
The Impact of Managed Accounts on Participant Savings and Investment Decisions

2025 Update

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Introduction

This 2025 edition of “The Impact of Managed Accounts on Participant Savings and Investment Decisions” marks 11 years of Morningstar investigating how managed accounts affect investors’ readiness for retirement within the defined-contribution space. What we have found across our publications (released in 2014, 2018, 2022, and 2025) is that our managed accounts service has the potential to significantly improve the retirement outcomes of its users.

We measure the effectiveness of managed accounts by comparing investment decisions and savings behavior before and after enrolling in Morningstar Retirement’s managed accounts service, Morningstar Retirement Manager. We further segment our analysis by dividing participants into test groups based on their previous retirement savings behaviors: those on track for retirement versus those not on track, and self-directors versus allocation-fund users.

In our analysis of 84,875 participants, this report reinforces the findings determined in previous editions that have shown that managed accounts can improve retirement outcomes across all test groups—with not-on-track self-directors poised to reap the greatest benefit.

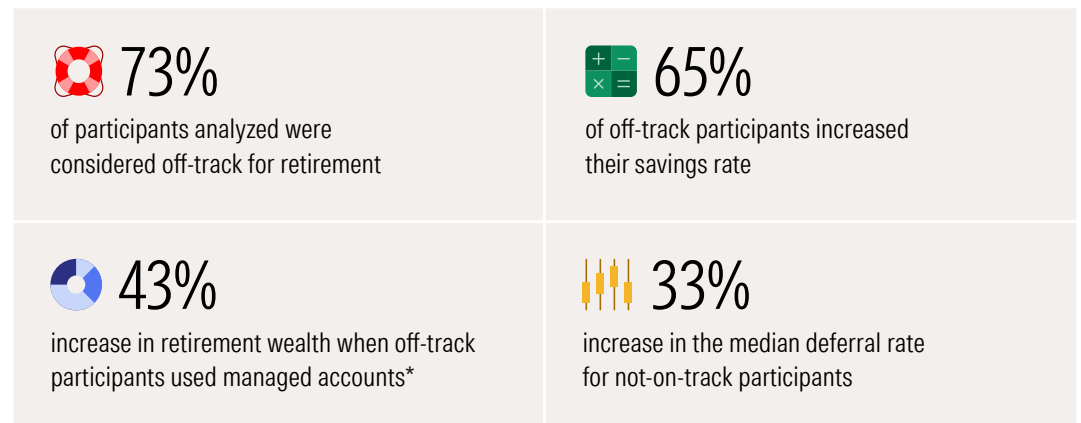
Summary of 2025 Findings¹

Analyzing the changes in investing and savings behavior of 84,875 Morningstar Retirement Manager users before and after enrolling in our managed accounts service, we found that managed accounts can continue to provide value to defined-contribution plan participants. Prior to enrolling in managed accounts, 73% were considered not on track for retirement, as their projected retirement income was less than 70% of their salary. 58% of participants analyzed are considered self-directors, meaning that less than 90% of their portfolio is in an “allocation” fund, such as a target-date fund. We distinguish between these groups, and combinations within them, because the amount they could benefit and how they could benefit differs by group. For example, our findings indicate that participants identified as not-on-track self-directors benefited the most from the personalized advice offered by a managed accounts service.

¹Note for distributors: Please do not distribute the summary of findings independently of the methodology. The entire paper must be distributed as a whole for public consumption.

This report is intended for financial professional, institutional investor, and sophisticated plan sponsor audiences only. It may not be provided or made available to any other audience.

After enrolling in managed accounts, 65% of not-on-track participants and 42% of on-track participants increased their savings rates. Notably, we found a 33% increase in the median deferral rate for not-on-track participants (averaging 2% of their salaries) and a 12.5% increase in the median deferral rate for on-track participants (averaging 1.1% of their salaries). We found that another 10% of off-track participants and 5% of on-track participants increased their deferral rates to fully take advantage of their employer match.



*Based on the average not-on-track self-director who is charged a 0.40% annual managed accounts fee.

These outcomes will not be representative of each individual participant's experience with a managed accounts service. Actual results may differ substantially and could include an individual client incurring a loss or having less income in retirement. Please refer to the methodology for important information about the assumptions and limitations of this analysis.

Investing through a managed accounts service further placed participants into what we consider more efficient, high-quality, and risk-appropriate portfolios. For both self-directors and allocation fund users, we observed improved expected annual returns both in nominal and risk-adjusted terms. Self-directors also experienced an increase in utility due to their more risk-appropriate portfolios.

The compounding effects of these improved savings and investment decisions result in better retirement income projections for the average defined contribution investor. While all groups experienced increased retirement wealth, the greatest increase was experienced by not-on-track participants: Assuming a 40-basis-point managed account advisory fee, the average not-on-track self-director saw a 43% increase in retirement wealth and the average not-on-track allocation-fund user saw a 30% increase in retirement wealth. The effects of managed accounts on retirement income are felt most by younger users, with the average 30-year-old participant seeing a 26% increase in retirement income. Therefore, by adjusting participants' saving and investing decisions, managed accounts can have a positive effect on their retirement outlook.

Conclusion

The updated data of this report reflects trends current through the end of 2024, making it relevant to the ever-changing financial landscape as of this writing in 2025. The fact that these findings have consistently shown the potential value of Morningstar Retirement Manager managed accounts over the past 11 years—namely, that it can have a positive impact in helping participants to save and invest for retirement—indicates that managed accounts remain a positive force in increasing participants' abilities to stay on track for their retirement goals.

We believe that managed accounts can have a tremendous impact on the everyday investor who may not be aware that they are off track and/or are unable or unwilling to hire a personal financial advisor. As such, managed accounts may continue to bring value to today's retirement advice landscape.

Methodology

Appendix 1: Methodology

Data Set

The data for this analysis comes from recordkeepers of participants using Morningstar Retirement's managed account (that is, robo-advice) service, Morningstar Retirement Manager, from Jan. 5, 2007, to Dec. 31, 2024. Participants have access to the managed accounts service through an employer-sponsored defined-contribution plan, most often a 401(k) plan.

For those unfamiliar with managed accounts, it is a service provided by a registered investment advisor that provides ongoing discretionary asset allocation and, typically, retirement advice for participants. (In the case of Morningstar Retirement Manager, advice is given by Morningstar Investment Management LLC.) Savings and investment recommendations can be implemented within a managed accounts service. Portfolio allocations are customized based on information about the participant, which is provided by the recordkeeper or the participant. The cost of Morningstar Retirement Manager varies by provider and is assessed based on assets.

When a participant self-enrolls into Morningstar Retirement Manager, on their first interaction, they will be asked to share information about themselves, such as their target retirement age, spending expectations, spousal data, outside account information, and so on. Morningstar Retirement Manager will then provide savings rate and portfolio advice. The participant can choose to accept the advice or revise certain aspects of the advice. Every time the participant visits the Morningstar Retirement Manager portal, they will be provided with updated advice based on their updated profile. Additionally, Morningstar Retirement Manager performs a quarterly portfolio rebalance and annual plan line-up review. In this study, we focus on changes in savings rate and investment decisions when the participant first enrolled in the managed account service.

Six filters are applied to the initial available data. First, there must be data available on the participant's age, salary, and deferral rate (both before and after receiving robo-advice). Second, the participant must have a minimum annual salary of USD 10,000 (adjusted to December 2024 dollars). Third, the individual must have a deferral rate greater than zero before and after the robo-advice session. Fourth, the change in deferral rates cannot be greater than 25 percentage points (positive or negative).² Fifth, the individual must be provided with an opportunity to change both the deferral rate and investment allocation as a part of the managed accounts enrollment process. Sixth, only participants who opted into the service are included (that is, this analysis excludes participants who were defaulted into managed accounts). These filters resulted in a dataset of 84,875 participants.

Exhibit 1 includes descriptive statistics for the variables included in the analysis.

²For example, a participant who increases the savings rate from 5% to 35% would be excluded.

Exhibit 1: Descriptive Statistics

	Percentile						Mean	Std. Deviation
	.05	.25	.5	.75	.95			
Age	26.00	34.00	43.00	53.00	62.00	43.65	11.48	
Salary (USD)	35,735	59,407	84,825	123,279	226,200	102,810	76,397	
Account Balance (USD)	334	5,021	26,389	104,077	460,277	101,031	195,156	
Deferral Rate-Before	2.00	5.00	7.00	10.00	19.00	8.27	5.65	
Deferral Rate-After	3.15	6.00	8.00	12.00	21.00	10.03	5.81	
Deferral Rate Change	0.00	0.00	1.75	2.00	9.00	1.77	3.55	
Savings Rate-Before	4.50	9.00	12.00	15.50	24.50	12.86	6.61	
Savings Rate-After	7.00	10.00	14.00	18.00	27.00	15.02	6.88	
Savings Rate Change	0.00	0.00	0.00	2.00	12.50	2.16	4.68	
On Track For Retirement Success (Before)³	0.00	0.00	0.00	1.00	1.00	0.27	0.44	
Equity %-Before	1.00	65.69	82.21	89.27	97.63	73.40	24.92	
Equity %-After	59.60	68.60	74.84	81.96	90.84	75.06	9.69	
Allocation-Fund User? (Before)⁴	0.00	0.00	0.00	1.00	1.00	0.42	0.49	

Source: Morningstar Investment Management LLC

The median age of participants in the dataset is similar to the average US workforce demographics. For example, the Bureau of Labor Statistics noted a median age of 42.0,⁵ while the median age for our participant data is 43. The median participant age in this dataset is the same as the median age among Vanguard's 4.9 million defined-contribution participants, which is 43 (Vanguard 2024). The median and average balances of the participants in this dataset are lower than those noted by Vanguard (2024), which are USD 35,286 and USD 134,128, respectively.

The individuals in this analysis have higher incomes than the average American but are generally consistent with participants in Vanguard's defined-contribution plans. The median income in this data is higher than the median personal income (at USD 64,430) in the US among those who worked full-time in 2023 based on the data from the US Census Bureau⁶. The median income is a little higher than the median income of individuals participating in Vanguard's defined-contribution plan, which is USD 82,000. Based on the statistics in Vanguard (2024), defined-contribution participants tend to have significantly higher wages than both all eligible employees (at USD 74,000) and all nonparticipating employees (at USD 39,000).

³Yes/No variable. 1 is on track and 0 is not on track for retirement.

⁴Yes/No variable. 1 is allocation-fund users and 0 is self-directors.

⁵<https://www.bls.gov/emp/tables/median-age-labor-force.htm>

⁶<https://www.census.gov/data/tables/time-series/demo/income-poverty/cps-pinc/pinc-01.html>

Deferral rates for these participants were slightly higher than those noted by Vanguard (2024), which found a median deferral rate of 6.2% and an average deferral rate of 7.4%. Total savings rates, including both employee deferral and employer matching contributions, were slightly higher than Vanguard's participants, which had a median savings rate of 11% and an average savings rate of 11.7%.

By design, our dataset contains participant data that could be dated as early as 2007. For example, participants who entered our managed accounts service in 2007 would be recorded in our dataset with their age and balance in 2007. Vanguard (2024) instead investigates its participant data based on 2023 values. Overall, we conclude that the demographics of the individuals included in this dataset appear to be reasonably consistent with investors participating in defined-contribution plans, based on comparisons to data available from Vanguard (2024); however, these individuals appear to be different from the average American. Therefore, this analysis should be viewed within the context of the average defined-contribution investor rather than the average American.

Test Groups

This analysis focuses on changes in participant behaviors after enrolling in managed accounts by comparing participant decisions before managed accounts (for example, savings rate and portfolio allocation) to behaviors after implementation. Changes across two key domains, investing and saving, are considered. For each of these two domains, participants are sorted into two groups.

For the investing analysis, participants are sorted based on whether they were building their own portfolio (that is, were “self-directors”) or were using a prepackaged multi-asset strategy, such as a target-date fund (that is, were “allocation-fund users”). More precisely, a participant is classified as a self-director if less than 90% of their portfolio was in an “allocation” fund, while an allocation-fund user is defined as having 90% or more of their portfolio in an allocation fund. Morningstar, Inc. uses a broad asset classification group for investments called “allocation,” which includes multi-asset strategies, such as balanced funds, retail target-date funds, and custom target-date funds.

Classifying participants by who is effectively responsible for making asset-allocation decisions is important when attempting to understand the “quality” of the investing decisions made by the participant (that is, portfolio efficiency). On average, defined-contribution participants are generally considered to be relatively unsophisticated investors; therefore, we would expect the portfolios constructed by “do-it-yourself” investors (that is, self-directors) to be different from the portfolios built by professional investment managers (for example, target-date funds).

Among the participants studied, 58% were classified as self-directors versus 42% as allocation-fund users. Compared with our prior study, there is a significant increase in the number of allocation-fund users. This is consistent with Vanguard (2024), which documented a consistent increase in the use of target-date, target-risk, or balanced funds. Vanguard noted that about 60% of its plan participants use target-date, target-risk, or balanced funds. In our dataset, the percentage of allocation-fund users (that is, participants who were using prepackaged investment products before entering managed accounts) increased over the test period, from approximately 20% in 2007 to 42% in 2024.

For the savings analysis, participants are estimated to be “not on track” or “on track” for retirement. A participant forecast to be on track has a projected retirement income over 70% of their current salary, which indicates an ability to maintain a similar level of after-tax income or lifestyle during retirement. The projected retirement income is from a Monte Carlo simulation performed by Morningstar Retirement Manager’s engine, which incorporates additional information provided by the participants about outside assets, savings at the time of enrollment, projected Social Security retirement benefit, and defined-benefit plan benefit. The projected retirement income is the income level that could achieve a 70% probability of success in the Monte Carlo simulation.

Segmenting participants based on whether they’re on track for retirement is important because not all participants need to save more for retirement. Participants using Morningstar Retirement Manager who are not on track will be guided to increase savings rates, while those who are on track may not need to make any changes to savings (so long as they are receiving the maximum employer match). On-track participants tended to be younger, with lower salaries, higher balances, and higher deferral rates.

Investment Impact Analysis

The impact of managed accounts on investor portfolios is viewed through a variety of lenses, including:

- **Portfolio Risk Level:** How did the risk level of a portfolio, defined as its allocation to equities, change after the participant enrolled in managed accounts?
- **Portfolio Efficiency:** How did the efficiency of the portfolios differ before and after managed accounts?
- **Risk Appropriateness:** How consistent was the risk level of the portfolio before managed accounts with the target allocation?

The target equity allocation for each investor is determined using Morningstar Investment Management's managed accounts engine, which uses a total wealth methodology. Using this total wealth approach, a participant's defined-contribution assets are viewed as a "completion portfolio" that is invested to help the investor achieve the overall desired target risk level across all of their financial and nonfinancial retirement assets. Investors with riskier financial assets (for example, an IRA invested heavily in stocks) or nonfinancial assets (for example, human capital) would typically get a more conservative recommendation, holding everything else constant. Similarly, investors with more conservative assets outside the defined-contribution plan portfolio would typically get a more aggressive recommendation for their defined-contribution plan assets. The methodology is described in greater detail in Appendix 2.

The style exposures of portfolios are determined using a returns-based style analysis. RBSA was introduced by William Sharpe (1988) as a low-cost path to analyzing mutual funds compared with holdings-based style analysis. RBSA uses constrained optimization to classify an investment by comparing the performance of an investment with a number of passive benchmark indexes. RBSA searches for some combination of index returns that best mimic the portfolio performance over the test period, by minimizing the variance of the residuals. RBSA is useful when underlying holdings data is not available for many of the investments, which is the case for our dataset.

The index proxies included in the RBSA are noted in Appendix 3. In an attempt to access the portfolio diversification and efficiency, the RBSA is performed at the portfolio level (not the individual fund level) using historical returns for the 36 months prior to receiving advice as of the last month-end. For example, for a participant who entered managed accounts on March 12, 2015, the RBSA would use returns from March 1, 2012, to Feb. 28, 2015. Aggregate portfolio returns are created using the underlying weights of the individual funds held by the participant, where the portfolio is assumed to be rebalanced monthly. For those investments that did not have available historical returns for the entire period, the Morningstar Category Average value is used as the return for that investment. There were 13,033 investments held among the participants.

The RBSA is run for portfolio allocations before and after entering managed accounts. Given the resulting asset-class weights, a variety of metrics are estimated. The first is the equity allocation of the respective portfolios, which is the sum of the weights to all noncash and nonbond asset classes—that is, the equity weight includes an allocation to commodities. Next, the expected return and risk characteristics of the portfolios are estimated using the capital market assumptions noted in Appendix 4. These are forward-looking capital market assumptions estimated by Morningstar Investment Management. We also estimate the future hypothetical performance one year after enrolling in managed accounts.⁷ Additional information about these tests is included in the respective subsection.

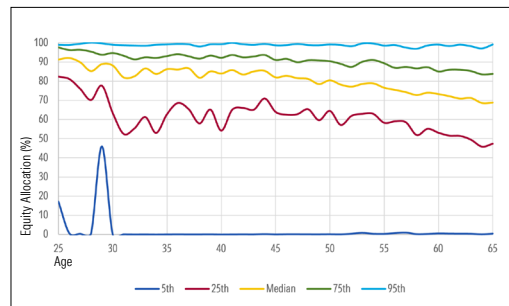
⁷This analysis is described as being "hypothetical" because we do not know what the actual portfolio decisions would have been for the investor over the year following entering advice, or how the portfolio might have changed after entering managed accounts.

Portfolio Risk Level

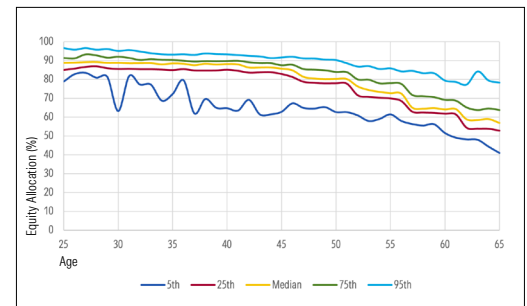
For our first test, we estimate the equity allocations for portfolios before and after the participant enrolled in managed accounts. The median (average) equity allocation for all users before managed accounts was 82% (73%) versus 75% (75%) after managed accounts. Self-directors had slightly conservative allocations before using managed accounts, with a median (average) equity allocation of 79% (69%) versus 84% (79%) for allocation-fund users. In Exhibit 2, we provide information about how the equity allocations differed by age before entering managed accounts for self-directors and allocation-fund users, in Panels A and B, respectively.

Exhibit 2: Equity Allocation Distribution Before Enrollment in Managed Accounts

Panel A: Self-Directors



Panel B: Allocation-Fund Users

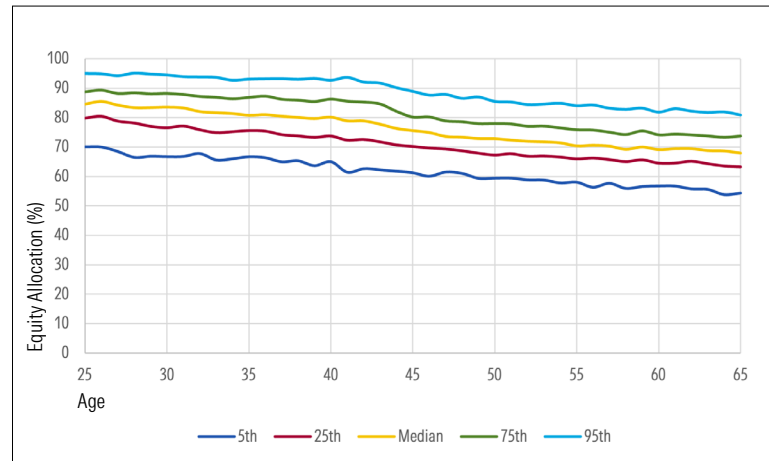


Source: Morningstar Investment Management LLC

The median equity allocations for self-directors (Exhibit 2, Panel A) and allocation-fund users (Exhibit 2, Panel B), before managed accounts, were relatively similar. This suggests the “average” participant had a similar level of risk before managed accounts across the two types. However, while the most conservative one in 20 (that is, fifth percentile) allocation-fund user still had a relatively aggressive portfolio, the most conservative one in 20 self-director had a very conservative portfolio compared with the most conservative allocation users. This suggests that focusing on the median participant may yield a different conclusion than considering all participants (that is, the entire distribution). Self-directors are more likely to have a very aggressive (nearly 100% in equity) or very conservative (nearly 0% in equity) portfolio regardless of their ages, compared with the allocation-fund users, raising a potential concern for participants’ risk appropriateness.

In Exhibit 3, we include the participant equity allocations after managed accounts. We do not break these out by participant type (that is, by self-director or allocation-fund user) because it doesn’t affect the recommended portfolio allocation, and thus, the distributions for the two groups are effectively the same.

Exhibit 3: Equity Allocations Distribution After Enrollment in Managed Accounts



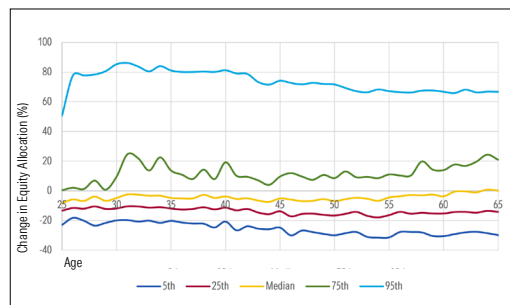
Source: Morningstar Investment Management LLC

The distribution of equity allocations for participants after entering managed accounts looks different from the pre-managed-accounts distributions of both self-directors and allocation-fund users. Overall, the equity allocations after entering managed accounts remains similar as participants age.

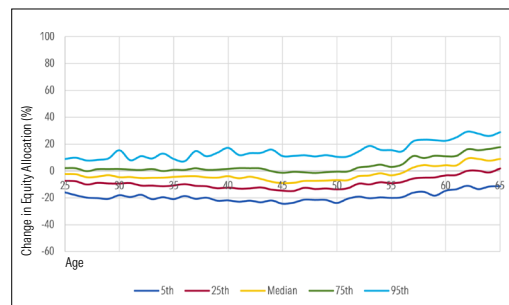
In Exhibit 4, we provide some insight into how equity allocations changed after enrolling in managed accounts for self-directors and allocation-fund users—Panels A and B, respectively. This is effectively the difference in Exhibits 3 and 2 for the respective groups.

Exhibit 4: Change in Equity Allocations After Enrollment in Managed Accounts

Panel A: Self-Directors



Panel B: Allocation-Fund Users



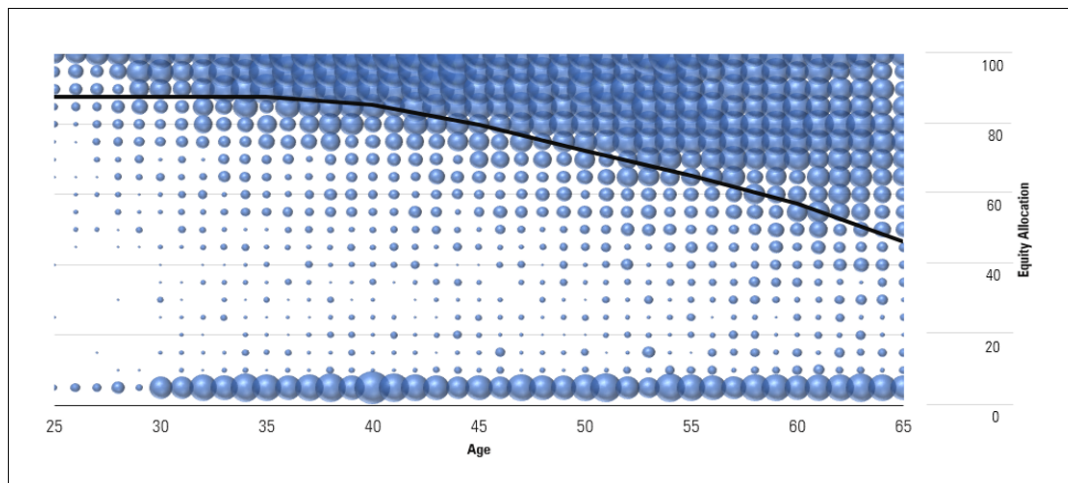
Source: Morningstar Investment Management LLC

The distribution of equity allocation changes is relatively compressed across most percentiles. However, there were considerable changes in risk levels for some participants, in particular a subset of self-directors who invested heavily in fixed income before entering managed accounts. These participants were generally invested too conservatively, according to our methodology, and had significant increases in their equity allocations after entering managed accounts.

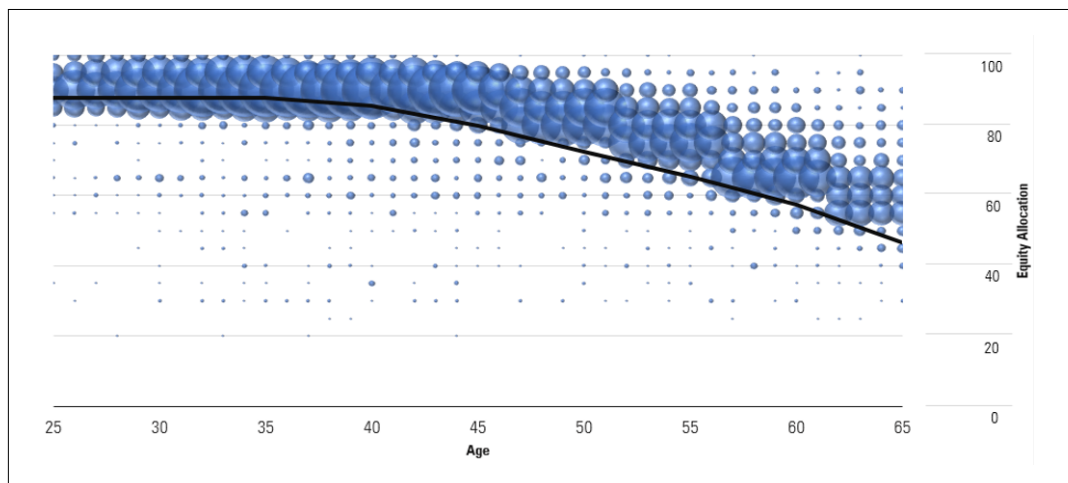
A number of participants ended up in more conservative portfolios after entering managed accounts. Assuming a positive risk premium, these participants may end up with less wealth at retirement in their defined-contribution plan because of the more conservative allocation (depending on portfolio efficiency, fund quality, and so on). While less wealth may seem like a worse outcome, virtually every target-date mutual fund derisks as it approaches retirement. The key, therefore, is ensuring the risk level for a portfolio is appropriate given the participant's (or investor's) situation, especially given the risk of assets outside the defined-contribution plan. We quantify the potential benefit of more-appropriate portfolios in a later section of this paper.

Exhibit 5: Equity Allocations Before Enrollment in Managed Accounts

Panel A: Self-Directors



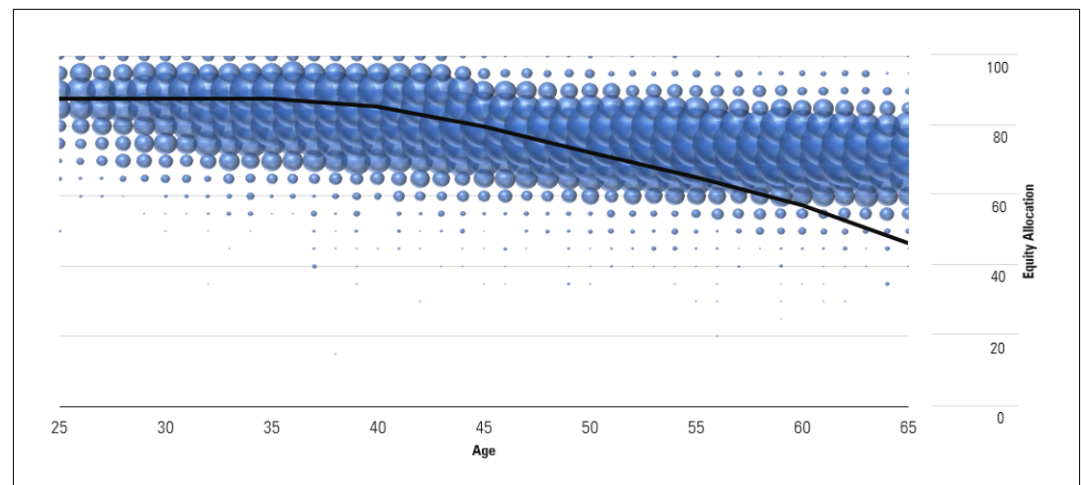
Panel B: Allocation-Fund Users



Source: Morningstar Investment Management LLC

We also plot all equity allocations in the form of a bubble chart, where equity allocations are grouped with 5% increments and the size of the bubble indicates the number of equity allocations that fall into each equity group at each age. Consistent with prior exhibits, while a number of self-directors derisked their investment as they approached retirement, a larger number of these participants still invested heavily in either equity or fixed-income portfolios. The rest of the self-directors customized their portfolio with any level of equity allocation possibly due to personal preferences and circumstances. Allocation-fund users had a different pattern. While some participants significantly modified their target-date fund vintage, hence their equity allocation, most participants had an equity allocation that was within a 20% band of a typical target-date fund glide path.

Exhibit 6: Equity Allocations After Enrollment in Managed Accounts



Source: Morningstar Investment Management LLC

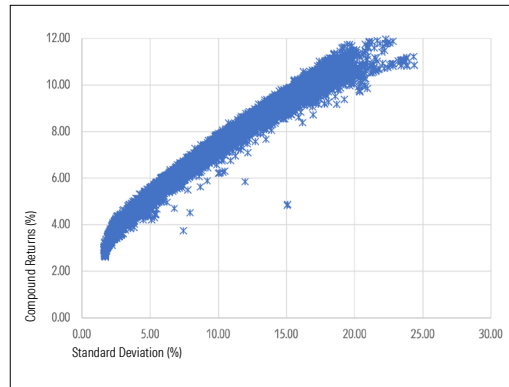
The equity allocations after participants entered managed accounts were more diverse than the equity allocations by the allocation-fund users before their enrollment in managed accounts—with most participants ending up with a less conservative portfolio. This highlights one benefit of managed accounts: appropriate risk level and personalized investment advice based on unique individual circumstances.

Portfolio Efficiency

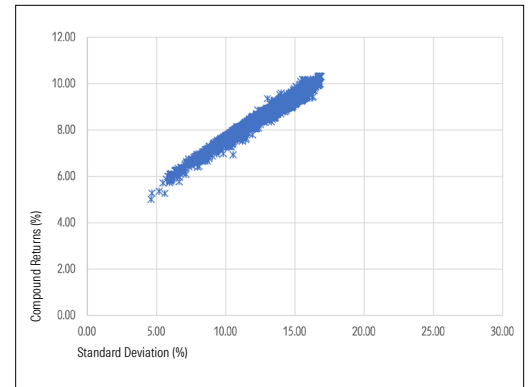
The next analysis explores efficiency, which is the expected risk-adjusted returns of the respective portfolios, before and after enrolling in managed accounts. As noted previously, to estimate the portfolio risk exposures, we perform a returns-based style analysis using the historical return of indexes listed in Appendix 3. We then estimate the risk and return for portfolios using the asset-class weights obtained from the RBSA and the capital market assumptions included in Appendix 4.⁸ These are forward-looking capital market assumptions estimated by Morningstar Investment Management. In detail, we estimate the expected arithmetic return and standard deviation for each participant's portfolio and then estimate the expected compounded (that is, geometric) return based on arithmetic return and standard deviation using equation 5.1 in Appendix 5. We do this for the allocations both before and after enrollment in managed accounts.

Exhibit 7: Portfolio Efficiency Before Enrolling in Managed Accounts, by Investor Type

Panel A: Self-Directors



Panel B: Allocation-Fund Users



Source: Morningstar Investment Management LLC

Exhibit 7 offers a scatterplot of the standard deviation and compounded (that is, geometric) returns for the self-director and allocation-fund user portfolios, in Panels A and B, respectively, before enrolling in managed accounts. The dispersion of portfolios is significantly greater for the self-directors (Panel A) compared with the allocation-fund users (Panel B). This is consistent with our expectations. Studies like Tang et al. (2010), Kramer (2012), and Lei and Yao (2016) have documented that individual investors often build undiversified portfolios and end up with lower risk-adjusted returns compared with professionally managed portfolios. We would expect professionally constructed portfolios (for example, target-date funds) to be relatively efficient and have similar risk/return attributes across providers.

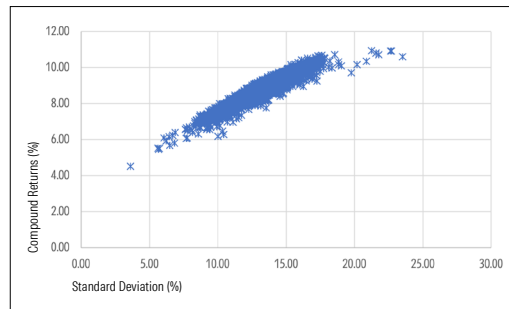
⁸ It is worth noting that the enrollment data of participants in our sample range between 2007 and 2024. The asset-class weights for each participant's portfolio are determined based on the 36 months prior to enrolling into managed accounts as of the last month-end. However, we estimate the risk and return for each participant's portfolio based on the same set of capital market assumptions, regardless of actual enrollment date. This is to ensure the comparability of these portfolios, as actual portfolio efficiency changes over time because of changes in expected returns and covariance.

One notable difference in the risk/return profiles for the self-directors and allocation-fund users is the wider distribution of self-directors. This is unsurprising, as self-directors wouldn't be expected to create portfolios that are as efficient as professionally managed allocation funds. The self-directors also create a wider range on the risk spectrum in their portfolios. This indicates that self-directors take on too much or too little risk compared with the allocation-fund users, which might be a conscious choice or a misunderstanding of their risk capacity.

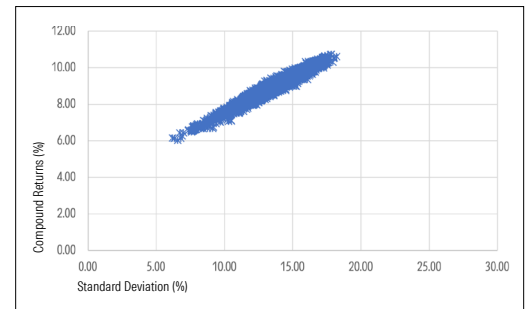
Information on portfolio efficiency for portfolios after enrolling in managed accounts is included in Exhibit 8.

Exhibit 8: Portfolio Efficiency After Enrollment in Managed Accounts, by Investor Type

Panel A: Self-Directors (After Enrollment)



Panel B: Allocation-Fund Users (After Enrollment)



Source: Morningstar Investment Management LLC

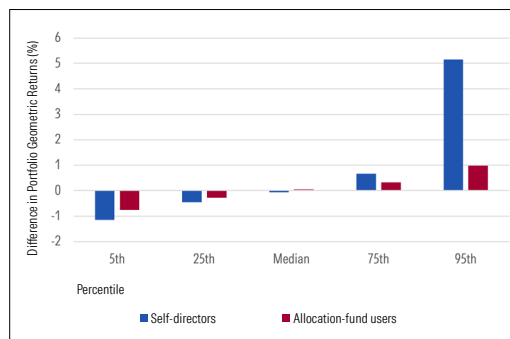
The portfolio efficiency after enrolling in managed accounts improves more for self-directors than for allocation-fund users. After enrolling in managed accounts, self-directors receive more efficient investment portfolios than before, as the new portfolios are closer to the efficient frontier. This is consistent with the prior exhibit; self-directors invested in less diversified and less efficient portfolios. The range of portfolio risk for both self-directors and allocation-fund users is shorter, indicating that managed accounts assign a more appropriate risk level to participants.

Next, we compare the expected compound returns for participant portfolios before and after enrolling in managed accounts. We compare pure returns in Panel A of Exhibit 9 and do so on a risk-adjusted basis in Panel B of Exhibit 9. For the risk-adjusted calculation, we compare the performance of each portfolio with a risk-adjusted benchmark and compare these respective differences with each other. The risk-adjusted calculation is explained in detail in Appendix 5.

Exhibit 9: Change in Expected Geometric Return After Enrolling in Managed Accounts

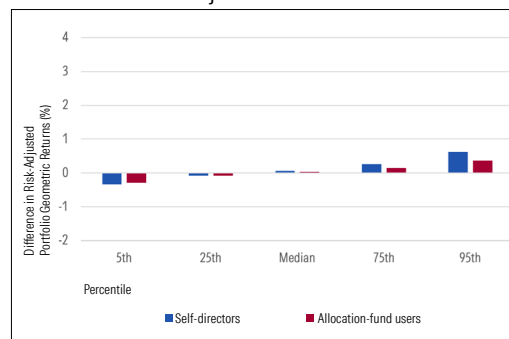
Panel A:

Difference in Portfolio Geometric Returns



Panel B:

Difference in Risk-Adjusted Portfolio Geometric Returns



Source: Morningstar Investment Management LLC

The differences in pure performance before and after managed accounts (Exhibit 9, Panel A) are significantly greater than the risk-adjusted differences (Exhibit 9, Panel B). This should not be surprising. For example, a participant who has an allocation of all cash before enrolling in managed accounts, who then gets invested in a relatively aggressive portfolio, would have a significant change (that is, increase) in return (Panel A). However, the difference in the risk-adjusted efficiency is unlikely to be nearly as significant (Panel B), assuming both portfolios were reasonably efficient.

Looking at the results of Panel A, the change, or difference, in return is positive for the average participant. For example, the median (average) change in expected compounded returns for self-directors was negative 6 basis points (positive 54 basis points) and positive 4 basis points (positive 6 basis points) for allocation-fund users. The average is much higher than the median among self-directors, owing to those participants that went from very conservative portfolios to allocations with greater risk. On a risk-adjusted basis, the median (average) changes in expected compounded returns were all positive: 7 basis points (10 basis points) for self-directors and 4 basis points (4 basis points) for allocation-fund users. This is consistent with our prior observations: Self-directors' portfolios before enrolling into managed accounts were less efficient compared with the recommended portfolios after enrolling in managed accounts.

Overall, the findings in this section suggest participants who were self-directing their portfolios realized a wide range of differences before and after enrolling in managed accounts. The best self-directors were likely to realize a small negative expected return, while the worst self-directors were likely to see a greater efficiency benefit for enrolling in managed accounts. The difficulty, of course, is identifying the self-directors who need the most help prior to them making their own investment decisions.

Risk Appropriateness

An important component of financial advice is helping ensure an investor has a portfolio with a risk level appropriate for the investor's facts and circumstances. Each participant in managed accounts receives a personalized portfolio recommendation that could be significantly different from the portfolio the individual selected for themselves before enrolling in managed accounts, even if the investor was using a target-date fund. For example, while target-date funds would be expected to have risk levels appropriate for the average participant, they are, by definition, a "one-size-fits-all" investment that can result in situations where the risk level (that is, glide path) is not appropriate for certain participants given their facts and circumstances. For example, if the participant has a large IRA that is invested aggressively (conservatively), the defined-contribution money may need to be invested relatively conservatively (aggressively) to ensure consistency with the target risk level of the participant's total wealth. A target-date fund is unable to incorporate outside assets or other information about the participant into the portfolio assignment process.

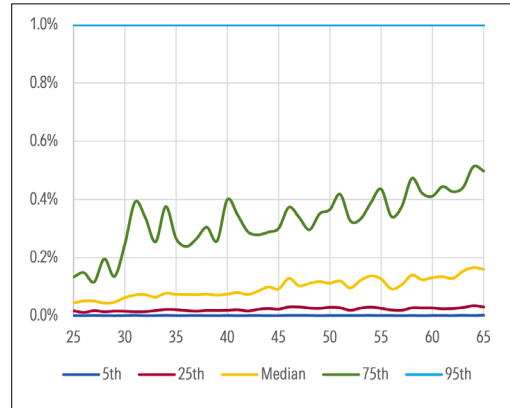
For this analysis, we attempt to estimate the "cost" of being invested in a portfolio that is not consistent with the ideal risk level for the investor. We do so by first assuming the recommended equity allocation for managed accounts is the optimal target risk level for the investor. This allocation is determined using all information provided by the investor as part of the managed accounts enrollment process. Next, we compare this target equity allocation to the investor's premanaged accounts portfolio. We use utility theory to quantify the "cost" associated with being invested suboptimally (assuming the equity allocations before and after managed accounts differ).

This approach allows us to estimate the additional return (that is, alpha) that would be required to compensate an investor to be indifferent between being invested in the managed accounts portfolio compared with their previous portfolio, which may have had a different risk level. The further the risk level of the portfolio before enrolling in managed accounts is from the target risk level, the larger the "cost" associated with being invested suboptimally would be. These costs are noted in "alpha" terms for ease of reference purposes. Additional details on the exact calculations are included in Appendix 6.

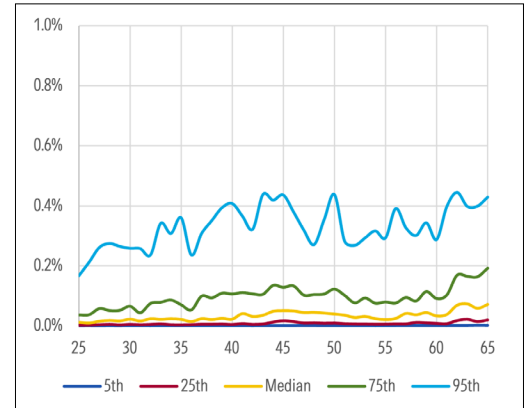
The distribution of the estimated alpha misfit costs, by age, for self-directors and allocation-fund users are noted in Panel A and Panel B of Exhibit 10, respectively.

Exhibit 10: Alpha Implied Cost of Suboptimal Risk Portfolio Level

Panel A: Self-Directors



Panel B: Allocation-Fund Users



Source: Morningstar Investment Management LLC

As a reminder, the “alpha misfit costs” noted in Exhibit 10 quantify the “cost” associated with being invested suboptimally (as defined by utility theory), when comparing the risk level of the portfolio before enrolling in managed accounts with the target risk level recommended by the managed accounts service. These values provide some context as to what the potential value of receiving personalized advice or guidance on portfolio assignment would be, versus investors making these decisions themselves. Personalization usually comes with an additional cost; therefore, the values in Exhibit 10 provide an estimate of the value managed accounts can provide by focusing only on helping participants invest more appropriately. This assessment is independent of other potential gains, such as more efficient portfolios (noted previously). For example, it is possible for a participant to be invested in an efficient portfolio but one that is inappropriate given that investor’s facts and circumstances.

Overall, the analysis suggests the median (average) improvement in utility from investing in more-appropriate portfolios through a managed accounts service is 10 basis points (3 basis points) for self-directors and 3 basis points (8 basis points) for allocation-fund users. The impact clearly differed by age, with the benefit of a more-appropriate portfolio increasing at older ages (where more benefit equals a higher implied alpha misfit cost). These age differences reflect, to some extent, how the target equity allocations diverged for managed accounts participants at older ages (see Exhibit 2-4).

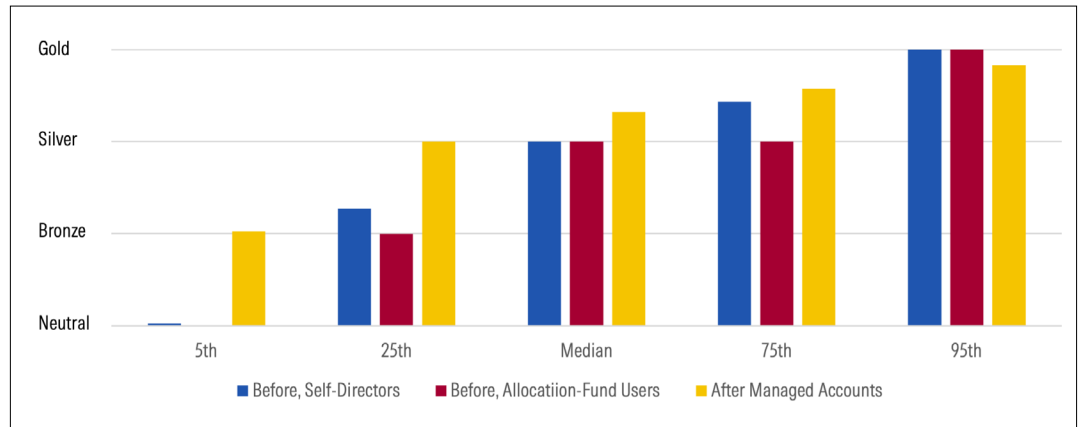
Fund Quality

The next analysis focuses on the quality of respective investment vehicles used in the portfolios before and after managed accounts. Measuring the quality of an investment is obviously a subjective exercise, where the expense ratio is likely to be a key driver in future performance (as noted by Carhart 1997, among others). The assessment of fund quality is unique in employer-sponsored plans, compared with an IRA, since the participant typically only has access to a limited number of investments (that is, core menu), which is determined by the plan sponsor.

Morningstar Medalist Ratings are used as the proxy for fund quality for the analysis. The Morningstar Medalist Rating is the summary expression of the forward-looking analysis of investment strategies. This fund rating is expressed on a five-tier scale: Gold, Silver, Bronze, Neutral, or Negative. The top three ratings indicate that the rated fund is expected to outperform its peer group or a relevant benchmark over the long term, after accounting for risk and expenses. The higher the rating (for example, Gold versus Silver versus Bronze), the higher the analyst's conviction in a fund's ability to outperform.

For the analysis, we assign a value to each rating: 3 for Gold-rated funds, 2 for Silver-rated funds, 1 for Bronze-rated funds, and 0 for Neutral and Negative. Given these weightings, we can then estimate the weighted average "quality" of portfolios. To be included in this analysis, ratings for all funds held by the investor before and after enrolling in managed accounts must be available. It is important to note that all Medalist Ratings included in this analysis are the latest ratings as of the time of this analysis. Comparing the fund ratings at each participant's enrollment date is more accurate, but we argue that, because these Medalist Ratings are developed to assess the performance in the long term, the ratings have been fairly stable over time. The distribution of these dollar-weighted average Medalist Ratings is included in Exhibit 11.

Exhibit 11: Distribution of Morningstar Medalist Ratings



Source: Morningstar Investment Management LLC

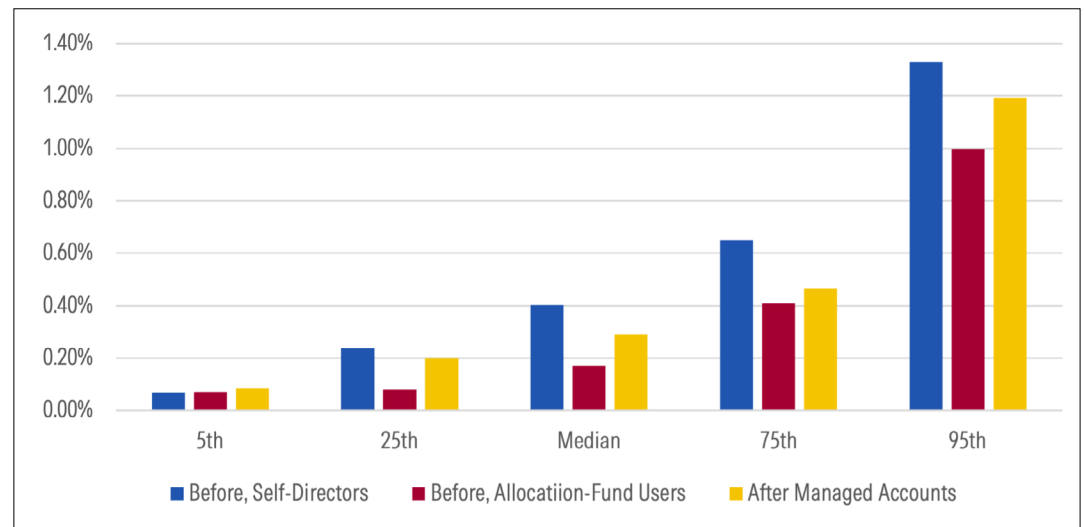
The median fund ratings are around Silver for participants' portfolios before enrolling into managed accounts. This is not surprising, as the employers or plan sponsors are responsible for creating the investment menu and most likely carry the fiduciary duty in fund selection. The self-directors had a large variation in the fund ratings before enrolling into managed accounts. This suggests that some self-directors might not have the sophistication to pick high-quality funds, whereas other self-directors might be able to leverage available resources and concentrate their investment in high-quality funds. Allocation-fund users had a smaller variation in fund ratings compared with self-directors; this makes sense because employers or plan sponsors typically only pick one series of target-date funds from one fund family, and we would expect them to generally select a target-date fund series of reasonably high quality.

Looking at fund ratings after enrolling into managed accounts, the distribution is even smaller (ranging from Bronze to Gold ratings) and higher than the fund ratings before enrolling into managed accounts except at the top 95th percentile group. This provides evidence that managed accounts service provides an investment recommendation that utilizes high-quality funds from those funds available in the plan's investment lineup.

Fund Expenses

This analysis focuses on the expenses of respective investment vehicles used in the portfolios before and after managed accounts. Carhart (1997) argues that the expense ratio is likely to be a key driver in future performance. Similar to fund quality, employers or plan sponsors are responsible for creating the investment menu and most likely carry the fiduciary duty in fund selection. While we would expect the investment menu already has low-cost funds, it is still interesting to see the expenses of participants' portfolios before and after enrolling into managed accounts.

Exhibit 12: Distribution of Participant Portfolio Expenses



Source: Morningstar Investment Management LLC

For the analysis, we start with the annual net expenses of each fund in the portfolio. For target-date funds, the net expenses include the target-date fund wrap fee as well as the net expenses of underlying funds. We then estimate the weighted average net expenses of participants' portfolios. To be included in this analysis, net expenses for all funds held by the investor before and after enrolling in managed accounts must be available. It is important to note that all net expenses included in this analysis are the latest expenses as of the time of this analysis. Comparing the fund expenses at each participant's enrollment date is more accurate, but we argue that the net expenses are typically stable over time. The distribution of these dollar-weighted average net expenses is included in Exhibit 12.

The self-directors had a large variation in the portfolio expenses before enrolling into managed accounts. This suggests that some self-directors might not have the sophistication to pick the low-cost funds, whereas some self-directors might be able to identify low-cost funds and concentrate their investment in these funds. After these self-directors enrolled into managed accounts, their portfolio expenses consistently dropped, except for the lowest 5%. The allocation-fund users consistently had the lowest portfolio expenses at all percentiles before enrolling into managed accounts. This is possibly due to the fact that target-date funds are the most common investment option in defined-contribution plans and typically charge much lower and more competitive institutional pricing.

Savings Impact Analysis

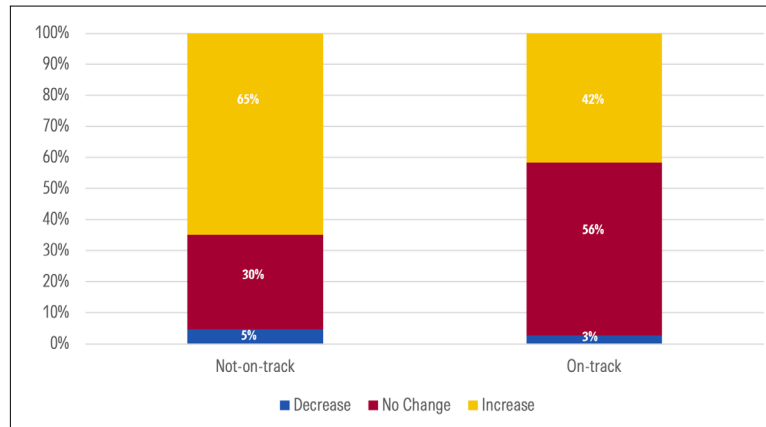
In this section, we explore how savings rates changed for participants after entering managed accounts. The savings rate analysis is more straightforward than the investment analysis since there are fewer domains to consider.

As noted previously, for the savings-rate analysis, participants are segmented into two groups, based on whether the participant was forecast to be on track for retirement or not. This calculation includes additional information provided about the participant's situation, which would include information about outside savings and investments, as well as Social Security retirement benefits and defined-benefit plan benefits. Overall, 73% of participants were forecast to be not on track, while 27% were on track, which increased from 20% in our prior 2022 study.

Segmenting participants by whether they were on track to retire is an important distinction because savings rate recommendations will differ based on the participant's situation. Participants using Morningstar Retirement Manager who are forecast to not be on track for retirement will be urged to increase their savings rates, while those who are on track would only receive a recommendation to increase savings rates if the participant was not taking full advantage of their employer match. Morningstar Retirement Manager will never recommend participants to reduce their savings rate regardless of whether they are forecast to be on track or not. However, any participant can elect to increase or reduce their savings rate and override the advice.

We expect that whether the participant is on track for retirement will not have a significant impact on the resulting potential changes in savings behaviors after enrolling in managed accounts. The differences in savings rate changes for the two groups are included in Exhibit 13, where the changes are grouped into whether the change in savings rate is positive (increases), negative (decreases), or does not change.

Exhibit 13: Changes in Savings Rates Based on Whether the Participant Is On Track for Retirement



Source: Morningstar Investment Management LLC

Savings-rate behaviors differed significantly based on whether the participant was on track for retirement or not. The majority of participants who were not on track decided to increase savings rates (65%), whereas 42% of on-track participants increased their savings rate. This savings-rate difference is notable because the savings impact of managed accounts is likely to vary significantly based on the retirement readiness of the participant population. For example, a plan with participants that are well-funded for retirement (for example, with a generous defined-benefit plan or large retirement account balance) will be less likely to realize savings-rate increases compared with a plan where participants are poorly funded (for example, in a plan with no employer match).

It's also worth noting that not-on-track participants could receive a recommendation to delay their retirement age; a delay prepares them for retirement without necessarily increasing their savings rate. So, the percentage of participants who were not on track for retirement and decided to make positive changes to improve their retirement readiness could be higher.

In Exhibit 14, we provide some perspective on the distribution of changes in savings levels. We include information on both deferral rates and total savings rates. Total savings rates include employer matching contributions. If for some reason an employer's matching schedule information is not available for a plan, we don't include these participants in the savings-rate calculation.

Exhibit 14: Distribution of Changes in Participant Savings Levels

Deferral Rates								
Percentiles	Not-on-Track				On-Track			
	Before	After	Absolute Change	Relative Change	Before	After	Absolute Change	Relative Change
5th	2.0	3.0	1.0	50.0	3.0	4.0	1.0	33.3
25th	5.0	6.0	1.0	20.0	5.6	6.0	0.4	7.4
Median	6.0	8.0	2.0	33.3	8.0	9.0	1.0	12.5
75th	10.0	12.0	2.0	20.0	11.3	13.0	1.7	15.5
95th	17.7	21.0	3.3	18.7	20.0	23.0	3.0	15.0
Average	7.8	9.8	2.0	25.5	9.4	10.6	1.2	12.1

Total Savings Rates								
Percentiles	Not-on-Track				On-Track			
	Before	After	Absolute Change	Relative Change	Before	After	Absolute Change	Relative Change
5th	4.5	6.8	2.3	50.1	6.0	7.0	1.0	16.7
25th	8.5	10.0	1.5	17.6	9.0	10.0	1.0	11.1
Median	12.0	14.0	2.0	16.7	12.3	13.5	1.3	10.2
75th	15.0	18.0	3.0	20.0	16.0	18.0	2.0	12.5
95th	23.0	27.0	4.0	17.4	27.0	28.5	1.5	5.6
Average	12.4	14.9	2.5	20.5	13.8	15.2	1.4	9.8

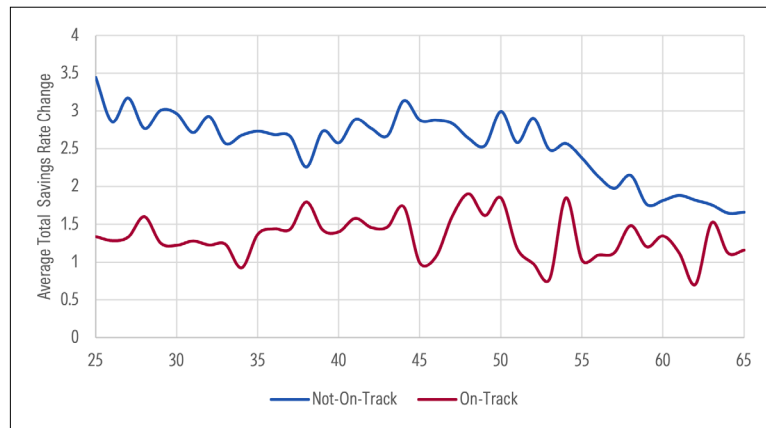
Source: Morningstar Investment Management LLC

Consistent with the results in Exhibit 13, there were notable differences in the impact of managed accounts on savings behaviors depending on the retirement readiness status of participants. The median (average) absolute change in deferral rates for those who were not on track was positive 2 percentage points (positive 2 percentage points) with a relative change of positive 33.3% (positive 25.5%). The change in deferral rate is consistent with the base recommendation used by Morningstar Retirement Manager if the participant was estimated to not be on track to retire, which is to increase deferral rates by 2 percentage points. For the participants who were not on track, savings rates were higher than deferral rates at all percentiles because savings rates include employee deferral and employer matching. The changes in total savings rates were higher than the changes in deferral rates on an absolute basis but lower on a relative basis because the total savings rates were higher.

The deferral and saving rates by those who were on track were mostly higher than those who were not on track. However, the absolute and relative changes in deferral rates and savings rates were lower than those who were not on track at all percentiles. The median (average) absolute change in deferral rates for those who were on track was positive 1 percentage points (positive 1.2 percentage points) with a relative change of positive 12.5% (positive 12.1%).

Changes in savings rates were not constant across ages. In Exhibit 15, we provide information about average changes in total savings rates by age.

Exhibit 15: Average Change in Total Savings Rates by Age



Source: Morningstar Investment Management LLC

Average changes in savings rates were larger for younger participants. These were participants who, on average, were saving less for retirement before enrolling in managed accounts. This is important since higher savings rates are going to have a greater impact on retirement outcomes for younger participants, given the longer time period available for the wealth to compound (compared with older participants).

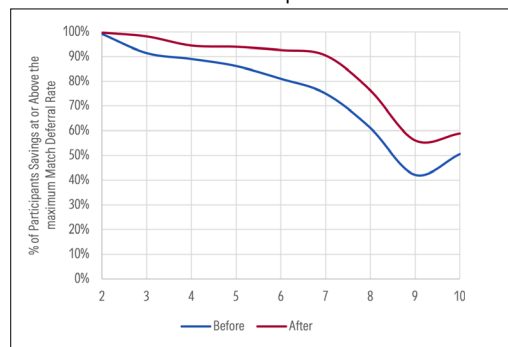
Average changes in savings rates were smaller for older participants, especially for those who were not on track for retirement. Morningstar Retirement Manager could recommend increasing savings rate and/or delaying retirement age to improve retirement outcome. For older participants, delaying retirement age will generally be more effective in improving retirement outcomes. Therefore, participants who were age 55 and older may have decided to delay retirement age before increasing their savings rate, leading to the smaller average changes.

Total savings rates increased more than deferral rates because the managed accounts savings rate recommendation used by Morningstar Retirement Manager always considered whether the participant was achieving the maximum employer match (and total savings rates include employer contributions). Even if the participant were forecast to be on track for retirement, the participant would receive a recommendation to increase savings up to the match since the employer match is effectively “free money.”

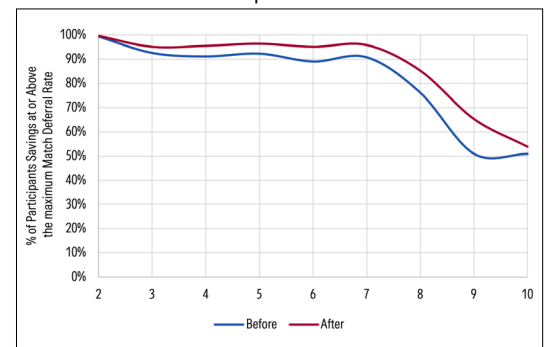
In Exhibit 16, we provide some perspective on on-track and off-track participants saving up to the maximum employer match limit, in Panels A and B, respectively, for different match limit levels, before and after enrolling in managed accounts. We only include plans that offered an employer match in this analysis.

Exhibit 16: Participants Receiving the Maximum Employer Match Before and After Enrolling in Managed Accounts

Panel A: Not-on-Track Participants



Panel B: On-Track Participants



Source: Morningstar Investment Management LLC

On average, 10% of not-on-track participants increased their deferral rate to receive the maximum match, when a match was available, versus 5% among on-track participants. The fact that improvement among on-track participants wasn't as strong is not surprising because savings rates for on-track participants were so much higher on average; therefore, they were more likely to already be receiving the maximum employer match.

From a plan design perspective, plans with a higher threshold for employees to receive the maximum employer match had fewer participants who saved enough to receive the maximum match. While the purpose of a higher threshold might be to lure employees to make more retirement savings, the reality is that participants, especially those who were not on track, were not that responsive to this incentive. Morningstar Retirement Manager effectively increased participants' deferral rate and, in turn, increased the percentage of employees who received the maximum employer match. The impact is greater for plans with higher maximum matches.

Combined Savings and Investment Impact

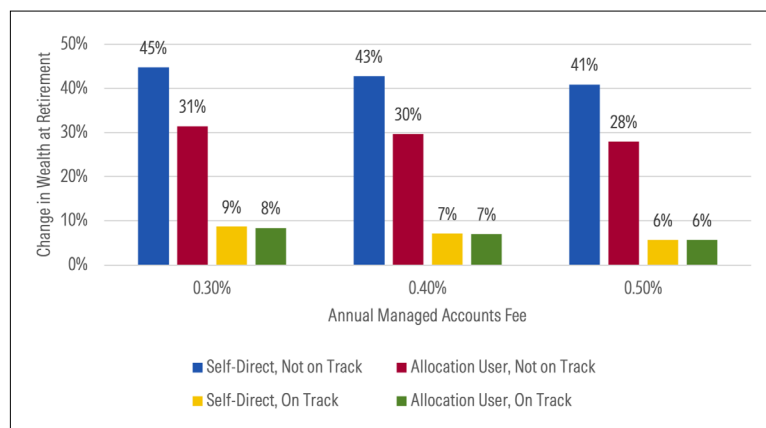
The analysis conducted so far suggests that participants, on average, who enroll in managed accounts are likely to experience higher returns and save more for retirement, although the likely impact varies based on participant attributes (for example, whether the participant is on track to retire). In order to determine the combined impact of these changes, we analyze expected wealth at retirement. The analysis uses a time value of money (that is, future value) calculation, using as inputs the years to retirement at age 65, the expected compounded/geometric return of the portfolio (estimated in the prior sections), the total savings amount (which is the total savings rate times the salary), and the current balance. We estimate these values for participants both before enrolling in managed accounts (for example, the pre-managed accounts' savings amounts and geometric returns) and after enrolling in managed accounts and focus on the difference between the two values. We limit this analysis to participants who have a positive current balance and exclude participants who elected to reduce their savings rate, as Morningstar Retirement Manager will never recommend reducing the savings rate.

This analysis effectively assumes that the income, savings rate (or amount), and portfolio risk level remain constant until retirement. In reality, these would each likely change over time. For example, income and savings rates would generally be expected to increase with age, while portfolio risk levels would generally be expected to decrease. These changes would likely differ by participant, and assuming these values remain constant until retirement is obviously a simplifying assumption; however, it's not clear to what extent a more complex approach would improve the projection.

For the combined analysis, participants are segmented into one of four groups, based on whether the participant is self-directing their portfolio and whether the participant is on track for retirement. If we average the groups by age, so that each age has the same impact on the overall results, the largest group of participants was not-on-track self-directors (34.5%), followed by on-track self-directors (30.6%), on-track allocation-fund users (17.5%), and not-on-track allocation-fund users (17.4%).

Fees are an important aspect to consider when attempting to estimate the value of any type of advice service. There are typically fees associated with managed account services, so it's important to understand how the potential value changes for different fee levels. Therefore, we perform this combined analysis based on three fee levels for managed accounts: 30 basis points, 40 basis points, and 50 basis points. While fees vary significantly by provider, 40 basis points is a reasonable proxy for the average fee assessed by managed accounts providers today. All fees for the analysis are assumed to be assessed annually against the current employer's plan balance each year until retirement. These results are included in Exhibit 17.

Exhibit 17: Average Change in Retirement Wealth by Managed Accounts Fee

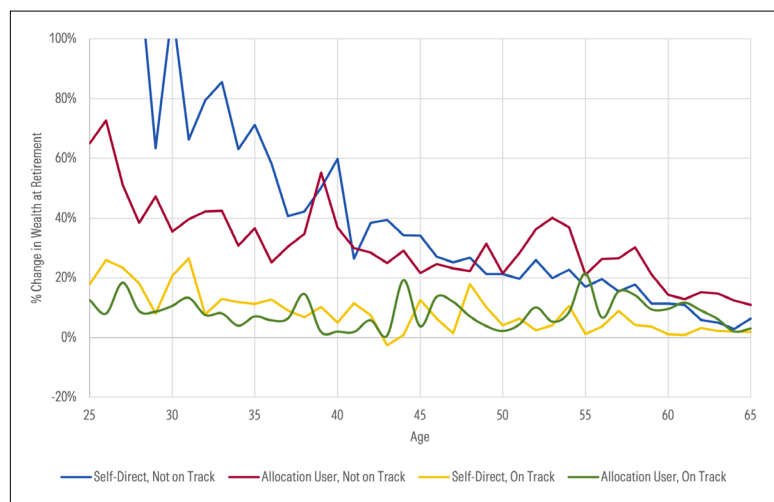


Source: Morningstar Investment Management LLC

With a 40-basis-point fee, which is a reasonable approximation of the average fee for managed accounts services today, the average change in wealth was positive for each of the four groups. The expected median (average) change in wealth at retirement is positive 3% (positive 43%) for not-on-track self-directors, positive 5% (positive 30%) for not-on-track allocation-fund users, negative 2% (positive 7%) for on-track self-directors, and negative 2% (positive 7%) for on-track allocation-fund users.

The average estimated difference in wealth at retirement for each of the four groups, by participant's age upon enrollment, is included in Exhibit 18. The results in Exhibit 18 include a 40-basis-point fee for managed accounts. Younger participants would be expected to realize the greatest benefit from managed accounts, although the impact clearly varied by participant group.

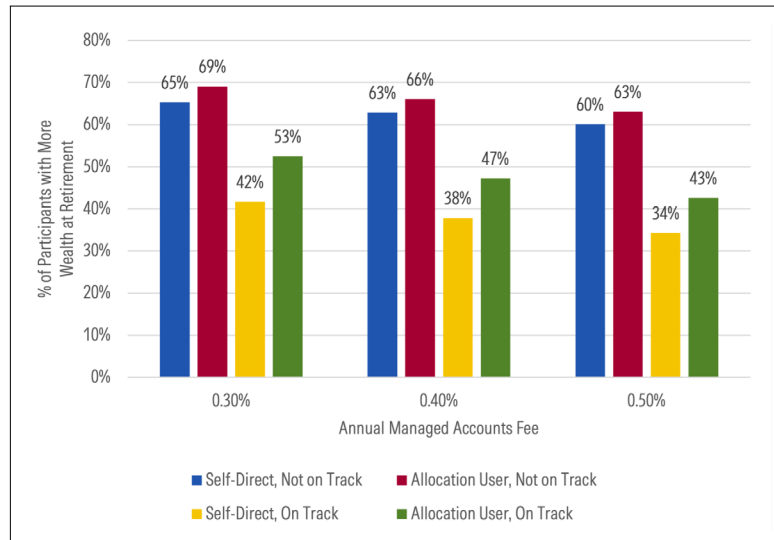
Exhibit 18: Average Change in Retirement Wealth by Participant Age (40-Basis-Point Fee)



Source: Morningstar Investment Management LLC

In Exhibit 19, we estimate the percentage of participants who had more wealth at retirement for different fee levels. We find that most participants would be expected to have more wealth at retirement, especially participants who were not on track for retirement. This is primarily due to the increases in savings levels noted among participants who were not on track for retirement when entering managed accounts. Not surprisingly, the percentage of participants who are better off declines at higher assumed fee levels.

Exhibit 19: Percentage of Participants With More Wealth at Retirement



Source: Morningstar Investment Management LLC

More wealth at retirement should result in more retirement income. To provide some perspective on the potential impact of managed accounts on retirement income, we convert the expected wealth differences into income values. For this calculation, we simply divide the difference in wealth at retirement by 25 and assume that is the difference in income the participant would receive during retirement. This factor (25) is roughly assuming the participant takes a 4% initial withdrawal from the portfolio at retirement, where that amount is increased annually for inflation. While the 4% rule may be less prudent today given lower expected returns compared with historical long-term averages (Blanchett 2017, Arnott et al. 2024), it is still a reasonable income assumption for the purposes of this analysis. For example, Arnott et al. (2024) find that by applying simple retirement income strategies, the sustainable withdrawal rate could be significantly improved with the forward-looking market expectation.

The average impact of managed accounts on annual retirement income is estimated for various age groups and fee levels for the four participant groups noted previously, and the results are included in Exhibit 20.

Exhibit 20: Annual Retirement Income Impact of Managed Accounts

30 bps Managed Accounts Fee (USD)					
	Self-Direct, Not on Track	Allocation User, Not on Track	Self-Direct, On Track	Allocation User, On Track	All Participants
Age 25-34	\$17,750	\$15,715	\$1,900	\$2,031	\$5,732
Age 35-44	\$6,728	\$4,336	-\$961	\$311	\$3,429
Age 45-54	\$2,404	\$1,976	-\$810	\$44	\$1,628
Age 55-65	\$678	\$514	\$99	\$215	\$513

40 bps Managed Accounts Fee (USD)					
	Self-Direct, Not on Track	Allocation User, Not on Track	Self-Direct, On Track	Allocation User, On Track	All Participants
Age 25-34	\$16,015	\$13,792	-\$15	\$419	\$3,981
Age 35-44	\$5,703	\$3,634	-\$2,096	-\$471	\$2,537
Age 45-54	\$2,018	\$1,751	-\$1,252	-\$219	\$1,305
Age 55-65	\$600	\$478	-\$ 2	\$173	\$448

50 bps Managed Accounts Fee (USD)					
	Self-Direct, Not on Track	Allocation User, Not on Track	Self-Direct, On Track	Allocation User, On Track	All Participants
Age 25-34	\$14,325	\$11,919	-\$1,879	-\$1,152	\$2,276
Age 35-44	\$4,698	\$2,946	-\$3,209	-\$1,237	\$1,661
Age 45-54	\$1,637	\$1,528	-\$1,688	-\$478	\$985
Age 55-65	\$522	\$443	-\$102	\$131	\$384

Source: Morningstar Investment Management LLC

Consistent with the results in Exhibit 18, younger participants are likely to realize more annually in retirement from managed accounts than older participants. If we focus on the youngest age group (25 to 34), we could generally assume that the average 30-year-old participant using a managed accounts service would increase their retirement income by USD 3,981, assuming a 40-basis-point managed accounts fee. This corresponds to an average increase of 26% in retirement income.

Limitations of Analysis

While the updated data outlined above upholds the clear value of managed accounts, we do want to acknowledge a few limitations in this analysis. First, potential bias may exist in the sample population. Of the 84,875 participants analyzed, 100% of them were enrolled in Morningstar Retirement Manager via “opt-in,” meaning they actively chose to enroll instead of being defaulted into the service. This sample could skew the results toward people who value personal investing advice enough to pay for it, as well as those who may possibly start out with insufficient retirement savings (given that 73% of participants analyzed in this dataset were not on track for retirement). As such, they likely do not fully reflect the general population at large.

Further, this analysis only examines the participants' initial enrollment interaction. We chose this as the moment on which to focus our analysis because this is when the most significant change to participants' retirement saving and investing strategies occurs and is therefore most reflective of how managed accounts can take not-on-track participants and make changes to put them on track to reach their goals. However, by not following participants over time, we are assuming that they will stay on the course set out for them by their managed accounts service and that they will remain enrolled. It is likely that this will not remain true for all participants, as they move in and out of the service by changing jobs or seeking more personal control over their investment elections. However, should a participant deviate from the advice that managed accounts provides or unenroll from the service, then the value of managed accounts would be rendered moot, as its value lies in the participant following the advice it provides.

Appendix 2: Portfolio Assignment Approach

The approach to determining the appropriate risk level for an investor's optimal portfolio allocation (that is, portfolio assignment) is based on taking a holistic view of an investor's assets. This approach incorporates the total value and risk attributes of assets that are often overlooked, such as human capital and pension wealth, and uses the financial assets in the defined-contribution plan as the "completion portfolio" to ensure diversification of the individual's total wealth.

A fundamental part of the total wealth process is modeling and understanding how an individual's wealth changes over the lifecycle. For younger individuals, human capital is typically the dominant household asset. Human capital can be thought of as the mortality-weighted net present value of an individual's future wage income. As individuals age, they tend to save money for retirement, thereby accumulating financial assets (both inside the defined-contribution plan as well as potentially outside it), along with accruing benefits in pension plans (such as Social Security). In other words, over time, investors convert a portion of their salary (that is, human capital) into financial capital by saving and accruing pension benefits, both of which can be used to fund retirement.

Research by Blanchett and Straehl (2015), among others, has noted that human capital is generally a relatively bondlike asset—it usually pays a steady "coupon" in the form of a paycheck, but its risk varies considerably across business cycles, by job skills, as well as the specific occupation and industry of the worker. Because human capital is bondlike and untradable, a younger investor's financial assets should generally be invested more aggressively to achieve a more balanced risk level from a total wealth perspective. As the relative value of human capital (as a percentage of total wealth) declines as the individual ages, financial capital should generally be invested more conservatively to ensure the risk of the total wealth remains balanced throughout the lifecycle. This is the economic rationale underpinning the shape of many glide paths today.

There are two final considerations when determining the optimal risk level for a participant's portfolio. The first is how "on track" that individual/household is for retirement. Within the portfolio assignment process, individuals who are better funded (that is, have higher funded ratios) can potentially take on more risk in their portfolio based on their target risk level using the total wealth approach. Second, other nonadvisable portfolios (for example, an IRA or, really, any monies outside the defined-contribution plan) must be considered. For example, if an investor has a large IRA that is invested very aggressively, yet the overall total wealth target risk level is more balanced, the money in the defined-contribution plan should be invested more conservatively (and vice versa).

Appendix 3: RBSA Index Proxies

Asset Class	Index Proxy
Large Growth	Morningstar US Large Cap Broad Growth
Large Value	Morningstar US Large Cap Broad Value
Mid Growth	Morningstar US Mid Cap Broad Growth
Mid Value	Morningstar US Mid Cap Broad Value
Small Growth	Morningstar US Small Cap Broad Growth Extended
Small Value	Morningstar US Small Cap Broad Value Extended
Real Estate	Morningstar US Real Estate TR USD
International Equity	Morningstar DM xUS GR USD
Emerging Markets Equity	Morningstar EM GR USD
Commodities	Bloomberg Commodity TR USD
Short Bond	Morningstar US Short Core Bd TR USD
Intermediate Bond	Morningstar US Inter Core Bd TR USD
Long Bond	Morningstar US Long Core Bd TR USD
Short TIPS	Morningstar US Short TIPS TR USD

Appendix 4: Capital Market Assumptions

Asset Class	Return	Std Dev	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Large Growth	10.45%	18.85%	1.00	0.815	0.883	0.743	0.773	0.682	0.578	0.790	0.574	0.245	0.067	0.167	0.166	0.190	0.153	0.520	0.220	0.405	-0.005
Large Value	9.48%	16.05%	0.815	1.000	0.811	0.924	0.740	0.847	0.648	0.799	0.602	0.267	0.139	0.224	0.215	0.254	0.193	0.555	0.259	0.423	0.049
Mid Growth	10.31%	20.90%	0.883	0.811	1.000	0.820	0.908	0.807	0.650	0.824	0.612	0.281	0.065	0.158	0.179	0.206	0.167	0.543	0.220	0.459	-0.008
Mid Value	11.31%	18.54%	0.743	0.924	0.820	1.000	0.791	0.937	0.711	0.796	0.618	0.278	0.145	0.233	0.228	0.252	0.211	0.603	0.256	0.435	0.034
Small Growth	11.22%	24.31%	0.773	0.740	0.908	0.791	1.000	0.843	0.617	0.775	0.576	0.250	0.029	0.115	0.136	0.177	0.135	0.509	0.184	0.430	-0.021
Small Value	12.98%	22.66%	0.682	0.847	0.807	0.937	0.843	1.000	0.690	0.772	0.601	0.271	0.117	0.191	0.181	0.247	0.172	0.587	0.216	0.413	0.014
Real Estates	9.85%	20.92%	0.578	0.648	0.650	0.711	0.617	0.690	1.000	0.595	0.441	0.222	0.279	0.372	0.383	0.297	0.334	0.548	0.325	0.429	0.028
International Equity	9.17%	17.42%	0.790	0.799	0.824	0.796	0.775	0.772	0.595	1.000	0.679	0.389	0.073	0.159	0.153	0.210	0.153	0.571	0.297	0.434	0.010
Emerging Markets Equity	10.86%	24.37%	0.574	0.602	0.612	0.618	0.576	0.601	0.441	0.679	1.000	0.260	-0.003	0.048	0.056	0.136	0.062	0.442	0.147	0.606	-0.029
Commodities	4.55%	15.52%	0.245	0.267	0.281	0.278	0.250	0.271	0.222	0.389	0.260	1.000	-0.005	0.019	0.002	0.156	0.019	0.173	0.148	0.151	0.037
Short Bond	3.96%	2.36%	0.067	0.139	0.065	0.145	0.029	0.117	0.279	0.073	-0.003	-0.005	1.000	0.828	0.745	0.496	0.638	0.325	0.580	0.330	0.381
Intermediate Bond	4.59%	4.54%	0.167	0.224	0.158	0.233	0.115	0.191	0.372	0.159	0.048	0.019	0.828	1.000	0.885	0.491	0.764	0.388	0.641	0.416	0.144
Long Bond	5.49%	11.45%	0.166	0.215	0.179	0.228	0.136	0.181	0.383	0.153	0.056	0.002	0.745	0.885	1.000	0.397	0.796	0.383	0.582	0.435	0.055
Short TIPS	3.88%	3.80%	0.190	0.254	0.206	0.252	0.177	0.247	0.297	0.210	0.136	0.156	0.496	0.491	0.397	1.000	0.629	0.323	0.419	0.263	0.134
Long TIPS	5.22%	13.20%	0.153	0.193	0.167	0.211	0.135	0.172	0.334	0.153	0.062	0.019	0.638	0.764	0.796	0.629	1.000	0.288	0.592	0.368	-0.010
High Yield Bond	7.01%	9.13%	0.520	0.555	0.543	0.603	0.509	0.587	0.548	0.571	0.442	0.173	0.325	0.388	0.383	0.323	0.288	1.000	0.267	0.441	0.071
International Bond	4.29%	8.03%	0.220	0.259	0.220	0.256	0.184	0.216	0.325	0.297	0.147	0.148	0.580	0.641	0.582	0.419	0.592	0.267	1.000	0.316	0.080
Emerging Markets Bond	7.43%	13.45%	0.405	0.423	0.459	0.435	0.430	0.413	0.429	0.434	0.606	0.151	0.330	0.416	0.435	0.263	0.368	0.441	0.316	1.000	0.024
Cash	2.61%	1.71%	-0.005	0.049	-0.008	0.034	-0.021	0.014	0.028	0.010	-0.029	0.037	0.381	0.144	0.055	0.134	-0.010	0.071	0.080	0.024	1.000

Source: Morningstar Investment Management LLC

Appendix 5: Risk-Adjusted Portfolio Efficiency

To estimate the risk-adjusted portfolio efficiency we for each portfolio we use the estimated risk and return values for each portfolio and compare those values to a risk-adjusted benchmark. The benchmark is a two-asset portfolio, consisting of a safe and risky asset. The safe asset is assumed to be 100% Cash, which has an expected return of 2.31% and a standard deviation of 1.73%. For the risky asset, we assume an allocation that is 20% Large Growth, 20% Large Value, 10% Small Growth, 10% Small Value, 25% International Equity, and 15% Emerging Market (i.e., a well-diversified portfolio of risky securities). The risk asset has an expected return of 10.04% and a standard deviation of 16.9%. The correlation between the risky and safe asset is assumed to be zero.

We determine the arithmetic return ($R_{p,a}$) and standard deviation (σ_p) for each combination between the safe and risk asset from 0% to 100% in 1% increments. For each increment we estimate the geometric return ($R_{p,g}$) using equation 5.1.

$$R_{p,g} = e^{\left(\ln(1+R_{p,a}) - .5\ln\left(1 + \frac{\sigma_p^2}{(1+R_{p,a})^2}\right)\right)} - 1 \quad [5.1]$$

Next, we determine the compounded returns for each increment between the safe and risky asset from 0% to 100% in 1% increments. This gives us target compounded return for each portfolio standard deviation. We determine the portfolio efficiency by subtracting the actual portfolio geometric return to the target compounded return based on the participant portfolios standard deviation.

For example, if the standard deviation of a portfolio (σ_p) was 10% (based on the underlying sub-asset class exposures), the return target (R_t) would be 5.32%. If the expected return of the portfolio was only 5.00% the portfolio efficiency would be -.32%. This calculation is performed for both the allocation before and after entering managed accounts.

Appendix 6: Risk Appropriateness

Harry Markowitz (1952) established the mean-variance optimization framework, which requires three sets of inputs: returns, standard deviations, and pair-wise correlations for the assets in question. When seeking the optimal mix (the utility maximizing mix) for a specific investor, the mean-variance optimization framework can be determined using equation 6.1, where U is the investor's utility for the asset allocation, (R_p) is the return of the asset allocation, λ is the investor's risk aversion coefficient, and σ_p^2 is expected variance of return of the asset allocation.

$$U = E(R_p) - .5\lambda\sigma_p^2 \quad [6.1]$$

In a two-asset portfolio, we can determine the target risk aversion level for a portfolio using equation 6.2

$$\lambda = \frac{R_e - R_b}{(\sigma_e^2 + \sigma_b^2 - 2\sigma_{e,b}) * wt_e - \sigma_{e,b} - \sigma_b^2} \quad [6.2]$$

The two-asset portfolio is assumed to consist of a safe and risky asset. We use the same assumptions for the safe and risky asset as those used for the risk-adjusted efficiency test, as noted in Appendix 5.

For this test the ideal equity allocation is assumed to be the managed accounts recommended portfolios. This ideal allocation would be assumed to result in zero utility loss, since it represents the utility-maximizing asset allocation. We can use this target equity allocation, which is assumed to be target allocation to the risky asset, in conjunction with equation 6.2 to estimate the implied target risk-aversion (λ_t) coefficient that would make the recommended stock/bond asset allocation the utility-maximizing mix. Unless the asset allocation of both the recommended and existing allocations are identical, there is a potential loss associated with being invested sub-optimally.

Next, given the risk of the target equity allocation (σ_t^2) and the participant's portfolio before managed accounts (σ_c^2) we can determine the "utility cost" for being invested sub-optimally, using equation 6.3

$$Utility\ Cost = (E(R_t) - .5\lambda_t\sigma_t^2) - (E(R_c) - .5\lambda_t\sigma_c^2) \quad [6.3]$$

For readers interested in learning more about this model, we recommend Blanchett (2017) or Idzorek, Blanchett, and Bruns (2018).

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