Managing to Target: Dynamic Adjustments for Accumulation 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
Planning for retirement, particularly during the accumulation period, largely consists of setting a target value for the retirement portfolio and implementing a policy aimed at hitting that target. Financial plans are inevitably based on expected returns, which are likely to be different from those an individual experiences during the accumulation period. Thus, when the portfolio deviates from the path outlined in the plan, the individual can choose between a static policy of sticking to his plan and simply hope to hit the target, or dynamic policies designed to keep the portfolio close to its path. This article evaluates three types of such dynamic policies, broadly referred to as 'managing to target' (M2T), that adjust the periodic contributions or the portfolio's asset allocation. The results reported show that some of the dynamic policies outlined outperform a static policy, and adjusting contributions is far superior to adjusting the asset allocation.

April, 2019

1. Introduction

Casual evidence suggests that most individuals do not have a clear financial plan to build a retirement portfolio. In fact, most of them do not even have a target value for such portfolio on the retirement date, a figure often referred to as 'the number' (Eisenberg, 2006). This is most likely due to the fact that 'the number' depends on both life expectancy and the cost of the desired lifestyle during retirement, neither of which individuals find it easy to forecast, particularly in the early stages of their working years.

This article does not deal with how to determine a target amount for a retirement portfolio. Rather, it takes 'the number' as given and, first, makes a financial plan to hit the target; then it compares a static strategy of sticking to the plan to dynamic strategies that make adjustments to the plan along the way; and finally, in order to determine the best course of action, it proposes a way to evaluate investment strategies for the accumulation period.

The financial plan designed to hit the target retirement portfolio essentially consists of determining the (inflation-adjusted) constant annual contribution during the expected number of working years, given a selected asset allocation. The individual can then simply stick to the contributions and asset allocation specified in the plan, which is inevitably based on expected

* I would like to thank Jack Rader for his comments. Didac Gaznares provided research assistance. The views expressed below and any errors that may remain are entirely my own.

returns, and hope that the actual returns he obtains during his working years will lead him to meet, or at least end up close to, his target retirement portfolio.

Alternatively, whenever the actual returns experienced push the portfolio away from the path specified in the plan, referred to here as the expected path, the individual could adjust either the annual contributions or the asset allocation so that the portfolio returns, or at least moves closer to, the expected path. The ultimate issue addressed in this article is whether there is any benefit from engaging in such dynamic adjustments aimed at keeping the portfolio close to the expected path, a set of policies broadly referred to here as *managing to target* (M2T).

Three types of M2T policies are considered. The first group are effective but impractical policies, which may require an individual to adjust his periodic contributions more than he may be able or willing to tolerate. The second group are feasible but limited policies, which are easier for an individual to tolerate but generally yield lower benefits than the previous group. The third group are asset allocation policies, that stick to the contributions specified in the financial plan but adjust the asset allocation over time.

In order to determine whether to implement the contributions and asset allocation outlined in the plan, or alternatively to make dynamic adjustments along the way, the individual needs a criterion to decide. The most typical way to make this decision would be to compare the size of the portfolio on the retirement date across the strategies considered. However, this is appropriate only if the periodic contributions of the different strategies are the same; if they are not, then an alternative criterion is needed. The tool proposed here to evaluate investment strategies during the accumulation period is a strategy's net present value.

In a nutshell, the results discussed here suggest, first, that some dynamic policies designed to keep the portfolio close to the expected path do outperform a static policy of simply sticking to the plan. Second, adjusting the periodic contributions has a much larger and beneficial impact than adjusting the portfolio's asset allocation. And third, there is a trade-off between tolerating flexibility in the contributions and the benefits obtained from dynamic adjustments.

The rest of the article is organized as follows. Section 2 discusses how to set the financial plan and how to evaluate alternative strategies for the accumulation period. Section 3 evaluates a static policy of sticking to the plan and several dynamic M2T policies that make adjustments to the plan along the way. Finally, section 4 provides an assessment.

2. The Issue

This section addresses, first, how to set a financial plan aimed at retiring with a target value for a portfolio, thus determining the annual contributions and the portfolio's expected path. Then, it discusses the evaluation of accumulation strategies and proposes a strategy's net present value as the appropriate evaluation metric.

2.1. The Financial Plan

Consider a 25-year old individual that plans to work for 40 years and aims to retire with a $1 million portfolio in real (inflation-adjusted) dollars. As already mentioned, determining the appropriate size of the retirement portfolio, given the intrinsic uncertainty about life expectancy and the cost of the desired lifestyle in retirement, is far from trivial, but it is not the issue addressed in this article; 'the number' is taken as given here.

Our representative individual plans to make annual contributions to his retirement portfolio, constant in real terms, starting at the end of his first working year, and ending one year before retirement (that is, on his retirement date he does not make a contribution but rather liquidates the portfolio), for a total of 39 annual contributions.[1]

The retirement portfolio needs to have an appropriate asset allocation, which typically follows from three variables: an individual's goal (in this case, retirement), holding period (in this case, 40 years), and risk tolerance. For concreteness, assume that on the basis of these three variables our individual decides to build a portfolio consisting of 60% stocks and 40% bonds.

Although our representative subject can presumably make a firm commitment to stick to a financial plan, thus potentially eliminating the uncertainty about his future annual contributions, he will still have to bear the uncertainty of the returns he will obtain from his portfolio during his working years. Put differently, his plan will inevitably be based on *expected* returns. 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%. Consider, then, that figure as the expected annual return of our individual's portfolio.

At this point, our subject's problem comes down to the solution of a simple expression linking his 39 annual contributions to the $1 million portfolio with which he expects to retire. In general, he needs to find the constant annual real contribution (C), given the number of contribution to be made (T), the portfolio's expected annual real return (R), and the target retirement portfolio (P^*), that solves the expression

$$C \cdot \sum_{t=1}^{T} (1+R)^t = P^* \tag{1}$$

noting that $P_0 = C_{40} = 0$ and $C_t = C$ for $t = 1, \ldots, 39$; that is, the portfolio starts with 0 at the beginning of the working period, the next 39 contributions are constant, and there is no contribution at the end of the working period, when the portfolio is simply liquidated.

[1] None of these assumptions are critical. The essence of the results would not change if the individual were to make a contribution at the beginning of his working years and (or) another at the end of his working years. Similarly, the size of the target retirement portfolio and the number of years working and making contributions do not affect the key messages that stem from the analysis.

In our specific example, the individual needs to solve the expression

$$C \cdot \sum_{t=1}^{39}(1 + 0.05)^t = \$1{,}000{,}000 \quad (2)$$

which incorporates the number of contributions our subject will be making (39), the portfolio's expected annual real return (5%), and the target portfolio on the retirement date ($1 million). Solving (2) for C yields C = $8,347. In words, if our individual makes annual (inflation-adjusted) contributions of $8,347 during 39 years, and his portfolio grows at the annual real rate of 5%, then he will retire after 40 years with the target $1 million portfolio.

Putting together the constant annual real contributions just calculated ($8,347) and the expected return of the portfolio (5%) yields the portfolio's *expected path*, shown in Exhibit 1. This expected path plays the critical role of being the benchmark against which deviations from the plan are measured; in other words, dynamic adjustments are considered only when the actual portfolio deviates from this expected path.

Exhibit 1: Expected Path

This exhibit shows the expected path of a portfolio that receives 39 annual inflation-adjusted contributions of $8,347 and grows at the annual real rate of 5%. Portfolio values are in real terms and after each annual contribution.

Period	Portfolio	Period	Portfolio	Period	Portfolio	Period	Portfolio
1	$8,347	11	$118,588	21	$298,158	31	$590,659
2	$17,112	12	$132,864	22	$321,413	32	$628,539
3	$26,315	13	$147,855	23	$345,831	33	$668,313
4	$35,978	14	$163,595	24	$371,470	34	$710,076
5	$46,124	15	$180,122	25	$398,391	35	$753,927
6	$56,777	16	$197,475	26	$426,657	36	$799,971
7	$67,963	17	$215,696	27	$456,337	37	$848,317
8	$79,709	18	$234,828	28	$487,502	38	$899,080
9	$92,042	19	$254,917	29	$520,224	39	$952,381
10	$104,991	20	$276,010	30	$554,582	40	$1,000,000

To highlight the obvious, this expected path is based on the assumption that the portfolio will grow at 5% year after year, which is not really what any individual with a 60-40 allocation would expect over his 40-year accumulation period. In other words, the expected path is *not* to be expected. Or, put differently, in any given accumulation period, our individual's 39 annual contributions of $8,347 to a 60-40 stock-bond portfolio are most likely to result in a nest egg higher or lower than the $1 million target.

2.2. Evaluating Strategies

The standard way to evaluate an investment strategy during the accumulation period is to assess its terminal value (that is, the value of the portfolio on the retirement date) over a large number of historical or simulated accumulation periods. Essentially, this amounts to comparing several parameters or percentiles of the distribution of terminal values; see, for example, Basu et al (2011), Arnott et al (2013) and Estrada (2014), among others.

That is a plausible approach as long as the periodic contributions of the strategies considered are the same, as it would be the case, for example, when the strategies evaluated differ only in their asset allocation. However, an individual may adjust over time not only the portfolio's asset allocation but also the periodic contributions, in which case focusing just on terminal values would obviously be misleading.

During the accumulation period individuals make periodic contributions to their retirement portfolios, which they liquidate upon retirement.[2] Given the stream of negative cash flows (contributions) and the final positive cash flow (the retirement portfolio), a tool typically used to evaluate investment projects, the net present value (NPV), seems to suggest itself as a useful metric to evaluate accumulation strategies. For this reason, the strategies considered in the next section are evaluated with the expression

$$\text{NPV} = -\frac{C_1}{(1+R)} - \frac{C_2}{(1+R)^2} - \cdots - \frac{C_{39}}{(1+R)^{39}} + \frac{P_{40}}{(1+R)^{40}} \tag{3}$$

where C_t denotes a strategy's contribution in year t; R denotes the strategy's required return; and P_{40} is the value of the portfolio on the retirement date.

Another obvious possibility for the evaluation of accumulation strategies is a strategy's internal rate of return (IRR). As is well known, if the cash flows change in sign just once, as would be the case when all the contributions are negative cash flows and the liquidated portfolio is a positive cash flow, then both the NPV and IRR approaches would provide the same assessment. However, it is possible to conceive strategies in which, if the individual is above his expected path, he could make a withdrawal from (rather than a contribution to) the portfolio, thus generating a positive cash flow. And, as is also well known, when cash flows change signs more than once, then a unique solution for the IRR is not guaranteed. For this reason, comparing NPVs provides a slightly more general way of assessing accumulation strategies than comparing IRRs.

3. Evidence

This session first discusses the data used and methodology implemented in this article. Then it introduces the static and dynamic strategies considered here and evaluates their performance. And finally it discusses some caveats and extensions.

---

[2] Needless to say, liquidation is not strictly necessary. All that matters for a proper evaluation of accumulation strategies is that the retirement portfolios have a market value.

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 individual plans to work for 40 years and make 39 annual contributions to his retirement portfolio, constant in real terms, with the first contribution to be made at the end of his first working year. At the end of his last working year, he will not make a contribution but simply liquidate his holdings. His goal is to retire with a $1 million portfolio.

Throughout the accumulation period, our individual holds a 60-40 stock-bond allocation, rebalanced annually, and expects to obtain 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 this individual should make annual (inflation-adjusted) contributions of $8,347 to satisfy his goal of retiring with $1 million. Our subject's financial plan can be summarized by his portfolio's expected path displayed in Exhibit 1.

All strategies considered are evaluated over all the possible historical 40-year periods between 1899 and 2017; this yields 80 accumulation periods, beginning with 1899-1938 and ending with 1978-2017.[3] Each policy is thus exposed to 39 years of returns over each of the 80 accumulation periods considered, thus enabling the calculation of 80 NPVs per policy, which in turn results in a distribution of NPVs for each policy. These distributions are the basis of the evaluation of the different strategies considered below.

3.2. Accumulation Strategies

As already mentioned, 39 annual real contributions of $8,347 will result in a $1 million portfolio 40 years down the road if the portfolio compounds, year after year, at a 5% real return. However, since no portfolio is expected to evolve deterministically at this rate, the nest egg on the retirement date will depend on the actual returns obtained during any given 40-year accumulation period.

---

[3] The reason for beginning the analysis in 1899 is simply because the stock and bond returns in the sample start in 1900. Thus, given that our individual makes his the first contribution at the end of the first working year, he starts his portfolio with $8,347 at the beginning of 1900, split into 60% stocks and 40% bonds, and is therefore exposed to the returns of these two asset classes during the first year of returns available from the sample.

The first policy to be considered, then, is the *stick to the plan* (S2P) strategy, which simply sticks to making 39 annual real contributions of $8,347, regardless of whether or not the portfolio is on track towards the $1 million target. This is the only strategy of all those considered here that is static in the sense that it does not introduce any changes, either in contributions or in the asset allocation, during the accumulation period. It simply sticks to the plan and essentially *hopes* to result in a $1 million retirement portfolio. This strategy is the benchmark against which all the dynamic policies are evaluated.

Three types of dynamic policies are considered, some that adjust the annual contributions and others that adjust the asset allocation, all with the goal of returning the portfolio (at least close) to the expected path outlined in the financial plan. All these strategies are broadly referred to as *managing to target* (M2T).

Some M2T policies may be effective but impractical in the sense that they require the individual to do something he may be unable or unwilling to implement. Consider, for example, a strategy that in some years requires contributions many times larger, in real terms, than that made at the beginning of the accumulation period; or another whose contributions vary widely from year to year. Five such *effective but impractical* (EBI) policies are considered.

The first of these strategies (EBI1) makes a positive or negative contribution (that is, a withdrawal from the portfolio), so that at the end of each year the portfolio returns exactly to the expected path outlined in Exhibit 1. To illustrate, if at the end of the second working year the portfolio has $12,112 ($22,112), the individual would contribute (withdraw) $5,000 so that the portfolio is left with the $17,112 outlined in the expected path. This strategy may obviously result in very variable annual contributions (as will be seen below) even under normal market conditions. Furthermore, it is the only of all the strategies considered in this article that allows for withdrawals from the portfolio.

The second of these strategies (EBI2) limits the annual contributions to no more than 5% above or below the contribution made *the previous year*. It aims to limit the variability in contributions resulting from EBI1, and to avoid withdrawals from the retirement portfolio. The other three EBI strategies considered are similar but limit the annual contributions to no more than 10% (EBI3), 15% (EBI4), and 20% (EBI5) above or below the contribution made the previous year. In all cases contributions are increased (decreased) when the portfolio is below (above) the value outlined in the expected path.

The next set of M2T policies evaluated have pros and cons relative to the EBI strategies just discussed. Their main benefit is that they limit even more the variability of the annual contributions, thus making them more realistic; the associated cost is that they also limit the benefits they produce. Five such *feasible but limited* (FBL) strategies are considered, all of which limit the annual contributions to no more than 5% (FBL1), 10% (FBL2), 15% (FBL3), 20% (FBL4), and 50% (FBL5) above or below the contribution made *at the beginning of the accumulation period* ($8,347). As before, in all cases contributions are increased (decreased) when the portfolio is below (above) the value outlined in the expected path.

The final set of M2T polices to be considered does not adjust the annual contributions. Rather, every five years the portfolio's asset allocation is adjusted so that it becomes more aggressive (conservative) when the portfolio is below (above) the value outlined in the expected path. Three such *asset allocation* (AA) strategies are considered, the first limiting the change in the asset allocation to 10 percentage points (AA1), the second to 20 percentage points (AA2), and the third to 30 percentage points (AA3), in all cases with respect to the asset allocation set five years earlier.

3.3. Performance

Exhibit 2 summarizes the performance of the S2P and EBI strategies discussed in the previous part. Panel A summarizes the median of the distribution of NPVs, as well as its 5% (P5) and 10% (P10) cutoff points in the lower tail. Panel B focuses on the distribution of the value of the portfolio on the retirement date and reports its median, as well as the number of times it fell short from $1 million by 5% or more (Short5) and by 10% or more (Short10). Both distributions (that of NPVs and that of terminal values of the portfolio) have 80 observations, one for each of the 80 historical 40-year accumulation periods considered. Finally, panel C reports the minimum and maximum annual contributions of the 3,120 (=39×80) made by each strategy.

Exhibit 2: Effective But Impractical (EBI) Strategies

This exhibit summarizes the performance of the stick to the plan (S2P) strategy, as well as that of five effective but impractical (EBI) strategies, all as defined in the text. Panel A focuses on the distribution of NPVs and reports its median and the 5% (P5) and 10% (P10) percentiles in the lower tail. Panel B focuses on the distribution of retirement portfolios and reports its median, as well as the number of times the portfolio fell short from $1 million by 5% or more (Short5) and by 10% or more (Short10). Panel C reports the minimum (Min) and maximum (Max) contribution of the 3,120 made by each strategy. Performance is evaluated over all 40-year accumulation periods between 1899-1938 and 1978-2017. Contributions to the retirement portfolio are made at the end of each year, in all cases starting with $8,347.

	S2P	EBI1	EBI2	EBI3	EBI4	EBI5
Panel A						
Median	$15,259	$47,996	$32,878	$36,692	$50,126	$55,865
P5	–$52,697	–$43,164	–$44,799	–$38,532	–$34,031	–$31,855
P10	–$46,999	–$36,902	–$38,214	–$31,972	–$29,697	–$27,645
Panel B						
Median	$1,107,423	$1,011,696	$1,211,068	$1,261,080	$1,350,777	$1,425,974
Short5	25	22	17	17	17	19
Short10	20	13	17	14	15	17
Panel C						
Min	$8,347	–$249,660	$1,452	$278	$58	$13
Max	$8,347	$266,393	$19,690	$39,325	$66,608	$128,253

As already mentioned, the S2P strategy is the benchmark against which all the M2T strategies are evaluated, and a strategy's NPV is the metric used for the evaluation. Thus, the median NPV of $15,259, as well as the 5% and 10% cutoff points in the lower tail of the distribution (–$52,697 and –$46,999) shown in panel A are important reference points. So are the median value of the portfolio on the retirement date ($1,107,423), and the number of times the portfolio was 5% and 10% short from $1 million on that date (25 and 20 times), shown in panel B.

The ultimate question posed in this article is whether our subject can do better than simply sticking to his plan. *Is there any value in implementing dynamic adjustments during the accumulation period so that the portfolio remains close to the expected path?* The last five columns of Exhibit 2 aim to answer this question for the five EBI strategies considered here.

Panel A shows that all the EBI strategies outperform the S2P strategy, as they all have higher median NPV, as well as higher (less negative) 5% and 10% cutoff points in the lower tail. In words, the EBI strategies add value by increasing both average performance and performance in 'bad scenarios' (defined as those in the lower 5% and 10% of the distribution). Furthermore, based on these three variables, EBI5 delivers the best performance.

Panel B, which focuses on the value of portfolios on the retirement date, shows results that are broadly consistent (albeit more mixed) with those of panel A. Note that with the exception of EBI1, all the other EBI strategies deliver a higher median value of the retirement portfolio. That said, it is important to highlight that the goal of the M2T strategies considered here is *not* to enhance the value of the retirement portfolio; rather, it is to hit (or end up close to) the $1 million target.

Obviously, if the target is going to be missed, it is better to end up with more rather than with less than $1 million, which is what the next two rows of panel B focus on. These figures show that all EBI strategies mitigate the number of shortfalls relative to those of the S2P strategy, and that they do so in different degrees. From this perspective of limiting shortfalls, EBI3 seems to deliver the best overall performance.

Finally, panel C shows why the EBI strategies are impractical. Taking as a reference point the initial annual contribution of $8,347, note that all strategies make contributions much higher than this amount, in real terms. In the case of EBI3, for example, the $39,325 contribution is almost five times larger than the initial contribution, something that many individuals may be unable or unwilling to implement. EBI1, on the other hand, reveals itself as the most impractical of all the EBI strategies, given that in one period our individual could have *withdrawn* $249,660 from his portfolio, and in another he would have had to contribute $266,393.

The empirical impracticality of EBI policies opens the door to explore the FBL policies outlined in the previous part. Exhibit 3 summarizes their performance, reporting again for reference the performance of the S2P strategy. Panel A shows that all FBL strategies outperform the S2P strategy both in terms of average performance (an increase in the median NPV between

9% for FBL1 and 69% for FBL5) and performance in bad scenarios (an increase in P5 between 3% for FBL1 and 21% for FBL5, and an increase in P10 between 3% for FBL1 and 25% for FBL5). Note that the more flexibility in the contributions FBL strategies allow for, the higher are the benefits they provide.

Exhibit 3: Feasible But Limited (FBL) Strategies

This exhibit summarizes the performance of the stick to the plan (S2P) strategy, as well as that of five feasible but limited (FBL) strategies, all as defined in the text. Panel A focuses on the distribution of NPVs and reports its median and the 5% (P5) and 10% (P10) percentiles in the lower tail. Panel B focuses on the distribution of retirement portfolios and reports its median, as well as the number of times the portfolio fell short from $1 million by 5% or more (Short5) and by 10% or more (Short10). Panel C reports the minimum (Min) and maximum (Max) contribution of the 3,120 made by each strategy. Performance is evaluated over all 40-year accumulation periods between 1899-1938 and 1978-2017. Contributions to the retirement portfolio are made at the end of each year, in all cases starting with $8,347.

	S2P	FBL1	FBL2	FBL3	FBL4	FBL5
Panel A						
Median	$15,259	$16,650	$17,787	$19,032	$19,953	$25,815
P5	–$52,697	–$51,165	–$50,135	–$50,012	–$48,479	–$41,754
P10	–$46,999	–$45,483	–$43,760	–$42,564	–$41,085	–$35,063
Panel B						
Median	$1,107,423	$1,126,037	$1,153,662	$1,178,273	$1,202,186	$1,214,066
Short5	25	25	23	22	21	19
Short10	20	21	20	19	18	16
Panel C						
Min	$8,347	$7,930	$7,513	$7,095	$6,678	$4,174
Max	$8,347	$8,765	$9,182	$9,599	$10,017	$12,521

Panel B reinforces the results of panel A. In fact, not only do all FBL strategies outperform the S2P strategy but also, as in panel A, the outperformance is increasing in the flexibility tolerated in the contributions. This is reflected by the fact that the average size of the retirement portfolio monotonically increases, and the number of shortfalls monotonically decreases, from FBL1 to FBL5.

Panel C again provides a reality check by highlighting the trade-offs involved. FBL5 delivers the best overall results, but it forces the individual to contribute more than he may be willing or able to do, as reflected in a contribution 50% higher, in real terms, than that made at the beginning of the accumulation period. The individual may obviously choose to limit the increases in annual contributions (move to the left in the exhibit), but that would also limit the benefits he would obtain from trying to remain close to the expected path.

Finally, the comparison between Exhibits 2 and 3 provides an interesting perspective and further highlights the relevant trade-offs. FBL policies have the advantage of more predictable, and largely feasible, contributions; each FBL strategy limits the annual contributions to just three possible values ($8,347, *x*% above, and *x*% below), whereas EBI strategies display much more variable and extreme contributions. On the other hand, in terms of NPV (on average and in bad scenarios) and the final value of the retirement portfolio (on average and in terms of shortfalls), FBL strategies generally underperform EBI strategies.

The final set of M2T policies evaluated does not adjust the contributions but the portfolio's asset allocation. Exhibit 4 summarizes the performance of the three AA policies outlined in the previous part, reporting again for reference the performance of the S2P strategy. Panel A shows that these policies substantially underperform the S2P strategy both in terms of median NPV and NPV in bad scenarios.[4]

Exhibit 4: Asset Allocation (AA) Strategies

This exhibit summarizes the performance of the stick to the plan (S2P) strategy, as well as that of three asset allocation (AA) strategies, all as defined in the text. Panel A focuses on the distribution of NPVs and reports its median and the 5% (P5) and 10% (P10) percentiles in the lower tail. Panel B focuses on the distribution of retirement portfolios and reports its median, as well as the number of times the portfolio fell short from $1 million by 5% or more (Short5) and by 10% or more (Short10). Panel C reports the minimum (Min) and maximum (Max) contribution of the 3,120 made by each strategy. Performance is evaluated over all 40-year accumulation periods between 1899-1938 and 1978-2017. Contributions to the retirement portfolio are made at the end of each year, in all cases starting with $8,347.

	S2P	AA1	AA2	AA3
Panel A				
Median	$15,259	$6,052	$6,073	$1,956
P5	–$52,697	–$59,717	–$65,900	–$68,078
P10	–$46,999	–$51,563	–$51,754	–$49,359
Panel B				
Median	$1,107,423	$1,042,608	$1,042,753	$1,013,769
Short5	29	36	36	39
Short10	25	31	32	31
Panel C				
Min	$8,347	$8,347	$8,347	$8,347
Max	$8,347	$8,347	$8,347	$8,347

Panel B reinforces the previous results by showing that AA policies underperform the S2P strategy in terms of the value of the retirement portfolio, both on average and in terms of shortfalls. Curiously, more aggressive adjustments to the asset allocation (moving to the right in the exhibit) do not lead to better results; in fact, as shown in panels A and B, largely the opposite seems to be the case. Panel C simply shows that the annual contributions are not the variable used in these strategies to attempt to return the portfolio close to the expected path.

The big picture of exhibits 2 through 4 reveals that, in terms of NPV (both on average and in bad scenarios) and in terms of the retirement portfolio (both on average and in terms of shortfalls), AA policies underperform all the EBI and FBL strategies considered. Put differently, if the goal is to keep a portfolio on track along its expected path, adjusting contributions is far more effective than adjusting the asset allocation.

The fact that AA strategies underperform EBI and FBL strategies, and that they do so to such a large degree, is perhaps not entirely surprising. The latter policies adjust annual contributions and its impact on the portfolio is immediate and in the right direction. The former

[4] It should be noted that the distributions of NPVs of AA policies are much more (positively) skewed than all the other NPV distributions considered here. To illustrate, the mean and median NPV for the S2P policy are $20,445 and $15,259, whereas those of the AA1 policy are $18,731 and $6,052.

policies, on the other hand, adjust the asset allocation, but nothing guarantees that a more aggressive or conservative portfolio will perform as expected in the short term. In other words, AA policies take longer to impact the portfolio and may even initially do so in the wrong direction.

3.4. Some Further Thoughts

The results in the previous part suggest that, as far as feasible M2T strategies is concerned, dynamic adjustments that aim to keep a portfolio close to the expected path outlined in a financial plan are valuable. Relative to the S2P strategy, FBL strategies have higher NPVs, both on average and in bad scenarios; result in larger retirement portfolios; and reduce the number of shortfalls from the target portfolio. The results also suggest that if an investor is going to introduce dynamic adjustments during the accumulation period, he will obtain much better results adjusting his contributions than his asset allocation.

A few comments and caveats to the previous results may be in order. First, when calculating the expected path that summarizes the financial plan (Exhibit 1), it was assumed that the portfolio would evolve at the historical mean return of the (60-40) asset allocation selected. Of course this does not have to be the case. Looking ahead, the individual may have an outlook for the return of his portfolio that is more optimistic or pessimistic than the historical return of his chosen asset allocation. The analysis performed would easily accommodate any outlook in terms of returns.

Second, it was assumed that the individual would make constant contributions, in real terms, throughout the accumulation period. Again, this does not have to be the case. It is perfectly possible that, as the individual's compensation increases in real terms over his working years, he may decide to also increase his nominal contributions above the inflation rate. The analysis performed would easily accommodate any plan for the contributions made during the accumulation period. The only restriction is that *there has to be a plan*; without it, the expected path cannot be calculated and there would be no benchmark to assess deviations from the plan.

Third, the discount rate used to calculate the NPV of all strategies was 5%, which is the required return on the selected (60-40) asset allocation. However, it is conceivable that an individual may decide that different strategies should have different discount rates; the analysis performed would easily accommodate such possibility. That said, it is perhaps not convenient to build different discount rates into the analysis, given that it is not entirely clear how to determine an appropriate discount rate for each of the strategies considered.

Fourth, throughout the analysis the benchmark asset allocation used was 60% in stocks and 40% in bonds, and perhaps more importantly, it was assumed to be constant during the whole accumulation period (except, obviously, in the AA policies). The 60-40 breakdown is obviously as good as any other that could have been used, but the constant allocation may be more questionable, particularly given the standard policy followed by target-date funds, which make the asset allocation more conservative over time. That said, the analysis performed could have easily accommodated a dynamic allocation in the financial plan.

Finally, it may be argued that the AA strategies were handicapped by the fact that they are reconsidered every five years, instead of annually as was done with the other dynamic strategies. However, that is not the case. On the one hand, and as already mentioned, changes in the asset allocation may take time to have the impact expected in the portfolio, and five years seems to be a reasonable period for mean reversion to kick in. On the other hand, if the three AA strategies considered adjusted the asset allocation annually instead of every five years, their results (not reported) would be even worse than those displayed on Exhibit 4.

4. Assessment

It is clear that in investing, as in life, if you do not know where you are going, you will never know whether you have reached your destination. When planning for retirement, it is particularly important to set a target for the retirement portfolio ('the number'), and to evaluate the success or failure of different accumulation strategies with respect to that target.

This article does not deal with how to set 'the number' but rather takes it as given and evaluates policies that aim to hit it. When setting a target for the portfolio, and determining the periodic contributions that are expected to lead to it, the individual is essentially specifying a financial plan summarized by the expected path of his portfolio. A possible accumulation strategy is simply to stick to the contributions outlined in the plan and hope to hit (or end up close to) 'the number' chosen.

An alternative to the previous static strategy is to take a more dynamic approach and introduce adjustments when the portfolio deviates, as it inevitably will, from its expected path. Thus, the individual may choose to adjust his periodic contributions or the portfolio's asset allocation in order to return the portfolio (at least closer) to its expected path, a set of policies broadly referred to here as managing to target (M2T).

As long as the contributions of different strategies evaluated are the same, then comparing the terminal value of the portfolios, as well as moments or percentiles of the distribution of terminal values, provides a sound evaluation. However, when different policies call for different contributions, the previous comparison is no longer appropriate. The tool proposed here to evaluate accumulation strategies, allowing for different contributions, is a strategy's NPV.

The evidence discussed, based on long-term data for the U.S. market, suggests that adjusting the periodic contributions is far superior to adjusting the asset allocation. Furthermore, of the *feasible* adjustments to the contributions discussed (that is, the FBL policies), the results show that the more flexibility an individual is able or willing to accept in the periodic contributions, the larger are the benefits obtained from the M2T policies considered.

The benefits obtained from these dynamic policies, relative to a static strategy that simply sticks to the plan, are twofold. First, M2T strategies improve average performance and performance in bad scenarios as measured by their NPV. And second, they yield larger nest eggs on the retirement date (although, strictly speaking, that is not their goal) and reduce the number of shortfalls from the target portfolio chosen.

All in all, the results discussed here show that it pays off for an individual to periodically assess whether his retirement plan is on track, and to introduce adjustments to the periodic contributions when it is not. These dynamic adjustments, not at all based on elusive market timing but simply on deviations from the plan outlined, should help individuals improve the performance of their retirement portfolios. And that is what financial planning is largely about.

References

Arnott, Robert, Katrina Sherrerd, and Lillian Wu (2013). "The Glidepath Illusion … and Potential Solutions." Journal of Retirement, 1, 2, 13-28.

Basu, Anup, Alistair Byrne, and Michael Drew (2011). "Dynamic Strategies for Target Date Retirement Funds." Journal of Portfolio Management, 37, 2, 83-96.

Eisenberg, Lee (2006). *The Number – What Do You Need for the Rest of Your Life, and What Will It Cost?* The Free Press.

Estrada, Javier (2014). "The Glidepath Illusion: An International Perspective." Journal of Portfolio Management, 40, 4, 52-64.