses the "average annual rate of return" for any number of periods. Given our methodology, we can calculate those values and provide cash flow values for each along with our "real market value returns." We have found that there are as many as 15 consecutive 25-year time frames where each "annualized" rate of return of the assets would ensure success, but for each real market experience you would have run out of money before the time frame ended. The problem is that the capital markets generally seldom move in a linear fashion or perform on an "annualized" basis—they experience wide swings, with inflation becoming a counter-productive force on the markets. In essence, if inflation goes up, the capital market goes down and vice versa.

In follow-up studies, we have begun to explore the impact of using international equities, along with two domestic equity indices (S&P 500 and small-cap index). The Europe, Asia, Far East (EAFE) Index is a capital market-weighted index of foreign securities and is recognized as a proxy for foreign investments. As the EAFE Index began in 1970, there are only 29 years of available data. Although the data is more limited in incorporating EAFE performances, international investing is taking a main stage in asset allocation. Given the diversification potential available through this sector of the market, it is critical to include foreign asset performances in future studies. This future study will focus on developing a systematic methodology that would enable participants, plan administrators and trustees to understand how they can manage and mentor the funding programs they administer.