Managing to Target (II): Dynamic Adjustments for Retirement Strategies

Javier Estrada*
IESE Business School, Department of Finance, Av. Pearson 21, 08034 Barcelona, Spain
Tel: +34 93 253 4200, Fax: +34 93 253 4343, Email: jestrada@iese.edu

Abstract
All individuals need to determine a withdrawal policy for their retirement. This decision needs to balance the goal of funding a desired lifestyle (and perhaps leaving a bequest) with the goal of not running out of money too early, which is best done by outlining a financial plan. When the returns of his portfolio differ from those expected in the plan, what should a retiree do? Should he statically stick to the withdrawals specified in his plan? Should he introduce dynamic adjustments in order to push the portfolio closer to the path outlined in the plan instead? This article evaluates two types of dynamic policies, broadly referred to as 'managing to target' (M2T) strategies, that adjust either the periodic withdrawals or the portfolio's asset allocation. The results reported show that dynamic M2T strategies outperform a static strategy of sticking to the plan, and that adjusting withdrawals is superior to adjusting the portfolio's asset allocation.

February, 2020

1. Introduction

Should retirees have a financial plan determining the periodic withdrawals to be made from their portfolio during their expected retirement period? Should they stick to the withdrawals in the plan through thick and thin or should they adjust their withdrawals depending on market conditions? What tools can a financial planner use to advise retirees on the best course of action? These critical questions for retirees and financial planners are at the core of the issues addressed in this article.

It is not easy for most individuals to determine how much money they will need to live comfortably in retirement, nor is it easy to put a financial plan in place to hit the target portfolio by the retirement date. Even if those two issues are dealt with, individuals still need to consider whether to stick to the contributions in the financial plan or to adjust their contributions or asset allocation when market conditions change.

Estrada (2019) focuses on the accumulation period and highlights the benefits of both having a financial plan and adjusting the contributions when the returns experienced differ from those expected in the plan. He finds that some dynamic policies designed to push the portfolio closer to the expected path outlined in the plan outperform a static policy of simply sticking to the plan. He also finds that adjusting contributions is far superior to adjusting the portfolio's asset

* I would like to thank Mark Kritzman, Jack Rader, and an anonymous referee for their comments. The views expressed below and any errors that may remain are entirely my own.

allocation; and that the more flexibility in the periodic contributions an individual is able to tolerate, the higher are the benefits of dynamic policies.

A similar issue is explored in this article but concerning the retirement period. More precisely, this article explores whether a retiree should set a withdrawal plan and implement a static policy of simply sticking to it; or, when the returns experienced differ from those expected in the plan, he should implement a dynamic policy designed to push the portfolio closer to its expected path. As in Estrada (2019), the dynamic policies explored here are broadly referred to as *managing to target* (M2T) strategies; however, in this case, the target is not a retirement portfolio but a desired bequest. Two types of M2T policies are explored, some that adjust withdrawals and some that adjust a portfolio's asset allocation, both sharing the goal of aiming to push the portfolio closer to the path outlined in the plan.

In order to determine whether a retiree would be better off by implementing a static policy of sticking to the plan or dynamic M2T policies, a financial planner needs a criterion on which to base his recommendation. The tool proposed here to make this decision is the coverage ratio introduced by Estrada and Kritzman (2019), which takes into account more information that the ubiquitous failure rate.

The approach in this article differs from those in the previous literature on the topic in at least two ways. First, the dynamic strategies considered here revolve around a financial plan that sets a schedule of withdrawals and an expected path for the portfolio for the whole retirement period. Second, the evaluation of the competing strategies is based only marginally on the failure rate; it ultimately rests on a more thorough and recent metric, the coverage ratio. Furthermore, unlike most articles in the literature, which focus on adjusting either withdrawals or asset allocations, this article considers adjustments to both.

In a nutshell, the results from the evidence discussed here can be summarized as follows. First, dynamic M2T policies designed to push the portfolio closer to the expected path outlined in the financial plan outperform a static policy of simply sticking to the plan. And second, adjusting withdrawals is superior to adjusting a portfolio's asset allocation.

The rest of the article is organized as follows. Section 2 discusses how to set the financial plan and how to decide which policy to implement. Section 3 discusses the evidence on all the policies considered, as well as some caveats and extensions. Finally, section 4 concludes with an assessment and makes concrete suggestions for retirees to implement.

2. The Issue

This section discusses how to set a financial plan that determines the periodic withdrawals to be made and the corresponding evolution of the retirement portfolio. It also discusses the coverage ratio, a metric introduced recently that provides a more thorough evaluation of retirement strategies than the widely-used failure rate.

2.1. The Financial Plan

Consider an individual about to retire with a $1 million portfolio and a life expectancy of 30 years. He plans to spend his whole portfolio during his 30-year retirement period, thus leaving no bequest to his heirs.[1] He expects to make 30 withdrawals from his portfolio, one at the beginning of each year in retirement, and to keep his purchasing power constant over time.[2]

Our retiree's portfolio needs to have a proper asset allocation, which typically follows from his goal (spending as much as possible without running out of money too early), holding period (30 years), and risk tolerance. For concreteness, assume that on the basis of these three variables our retiree builds a 60-40 stock-bond portfolio. Over the 1900-2017 period, an annually-rebalanced 60-40 portfolio of U.S. stocks and bonds delivered an annualized real return of 5.0%, so consider that as the expected annual (real) return of the retiree's portfolio.

In general, our retiree's problem is to find the constant annual real withdrawal W from a retirement portfolio P, earning an annualized real return R, that will leave a bequest B after T years. Formally, this problem can be expressed as

$$(P-W) - [(P-W)(1+R)-W] - \{[(P-W)(1+R)-W](1+R)-W\} - \ldots = B \quad (1)$$

which can be rewritten as

$$P \cdot (1+R)^{T-1} - W \cdot \sum_{t=0}^{T-1}(1+R)^t = B \quad (2)$$

where t indexes periods. Solving for W yields the optimal constant annual inflation-adjusted withdrawal (W^*) , which is given by

$$W^* = \frac{P \cdot (1+R)^{T-1} - B}{\sum_{t=0}^{T-1}(1+R)^t} \quad (3)$$

In the specific case of our retiree, who starts with a $1 million portfolio ($P$=1,000,000), has a life expectancy of 30 years (T=30), aims to leave no bequest (B=0), and builds a portfolio expected to earn an annualized real return of 5% (R=0.05), the optimal constant annual inflation-adjusted withdrawal that would exhaust his portfolio in 30 years is

---

[1] The 30-year retirement period is by far the most often used in the literature. That said, it is obvious that no individual can ascertain with certainty the number of years he will spend in retirement; Totten and Siegel (2019) discuss the important issue of longevity risk and how to hedge it.

[2] None of these assumptions are essential and can easily be modified; this issue is further discussed in section 3.5 (Caveats).

$$W^* = \frac{\$1{,}000{,}000 \cdot (1+0.05)^{29}}{\sum_{t=0}^{29}(1+0.05)^t} = \$61{,}954 \quad (4)$$

thus implying an initial withdrawal rate of just under 6.2%.

This information can be used to create a financial plan that yields the portfolio's expected path shown in Exhibit 1, which plays the critical role of being the benchmark against which deviations from the plan are assessed. In other words, dynamic adjustments are considered only when the actual portfolio deviates from the portfolio's expected path.

Exhibit 1: Expected Path

This exhibit shows the expected path of a portfolio that starts with $1 million, earns a 5% annual real return, and is subject to 30 withdrawals of $61,954 in inflation-adjusted dollars at the beginning of each year.

Period	Portfolio	Period	Portfolio	Period	Portfolio
1	$938,046	11	$748,731	21	$440,356
2	$922,995	12	$724,214	22	$400,420
3	$907,191	13	$698,471	23	$358,488
4	$890,597	14	$671,440	24	$314,458
5	$873,173	15	$643,059	25	$268,227
6	$854,878	16	$613,258	26	$219,685
7	$835,668	17	$581,967	27	$168,715
8	$815,497	18	$549,112	28	$115,197
9	$794,318	19	$514,613	29	$59,004
10	$772,081	20	$478,390	30	$0

This expected path for the portfolio is based on earning a 5% annual real return year after year, which is obviously not expected to happen over any specific 30-year retirement period. Thus, in any given empirical retirement period, the portfolio is very likely to either run out of money too early or leave a bequest.

2.2. The Coverage Ratio

Many variables have been proposed in the literature to evaluate the performance of retirement strategies, but none has a longer history and is more widely used than the failure rate (F), which is formally given by

$$F = \left(\frac{1}{N}\right) \cdot \sum_{t=1}^{N} f_t \quad (5)$$

where N is the number of (historical or simulated) retirement periods evaluated, f is a variable that takes a value of 1 in a retirement period in which a strategy failed and 0 otherwise, and t indexes retirement periods.

This failure rate suffers from at least two shortcomings. First, it measures *whether* a strategy failed but not *when* (by how much) it failed; it is obviously very different for a retiree to run out of money half way into the retirement period than one year earlier than planned. Second, it fails to account for the size of the bequest left; a strategy that enabled a retiree to live just 30 years is very different from one that left a sizeable bequest.

To overcome both limitations, Estrada and Kritzman (2019) introduced the coverage ratio, which aims to capture the number of years of withdrawals during and after retirement supported by a strategy, relative to the length of the retirement period considered. Importantly, this metric accounts for the number of years a strategy sustained withdrawals both when failing (depleting the portfolio too soon) and when succeeding (leaving a bequest).

Formally, let Y_t be the number of years of inflation-adjusted withdrawals sustained by a strategy in retirement period t, both during and after the end of the retirement period, and T be the length of the retirement period considered. Then, the *coverage ratio* in retirement period t (C_t) is given by

$$C_t = Y_t/T \tag{6}$$

By definition, C<1 indicates that a strategy depleted a portfolio before the end of the retirement period; C>1 indicates the strategy sustained withdrawals through the entire retirement period and left a bequest; and C=1 indicates that the strategy sustained withdrawals exactly through the end of the retirement period and left no bequest.

To illustrate, consider a 30-year retirement period, a $1 million retirement portfolio, annual inflation-adjusted withdrawals of $40,000 and three strategies. The first strategy depletes a portfolio in 24 years, the second does so in exactly 30 years, and the third sustains withdrawals for 30 years and leaves a bequest of $240,000, which can support another six years of $40,000 withdrawals. Then, Y_t would be 24, 30, and 36, for the first, second, and third strategies; and C_t would respectively be 0.8, 1.0, and 1.2.

The coverage ratio can be used by itself or together with a utility function. Estrada and Kritzman (2019) use a kinked utility function that incorporates the idea that retirees are more displeased with failures than are pleased with successes. Formally, this utility function is given by the expression

$$U(C) = \frac{C^{1-\gamma} - 1}{1-\gamma} \qquad \text{for } C \geq 1$$

$$U(C) = \frac{1^{1-\gamma} - 1}{1-\gamma} - \lambda(1 - C) \qquad \text{for } C < 1 \tag{7}$$

where U denotes utility; γ is the coefficient of risk aversion, which determines the curvature of the slope when C>1; and λ is a linear penalty coefficient when C<1. This utility function assumes that as the coverage ratio increases above 1, the retiree's utility increases at a decreasing rate; and as the coverage ratio falls below 1, the retiree's utility decreases linearly and steeply.

The utility function's kink at C=1 has an appealing property. When a strategy exactly funds a retirement period (C=1), utility equals zero; when a strategy leaves a bequest (C>1), utility is positive and increases at a decreasing rate as the coverage ratio rises above 1; and when a strategy fails before the end of the retirement period (C<1), utility declines steeply and linearly as the coverage ratio falls below 1.

A strategy's expected utility, which is the way all the strategies considered here are ultimately evaluated, is calculated as follows. Each of the 90 retirement periods considered yields a coverage ratio; the utility of each coverage ratio is then calculated using expression (7); and the 90 utilities from the previous step are subsequently averaged. Formally, then, a strategy's expected utility (EU) is given by

$$\text{EU}(C) = \left(\frac{1}{N}\right) \cdot \sum_{t=1}^{N} U(C_t) \quad (8)$$

where N, as before, is the number of retirement periods considered (90 in our case), and U is given by expression (7).

3. Evidence

This section first describes the data and methodology; then it introduces all the static and dynamic retirement strategies considered; and then it briefly discusses some of the related literature. It also discusses the evidence on all the strategies, some caveats of the analysis, and some extensions.

3.1. Data and Methodology

The sample consists of annual stock and bond returns for the U.S. market between 1900 and 2017. Stocks are represented by the S&P 500 and bonds by 10-year Treasury Notes, both in their total return version (including capital gains/losses and cash flows paid), downloaded from Global Financial Data. All returns are real, adjusted by inflation as measured by the Consumer Price Index. During the 118-year period considered, stocks and bonds delivered annual returns of 6.4% and 1.6%, with annual volatility of 20.0% and 9.4%; their correlation over the whole sample period was 0.23.

Our representative retiree has a $1 million portfolio, a life expectancy of 30 years, and expects to make 30 withdrawals, constant in real terms, at the beginning of each year in retirement. He plans to leave no bequest, therefore aiming to exhaust his portfolio by the end of the retirement period. Throughout his retirement he plans to have a 60-40 stock-bond allocation, rebalanced annually, and expects to earn a 5.0% annualized real return, which is the long-term historical average for this allocation. As discussed in the previous section, under these conditions our retiree could make 30 annual inflation-adjusted withdrawals of $61,954 and exhaust his portfolio in 30 years. His financial plan is summarized by his portfolio's expected path shown in Exhibit 1.

All the strategies considered are evaluated over all the possible 30-year retirement periods between 1900 and 2018; this yields 90 retirement periods, beginning with 1900-1929 and ending with 1989-2018. This set up generates a distribution of 90 portfolio terminal values per strategy. These 90 terminal values enable the calculation of 90 coverage ratios with expression (6); their corresponding utility with expression (7); and ultimately the expected utility of each strategy with expression (8). Furthermore, the failure rate (F) is calculated with expression (5) and reported for all the strategies considered, just for the sake of completeness.

In order to calculate the utility of each coverage ratio an assumption needs to be made about the values of γ and λ for the utility function in expression (7). Following Estrada and Kritzman (2019) the values assumed are γ=0.9999 (essentially log utility for C>1) and λ=10. However, because these two values (and particularly the latter) are rather arbitrary, a sensitivity analysis is subsequently performed.

3.2. Retirement Strategies

The first policy considered is the *stick to the plan* (S2P) strategy, which simply commits to the schedule of withdrawals and asset allocation in the financial plan shown in Exhibit 1. This policy is static in the sense that it does not introduce any changes to the plan; it simply sticks to the withdrawals and asset allocation in the plan thus *hoping* to exactly fund the retirement period, leaving no bequest. This strategy is the benchmark against which all other strategies are evaluated.

Two types of dynamic strategies are considered, some that adjust the periodic withdrawals and some that adjust the portfolio's asset allocation. Both types of strategies have in common the goal of aiming to push the portfolio closer to the expected path outlined in the financial plan (Exhibit 1) whenever the returns experienced differ from those expected in the plan. Following Estrada (2019), all these policies are referred to as *managing to target* (M2T) strategies, the target in this case being a desired bequest of $0.

The M2T strategies that adjust periodic withdrawals rest on the idea that most retirees would tolerate some fluctuations of their purchasing power due to changing market conditions. Four such *withdrawal strategies* are considered, limiting the change in the periodic withdrawals to 5% (WS5), 10% (WS10), 15% (WS15), and 20% (WS20) above or below the initial withdrawal ($61,954). In all cases, withdrawals are decreased (increased) when the portfolio is below (above) its expected path.

Alternatively, retirees may stick to the withdrawals in the plan and respond to changing market conditions by adjusting their portfolio's asset allocation. Thus, *allocation strategies* adjust the portfolio's allocation to stocks by 10 (AS10), 20 (AS20), and 30 (AS30) percentage points above or below the asset allocation set five years before.[3] In all cases, the asset allocation becomes more aggressive (conservative) when the portfolio is below (above) its expected path; also, in all cases, all the periodic withdrawals are those in the financial plan ($61,945).[4]

3.3. Previous Research

There is a vast literature discussing the impact of adjusting both withdrawals and asset allocations during the retirement period. Bengen (1994) is widely considered the seminal paper on the topic, although he did not explicitly consider dynamic adjustments to either variable; rather, for a given asset allocation he aimed to find an initial withdrawal rate that, coupled with inflation-adjusted withdrawals, implied an acceptable (or safe) failure rate. This was the beginning of the widely used and hotly debated 4% rule.[5]

Many articles in the literature focus on dynamic withdrawals, stating different goals, including the minimization of the failure rate; these include Guyton (2004), Guyton and Klinger (2006), Stout and Mitchell (2006), Spitzer et al (2008), Stout (2008), Blanchett and Frank (2009), Jaconetti et al (2013), and Zolt (2014), among many others. Perhaps an even broader literature focuses on dynamic asset allocations, also stating different goals; these include Ameriks et al (2001), Blanchett (2007), Spitzer and Singh (2007), Spitzer et al (2007), Garrison et al (2010), Pfau (2012), Pfau and Kitces (2014), Kitces and Pfau (2015), Estrada (2016), and Estrada and Kritzman (2019).

The approach in this article differs from most of the previous literature on the topic in at least two ways. First, the dynamic strategies considered here revolve around a financial plan that sets a schedule of withdrawals for the whole retirement period. Second, the evaluation of the competing strategies is based only marginally on the failure rate; it ultimately rests on a more thorough and recent metric, the coverage ratio. Furthermore, unlike most articles in the

---

[3] Changes in asset allocation may take time to affect a portfolio's return in the desired direction. For this reason, these adjustments are considered every five years, which seems to be a reasonable period for mean reversion to kick in.

[4] Waring and Siegel (2018) discuss how to properly assess risk when planning for retirement, emphasizing that more risk does not only imply a greater chance of a higher expected return but also a greater chance of downside. Ultimately, their advise is that if an individual is not comfortable with the risk of a strategy, he should change his asset allocation.

[5] This policy is often misinterpreted as suggesting that a retiree should withdraw 4% of his portfolio at the beginning of each year. However, that was not Bengen's (1994) suggestion. He suggested instead that a retiree should withdraw 4% of his portfolio at the beginning of retirement, and then adjust all subsequent withdrawals by inflation, thus keeping his purchasing power constant over time.

literature, the discussion here focuses on both dynamic withdrawals and asset allocations, not on either one or the other.

3.4. Performance

Exhibit 2 summarizes the performance of the S2P static strategy and the four dynamic M2T withdrawal strategies already introduced. Panel A shows, across the 90 retirement periods considered, the average coverage ratio (C), expected utility (EU), and failure rate (F) for each strategy, all as already defined.

Exhibit 2: Withdrawal Strategies

This exhibit summarizes the performance of the stick to the plan (S2P) strategy and four withdrawal strategies that limit the change in the periodic withdrawals to 5% (WS5), 10% (WS10), 15% (WS15), and 20% (WS20) above or below the initial withdrawal ($61,954). Panel A shows each strategy's average coverage ratio (C); expected utility (EU) given by expression (8); and failure rate (F) given by expression (5). Panel B shows the lowest and highest withdrawal of the 2,700 made by each strategy, as well as the variability of withdrawals as defined in footnote 4. The asset allocation is fixed at 60% stocks and 40% bonds. Performance is evaluated across the 90 retirement periods between 1900-1929 and 1989-2018.

	S2P	WS5	WS10	WS15	WS20
Panel A					
C	1.09	1.08	1.07	1.06	1.06
EU	–1.93	–1.75	–1.58	–1.34	–1.12
F	56.7%	53.3%	53.3%	52.2%	50.0%
Panel B					
Lowest	$61,954	$58,856	$55,758	$52,661	$49,563
Highest	$61,954	$65,051	$68,149	$71,247	$74,344
Variability	$0	$4,884	$5,630	$6,985	$7,820

As panel A shows, the average coverage ratio is rather similar across all strategies; expected utility, however, rises with the flexibility of the strategies. WS20 displays the higher expected utility (highlighted) of all the strategies considered in the exhibit, as well as the lowest failure rate. Interestingly, EU increases monotonically from left to right in the exhibit, thus suggesting that the more variability a retiree is willing to tolerate in terms of withdrawals, the better off he will be. Put differently, flexibility is valuable, a result consistent with the findings of Fox (2020).

Panel B shows the lowest and highest withdrawals across the 2,700 (=30×90) made by each strategy, as well as the variability of withdrawals.[6] By definition, withdrawals are limited to be within 5%, 10%, 15%, or 20% of the initial withdrawal ($61,954). Obviously, strategies that allow for larger departures from the initial withdrawal will have a larger difference between the lowest and the highest withdrawal, and a larger variability of withdrawals.

[6] Recall that in each retirement period 30 withdrawals are made. The standard deviation of these 30 withdrawals can be calculated, thus obtaining the volatility of withdrawals in a given retirement period. Doing the same for the 90 retirement periods considered yields 90 standard deviations. The average of those 90 standard deviations is the 'Variability' figure reported in the exhibit.

Exhibit 3 shows a similar analysis for the dynamic M2T allocation strategies already introduced, with the results of the S2P strategy reported again for ease of comparison. Panel A shows that the average coverage ratio decreases with the flexibility of the strategies. The highest EU (highlighted) corresponds to the AS20 strategy, and the lowest failure rate to the AS10 strategy. Ultimately, this panel suggests that adjusting the asset allocation in response to changing market conditions is superior to a static strategy of simply sticking to the plan.

Exhibit 3: Allocation Strategies

This exhibit summarizes the performance of the stick to the plan (S2P) strategy and three allocation strategies that limit the change in the portfolio's allocation to stocks to 10 (AS10), 20 (AS20), and 30 (AS30) percentage points above or below the asset allocation set five years earlier. Panel A shows each strategy's average coverage ratio (C); expected utility (EU) given by expression (8); and failure rate (F) given by expression (5). Panel B shows the lowest and highest withdrawal of the 2,700 made by each strategy, as well as the variability of withdrawals as defined in footnote 4. All periodic withdrawals are fixed at $61,954 in real dollars. Performance is evaluated across the 90 retirement periods between 1900-1929 and 1989-2018.

	S2P	AS10	AS20	AS30
<u>*Panel A*</u>				
C	1.09	1.05	1.03	0.99
EU	–1.93	–1.79	–1.72	–1.77
F	56.7%	51.1%	50.0%	55.6%
<u>*Panel B*</u>				
Lowest	$61,954	$61,954	$61,954	$61,954
Highest	$61,954	$61,954	$61,954	$61,954
Variability	$0	$0	$0	$0

Panel B simply shows that withdrawals are not the variable used by these strategies to push the portfolio closer to its expected path. Under allocation strategies, withdrawals are constant in inflation-adjusted dollars and equal to those in the financial plan ($61,954).

A comparison of exhibits 2 and 3, and particularly the expected utility of all the strategies considered, suggests two important results. First, flexibility is valuable; that is, adjusting either withdrawals or a portfolio's asset allocation clearly outperforms simply sticking to the plan. Second, adjusting withdrawals outperforms adjusting a portfolio's asset allocation; in fact, as the EU figures reveal, tolerating just 5% flexibility in withdrawals (WS5) would make a retiree better off than he would be by tolerating an increase of 30 percentage points in the allocation to stocks (AS30).

3.5. Caveats

None of the assumptions made in the previous analysis are critical. The $1 million portfolio is a notional amount that could be replaced with any other. The 30-year retirement period, although by far the most common in the literature, could easily be changed to a shorter or longer period. Annual withdrawals made at the beginning of the period could be changed to more or less frequent withdrawals, made at the beginning or at the end of each period. Keeping purchasing power constant over time is a typical, though by no means necessary, assumption;

rising or declining purchasing power over time could be easily incorporated into the financial plan.

The 60-40 stock-bond allocation could also be easily changed to any other static allocation, or even to a declining-equity glidepath as typically featured in target-date funds. In addition, the expected return for the chosen asset allocation could be its historical annualized return, as assumed here, or it may be a higher or lower return should a financial planner have a more optimistic or pessimistic view of the future.

Setting the target bequest at $0 (that is, leaving no bequest) could clearly be changed to any other target chosen by a retiree. But, importantly, there has to be a target either for the bequest (to solve the problem for the withdrawals) or for the withdrawals (to determine the expected bequest). Without either target there is no financial plan and, therefore, no way to determine when to introduce dynamic adjustments.

Finally, the values assumed in the base case for the risk aversion coefficient (γ=0.9999) and the penalty coefficient (λ=10) of the utility function can easily be changed to other values indicating higher or lower risk aversion, or a higher or lower penalty for failure. In fact, the next section reports the results of a sensitivity analysis performed on the value of these two coefficients.

3.6. Some Further Thoughts

It may seem surprising that the best strategy (WS20), as measured by expected utility, has such a high empirical failure rate (50%), particularly given that its average coverage ratio is higher than 1 (1.06). In this regard, it is important to note two things. First, a high F and C>1 are not inconsistent with each other; this may happen if a strategy fails often and at the same time leaves large bequests when it succeeds.

Second, the financial plan in Exhibit 1 is 'priced to perfection' in the sense that the $61,954 withdrawals and the $0 bequest are consistent with each other if the portfolio returns are 5% year after year. However, if (for the sake of the argument) in half of the retirement periods considered annualized returns are below 5% and in the other half above 5%, then a failure rate of 50% would follow.[7]

As much as a retiree may find the financial plan in Exhibit 1 appealing, he may also find the *empirical* 56.7% (50%) failure rate of the S2P (WS20) strategy unacceptable.[8] Would the

[7] Needless to say, this argument is oversimplified. An issue this argument ignores is sequence of returns risk; that is, the fact that two retirement periods with the same annualized return may have dramatically different results depending on whether the 'bad' returns come early or late. Fox (2020) addresses this issue in some detail.

[8] These high empirical failure rates, based on an initial withdrawal rate of almost 6.2%, should not be entirely surprising. For a 30-year retirement period, many argue that even 4% may be implausibly high

conclusions drawn so far change substantially if the financial planner proposed a plan with lower withdrawals in order to lower the empirical failure rate? Exhibit 4 aims to answer this question.

Exhibit 4: 4% Initial Withdrawal Rate

This exhibit summarizes the performance of all the strategies considered in Exhibits 2-3. Panel A shows each strategy's average coverage ratio (*C*); expected utility (EU) given by expression (8); and failure rate (*F*) given by expression (5). Panel B (in thousands of dollars) shows the lowest and highest withdrawal of the 2,700 made by each strategy, as well as the variability of withdrawals as defined in footnote 4. The initial withdrawal is $40,000 and the initial asset allocation is 60% stocks and 40% bonds. Performance is evaluated across the 90 retirement periods between 1900-2029 and 1989-2018.

	S2P	WS5	WS10	WS15	WS20	AS10	AS20	AS30
Panel A								
C	2.32	2.30	2.27	2.23	2.20	2.07	1.94	1.84
EU	0.66	0.72	0.72	0.71	0.70	0.62	0.57	0.50
F	6.7%	1.1%	0.0%	0.0%	0.0%	4.4%	2.2%	4.4%
Panel B								
Lowest	$40.0	$38.0	$36.0	$34.0	$32.0	$40.0	$40.0	$40.0
Highest	$40.0	$42.0	$44.0	$46.0	$48.0	$40.0	$40.0	$40.0
Variability	$0.00	$1.12	$2.31	$3.54	$4.79	$0	$0.00	$0.00

A financial plan maintaining all the previous assumptions but lowering the annual withdrawals from $61,954 to $40,000 would result in a bequest of $1.46 million. The empirical failure rate of sticking to such plan, as the first column of Exhibit 4 shows, decreases dramatically from the 56.7% reported in Exhibits 2-3 to 6.7%. In fact, the lower withdrawals reduce substantially the empirical failure rate of all the strategies, to the point that three withdrawal strategies (WS10, WS15, WS20) never failed and the remaining one (WS5) failed only once.

The expected utility of all the strategies increases substantially with respect to those reported in Exhibits 2-3, but allocation strategies now have lower EU than the S2P strategy. Importantly, it remains the case that dynamic M2T withdrawal strategies outperform both the S2P strategy and allocation strategies. However, in this case, WS10 reveals itself as the best strategy (as opposed to WS20 in the base case).

These results suggest that if a retiree finds the empirical failure rates of the financial plan in Exhibit 1 unacceptably high, he always has the option of reducing the inflation-adjusted withdrawals at the cost of possibly leaving an unintended bequest. In fact, the EU figures for each strategy in Exhibit 4 are higher than those for the respective strategies in Exhibit 2, thus supporting such a trade-off.

One final issue to be addressed is whether the conclusions drawn so far depend on the particular choice of parameters of the utility function in expression (7); that is, on the specific choice of γ=0.9999 and λ=10 for the risk aversion and penalty coefficients. Exhibit 5 aims to answer this question, presenting a sensitivity analysis on the value of both coefficients. The

given expected (rather than historical) returns for stocks and bonds both in the U.S. and in other global markets; see, for example, Pfau (2010) and Estrada (2016).

figures in the table are the EU of each strategy; the values highlighted are the highest EU for each value of γ and λ considered.

Exhibit 5: Sensitivity Analysis

This exhibit shows the expected utility (EU) of all the strategies considered in Exhibits 2-4, for different values of the risk aversion coefficient (γ), given λ=10, and for the penalty coefficient (λ), given γ=0.9999, of the utility function in expression (7). EU is given by expression (8). The initial withdrawal is $61,954 and the initial asset allocation is 60% stocks and 40% bonds. Performance is evaluated across the 90 retirement periods between 1900-1929 and 1989-2018.

$\gamma \rightarrow$	**0.5**	**0.9999**	**1.5**	**2.0**	**3.0**	**5.0**
S2P	−1.89	−1.93	−1.96	−1.98	−2.02	−2.06
WS5	−1.71	−1.75	−1.77	−1.79	−1.83	−1.86
WS10	−1.55	−1.58	−1.60	−1.62	−1.64	−1.68
WS15	−1.32	−1.34	−1.36	−1.38	−1.40	−1.43
WS20	−1.10	−1.12	−1.13	−1.15	−1.17	−1.19
AS10	−1.76	−1.79	−1.81	−1.83	−1.86	−1.89
AS20	−1.70	−1.72	−1.74	−1.76	−1.78	−1.81
AS30	−1.75	−1.77	−1.78	−1.80	−1.82	−1.84
$\lambda \rightarrow$	**0**	**5**	**10**	**20**	**50**	**100**
S2P	0.21	−0.86	−1.93	−4.08	−10.51	−21.23
WS5	0.20	−0.78	−1.75	−3.69	−9.53	−19.25
WS10	0.18	−0.70	−1.58	−3.33	−8.60	−17.38
WS15	0.16	−0.59	−1.34	−2.84	−7.34	−14.84
WS20	0.14	−0.49	−1.12	−2.38	−6.16	−12.45
AS10	0.18	−0.80	−1.79	−3.77	−9.69	−19.56
AS20	0.17	−0.78	−1.72	−3.61	−9.28	−18.72
AS30	0.14	−0.81	−1.77	−3.68	−9.41	−18.97

The top panel considers values between 0.5 and 5 for γ, given λ=10. As the EU figures clearly show, regardless of the value of γ, dynamic M2T strategies outperform the S2P strategy; withdrawal strategies generally outperform allocation strategies; and WS20 is the best overall strategy. The bottom panel considers values between 0 and 100 for λ, given γ=0.9999. With the sole exception of the no-penalty case (λ=0), the three results just mentioned remain valid; in fact, with a penalty as low as λ=0.9, those three results are restored.

Finally, note that the fact that withdrawal strategies outperform allocation strategies should not be entirely surprising. Adjusting withdrawals impacts the portfolio immediately and in the right direction; adjusting the portfolio's asset allocation, on the other hand, takes a longer time to impact the portfolio, and it may initially do so in the wrong direction. If a portfolio is below its expected path and a retiree implements a more aggressive asset allocation, it is possible that in the next period the stock market drops sharply, thus pushing the portfolio even further away from its expected path than it would have been the case with the previous allocation.

4. Assessment

All retirees need to be aware of the importance of having a financial plan that outlines the periodic withdrawals to be made from their portfolio during retirement. Such financial plan needs to take into account a set of withdrawals that can sustain a retiree's lifestyle, as well as a target bequest, at the same time avoiding depleting the portfolio too early.

Financial plans are inevitably based on expected returns, which are unlikely to be the same as those experienced by any given individual during retirement. Thus, when the returns experienced differ from those expected in the plan, what should a retiree do? Should he statically stick to his plan, or should he introduce dynamic adjustments that aim to push the portfolio closer to the path outlined in the plan? That is the key issue addressed in this article.

A static policy of simply sticking to the plan is evaluated against dynamic 'managing to target' (M2T) strategies, which aim to push the portfolio closer to the path outlined in the plan. Two types of dynamic M2T polices are considered, some that adjust the periodic withdrawals and some that adjust the portfolio's asset allocation.

Although the failure rate is the most common way to evaluate the performance of retirement strategies, the metric used here is the coverage ratio recently introduced by Estrada and Kritzman (2019). This metric overcomes the shortcomings of the failure rate and provides a more comprehensive evaluation of retirement strategies. This coverage ratio is coupled with a kinked utility function that incorporates the idea that retirees are more displeased with failures (running out of money too early) than are pleased with successes (leaving a bequest).

The long-term evidence for the U.S. market suggests that dynamic M2T strategies outperform a static strategy of simply sticking to the plan. It also suggests that withdrawal strategies are superior to allocation strategies, and that tolerance to adjustments is valuable. These results do not really depend on the specific assumptions made in the analysis but rather apply more generally to retirees in different circumstances, such as different portfolios, asset allocations, life expectancy in retirement, target bequest, or preferences.

All in all, these results suggest, first, that retirees should have a financial plan; without one, they are simply hoping to hit a target in the dark. Second, that retirees should be flexible when markets conditions change; sticking to the original plan is unlikely to be the best strategy, and none of the adjustments discussed here are difficult to implement. And finally, when things do not go exactly as planned, retirees should adjust their periodic withdrawals, thus tolerating limited fluctuations in their purchasing power; doing so will ultimately make them better off.

References

Ameriks, John, Robert Veres, and Mark Warshawsky (2001). "Making Retirement Income Last a Lifetime." Journal of Financial Planning, December, 60-76.

Bengen, William (1994). "Determining Withdrawal Rates Using Historical Data." Journal of Financial Planning, 7, 4, 171-180.

Blanchett, David (2007). "Dynamic Allocation Strategies for Distribution Portfolios: Determining the Optimal Distribution Glide Path." Journal of Financial Planning, 20, 12, 68-81.

Blanchett, David, and Larry Frank (2009). "A Dynamic and Adaptive Approach to Distribution Planning and Monitoring." Journal of Financial Planning, April, 52-66.

Estrada, Javier (2016). "The Retirement Glidepath: An International Perspective." Journal of Investing, 25, 2, 28-54.

Estrada, Javier (2019). "Managing to Target: Dynamic Adjustments for Accumulation Strategies." Journal of Financial Planning, 32, 8, 46-53.

Estrada, Javier, and Mark Kritzman (2019). "Toward Determining the Optimal Investment Strategy for Retirement." Journal of Retirement, 7, 1, 35-42.

Fox, Steve (2020). "Linking Metrics to Objectives: Retirement Saving, Spending and Active Management." Journal of Retirement, forthcoming 2020.

Garrison, Michael, Carlos Sera, and Jeffrey Cribbs (2010). "A Simple Dynamic Strategy for Portfolios Taking Withdrawals: The Case for Using a 12-Month Simple Moving Average." Journal of Financial Planning, February, 51-61.

Guyton, Jonathan (2004). "Decision Rules and Portfolio Management for Retirees: Is the 'Safe' Initial Withdrawal Rate *Too* Safe?" Journal of Financial Planning, October, 54-62.

Guyton, Jonathan, and William Klinger (2006). "Decision Rules and Maximum Initial Withdrawal Rates." Journal of Financial Planning, March, 48-58.

Jaconetti, Colleen, Francis Kinniry, and Michael DiJoseph (2013). "A More Dynamic Approach To Spending For Investors in Retirement." Vanguard Research, October, 1-12.

Kitces, Michael, and Wade Pfau (2015). "Retirement Risk, Rising Equity Glide Paths, and Valuation-Based Asset Allocation." Journal of Financial Planning, 28, 3, 38-48.

Pfau, Wade (2010). "An International Perspective on Safe Withdrawal Rates: The Demise of the 4 Percent Rule?" Journal of Financial Planning, December, 52-61.

Pfau, Wade (2012). "Withdrawal Rates, Savings Rates, and Valuation-Based Asset Allocation." Journal of Financial Planning, April, 34-40.

Pfau, Wade, and Michael Kitces (2014). "Reducing Retirement Risk with a Rising Equity Glide Path." Journal of Financial Planning, 27, 1, 38-48.

Spitzer, John, and Sandeep Singh (2007). "Is Rebalancing a Portfolio During Retirement Necessary?" Journal of Financial Planning, June, 46-57.

Spitzer, John, Jeffrey Strieter, and Sandeep Singh (2007). "Guidelines for Withdrawal Rates and Portfolio Safety During Retirement." Journal of Financial Planning, October, 52-59.

Spitzer, John, Jeffrey Strieter, and Sandeep Singh (2008). "Adaptive Withdrawals." Journal of Investing, Summer, 104-113.

Stout, Gene (2008). "Stochastic Optimization of Retirement Portfolio Asset Allocations and Withdrawals." Financial Services Review, 17, 1-15.

Stout, Gene, and John Mitchell (2006). "Dynamic Retirement Withdrawal Planning." Financial Services Review, 15, 117-131.

Totten, Thomas, and Laurence Siegel (2019). "Combining Conventional Investing with a Lifetime Income Guarantee: A Blueprint for Retirement Security." Journal of Retirement, 6, 4, 45-59.

Waring, Barton, and Laurence Siegel (2018). "What Investment Risk Means To You, Illustrated: Strategic Asset Allocation, the Budget Constraint, and the Volatility of Spending During Retirement." Journal of Retirement, 6, 2, 7-26.

Zolt, David (2014). "Retirement Planning by Targeting Safe Withdrawal Rates." Journal of Financial Planning, October, 20-23.