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A Comparative Study of Retirement-Income Bucket Strategies

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Contents

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Abstract

Bucket strategies have been widely referred to in the financial planning and wealth-management industry as a retirement-income management tool to segregate retirement funding based on near-term, intermediate, and long-term needs. There are no well-established guidelines on how to apply these strategies, and current literature on the comparative performance of bucket strategies is limited. This study compares the systematic withdrawal strategy against four retirement-income bucket strategies: the cash flow reserve bucket strategy, two variations of the three buckets strategy, and the time bucket strategy.

Key Takeaways

- The systematic withdrawal strategy, though very simple, has the ability to provide a high plan success rate and ending wealth.
- The cash flow reserve bucket strategy and the two variations of the three buckets strategy underperform the systematic withdrawal strategy because of the opportunity cost of placing the first few years' worth of spending in cash or bonds. With proper decision rules in place, however, the three buckets strategies could be able to handle the ending wealth shortfall risk and provide relatively high growth potential. The primary benefits of these strategies are behavioral. These strategies are best used by investors who are likely to overreact to market volatility.
- The time bucket strategy provides the highest viable retirement spending and ending wealth in our study, along with the largest variation in outcomes because of the high equity concentration in the later phase of retirement. However, this high equity exposure toward the end of retirement could be challenging for some clients. This strategy is best used when an investor is willing to take more risk in exchange for a potential boost to their retirement income. Client education is needed to help the investor understand the risks of high equity exposure in later retirement.

Systematic Withdrawal Strategy

Beginning with Bengen (1994), the systematic withdrawal strategy is commonly used in retirement planning because it is easy to communicate and understand. This strategy assumes investors have a constant equity and bond allocation consistent with the client's risk tolerance (rebalanced monthly in this study). Financial needs are funded every month proportionally from both the equity and bond assets, and the portfolio is rebalanced according to a predefined decision rule. The primary criticism of this strategy is its exposure to sequence risk, which occurs when retirees must liquidate depressed assets in a bad market at the beginning of retirement.

Retirement-Income Bucket Strategies

Bucket strategies have been proposed as a retirement-income management tool in recent decades. The basic idea is to establish multiple asset buckets with different levels of risk and funding purposes. There are several benefits to using bucket strategies. Given clients' mental accounting bias as described by Thaler (1999), bucket strategies consist of multiple "accounts" for different time horizons or financial goals. These buckets align with clients' mental accounts to help ensure consistent behavior in the financial plan. Moreover, the conservative assets earmarked to fund near-term financial needs helps the client avoid panic-selling during market downturns. Finally, by separating assets to fund near-term financial needs and positioned to generate potential long-term capital growth, investors may be more comfortable investing in a risky portfolio that provides the opportunity for higher growth potential.

While bucket strategies may sound like a simple approach, the actual implementation involves several decisions. Exhibit 1 summarizes the major decision points and actions associated with bucket strategies in general. The first step is to determine the number and purpose of each bucket, which in turn determines the asset allocation within each bucket. Pfeiffer and others (2013) propose a cash flow reserve bucket strategy in which one year of retirement spending is placed in a cash bucket and the remaining assets are invested in other buckets, with an asset allocation matched to the client's risk tolerance. Benz (2016A) proposes a three buckets strategy, where Bucket 1 is used to fund the first one or two years of retirement spending, Bucket 2 contains investments to fund five to eight years of retirement spending, and the last bucket is used to fund the remaining years of spending. Reinhard and others (2010) propose a time bucket strategy that divides the portfolio into four buckets that cover equal amounts of retirement periods, and a legacy bucket for bequest and other inspirational goals. For example, clients expecting 30 years in retirement will require four equally divided time buckets to serve their income needs. Pfau (2017) studies a similar time-segmentation strategy. While goal-based investing has become popular in recent years, we have not included a goal-based bucket strategy in this study.

An equally important but overlooked decision is how the assets are maintained after initiation. Essentially, the question is whether the underlying assets roll over when the first bucket is depleted. In the strategies described by Reinhard and others (2010), the first bucket is fully depleted before the next bucket takes over. In the strategies described by Pfeiffer and others (2013) and Pfau (2017), the first bucket, usually containing cash or other conservative assets, always funds near-term spending needs.

This income bucket is refilled periodically based on a certain decision rule, which can be categorized according to Benz (2016B) and Pfau (2017) as:

- Automatic refill approach. The first bucket is refilled automatically at the beginning of each period. The assets in the other buckets will be liquidated regardless of their past performance. Although easy to implement, this approach could be subject to sequence risk. One example is a plain-vanilla systematic withdrawal strategy. Without additional decision rules, depressed assets could be liquidated to fund the spending.
- Income approach. Only the income harvested from the portfolio will be used to refill the first bucket. While this approach avoids sequence risk, the preservation of the asset balance might not align with the client's financial objective. This is especially true when the income produced by the current portfolio is not sufficient to support near-term spending needs. This approach needs to be combined with other approach(s) to refill the buckets.
- Rebalancing approach. In this approach, the first bucket is refilled by the proceeds from rebalancing. When the proceeds are insufficient, assets can be liquidated to fill the gap. Benz (2006B) proposes a "strict constructionist total return" approach, where the assets within each bucket are positioned to grow in a total-return manner. Appreciating assets are rebalanced and fill the first bucket. Alternatively, this rebalancing approach can be combined with the income approach above, where the combination of dividends, interest income, and rebalancing proceeds from capital gains are used to refill the first bucket.
- Market-based (or opportunistic) approach. Refilling each bucket involves consideration of market-timing. For example, Pfeiffer and others (2013) only refill the cash bucket when at least one of the asset classes' prior year's returns is positive and when the cash bucket balance drops below two months of spending. However, tax-loss harvesting strategies could justify the liquidation of worst-performing assets. This approach can be combined with the rebalancing approach as an additional decision rule for bucket refilling.
- Personalized approach. Pfau (2017) tests a strategy to refill the bucket only when the current portfolio exceeds the minimum value necessary to fund client goals. The notion is that if the current wealth fails to fund the client's financial goals fully, the assets should stay in the buckets with riskier asset allocation designed to provide quick portfolio recovery and growth.

Financial planners/advisors must decide whether and how to adjust the portfolio asset allocation to match the changing time horizon as their clients move along the financial plan. Similarly, portfolio rebalancing may be needed to properly align the asset allocation to the client's risk tolerance. Pfau (2017) assumes no rebalancing for its risky bucket, arguing that since near-term spending needs are secured in the first bucket, the risk of the other buckets won't matter to the client. By contrast, Pfeiffer and others (2013) propose maintaining a fixed asset allocation through an opportunistic rebalancing scheme, while funding the next year's spending in a cash bucket.

Exhibit 1 Decision Points of Bucket Strategies

Decision	Option 1	Option 2	Option 3
Number of buckets, purpose, and initial asset allocation	One cash flow reserve (CFR) bucket for near-term spending and the rest in a portfolio in a total-return bucket.	One bucket for the first one or two years of spending, second bucket for the next five to eight years of spending, third bucket for the remaining years of spending.	Each (time) bucket is created to fund the financial needs in different time periods.
Size and asset in each bucket	Use later buckets to retire former buckets while the underlying assets remain in the original buckets.	The first bucket remains and is refilled by the following rules: automatic refill; income approach; rebalancing approach; market-based/opportunistic approach; personalized approach.	N/A
Asset allocation	Update asset allocation based on changing time horizon or glide path	Fixed asset allocation	No adjustment to asset allocation
Rebalancing policy	No rebalance	Rebalance when deviated over a threshold	Market-based/ opportunistic rebalance

Source: Morningstar.

Our Research Agenda

Theoretically, the various options at each decision point outlined in Exhibit 1 can be mixed and matched to form new bucket strategies. Indeed, the actual implementation of bucket strategies does vary significantly among practitioners, and there are no well-established guidelines on how to apply these strategies. For example, a planner creating a time bucket strategy for a 30-year planning horizon can create four buckets, three buckets, or even five buckets based on unique client situations. There is a consensus that the maintenance decision rules are more impactful to the success of bucket strategies than the initial setup of buckets. For example, Kitces (2014) suggests that the typical decision rules implemented by bucket strategies prevent selling depressed equities but fail to buy more, which could lead to a worse outcome than a simple rebalancing approach. Javier (2019) provides further evidence that retirement outcomes vary by equity allocation decisions, bucket-refilling rules, and the initial size of the cash bucket.

According to the existing literature, bucket strategies might not improve retirement income. Pfeiffer and others (2013) compare the cash reserve strategy with the systematic withdrawal strategy. Reinhard and others (2010) compare the time bucket strategy with the systematic withdrawal strategy. Both studies confirm that bucket strategies, when organized properly, outperform traditional systematic withdrawal strategies. However, Pfau (2017) finds that the time bucket strategy underperforms the systematic withdrawal strategy and argues that the benefits of bucket strategies are mainly behavioral. One

difference between Pfau's (2017) two time-segment buckets and the Pfeiffer and others (2013) cash bucket strategy is that Pfau's income bucket is composed of a bond ladder designed to fund the first 10 years of spending, whereas Pfeiffer's cash bucket is intended to fund only one year of spending through very liquid assets. Javier (2019) performs his analysis based on return data from 21 countries and shows that a static strategy with periodic rebalancing outperforms bucket strategies. Tomlinson (2020) does not agree with Javier's (2019) finding but also rejects the claims that bucket strategies offer outperformance.

Like Pfau (2017), much of the current literature indicates that bucket strategies might only possess behavioral benefits. Pfeiffer and others (2013) and Benz (2016A) suggest that bucket strategies provide investor confidence, are easy to communicate, and are better aligned with investors' tendency toward mental accounting. Javier (2019) argues that financial advisors should help their clients overcome their mental accounting biases, and Kitces (2013, 2014) proposes that financial advisors should only report investment holdings in buckets. It is difficult to measure the behavioral benefits. Reinhard et al. (2010) constructed an "emotional-reaction portfolio" where investment assets are relocated to cash when the market drops and returned when equities recover, ultimately leading to worse retirement outcomes. The primary advantage of a bucket strategy then is that investors are less likely to hold an "emotional-reaction portfolio."

Here, we compare the performance of the systematic withdrawal strategy to four types of bucket strategies: the cash flow reserve bucket proposed by Pfeiffer and others (2013); two variations of the three buckets strategy proposed by Benz (2016B), and the time bucket strategy documented by Reinhard and others (2010). We examine the performance with respect to viable spending amount, retirement ending wealth, sensitivity to sequence risk, and investor overreaction.

Case Assumptions

Our performance comparison is based on a simplified client case. We assume that an investment policy statement has been developed as follows:

- Client information: The client expects to retire now, at age 65, with $2 million in financial assets. These assets are placed in a combination of brokerage and tax-deferred accounts.
- Goals and objectives: In addition to retirement spending, the client also wants to fund vacation spending once every year for the first five years of retirement and then every other year for the subsequent five years. The client also plans to fund a grandchild's education. No bequest is made from investment assets before or after the end of the financial plan. Vacation spending has an inflation rate identical to general inflation, while education funding has an additional 3% of inflation on top of the general inflation.
- Return and risk objectives: Both the capacity and willingness to take risk is medium. The client desires portfolio returns consistent with risk tolerance.
- Investment constraints:
    - Time horizon: 30-year retirement horizon.
    - Liquidity needs: Exhibit 2 shows additional cash outflows expected above retirement spending, shown in real dollars terms.

- Tax considerations: The cost basis is assumed to be $0.5 million, which accounts for the tax-deferred retirement savings and asset appreciation during working years. We assume that the client is subject to an ordinary income tax rate of 18% and a long-term capital gains rate of 15%. Interest payments from bond investments and dividends from equities are taxed at the ordinary income tax rate. Capital gains are realized upon portfolio withdrawals and taxed at the long-term capital gains rate.
- No unique circumstances serve as investment constraints.

- Asset allocation: Based on the client's preferences and investment constraints, it is determined that 60% of the investment portfolio is invested in equities and the rest in bonds if a systematic withdrawal strategy is implemented.
- Transaction cost: We assume no transaction cost in portfolio rebalancing and liquidation. This is consistent with the current cost structure in major brokerage firms.

Exhibit 2 Expected Cash Outflow by Month

Expected Cash Outflow	Expected Month
Travel $10,000	Months 1,12,24,36,48,72,98
Education $33,598	Month 120
Education $34,606	Month 132
Education $35,644	Month 144
Education $36,713	Month 156

Source: Morningstar.

Because of variability in the implementation of these bucket strategies, it is necessary to specify the decision rules of each strategy used in this study.

- Benchmark strategy. Similar to the study by Clare and others (2017), we use the simple systematic withdrawal strategy as the benchmark. Financial needs are funded at the beginning of each month proportionally from equities and bonds. This strategy assumes the client has a constant equity and bond allocation that is rebalanced upon the monthly withdrawal. This is a plain-vanilla strategy, as no market-timing or tax-optimization treatment is implemented to improve the financial planning outcome.
- Cash flow reserve strategy. Following Pfeiffer and others (2013), a one-year cash reserve bucket is created. The remainder of the portfolio is invested in a second bucket with an overall asset allocation of 60% equity and 40% bonds. All financial needs are funded through the cash reserve bucket, which is refilled with interest payments, dividend income, and the rebalancing proceeds from the primary portfolio. The portfolio is rebalanced when the deviation of each asset class from its initial position is larger than 5%. The rebalancing proceeds are used to refill the cash reserve bucket only when the previous year's cumulative return of at least one of the two asset classes is positive. Once the cash reserve bucket is refilled to its initial balance, the rest of rebalancing proceeds stay with the primary portfolio. When the cash bucket balance drops below two months' worth of retirement needs, forced

portfolio liquidation is triggered. If the cash bucket balance surpasses 15 months' worth of retirement needs, the cash surplus flows to the asset class with a lower prior-year cumulative return.

- Three buckets strategy A. We follow Benz (2016B) and test two variations of the three buckets strategy. In strategy A, we follow Benz's opportunistic approach. Bucket 1 is filled with cash and used to fund the first year of retirement spending. Bucket 2 invests in long-term bonds and holds funds worth five years of retirement spending. Bucket 3 is filled with equities and set aside for asset growth. The aggregated initial asset allocation will be a function of the annual retirement spending. The monthly interest payments and dividends income from Bucket 2 and Bucket 3 flow to Bucket 1 to fund current retirement spending. When the balance in Bucket 2 surpasses 105% of its initial balance, the surplus is used to refill Bucket 1 to its initial balance and the remaining surplus flows to Bucket 3. When the previous year's cumulative return in Bucket 3 is larger than 15%, the balance in Bucket 3 is used to refill Bucket 1 to its initial balance. When the balance of Bucket 1 drops below two months of retirement needs, Bucket 3 is liquidated to refill Bucket 1. When the balance of Bucket 2 is smaller than 80% of its initial balance and the previous year's cumulative return in Bucket 3 is larger than 10%, Bucket 3 is liquidated to refill Bucket 2 to its initial balance. If the balance of Bucket 1 surpasses 15 months' worth of retirement needs, the cash surplus flows to Bucket 2 first and then to Bucket 3.
- Three buckets strategy B. We follow Benz's "strict constructionist total return" approach. Under this strategy, all interest payments, dividend income, and capital gains remain with the assets in Bucket 2 or Bucket 3. Bucket 1 is filled with cash and used to fund the first two years of retirement spending. Bucket 2 invests in long-term bonds and hold funds worth five years of retirement spending. Bucket 3 is filled with equity and set aside for asset growth. The aggregated initial asset allocation is a function of the annual retirement spending. When the balance in Bucket 2 surpasses 105% of its initial balance, the surplus is used to refill Bucket 1 to its initial balance and the remaining surplus flows to Bucket 3. When the previous year's cumulative return in Bucket 3 is larger than 15%, the balance in Bucket 3 is used to refill Bucket 1 and Bucket 2 to their respective initial balances. When the Bucket 1 balance drops below two months of retirement needs and the previous year's cumulative return in Bucket 3 is positive, Bucket 3 is liquidated to refill Bucket 1 to its initial balance. But when the Bucket 1 balance drops below two months of retirement needs and the previous year's cumulative return in Bucket 3 is negative, Bucket 2 is liquidated to refill Bucket 1 to half of its initial balance. When the balance of Bucket 2 is smaller than 80% of its initial balance and the previous year's cumulative return in Bucket 3 is larger than 10%, Bucket 3 is liquidated to refill Bucket 2 to its initial balance. If the balance of Bucket 1 surpasses 27 months of retirement needs, the cash surplus flows to Bucket 3.
- Time bucket strategy. We construct three time buckets. The first bucket funds the first five years with an initial balance of $600,000 allocated entirely to long-term bonds. The second bucket aims to cover the spending in years six through 10, with $800,000 invested in 50% equities and 50% bonds. The third bucket is the most aggressive, in which the remaining $600,000 is invested in 100% equities. The aggregated initial allocation is 50% equities and

50% bonds, which is more conservative than the systematic withdrawal strategy. After the fifth year, the first bucket retires, and the second bucket takes over to fund financial needs. Any surplus or deficit from the first bucket will be carried over to the next bucket. In this strategy, we assume that the asset allocation within each bucket will not be adjusted as the client approaches the end of retirement.

Methodology for Comparison

Like Clare and others (2017), we use monthly U.S. equities and bond returns from 1926 to 2022 as the input to the Monte Carlo simulation. Poterba and Summers (1988) and Wainscott (1990) showed that the historical return displays mean reversion and varying correlation between asset classes. Whereas Clare and others randomly draw one monthly return with replacement and form its return sequence, we randomly draw a continuous 360-month sequence from historical returns. Essentially, we are comparing clients who turn 65 years old within one month of each other between 1926 and 1992.

We use Stocks, Bonds, Bills, and Inflation (SBBI) large-cap stock return indexes to proxy U.S. equity performance and long-term government-bond return indexes to proxy bond performance. These indexes include monthly income return and price return. We adjust the nominal return indexes to real terms based on historical inflation.

Performance Comparison Matrix

Each strategy is designed to address a particular issue, which can lead to varying performance in other areas of financial planning. The criteria below outline the major issues in designing and executing a financial plan.

- Clarity and consistency of asset allocation. Asset allocation is a primary element of an investment policy statement, a standard document developed in the financial planning process. These criteria are used to determine if investment decisions align with a client's risk and return objectives, as well as their investment constraints. When clients' short-term funding needs are safeguarded, the risk of their investment portfolio may be considered less relevant. Nevertheless, we consider clarity and consistency to evaluate the initial asset allocation and its evolution through time.
- Opportunity cost. A criticism of retirement-income bucket strategies is that they tend to allocate a portion of the portfolio to liquid assets, which, in turn, diminishes the opportunity to grow. This is especially true for the cash flow reserve bucket strategy and three buckets strategies, as it places one or two years of financial needs in cash or cash equivalents. This criterion is included to evaluate how each strategy differs in the level of opportunity cost.
- Viable spending amount. As per Cooley and others (1998), the viable withdrawal amount provides a quantitative measure of the performance of a retirement-income strategy. Built on Monte Carlo simulations, it is the amount that could sufficiently fund a client's financial objectives at a given success rate.
- Financial plan tail risk and upside growth potential, as captured through the percentile distribution of the ending wealth at a given success rate. The distribution of the portfolio balance at the end of the 30-year planning horizon informs the ending wealth shortfall or

surplus at the worst or best scenario. A tight distribution signals a more predictable and controllable outcome.

- Sequence risk management. All four retirement-income strategies in this study allocate a portion of assets in conservative investments to fund near-term spending that, in turn, avoids liquidating depressed assets during a down market. Their ability to mitigate sequence risk, however, might differ given how the buckets are set up. Sequence risk management addresses how each strategy mitigates the consequence of a bad market occurring at the beginning of retirement.
- Management of investor overreaction. During times of extreme market volatility, investors may panic and make an irrational decision to exit the market. The cash reserve bucket strategy and three buckets strategies are specifically designed to help clients by setting aside sufficient cash to fund the subsequent year's financial needs. Indeed, Pfau (2017) argues that the primary benefit of bucket strategies is behavioral. This study evaluates an investor overreaction scenario to test how an investor's irrational decisions could affect retirement outcome.

Comparison of the Bucket Strategies

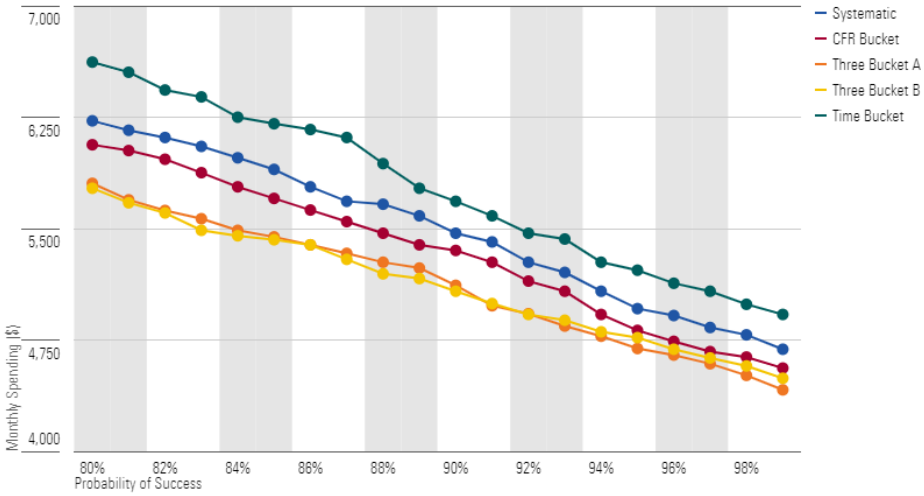
By design, the systematic withdrawal and cash flow reserve strategy have a clear asset allocation aligned with clients' risk tolerance. In this study, the cash flow reserve bucket strategy has a similar overall asset allocation to the systematic withdrawal strategy except that the cash bucket contains one year of retirement spending. Over time, the overall asset allocation of cash flow reserve strategy drops as the size of the primary investment portfolio decreases after rebalancing or liquidation. However, because the first year of retirement spending is relatively secure, it might justify a slightly riskier asset allocation in the primary investment portfolio. For the three buckets strategies and time bucket strategy, an overall asset allocation can be determined at the start of retirement, but this initial asset allocation depends on the annual retirement spending needs. For the three buckets strategies, the changes in asset allocation over time depend on the actual asset returns and size of each bucket. Because no portfolio rebalancing is implemented for each bucket in the time bucket strategy, the overall asset allocation moves toward an asset allocation with more equities.

All the bucket strategies allocate a portion of assets in conservative investments and impose the strategy at a certain level of opportunity cost. At the beginning of retirement, the time bucket strategy has an equity allocation of 50%, but its overall asset allocation is likely to increase because no portfolio rebalancing is required. For the three buckets strategy, Bucket 1 holds one or two years of retirement spendings in cash. The overall asset allocation depends on the planned annual retirement spending and size of Bucket 2, which is filled with bonds. In general, the cash flow reserve bucket strategy and three buckets strategies have higher opportunity costs due to one or two years of cash reserve. However, these strategies can moderately increase their allocation to risky investments because clients have more confidence with the near-term consumption and are less likely to panic.

We compare the performance of these four strategies through viable monthly retirement spending amounts at various success rates. As shown in Exhibit 3, moderate differences among strategies at

different success rates can be observed. The time bucket strategy stands out slightly from the other strategies. At an 85% funding success rate, the time bucket strategy viable monthly retirement spending is $6,206, while the systematic withdrawal strategy viable monthly retirement spending is $5,898. Converted to annual spending, the time bucket strategy provides an annual viable spending $3,691 higher than the systematic withdrawal strategy. The slight outperformance of the time bucket strategy is explained by the large equity exposure in the last bucket. Because there is no rebalancing within the buckets, the overall asset allocation increases to 100% equity after year 10 when the first two buckets are retired. The spending amount provided by the systematic withdrawal strategy is lower than Bengen's (1994) 4% withdrawal rate, but it is expected because our methodology accounts for multiple financial objectives and taxes on investment and withdrawals. At an 85% funding success rate, the cash reserve bucket strategy provides $5,703 in viable monthly spending. Converted to annual spending, the systematic withdrawal strategy provides $2,343 more in viable spending than the cash reserve bucket strategy. The main reason for the underperformance of the cash flow reserve strategy is the opportunity cost of always placing one year's worth of retirement income in cash. The two variations of the three buckets strategies provide the lowest viable spending. Given the limitations of the decision rules in our bucket strategy modeling, however, this is not surprising. As Benz (2022) suggests, a judgment-based override could be implemented to decide how to refill the buckets in response to challenging market conditions. Benz and others (2021) test a few strategies that adjust retirement spending according to market performance and retirement asset balance. We did not model this type of decision rule in this study but recognize that the performance would improve under such a regime.

Exhibit 3 Viable Monthly Spending by Strategies at Different Success Rates

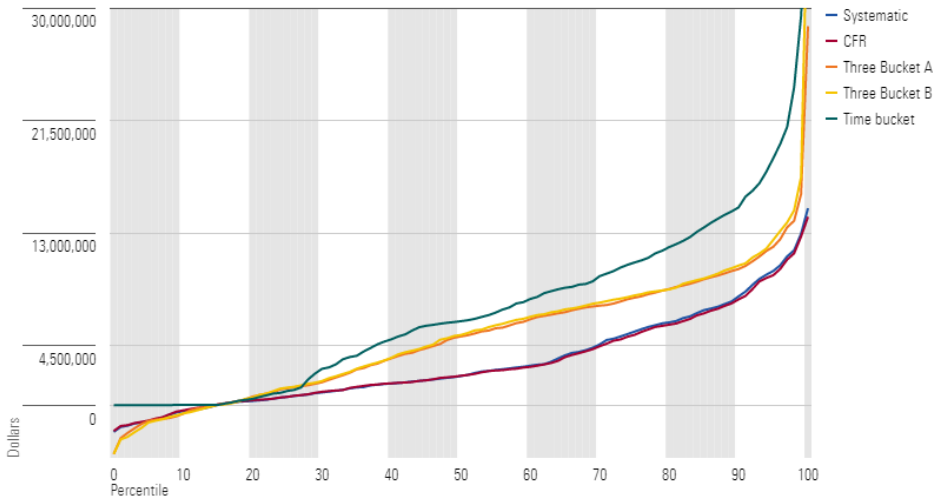


Source: Morningstar.

A major criticism of using plan success rate, or the probability of success, as the measure of retirement outcome is that it fails to capture the magnitude of wealth shortfall and surplus at the end of retirement. For example, while both are considered as a failed plan, one scenario can be short $1 at the end of retirement while the other scenario can be short $500,000. Ending wealth allows us to look through the success rate and understand the distribution of the underlying retirement outcomes.

Exhibit 4 shows the ending wealth distribution for each strategy at 85% success rate, or 15% failure rate. The lowest 15% of the ending wealth distribution shows the ending wealth shortfall when the retirement plan fails, while the rest of the ending wealth distribution shows the potential ending wealth available for bequest, providing a view of how each strategy manages tail risk and upside growth potential. The time bucket strategy is the most positively skewed, offering the largest upside growth potential and the smallest ending wealth shortfall when the plan fails. By contrast, the cash flow bucket strategy offers the smallest upside growth potential and relatively low ending wealth shortfall when the plan fails. Recall from Exhibit 3, the two variations of three buckets strategies provide the lowest viable spending amount at all success rates. The wealth shortfall of these two variations of three buckets strategies are the largest of all strategies, suggesting that three buckets strategies might be vulnerable to extreme market conditions unless an intervention rule is deployed as outlined above. Under extreme market conditions, the last bucket can be completely exhausted while the rest of the assets are fully invested in bonds. However, the two variations of three buckets strategy leverage good market conditions, providing larger upside growth potential than the cash reserve bucket strategy and systematic withdrawal strategy. See Appendix 1 for an analysis of the underlying asset-allocation glide path of the three buckets strategy A.

Exhibit 4 Ending Wealth Distribution at 85% Probability of Success Rate



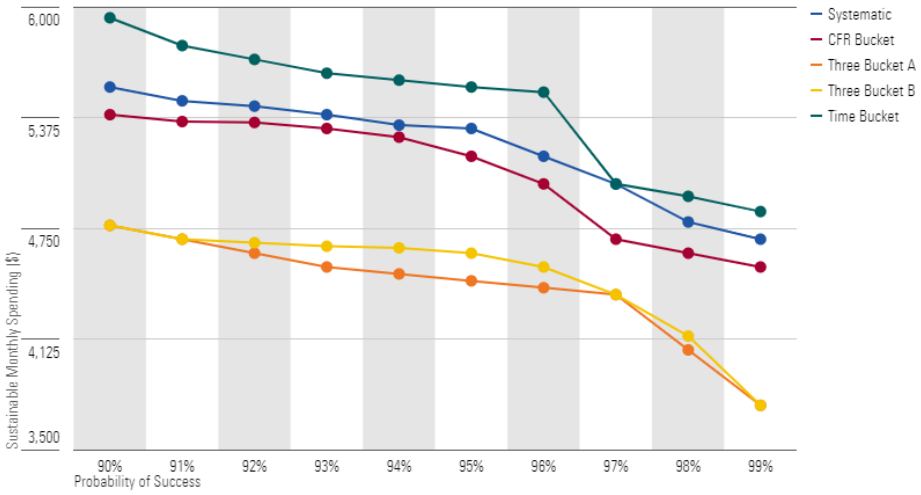
Source: Morningstar.

Sequence Risk Management

If an investment asset price drops significantly, liquidation will affect the household retirement outcome because there is no opportunity for recovery. This impact is greatest when the market is down at the beginning of the decumulation phase. In other words, the sequence of investment returns adds risk to household retirement outcomes. Some bucket strategies improve financial outcomes by preserving depressed assets, particularly in the beginning of the decumulation phase. The cash flow reserve bucket strategy starts with a cash reserve for the next year of retirement spending and travel expenses, which avoids the liquidation of any depressed asset. The time bucket strategy allocates the first five years of financial needs in 100% bond investments, thus avoiding liquidation of equity investment in the beginning phase. The three buckets strategies allocate the first six or seven years of financial needs in cash or bond investments. We investigate each strategy's performance in terms of managing sequence risk. In this test, risk sequence is defined by 150 hypothetical retirement starting dates that have the worst historical six-month returns following retirement. The hypothetical retirement starting date is filtered before 1992 to have enough 30-year data for the rolling analysis. Essentially, we compare clients who retire in a bad equity market between 1926 and 1992.

Exhibit 5 shows the viable monthly spending amount provided by different strategies when the client retires in a bad equity market. Compared with the base scenario summarized in Exhibit 3, all strategies provide slightly lower viable spending amounts at any success rate. The time bucket strategy still provides the highest spending under bad market conditions at all success rates. The differences in viable spending amount narrow between what is provided by the systematic withdrawal strategy and cash reserve bucket strategy, or the three buckets strategies. The overall differences among all strategies are still moderate.

Exhibit 5 Viable Monthly Spending With the Worst Historical Six Months' Return as Starting Point



Source: Morningstar.

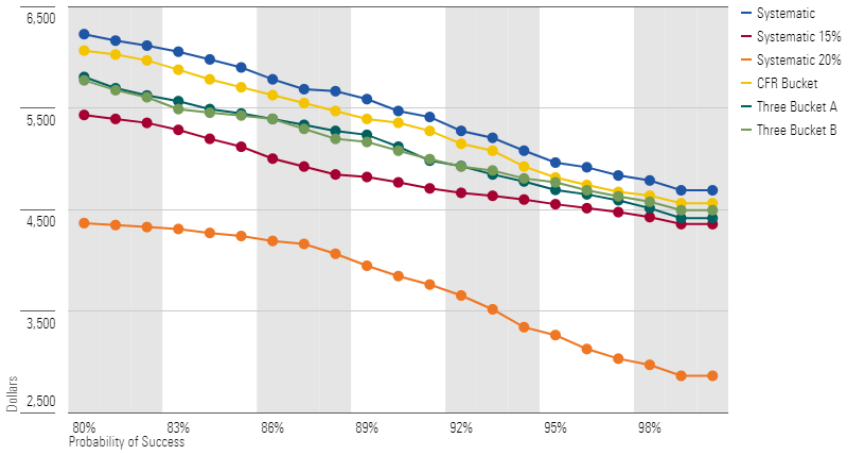
One explanation for the relatively benign impact of the sequence risk here is that our analysis is based on 150 hypothetical retirement starting dates that have the worst first six-month returns in the historical data. We assume a monthly withdrawal, which minimizes the impact to the investment portfolio even when it is depressed. Moreover, historical returns show strong mean reversion, allowing the investment portfolio to recover quickly.

Consequence of Investor Overreaction

The cash flow reserve bucket strategy and three buckets strategies cater to a client's mental-accounting needs by creating buckets for near-term spending and long-term asset growth. If a client's near-term spending is planned for, the temporary market fluctuation will be less of a concern. Under the systematic withdrawal strategy, one portfolio is used to fund both near- and long-term financial needs. When a client's near-term spending is affected by the current market performance, it could lead to an irrational decision and the client withdrawing from the equity market. Barber and Odean (2000) and Barber, Lee, Liu, and Odean (2008) provided evidence that investors experienced underperformance because of bad market-timing decisions, which in turn negatively affected financial outcomes.

We model the investor overreaction for the systematic withdrawal strategy by assuming that the client chooses to withdraw from an equity investment when returns drop by at least 15%, or 20% in the prior quarter. The client then returns to the equity market when the returns go up by at least 15%, or 20% in the prior quarter. Exhibit 6 shows the viable monthly spending when a client pulls out of the equity market when returns drop by 15% or 20%. The spending provided by systematic withdrawal and bucket strategies from the base scenario are also included in Exhibit 6 for reference. Under the systematic withdrawal strategy, the assumed investor overreaction during a bad market significantly reduces the viable spending amount in all scenarios. In the case in which a client exits the equity market after a negative 20% quarterly return, the investor's monthly retirement spending could be reduced by almost $2,000, equivalent to a $24,000 reduction in annual spending. When accounting for the investor overreaction, outcomes from the systematic withdrawal strategy are lower than what is provided by the cash flow reserve bucket strategy and the three buckets strategies. This evidence supports the behavioral benefit of a cash flow reserve bucket strategy. Even if these strategies provide a lower viable spending amount, it could be valuable if investors are prone to behavioral bias and irrational decisions.

Exhibit 6 Viable Monthly Spending When Investor Pulls Out of Equity Investment



Source: Morningstar.

Conclusion

This study assumes a simple scenario and compares multiple retirement-income bucket strategies documented in the current financial planning literature to the systematic withdrawal strategy. Exhibit 7 summarizes the qualitative and quantitative characteristics of each strategy. By design, the systematic withdrawal and cash flow reserve strategies have clear asset allocations that align with a client's risk tolerance. This is not the case for the other strategies. The asset allocations of the three buckets strategies and the time bucket strategy are mainly driven by viable spending amount or the size of the buckets. Ensuring the overall asset allocation matches the client's risk tolerance is challenging.

Although relatively simple in execution, the systematic withdrawal strategy provides a high plan success rate and ending wealth. It has a clear asset allocation that is consistent with an investor's risk tolerance and risk capacity. A plain-vanilla systematic withdrawal strategy uses a simple rebalance strategy, which buys lows and sells highs. However, without any opportunistic decision rule, this strategy might have high shortfall risk and low upside growth potential.

The time bucket strategy is shown to provide the highest viable retirement spending and ending wealth in our study, along with the largest variation in outcomes because of the high equity concentration in later phases of the plan. Contrary to the conventional belief in the significant sequence risk of the time bucket strategy, the variation is significantly positively skewed. Moreover, the time bucket strategy provides the lowest shortfall amount in the worst scenarios among all the strategies, indicating a superior ability to handle tail risk. However, the high equity allocation toward the end of retirement could be too risky for some clients. This strategy is best used when an investor is willing to take more risk in exchange for a potential boost to retirement income. Client education is needed to help the investor recognize the high equity exposure in later retirement.

The cash bucket strategy and the two variations of the three buckets strategies underperform the systematic withdrawal strategy because of the opportunity cost of placing the first few years of spending in cash or bonds. With proper decision rules in place, the three buckets strategies could address the ending wealth shortfall risk and provide relatively high upside growth potential. The primary benefits of these strategies are behavioral. The cash bucket strategy and three buckets strategies separate assets that are funding near-term financial needs from the risky assets that drive long-term growth to create a mental buffer. It may help clients avoid emotional investment decisions in a down market. Our analysis shows that in the systematic withdrawal strategy case where the client withdraws from equities after a negative 20% quarterly return and reallocates to equities after a positive 20% quarterly return, the viable monthly retirement spending is reduced by about $2,000, giving evidence for the behavioral benefit of bucket strategies. For investors using the time bucket strategy, the behavioral benefit is present when the first buckets are available and filled with conservative assets to fund retirement. But they might display the same market overreaction if 100% of their portfolio is invested in equities. The cash bucket strategy and the two variations of the three buckets strategies are best used for investors more likely to overreact in down markets.

Exhibit 7 Summary of Retirement-Income Strategy Comparison

Criteria for comparison	Systematic Withdraw	CFR Bucket Strategy	Three Buckets Strategy	Time Bucket Strategy
Clear asset allocation	Yes	Yes	No	No
Consistent asset allocation to risk tolerance	Yes	Yes	No	No
Opportunity costs	No	Yes	Yes	No
Sequence risk management	No	Moderate	Moderate	High
Sustainable spending supported	Relatively high	Moderate	Moderate	High
Ending wealth shortfall risk	Moderate	Moderate	High	Low
Ending wealth upside growth	Low	Low	Relatively high	High
Behavioral benefit	No	High	High	Moderate*

Source: Morningstar. *Negative at the later plan stage.

In summary, the cash bucket strategy and the three buckets strategies can generate acceptable financial outcomes with behavioral benefits, while the time bucket strategy is shown to provide the potential for the best financial outcomes at the highest risk, especially at the later stage of the plan. Implementing these strategies demands careful consideration of clients' preferences and behavioral traits.

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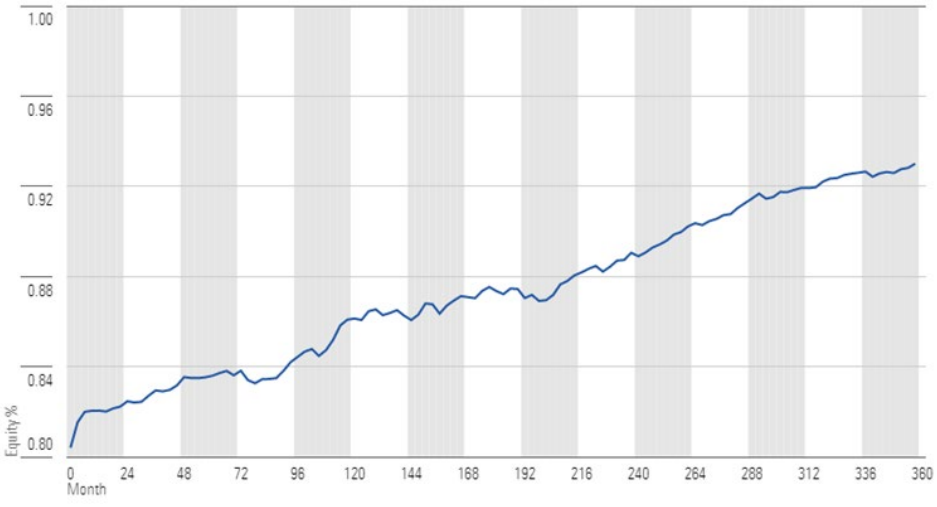
Appendix

Equity Glide Path Analysis

A key factor to the performance of these retirement-income strategies is the underlying asset allocation, which is not always clear to financial planning professionals. In this study, the systematic withdrawal strategy holds the asset allocation (60%/40%) constant. The investment portfolio in the cash reserve bucket strategy holds a constant asset allocation (60%/40%), while the aggregate asset allocation can deviate from the 60%/40% asset allocation depending on the relative size of investment portfolio to the cash reserve bucket. The aggregate asset allocation of the time bucket strategy approaches a 100% equity allocation as the first two buckets are depleted.

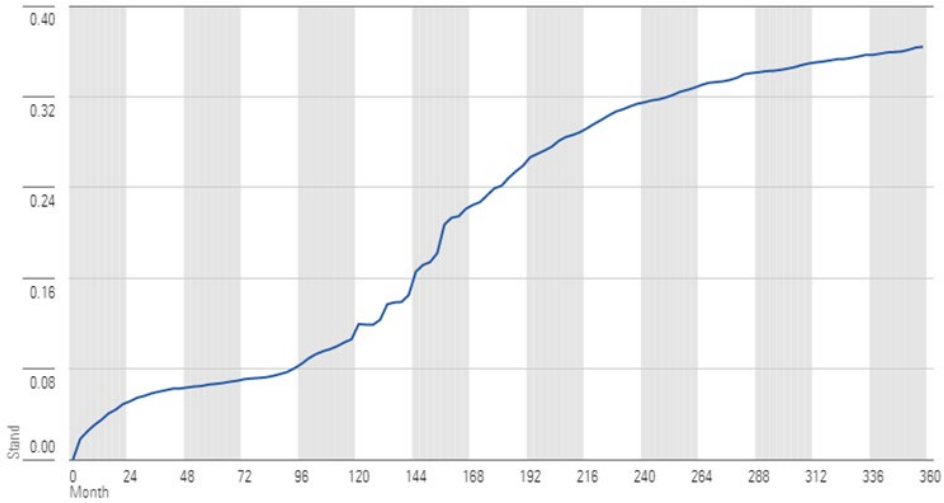
The purpose of this appendix is to illustrate the realized equity glide path of three buckets strategy A. Exhibit 8 presents the median monthly equity allocation based on the viable spending amount at the 85th percentile of plan success rate. The initial equity level for three buckets strategy A is at about 80%, because we allocate 12 months of retirement spending in Bucket 1 (cash) and 60 months of retirement spending in Bucket 2 (bonds), while the remaining assets are in equities. The median monthly equity allocation in three buckets strategy A shows a steady upward trend. As the equity glide path goes up over time, so does the standard deviation of the equity allocation as shown in Exhibit 9. This is consistent with the positive skewness in the ending wealth distribution. This strategy can take advantage of good market conditions with high equity exposure, resulting in significant upside growth potential.

Exhibit 8 Median of Equity Glide Paths - Three Buckets Strategy A



Source: Morningstar.

Exhibit 9 Standard Deviation of Equity Glide Paths - Three Buckets Strategy A

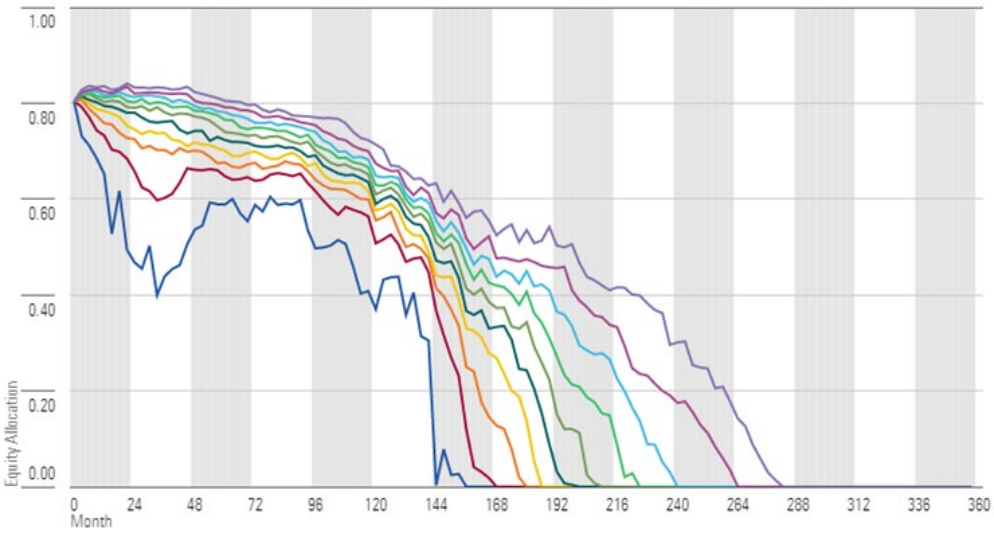


Source: Morningstar.

In scenarios where returns are consistently higher, there is likely a significant balance inside Bucket 3, which drives up the equity allocation. In scenarios where returns are consistently lower, Bucket 3 may run out of money and lead to 100% allocation in bonds.

Exhibit 10 shows the distribution of equity glide paths of all failed scenarios in three buckets strategy A. The equity glide paths go down to zero as assets in Bucket 3 run out. There are scenarios where the assets in Bucket 3 run out in only 16 years. This is because Bucket 3 is used to refill Bucket 1 and the balance is quickly exhausted because of a prolonged depressed market. The near-zero Bucket 3 balance misses the potential growth when the market recovers. Those factors together contribute to the apparent underperformance of three buckets strategy A.

Exhibit 10 Decile Distribution of Equity Glide Paths of Failed Scenarios in Three Buckets Strategy A



Source: Morningstar.

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