
The Value of a Gamma-Efficient Portfolio

Morningstar Research

Working Draft version October 25, 2017

David Blanchett, PhD, CFA, CFP®
Head of Retirement Research
Morningstar Investment Management LLC
david.blanchett@morningstar.com

Paul D. Kaplan, PhD, CFA
Director of Research
Morningstar Canada
paul.kaplan@morningstar.com

Abstract

In 2013, we introduced gamma, a new metric designed to quantify the value of more intelligent financial planning decisions, with a focus on the potential benefits of working with a financial advisor (Blanchett and Kaplan, 2013). This paper revisits gamma, but with a relatively narrow scope: to quantify the potential benefits of implementing a gamma-efficient portfolio strategy for an investor; i.e., to measure the gamma of investing decisions. We do this using a framework of seven questions an investor should consider during the portfolio construction process. This framework is far more comprehensive than simply selecting a few mutual funds.

Based on our empirical tests and existing research, we estimate that the “average” investor is likely to benefit significantly from working with a financial advisor, so long as the advisor provides comprehensive, high-quality portfolio services for a reasonable fee. The potential benefits associated with making better portfolio decisions will vary considerably by investor.

The Value of a Gamma-Efficient Portfolio

In 2013, we introduced a new metric, gamma, to quantify the value of more intelligent financial planning decisions, with a focus on the potential benefits of working with a financial advisor (Blanchett and Kaplan, 2013—henceforth, “BK”). This paper revisits gamma, but with a relatively narrow scope: to quantify the potential benefits of implementing a gamma-efficient portfolio strategy for an investor; i.e., to measure the gamma of investing decisions. This is slightly different from BK, which focused more on quantifying the benefits of good general financial planning decisions that could benefit a retiree, i.e., financial planning gamma. In both papers, the goal is the same: to understand the value associated with prudent financial advice.

We estimate the gamma of investment decisions using a comprehensive framework of seven questions an investor should consider during the portfolio construction process:

1. Why invest at all?
2. Which type of account may be best?
3. What is an appropriate risk level?
4. Which asset classes should be considered?
5. How does the risk of the goal affect how I invest?
6. What investments to implement with?
7. When should the portfolio be revisited?

These considerations result in a process that is far more comprehensive than simply selecting mutual funds for a client. The process necessitates the portfolio is consistent with the goals and risk objectives of the investor, is diversified, and built using high-quality, low-cost investments within a tax-aware framework (if applicable). This type of comprehensive and holistic approach will likely be increasingly important as the industry moves toward a fiduciary best-practices framework.

To quantify the benefits of these decisions, we both conduct empirical tests and cite existing research on the respective topics. Unlike the original gamma research, where BK used a retirement income metric¹ to contrast the potential value of different services, here we focus more on the potential performance-enhancing benefit of the respective service. That is, this approach quantifies the increase in expected return (or equivalent) associated with each decision and more easily lends itself to the cost of the respective financial advice, which is typically a fee based on assets under management.²

-
- 1 To be more precise, BK estimated certainty-equivalent income using a nested utility function. This higher income resulting from the more efficient strategies was then converted into an alpha-equivalent value using a separate model.
 - 2 Viewed differently, the financial advisor fee is negative alpha (i.e., the cost). In this piece, we explore the potential value associated with the decisions a financial advisor can help an investor make, the net of which would be the value of the advice.

Rather than contrast the optimal approach to the decisions that a single “average” (i.e., naïve) investor would make, we consider three types of investors, each with a different benefit level that we refer to as low, average, and high. Not surprisingly, the potential benefit that an investor is likely to realize across the decisions varies significantly across these three levels. Investors who are only seeking to fund a single goal (e.g., retirement) with a single account (e.g., a 401(k)) who would otherwise invest in an efficient prepackaged multi-asset solution (e.g., a high-quality, risk-appropriate, target-date mutual fund) are likely to realize significantly less benefit surrounding these portfolio decisions than an investor who seeks to fund a variety of goals with multiple potential accounts who would build portfolios without the help of an advisor.

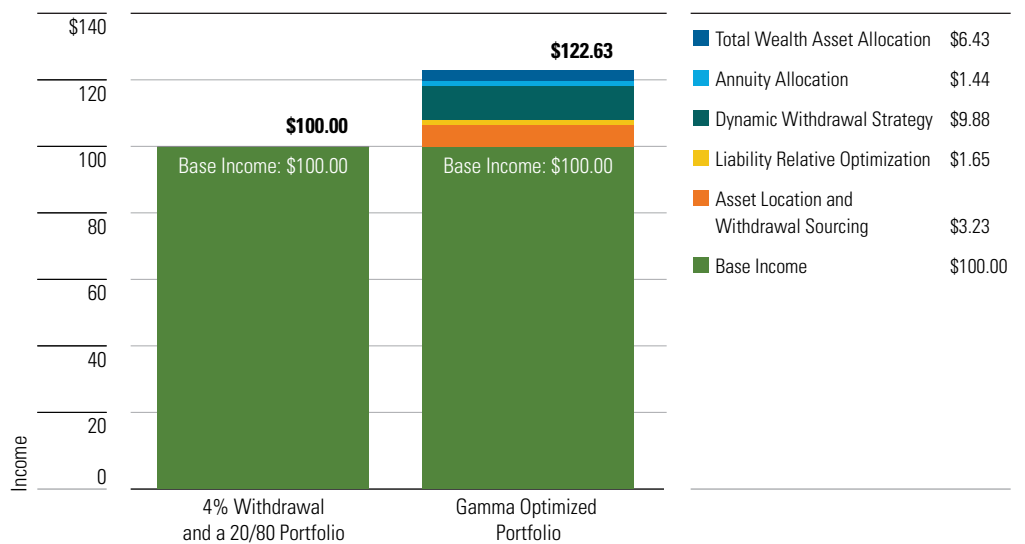
Overall, we estimate that the “average” investor is likely to benefit significantly from working with a financial advisor, even if the services are entirely related to building and monitoring the portfolio, so long as the advisor provides comprehensive, high-quality portfolio services for a reasonable fee. Providing other financial planning services (i.e., financial planning gamma), such as savings guidance, pension optimization, insurance planning, withdrawal planning, etc. are likely to result in even more value for the client, and while very important from an outcomes perspective, are not considered here.

The Value of Financial Advice

There is a growing interest in the value of financial planning services, especially given the movement toward fiduciary best practices and need to demonstrate that certain financial decisions (e.g., rolling over a 401(k) into an IRA) are in the best interests of an investor. While many investors may think that portfolio performance is the primary metric for the value of help from a financial advisor, there are many other activities and services a financial advisor can provide that can potentially result in a better outcome for a client.

We were the first to attempt to quantify the benefits of a comprehensive scope of financial planning services when we introduced a metric called gamma. While gamma, which is the third letter in the Greek alphabet (after alpha and beta), is used in other settings such as Black-Scholes options pricing models, we repurposed the word to describe the potential benefits of financial planner services. We used a nested utility function to estimate the increase in the certainty-equivalent retirement income that can result from intelligent financial planning decisions. We explored five fundamental financial planning decisions/techniques: a total wealth framework to determine the optimal asset allocation; a dynamic withdrawal strategy; guaranteed income products (e.g., annuities); tax-efficient decisions; and liability-relative asset allocation optimization. We found that a hypothetical retiree could generate 22.6% more certainty-equivalent income using a gamma-efficient retirement income strategy when compared to the base scenario (i.e., the decisions a naïve investor would make), as depicted in Exhibit 1. This increase in certainty-equivalent retirement income has a similar impact on expected utility as an increase in the arithmetic annual return of +1.59% (i.e., alpha-equivalent gamma). Source: Blanchett and Kaplan (2013)

Exhibit 1 The Potential Benefit of Various Financial Planning Services



Source: Blanchett and Kaplan (2013).

The fundamental goal of this paper is similar to our original (“BK”) research: to estimate the benefit from making better financial planning decisions. Unlike BK, though, where we focused on a variety of broader financial planning activities, here we focus more narrowly on decisions surrounding the portfolio.

In BK, we used a utility model to estimate the potential impact of the various financial planning services, then converted those estimates to an alpha-equivalent value for ease of cost-benefits analysis. In this paper, we rely entirely on an “alpha” metric to quantify the benefit of various decisions. The original BK utility model is better suited for financial planning outcomes because it can estimate the impact on a retiree’s consumption. But it is less suited for the focus of this paper, which is to quantify the potential increases in returns (both implicit and explicit) for portfolio decisions. This approach is also more comparable with portfolio advice costs, which are most commonly a fee based on advised assets (i.e., a fixed negative alpha from this quantification method).

There is some overlap with the concepts reviewed here and in BK. For example, asset location, which explores the potential benefits of holding different investments in various account types based on relative tax efficiency, was evaluated in BK and is also reviewed here. Another example is liability-relative optimization, which deals with how well the returns of the portfolio correlate with changes in the value of the goal. In reality, neither this piece nor the original BK research is able to effectively cover all the potential services (and potential benefits) that an investor can derive from financial planning; therefore, these papers should be viewed as complementary.

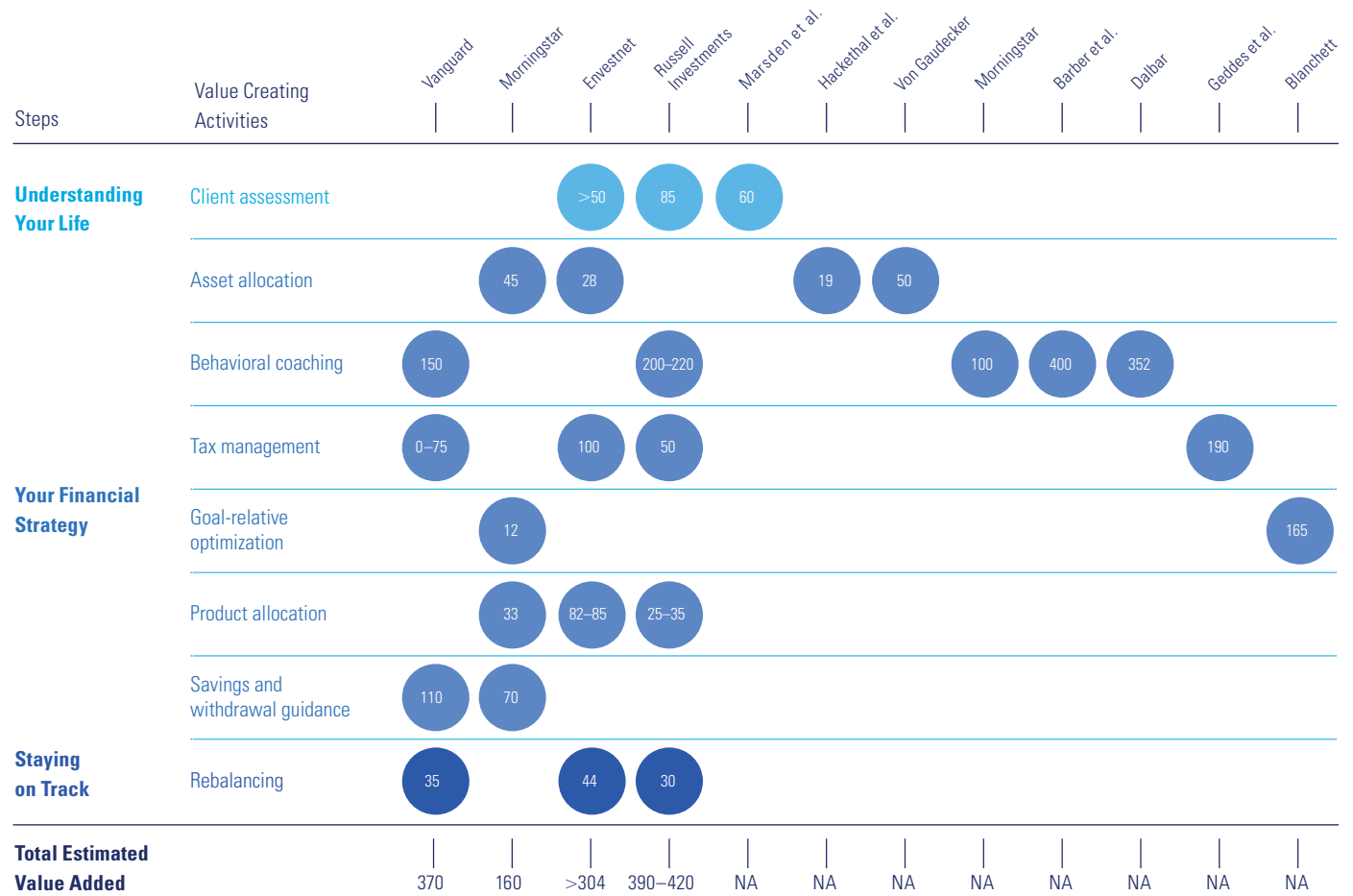
Another notable example of research that quantifies the value of various financial planning activities is Kinniry et al. (2014), who quantified Vanguard’s “Advisor’s Alpha” metric, which was introduced in 2001. Kinniry et al. explore the benefits of seven services, some of which were reviewed in BK, such as asset location and portfolio withdrawals, and others which are reviewed here (e.g., rebalancing, and cost-effective investments). Overall, Kinniry et al. (2014) note the value-add of these services is likely to be about 3% of an investor’s total assets. Additional research by Envestnet (2015),³ Jung (2016),⁴ and others also demonstrates the potential benefits investors can receive from working with a financial planner, which can be significant.

Merrill Lynch’s 2016 paper, “The Value of Personal Investment Advice,” summarizes the results from a variety of research papers that explored the value of various financial planning activities. An exhibit from their original research is included here as Exhibit 2.

³ <http://www.envestnet.com/sites/default/files/documents/ENV-WP-CS-0516-FullVersion.pdf>

⁴ https://russellink.russellinvestments.com/documents/sales_marketing_materials/russell_thevalueofyouradvisor_004707020.pdf

Exhibit 2 Estimated Value from Various Financial Planning Activities (in basis points)



Source: Merrill Lynch, "The Value of Personal Financial Advice"

A Comprehensive Assessment of Portfolio Efficiency

Building a gamma-efficient portfolio involves more than just purchasing a few mutual funds that have good historical performance versus some benchmark; a number of important and complex decisions must be made. In this paper, we explore these decisions using a seven-question framework. The ability of the investor to answer (and understand) each question, in conjunction with their situation and preferences, can determine to a large extent the potential benefits associated with working with a financial advisor (i.e., is the potential value likely to be low, average, or high?). These questions should be considered in this order:

Why Invest at All?

Before investing it is important to ensure that the savings are being used to best help the investor. For example, it may make more sense to pay down existing debt, especially high-interest consumer debt like credit cards, as well as to create an emergency savings fund, purchase insurance, etc., instead of investing in the stock or bond market. Ensuring this question has been adequately answered should provide an investor with some assurance that investing makes sense for their situation and that they can develop a goals-based financial plan.

Which Type of Account May Be Best?

Account-types and investments have different tax attributes; therefore, understanding how taxes will affect the account and investing appropriately can increase an investor's effective returns. One example of this is asset location, where investments are purchased in accounts to maximize their after-tax rate of return, such as buying bonds (or tax-inefficient assets) in a tax-deferred account and buying equities (or tax-efficient assets) in taxable accounts.

What Is an Appropriate Risk Level?

Creating a portfolio that is consistent with an investor's ability to take on risk is a complicated exercise. With the industry increasingly moving toward profiling techniques such as risk tolerance questionnaires (RTQs), it is important to make sure that the approach not only considers risk preference (i.e., how the investor would feel or react based on market performance), but also things like risk capacity (i.e., how much risk should the investor take given their resources and financial situation) and how the investor may respond to actual market events. Regardless of approach, though, ensuring the portfolio is consistent with the investor's risk appetite is a very important part of the portfolio process.

Which Asset Classes Should Be Considered?

After determining the appropriate target risk level, an investor must determine how to construct the portfolio. For example, if the investor is targeting an overall equity allocation of 60% of assets, they must determine how to invest in equities (i.e., for a given risk level). The investor could choose to invest entirely in domestic large-cap equities (e.g., the S&P 500 for a U.S. investor), or create a more efficient portfolio by considering additional asset classes such as domestic small caps, international equities, emerging markets, etc.

How Does the Risk of the Goal Affect the Portfolio?

People generally invest to fund a specific goal, e.g., retirement or college. Therefore, it's important to understand how the risks associated with the goal (i.e., the liability) itself should affect the portfolio and therefore include them in the portfolio optimization routine. One approach that can directly model the goal in the optimization routine is known as liability-relative optimization. Portfolios optimized this way can be considerably different than those optimized ignoring the goal. We explore this in greater depth later in this paper.

What Investments to Implement With?

Once the asset class targets have been set, an investor must then determine what investments to select.⁵ There are a variety of potential investment vehicles to choose from, such as mutual funds, ETFs, etc., as well as investment strategies (e.g., active or passive). Given the relative difficulty of consistently selecting funds that outperform peers on a risk-adjusted basis, financial advisors should focus on fees and have a proven system when selecting active managers.⁶

When Should the Portfolio Be Revisited?

Revisiting the portfolio is an important aspect of implementation to ensure the investments remain consistent with the underlying goals and objectives of the investor. At a minimum, assuming the client's goals and objectives have not changed, the portfolio should be rebalanced at least annually. Additionally, advisors can often provide important guidance to clients to help prevent them from making poor market-timing decisions as well as provide services like tax-loss harvesting that can increase the effective rate of return of the portfolio.

We assume in this paper that portfolios are very efficient (on a relative basis), which would suggest they come from a financial planner with significant knowledge and experience. The benefits associated working with advisors who are less experienced are obviously less and therefore the estimates should be viewed from that perspective.

⁵ In reality, it may be better to determine the asset class weights first and then investment allocations separately by considering the quality of the investments in the optimization routine, e.g., using some type of alpha-tracking error optimization. This approach is relatively rare, though, especially among financial planners. See Waring et al. (2000) for additional information on this approach.

⁶ Because past performance is no guarantee of future results!

Why Invest at All?

One of the most important, and basic, questions to ask before investing is whether there is a better use of the funds that are being or would be invested. Saving (or not tapping savings) implies a conscious choice to not consume money today so that some goal can potentially be achieved tomorrow, such as retirement, college funding, etc. Sometimes it may require taking a step back to make sure the method of investment will best help the individual achieve that goal.

For example, an investor who has revolving credit card debt (or some other type of liability) with an interest rate that is higher than the expected return on assets would likely be better off retiring debt than investing.⁷ The American Bankers Association estimates that 42% of American households had revolving credit card debt in 2015 with an average effective finance charge of 11.1%.⁸ If the goal of the investor is to maximize wealth at retirement, paying down high-rate debt likely will be better than investing, especially after considering fees and taxes. This perspective may apply to other consumer liabilities such as student loans and potentially even a mortgage, where the goal would be to direct additional savings to pay down these liabilities and then increase retirement contributions in the future.

Other important considerations would be things like ensuring the household has an emergency fund, having adequate insurance coverage, etc. With respect to insurance, the decision to purchase insurance is not typically wealth-maximizing since insurance companies (generally) price the risk appropriately. This is important from an outcome perspective since buying insurance (e.g., life insurance) may result in less savings, and therefore (potentially) less wealth at retirement. This does not mean the investor is “worse off” from buying the insurance (since expected wealth has been reduced, on average), because this perspective does not consider the full spectrum of risks and the potential incomes (e.g., the impact on the livelihood of a surviving spouse should the primary breadwinner pass away).

There may also be behavioral motivations at play that result in strategies that may not appear to be wealth-maximizing but are in fact in the best interests for clients. For example, an individual may feel strongly about repaying certain types of debt (e.g., student loans) even though the interest rate may be lower than the expected investment return. While this decision may seem irrational in isolation, if an individual is willing to (effectively) save more to repay the student loans and would be less willing to save toward some other goal (e.g., retirement) the actual expected wealth at retirement may be higher. For many people, reaching financial goals is more important than being rational or investing optimally. Investors who don't feel comfortable with their investment approach will likely be prone to destroy value through behavioral mistakes, such as selling out of a market after it has declined.

⁷ Especially after considering risk, since repaying a loan is effectively similar to earning that interest rate risk-free

⁸ <http://www.aba.com/Press/Documents/ABA2016Q1CreditCardMonitor.pdf>

Quantifying the benefit of helping an investor decide whether he or she (or they) should invest at all is complicated for a variety of reasons. First, if the investor decides not to invest at all or liquidate savings it means that the remaining portfolio decisions are less relevant (or potentially irrelevant) since there may be little (or no) monies available to be invested. These would be the types of situations, though, where the client is likely to benefit the most from this type of financial planning guidance. Second, the potential benefit is going depend significantly on each client situation, based on that individual's (or household's) existing liabilities, preferences, etc. Overall, though, there is clearly a benefit to understanding how the portfolio fits into the client's overall financial picture since it should result in more wealth at retirement.

For relatively sophisticated clients (e.g., with no credit card debt or loans with significant interest rates), we estimate the benefit of determining whether or not to invest is relatively small—equivalent to an alpha of 0.1% (10 basis points). It is not assumed to be zero given the fact even seemingly intelligent investors often make mistakes, and working with a financial planner can usually identify and correct some of those errors.

For less sophisticated clients—such as those who do not understand their complete financial picture, have high interest consumer debt, do not have an emergency fund or appropriate insurance, etc.—the benefit of this decision is likely to be significant, and could easily exceed 1.0% of whatever assets are under consideration. (In reality, the benefit could exceed 5.0% based on the facts and circumstances of the investor.) The potential benefits for a moderately sophisticated investor are more difficult to quantify given the potential large continuum of options, preferences, situations, etc. Therefore, we assume this potential benefit could be worth an alpha-equivalent of 0.3% (i.e., 30 bps) to be conservative, while acknowledging there is likely a significant amount of variation with this estimate.

Which Type of Account May Be Best?

Two important and interrelated decisions when determining which account type to use are selecting the optimal account type (e.g., a 529 account versus a taxable account) as well as investing the assets in a way that maximizes tax efficiency (something commonly referred to as asset location). The account type decision is important given the different tax statuses that exist across account-types. For example, if an investor is saving to fund college expenses for a child, a 529 account could potentially be a better method to fund the goal than a taxable account because all gains in the 529 used for qualifying education expenses are tax-free.

Asset location is important given the different way investments can be taxed and different tax statuses afforded to different account types. For example, bonds are relatively inefficient investments from a tax perspective, since the coupons are paid every year and taxed at ordinary income tax rates, which can sometimes be 35% or higher at the federal level. In addition, state taxes can often exceed 10% in some states. In contrast, equities can often be a far more efficient investment since qualified dividends are taxed at long-term capital gains rates, which can be as low as 15%, and all gains are taxed at long-term capital gains rates for stocks that are held for more than a year.

We can demonstrate the potential benefit from following both an optimal account selection methodology as well following an optimal asset location methodology using an analysis in which we estimate the differences in the growth of an initial investment (e.g., \$1) in different account types based on the assumed return, tax rate, and investment period. The wealth differences at the end of the period are converted into an annual “alpha” that results in the equivalent growth in wealth. We test investments where all gains are assumed to be realized annually (i.e., a bond or very tax inefficient equity fund) with annual returns of 2.0%, 3.0%, 4.0%, and 5.0%, investment periods of five, 10, 20, and 30 years, and tax rates of 15%, 25%, and 35%. Exhibit 3 presents the results.

Exhibit 3 Increase in Return From Either Delayed Taxation or No Taxation Versus Annual Taxation

Return%	Tax Rate%	Annual Taxation versus Delayed Taxation %				Annual Taxation versus NO Taxation %			
		Investing Period				Investing Period			
		5	10	20	30	5	10	20	30
2	15	0.01	0.03	0.06	0.10	0.32	0.35	0.41	0.48
3	15	0.02	0.06	0.15	0.27	0.50	0.56	0.71	0.88
4	15	0.04	0.11	0.30	0.55	0.68	0.80	1.08	1.40
5	15	0.07	0.18	0.51	0.98	0.88	1.07	1.53	2.05
2	25	0.02	0.04	0.09	0.15	0.53	0.57	0.65	0.74
3	25	0.04	0.09	0.22	0.38	0.82	0.91	1.10	1.31
4	25	0.06	0.16	0.42	0.76	1.12	1.29	1.64	2.01
5	25	0.10	0.26	0.71	1.30	1.44	1.70	2.27	2.82
2	35	0.02	0.04	0.10	0.18	0.74	0.78	0.88	0.98
3	35	0.04	0.10	0.26	0.45	1.13	1.24	1.45	1.67
4	35	0.08	0.19	0.49	0.87	1.55	1.73	2.12	2.48
5	35	0.12	0.31	0.83	1.47	1.98	2.27	2.86	3.38

Source: Author's calculations.

The potential benefits from helping an investor make more intelligent decisions regarding which account to invest in increases for longer investment periods, potentially higher returns, and higher tax rates. For example, the potential equivalent return increase for buying an investment in an account where no tax is paid on the gains, where the investment period is 10 years, the return is 4.0%, and the tax rate is 25% is 1.29%. This is obviously a significant potential source of "tax alpha" that can be achieved through prudent planning. Even delaying taxation through efficient asset location can potentially improve the effective return realized by the investor, using the previous scenario, although where taxation is delayed (similar to a traditional IRA) versus realized annually the equivalent annual return improvement is 16 bps.

The key behind asset location is structuring the investments to improve tax efficiency. Even though an investor may have a target equity allocation (e.g., of 50%) does not mean all the accounts should be invested in the same. Assuming an investor has multiple account types (e.g., taxable, traditional, and Roth) the taxable account should generally include more tax-efficient investments (e.g., stocks), the traditional account the less-tax-efficient investments (e.g., bonds), and the Roth account either the highest-returning assets (e.g., emerging markets equity) or least-tax-efficient assets (e.g., bonds), depending on the overall client scenario and relative account values. Note that it can be better for each account to hold at least two asset classes, even when this may mean reducing the tax efficiency. That's because it's much harder to control asset allocation at the total portfolio level when assets are spread among two or more accounts.

The list of scenarios presented in Exhibit 3 is by no means exhaustive. Actual client scenarios are likely to be far more complex. For example, the expected benefit from the decision to save in

either a traditional or Roth account depends significantly on projections of future tax rates, as well as a client's situation at retirement⁹; these estimates should only be considered as guidelines for individual application, not outcome guarantees.

Existing research suggests that despite the significant potential benefit associated with strategies like asset location, people often ignore them. For example, Amromin (2002) notes that many households hold highly taxed investments in taxable accounts and suggests that that liquidity considerations may partially explain this behavior. Barber and Odean (2003) find that the average households are tax-aware to some extent, although they mislocate one-third of their taxable bonds to taxable accounts. Shoven and Sialm (1999) note significant potential benefits for asset location that apply for both high-income and low-income individuals, as well as for risk-tolerant and risk-averse investors. Dammon, Spatt, and Zhang (2004) and others research similar conclusions through various quantitative and qualitative methods.

The potential benefit of account-type optimization will vary significantly by investor. Investors with a single goal who have access to an employer-sponsored 401(k) plan (e.g., younger investors) may be unlikely to benefit from account-type optimization. We assume the effective benefit is 10 bps although in reality it could be as low as 0 bps.¹⁰ Investors with complex financial scenarios with a variety of goals and account-types who are in a high marginal tax rate (e.g., older and wealthier investors) have the potential to benefit significantly. This benefit is assumed to be 50 bps, which is likely conservative. For the average investor, we assume the value is 25 bps, which is a relatively conservative estimate, especially given the range of potential outcomes shown in Exhibit 3.

⁹ The average investor will likely benefit from a traditional account because he/she will likely be in a lower marginal tax rate at retirement due to the tax-advantaged nature of retirement benefits (e.g., Social Security benefits) and the fact most retirees won't replace 100% of their preretirement income.

¹⁰ In theory, an advisor could still provide guidance on things like whether to save pretax (Traditional) or aftertax (Roth) in the 401(k) account, depending on availability.

What May Be an Appropriate Risk Level?

Ensuring the portfolio is consistent with the actual risk-aversion level of the investor, i.e., is risk-appropriate, is an important process when building a portfolio. Regardless of how efficient a portfolio may be in terms of maximizing expected return for the respective risk level, if it is not consistent with the risk-aversion level of the client, it would not be considered gamma-efficient.

Determining the appropriate risk level is complex. Today, risk-aversion is commonly measured through tools such as risk-tolerance questionnaires (RTQs). RTQs seek to understand how the investor feels about taking risk, and estimate how much risk the investor should consider taking given his or her financial situation (i.e., risk capacity). BK discuss the concept of “total wealth asset allocation,” where the appropriate equity allocation is estimated based on a combination of the investor’s human capital (an investor’s future potential savings) and financial capital. This concept has been explored in greater depth by Blanchett and Straehl (2015), among others, who generally note risk capacity should significantly affect optimal client portfolios. Additional aspects of risk capacity would be things like how well the goal is funded, time until the goals starts, how long it lasts (in the case of college or retirement), etc.¹¹

Households tend to invest their financial assets in many ways. To provide some perspective, we analyzed data from the 2013 Survey of Consumer Finances (SCF),¹² in particular the Summary Extract Public Data.¹³ We used the SCF data for this analysis, rather than a dataset explored with 401(k) allocations, since it provides a more comprehensive perspective of a household’s financial assets, of which 401(k)s are one important part. Focusing on only one account can provide incomplete information regarding holistic risk levels for investments. Later, we used individual 401(k) balances to explore how well participants build portfolios (i.e., how does the efficiency of portfolios differ by who creates them?).

The SCF contains data on the total equity of households both as a function of retirement assets (which is the total money in account-types like 401(k)s and IRAs) as well as total financial assets (which would also include monies in taxable accounts and annuities). We only include households that have both retirement assets (code RETQLIQ) and total financial assets¹⁴ (code FIN) totaling more than \$1,000.

We estimate the equity allocation for the respective households by dividing the total amount in each account held in equities (RETQLIQ and EQUITY, respectively) by the total assets. For household age, we either use the age of the respondent for single households or the average age of the couple for two-member households. When looking at total financial assets we exclude liquid transaction

¹¹ A relatively new field which explores the behavioral implications of risk is emerging. See Wendel (2017).

¹² This is the latest SCF dataset available; the 2016 version has not been released yet.

¹³ <https://www.federalreserve.gov/econresdata/scf/scfindex.htm>

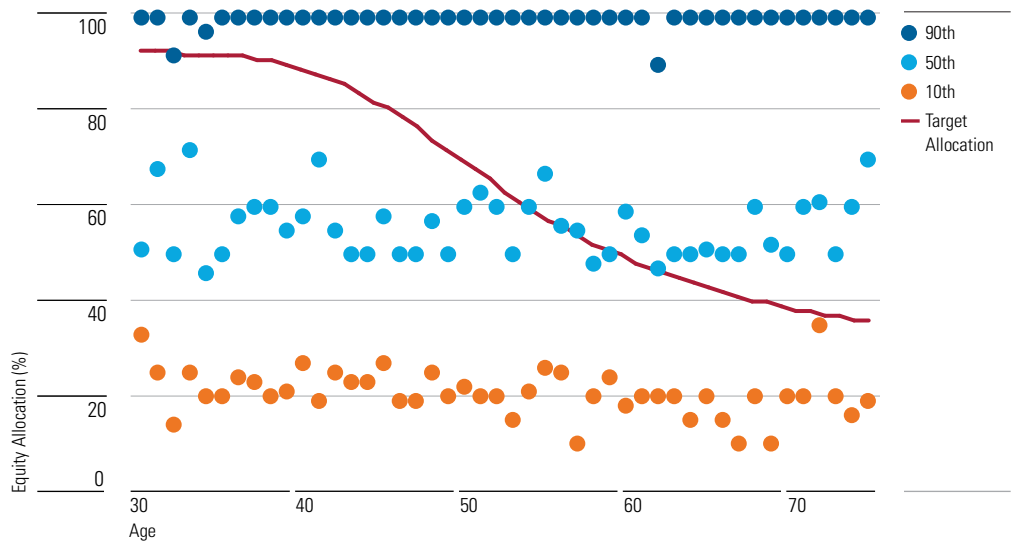
¹⁴ Retirement assets are a function of total financial assets so this is somewhat repetitive.

accounts (LIQ). After applying the filter, a total of 2,851 households are available for analysis. For simplicity, we ignore household weights.

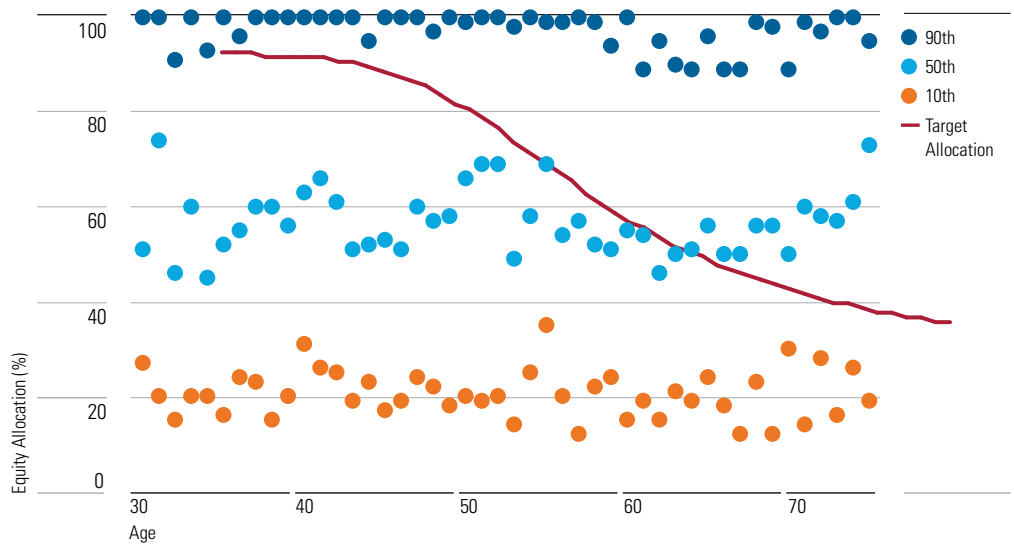
Exhibit 4 presents the distribution of equity allocations by age for retirement accounts and total financial assets in Panels A and B, respectively. We only include ages 30 to 75 since there are at least approximately 30 households for each age. The Morningstar® Lifetime Moderate IndexSM is used as a generally appropriate equity allocation benchmark.

Exhibit 4 Household Account Equity Allocation Distributions

Panel A: Retirement Accounts



Panel B: Total Financial Assets



Source: Survey of Consumer Finances, Authors' calculations.

The distribution of household equity allocation is relatively similar with retirement accounts and financial assets. This is not surprising since retirement assets compose 88% of financial assets for the median household and 69% of financial assets for the average household (again, excluding transaction accounts). It is worth noting that retirement assets include those held in IRAs as well as employer-sponsored plans.

Somewhat surprisingly, the equity allocations remain fairly consistent over time and across percentiles for both account types. This is inconsistent with generally accepted lifecycle investment theory and contrary to the glide path for virtually every target-date mutual fund series on the market.

To quantify the potential benefit of “good” asset allocation advice, we estimate the “cost” (from a negative alpha perspective) of investing in a portfolio that is not the optimal portfolio for each investor. To do this, we first solve for the optimal equity allocation for a given risk-aversion level in a two-asset class mean-variance optimization problem. The two asset classes are equity (*eq*) and cash (*c*). The problem is:

$$U_{max} = \max_x xM_{eq} + (1-x)M_c - \frac{\lambda}{2}(x^2S_{eq}^2 + (1-x)^2S_c^2 + 2x(1-x)S_{eq}S_c\rho)$$

where:

x = the equity allocation that maximizes utility

M_{eq} = the expected return on equity

M_c = the expected return on cash

λ = the risk aversion parameter for the investor

S_{eq} = the standard deviation of equity

S_c = the standard deviation of cash

ρ = the correlation between equity and cash

The expected return and risk estimates used are Morningstar Investment Management LLC’s 2017 Capital Market Assumptions. Equity has an expected return of 7.9% and a standard deviation of 15.0%, while cash’s expected return and standard deviation are both 2.0%. We assume a correlation of 0 between the two asset classes.

Next, we determine the target risk-aversion level for each household, which is based on the corresponding equity allocation for the Morningstar Moderate Lifetime Index for that respective age. This approach suggests, for example that an investor who is 56 years old should have a portfolio allocation that is invested in 61% equities. From the above optimization problem, we determine that an investor with a 61% equity allocation has a risk-aversion level of 3. If this same 56-year-old were

invested in a more conservative portfolio, e.g., 40% equities, this would be suboptimal. We can estimate the “cost” associated with being invested sub optimally using the optimization problem. For that investor to have the same utility investing in a 40% equity portfolio, when he/she should be invested in a 61% equity portfolio, the portfolio return would have to increase by 30 bps. This 30 bps could be viewed as the cost of being invested sub optimally, or as the alpha benefit of being invested optimally. In Exhibit 5, we show how the cost of being invested sub optimally varies across a variety of target allocations and actual allocations.

Exhibit 5 The Cost of Being in the Wrong Portfolio

Actual Equity Allocation (%)	Target Equity Allocation (%)				
	10	30	50	70	90
10	0.0	-0.5	-1.1	-1.8	-2.5
30	-1.5	0.0	-0.3	-0.8	-1.5
50	-6.0	-0.5	0.0	-0.2	-0.7
70	-13.5	-1.9	-0.3	0.0	-0.2
90	-24.0	-4.2	-1.1	-0.2	0.0

Source: Author’s calculations.

The cost associated with being invested sub optimally (i.e., in a portfolio that is not consistent with your risk aversion level) increases the further you move away from the target. This should be relatively intuitive. The largest differences are for those investors who should be invested very conservatively, but are invested in a very aggressive portfolio. For these investors, the costs associated with the higher levels of risk can be significant and lead to significant disutility.

We apply this model to each of the 2,851 households we have equity allocations for in the study to see how the cost varies across household. We assume the optimal allocation is that of the Morningstar Moderate Lifetime Index. This is obviously a simplifying assumption because the optimal portfolio depends on a household’s situation and preferences. Nevertheless, it provides some perspective on the potential cost associated with these divergent allocations. We find that the median cost of being invested sub-optimally is 34 bps and the average is 59 bps for the retirement assets, and 28 bps and 55 bps respectively, for financial assets. If we look across the distribution of households, the cost for the 10th percentile (i.e., worst 1 in 10 households) is 150 bps, while the cost for the 90th percentile (best 1 in 10) is 3 bps.

There is some evidence in the survey data itself that working with a financial planner results in portfolio recommendations that are more appropriate. One survey question asks for the source of information the household uses to make savings and investment decisions.¹⁵ Sorting by the 14 responses available in both the telephone and in-person interview, households who select “financial planner” as their primary source had the most appropriate portfolios for their situation, on average, followed by accountants and the internet. The worst three sources (in order) were friends, email, and television/radio. The average cost for a misallocated portfolio among the financial planning group is 54 bps, about 20% better than the average cost across the 14 options. It is not clear to what extent the considered assets are being managed by the financial planner and the extent of the financial advice. Therefore, these results should be viewed from a relative/directional perspective, rather than an absolute perspective (i.e., as a rule, it appears that getting guidance from a financial planner can be much better than getting it from friends).

In this section, we demonstrated there is a definite value to being invested in a risk-appropriate portfolio, although that value varies significantly across households. For investors that use prepackaged investment solutions (e.g., target-date funds), the benefit of working with a financial advisor is likely to be relatively low, and is estimated at 10 bps. It is not assumed to be 0 bps because even though a target-date fund (for example) might be appropriate “on average,” it can’t customize asset allocation for every investor. For investors in a portfolio that is significantly different than their optimal portfolio (in particular if they should be invested conservatively but are invested aggressively) the benefit is likely to easily exceed 1.0%, although is assumed to be 1.0% to be conservative. For the average investor, the potential benefit is assumed to be 40 bps, which falls within the average and median value estimated across households. Note, this analysis does not consider the potential benefit of staying invested over the long-term, which is addressed in a later section.

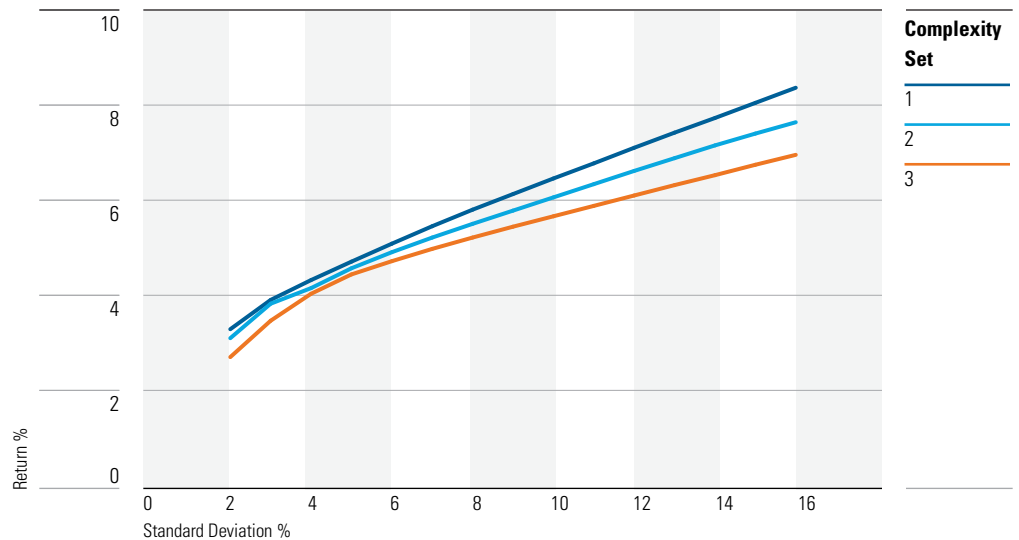
¹⁵ The exact question for the in-person survey version is: “What sources of information do you (and your family) use to make decisions about saving and investments?”

What Asset Classes Should Be Considered?

Once an investor has determined a target stock allocation, he or she must next decide how to build the portfolio. Portfolios are commonly constructed with asset classes that have different risk characteristics, such as U.S. domestic equities and international equities. In the absence of knowledge on the benefits of diversification, an investor may choose a simpler allocation that is less efficient than it could be.

It is possible to quantify the potential benefit of considering a larger opportunity set of investments as part of the portfolio construction process. We do this by testing three different “complexity sets” of asset classes. The simplest complexity set (Complexity Set 1) includes only four asset classes: cash, U.S. intermediate-term bonds, U.S. large-cap growth stocks, and U.S. large-cap value. This is a relatively basic opportunity set an investor with limited knowledge of investing may use to build a portfolio. The second complexity set includes the first opportunity set, but adds U.S. short-term bonds, U.S. long-term bonds, U.S. small-cap growth, and U.S. small-cap value. The third complexity set adds all the asset classes available for analysis listed in Appendix 1. Exhibit 6 shows the efficient frontier for the three complexity sets considered.

Exhibit 6 Improvement in Efficient Frontiers From More-Diversified Portfolios



Source: Authors' calculations.

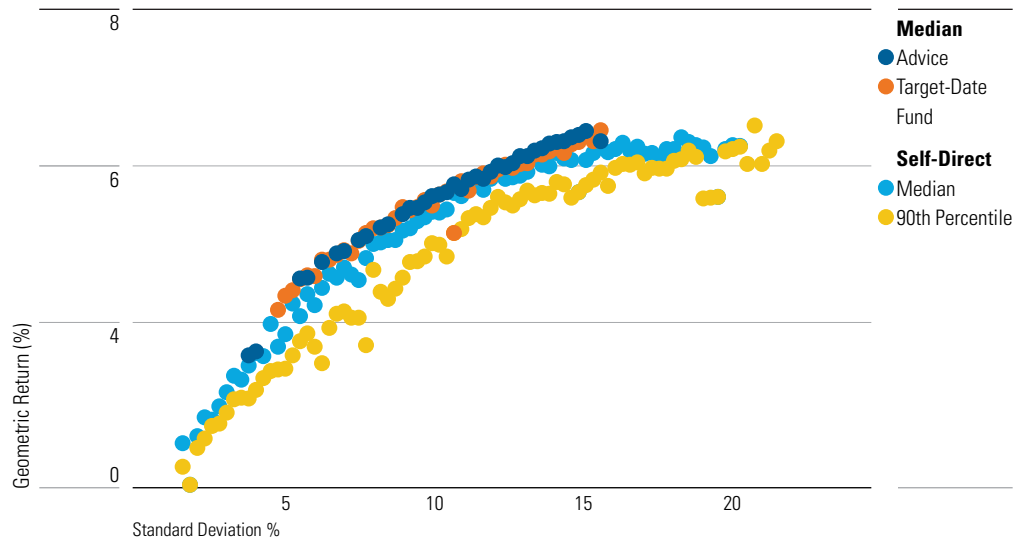
In Exhibit 6 we see that the potential benefit from a more diversified portfolio can be significant for a given level of risk. For example, for a standard deviation of 10% the expected return for Complexity Set 1 is 5.71% versus 6.11% for Complexity Set 2 and 6.51% for Complexity Set 3 (a range of 80 bps).

To better understand how investors actually build portfolios, we reviewed portfolio allocations for participants in 401(k) plans recordkept by Charles Schwab. All allocations were as of December 31, 2016. The initial dataset was quite large (data for over 300,000 participants); however, only participants who held funds that had identifiable securities with at least five years of historical performance were included in the analysis. This reduced the test set to 103,001 participants.

To estimate the relative efficiency of each portfolio, we first conducted a returns-based style analysis (RBSA) on each of the 946 funds held by the participants. RBSA is a method developed by William Sharpe (1988) and is best paraphrased by the saying (used by Sharpe in his original research paper), "If it acts like a duck, assume it's a duck." RBSA uses constrained optimization to determine what combination of benchmark indexes best describe the historical returns of an investment, such as a mutual fund. RBSA allows the user to determine the unique "beta" aspects, or market exposures, of an investment. This allows us to better estimate the risk exposures of each fund versus relying on more generic approaches, such as using the Morningstar Category. The asset classes included in the RBSA are those listed in Appendix 1, and the RBSA period is the five years ending December 31, 2016. Monthly data is used.

Using RBSA, it is possible to estimate the expected return and risk characteristics of each investor's portfolio using asset class assumptions presented in Appendix 1. We categorize participants into three groups: those using some type of in-plan advice solution (e.g., managed accounts, where the portfolios would be created by either Morningstar Investment Management LLC or Guided Choice); those with 95% or more of their assets invested in some type of packaged multi-asset investment (which is typically a target-date mutual fund); and those who are building their own portfolios.

Exhibit 7 presents aggregated results for the groups based on varying levels of standard deviations, in 0.25% increments. The first group is the median relative efficiency of those participants who have used some form of advice. The second group is the median relative efficiency of those participants who are using target-date funds. The third group is the median relative efficiency of participants who are self-directing (i.e., building their own portfolios). The fourth group is the 90th percentile (worst 1 in 10) relative efficiency of participants who are self-directing.

Exhibit 7 Relative Efficiency of Investor Portfolios

Source: Authors' calculations.

Exhibit 7 demonstrates that the most efficient portfolios tend to be those created by investment professionals, on average. These are either from the investment manager building portfolios from the 401(k) menu or target-date funds. In fact, the average difference in efficiency for the advice portfolios and the target-date funds for a given level of risk is 0%. This should be expected since both approaches are solutions investors can use to easily achieve highly diversified portfolios. The average difference in the median efficiency for those in advice (or target-date funds) and the median self-directors is 20 bps. This suggests that when investors build their own portfolios they are typically not as efficient as when an investment professional builds it for them. Finally, the average difference in the 90th percentile efficiency for those in advice or target-date funds (not depicted in Exhibit 7) and the 90th percentile self-directors is 60 bps. In other words, the relatively inefficient portfolios tend to be much less efficient than the portfolios created by investment professionals.

We can use these estimates of the potential benefits of more efficient portfolios when estimating the potential benefit of an advisor. The low benefit is assumed to be zero. This reflects the potential efficiency gains for an investor who would use a high-quality, prepackaged multi-asset investment solution (e.g., a target-date fund) if not a financial advisor. The high benefit is assumed to be 60 bps, which is consistent with the difference in the 90th percentile. Similar to past estimates, this is likely to be conservative. Finally, the average benefit is assumed to be the difference in the median professionally managed investments and the median self-directors, which is 20 bps.

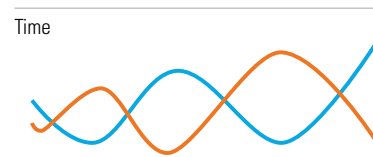
How Does the Goal Affect the Portfolio?

Once the target risk level has been determined and the opportunity set of asset classes estimated, the optimal portfolio needs to be determined. Portfolio allocations are usually determined using some type of optimization routine that focuses on the risk of the assets (as well as their expected returns and correlations) but ignores the risks associated with the investor's financial goal itself. In reality, the risks of the goal can (and should) play an important role in the portfolio optimization. For example, inflation is an important risk for many retirees who seek to generate some level of inflation-adjusted income for life. Any kind of asset-only focused optimization would not explicitly consider the risks associated with inflation and therefore may not result in the most efficient portfolio. By incorporating the liability into the portfolio optimization process, it is possible to build portfolios that can better hedge the risks faced by an investor. While these "liability-driven" portfolios may appear to be less efficient asset allocations when viewed from an asset-only perspective (more on this in a bit), they are actually more efficient when it comes to achieving a goal.

The theoretical advantage of an approach that directly considers the risk of the liability over any kind of asset-only optimization framework is depicted in Exhibit 8. The top panel represents the asset-only approach and the bottom panel represents the liability-relative approach. On the left side of both panels, the blue line representing the evolving true economic value (net present value) of the liability is identical. In the top left graph, we see that the asset-only approach leads to a portfolio of assets with a value that may not always move in the same direction as the value of liabilities because the portfolio of assets is determined in isolation with no knowledge of the liability. This, in turn, leads to a portfolio whose health/value (and/or the cost associated with funding the portfolio) can vary significantly over time as there can be large gaps between the value of the liability and the value of the assets. In contrast, in the bottom left graph, we see that the liability-relative approach can lead to a portfolio of assets with a value that is expected to move in unison with the value of the liabilities because the portfolio is determined in a single optimization that is expanded to include the liability as part of the total portfolio. This leads to a total portfolio whose health/value (and/or the cost associated with funding the portfolio) is steadier and more predictable over time as there are fewer mismatches between the value of the assets and the net present economic value associated with the liability.

Exhibit 8 Improving Total Portfolio Health With Liability-Driven Investing
Asset-Only Approach

Value of Liabilities vs Value of Assets

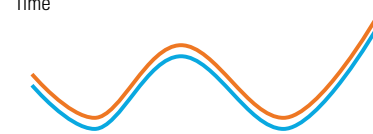


Portfolio Health/Funding Costs

Value of Assets
Vaule of Liabilities
Portfolio Health

Liability-Relative Approach

Value of Liabilities vs Value of Assets



Portfolio Health/Funding Costs

Source: Authors' calculations.

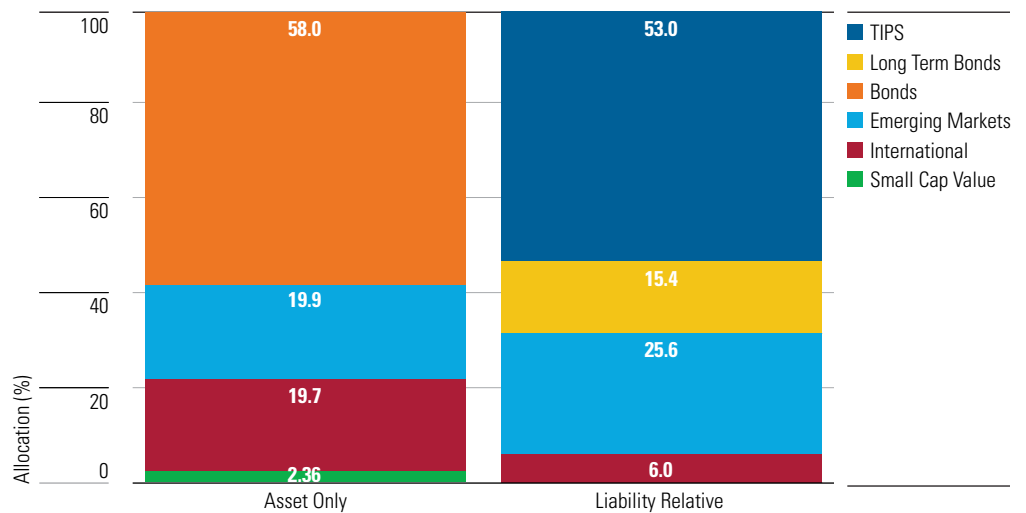
Three common liability-driven investment (LDI) frameworks are cash flow matching, duration matching, and liability-relative optimization. Of these, cash flow matching (the matching of the timing and size of cash flows from the assets with the required cash flows of the liability) and duration matching (matching the interest rate risk or sensitivity of the assets with that of the liability) are generally straightforward and tend to result in what most practitioners would consider ultra-conservative portfolios (i.e. invested entirely in bonds). In contrast, liability-relative optimization is a more sophisticated framework that builds on Harry Markowitz's mean-variance optimization "asset-only" framework to create a total-portfolio framework that simultaneously considers the assets, the liabilities, the interaction between assets and liabilities, and the size of the assets relative to the size of the liabilities (funding ratio).

Liability-relative optimization results in a continuum of optimal portfolios, referred to as the "liability-relative efficient frontier," where the most conservative portfolios are often similar to those that would be determined using either a cash flow matching or duration matching approach, while the more aggressive mixes are similar if not identical to the aggressive mixes from a traditional asset-only frontier. Most importantly, liability-relative optimized portfolios represent a wide range of potential mixes where the selected allocation is driven by the time horizon and risk tolerance of the investor.

We explored the potential benefits of liability-relative optimization in BK and revisit them here. To do so, we ran a liability-relative optimization where the liability was assumed to have the same risk factors as TIPS (i.e., TIPS are held short in the optimization routine). While we used inflation in BK, here we use TIPS under the assumption the retiree wishes to hedge out

both the risks associated with inflation as well as interest-rate risk. This is structurally similar to the perspective of a pension plan attempting to immunize a real pension liability. Exhibit 9 presents the portfolio allocations for a portfolio with a 6% expected return (in the asset-only space). Given an expected return for TIPS of 4.02%, the surplus return (i.e., the return of the portfolio minus the liability) is approximately 2% (1.98% to be exact).

Exhibit 9 Optimal Allocations for a 6% Expected Asset Return

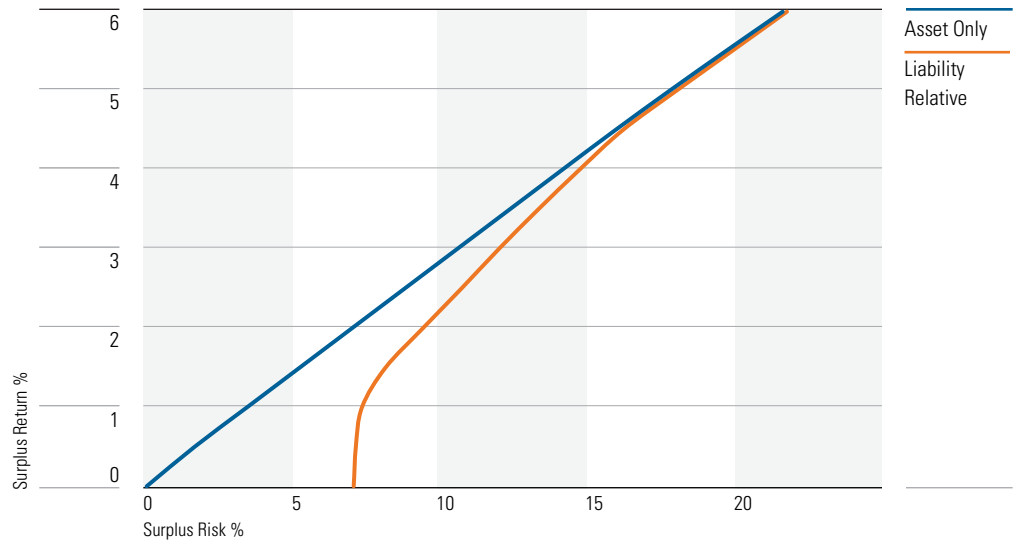


Source: Authors' calculations.

In Exhibit 9, we see that while parts of the allocations are similar there are notable differences. While both allocations have a reasonable allocation to emerging markets and they share a slight allocation to international equities, that is where the similarities end. The asset-only portfolio, which is optimized ignoring the liability, has a significant allocation to intermediate bonds (58%) and no allocation to TIPS, while the liability-relative optimized portfolio has a significant allocation to TIPS (53%) and no allocation to intermediate bonds.

These allocations result in significant differences in the relative efficiency, especially when contrasting the asset-only portfolio in the surplus space (i.e., the return and risk after accounting for return and risk of TIPS). These efficient frontiers are contrasted in the surplus space in Exhibit 10.

Exhibit 10 Efficient Frontiers for the Asset-Only Optimized Portfolios and Surplus Optimized Portfolios in the Surplus Space



Source: Authors' calculations.

The allocation with zero surplus risk is a 100% TIPS allocation, which we see in Exhibit 10. The allocation also has zero expected surplus return (the difference between the expected returns on the assets and the liabilities), since a portfolio invested in 100% TIPS would perfectly track the assumed liability. As the surplus risk increases, so does the expected surplus return. In other words, if an investor is willing to take on some risk with respect to the liability (i.e., not hedge it out perfectly) he/she could receive a higher expected return.

The minimum risk portfolio in the asset-only optimization has a significant allocation to short-term bonds, making it very different than the minimum risk liability-relative optimized portfolio. Although short-term bonds are low-risk assets in an asset-only framework, they add considerable risk to a liability-relative portfolio because of their shorter duration. This illustrates why some portfolios may look inefficient in an asset-only framework, but are actually very efficient in the liability-relative space (and vice versa). For example, the portfolio allocations in Exhibit 9 have the same expected surplus return (approximately 2%) yet the surplus risk for the liability-relative optimized portfolio is considerably lower than that of the asset-only optimized portfolio, 7.0% versus 9.4%. The liability-relative optimized portfolio with 9.4% of surplus risk has an expected surplus return of approximately 2.7%, which is 0.7% higher than the asset-only portfolio. This is equivalent to 70 bps of alpha for the investor using a liability-relative portfolio.

The efficient frontiers converge for riskier portfolios in Exhibit 10. However, riskier investors will generally be less interested in an LDI approach since very few goals have risks that are defined as equity-like. Also, more aggressive investors tend to be further away from their goal (e.g., a younger worker saving for retirement).

In practice, the liability is likely to differ by investor and can be difficult to correctly model and/or define. Therefore, while the results noted in this section were significant from a risk-return perspective, the potential benefit will vary across investors and goals. Therefore, we assume the average investor would benefit by 20 bps in a portfolio that incorporates the risks of the liability. This is slightly higher than the BK estimate of 12 bps, although the impact approach was very different. For investors who understand the liability, we assume 5 bps. For an investor who could benefit more from this type of portfolio (e.g., a retiree), we assume 50 bps.

What Investments to Implement With?

Once the asset allocation has been set, the next step is to select investments. These could include commonly available investments like ETFs or mutual funds, as well as less commonly used assets like hedge funds or private partnerships. Many investors seek investments they hope will outperform a benchmark on a risk-adjusted basis. The problem with this approach is that outperformance in this context, i.e., alpha, is a zero-sum game (on an asset-weighted basis), which means that for every investor who outperforms someone else must underperform,¹⁶ and this is before considering fees. Therefore, it is important for investors to carefully consider the attributes of the investments selected.

In this section, we review three key attributes that should be considered when selecting the investments used in the portfolio: cost, quality, and tax efficiency (for taxable accounts).

Investment Cost

Cost is one of the most important considerations when selecting an investment. Investment expenses, by definition, are negative alpha. While it is possible the portfolio manager may generate positive alpha through skill (or luck), we view the “skill” component to be a related to quality (i.e., expected likelihood of outperformance).

There are considerable differences in the costs of mutual funds today, especially when contrasting active and passive investments. Exhibit 11 presents data on the net prospectus expense ratios for mutual funds today. To be included in the dataset, a mutual fund must have an available expense ratio in Morningstar DirectSM. The data are based on the oldest share class for each fund. Funds that are tagged by Morningstar as “Index Funds” are assumed to be index funds. Categories with less than five available funds are presented as “N/A.”

¹⁶ Technically, this holds on an asset-weighted basis, so more investors could outperform, but the net alpha of total dollars invested is zero.

Exhibit 11 Distribution of Expense Ratios Across Active and Index Mutual Funds

Category	All Funds				Active Mutual Funds				Index Mutual Funds			
	Percentile				Percentile				Percentile			
	Wted Avg	10th	50th	90th	Wted Avg	10th	50th	90th	Wted Avg	10th	50th	90th
Large Growth	0.72	0.57	0.95	1.42	0.75	0.62	0.96	1.40	0.22	0.17	0.53	1.52
Large Blend	0.32	0.20	0.84	1.29	0.69	0.47	0.91	1.35	0.13	0.05	0.25	0.60
Large Value	0.66	0.55	0.89	1.30	0.70	0.56	0.89	1.27	0.18	0.06	0.37	1.57
Mid-Cap Growth	0.93	0.77	1.08	1.50	0.94	0.77	1.07	1.45	0.38	0.29	1.50	1.62
Mid-Cap Blend	0.40	0.23	1.00	1.47	0.77	0.66	1.09	1.50	0.14	0.07	0.29	0.60
Mid-Cap Value	0.85	0.69	1.00	1.30	0.85	0.66	1.00	1.30	N/A	N/A	N/A	N/A
Small Growth	0.90	0.83	1.16	1.62	0.97	0.85	1.16	1.55	N/A	N/A	N/A	N/A
Small Blend	0.64	0.53	1.10	1.50	0.92	0.79	1.14	1.50	0.19	0.05	0.24	0.74
Small Value	0.77	0.84	1.16	1.50	0.92	0.84	1.15	1.49	N/A	N/A	N/A	N/A
Foreign Large Growth	0.89	0.66	1.02	1.45	0.89	0.66	1.01	1.45	N/A	N/A	N/A	N/A
Foreign Large Blend	0.49	0.20	0.95	1.35	0.83	0.45	1.00	1.39	0.16	0.07	0.20	0.57
Foreign Large Value	0.78	0.33	0.93	1.38	0.79	0.34	0.94	1.38	N/A	N/A	N/A	N/A
World Stock	0.89	0.59	1.07	1.47	0.89	0.60	1.07	1.47	N/A	N/A	N/A	N/A
Short-Term Bond	0.41	0.23	0.55	0.94	0.49	0.26	0.55	0.94	N/A	N/A	N/A	N/A
Intermediate-Term Bond	0.38	0.23	0.54	0.91	0.50	0.30	0.55	0.93	0.14	0.06	0.16	0.36
Intermediate Gov't	0.48	0.28	0.63	1.06	0.48	0.32	0.63	1.07	N/A	N/A	N/A	N/A
High Yield Bond	0.78	0.58	0.83	1.25	0.78	0.58	0.83	1.25	N/A	N/A	N/A	N/A
World Bond	0.65	0.27	0.75	1.09	0.68	0.36	0.75	1.09	N/A	N/A	N/A	N/A
Diversified Emg Mkts	0.91	0.70	1.25	1.60	1.07	0.78	1.25	1.60	0.31	0.11	0.26	0.51
Simple Average	0.68	0.49	0.93	1.34	0.78	0.57	0.94	1.34	0.21	0.10	0.42	0.90

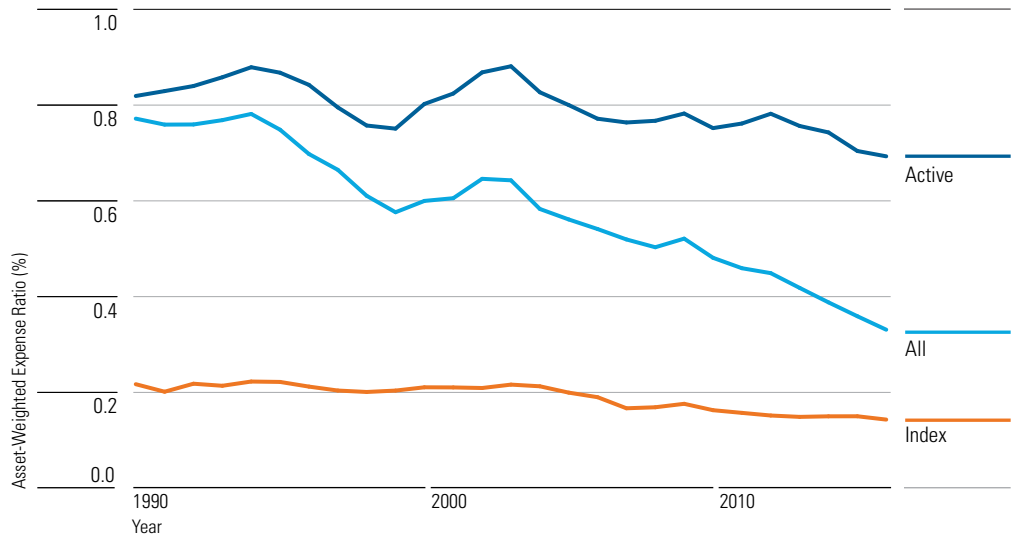
Source: Morningstar DirectSM and authors' calculations.

There a variety of notable takeaways from Exhibit 11. First, as expected, index funds tend to be significantly less expensive than actively managed mutual funds. Second, there is a clear preference among investors for lower-cost options. We see this when comparing the weighted average expense ratio to the percentile distribution. For every Morningstar Category, the weighted average expense ratio is less than the median expense ratio. This suggests investors tend to select less expensive funds, on average. Third, there is a considerable spread in expenses within each category and fund type. For example, among all funds the 10th to 90th percentile range is from 0.20% to 1.29%. This is a pretty considerable difference in expenses.

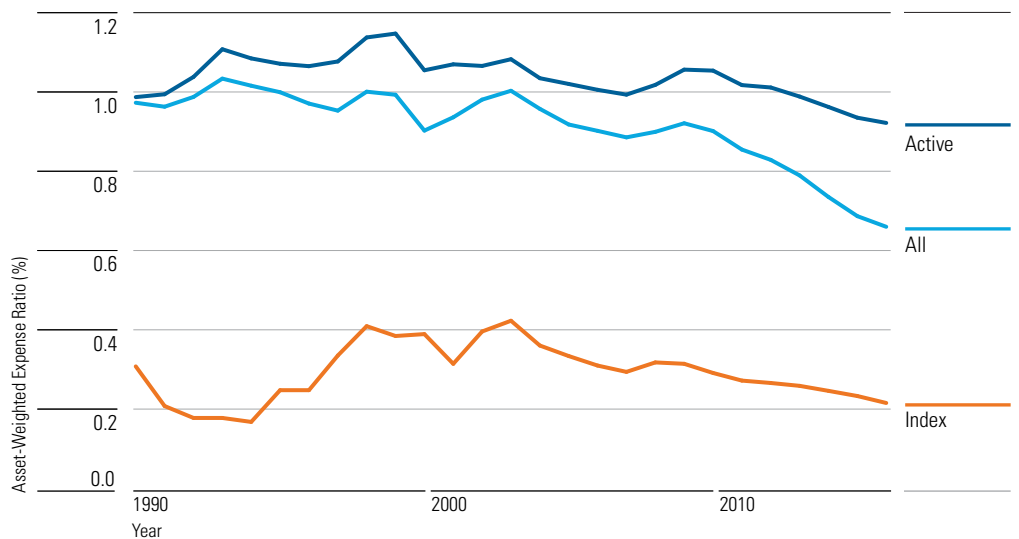
Expenses have also been decreasing over time. We see this in Exhibit 12 for Large Blend funds and all equity funds (weighted average by assets) in Panels A and B, respectively.

Exhibit 12 Asset-Weighted Expense Ratios for Mutual Funds: 1990-2016

Panel A: Large Blend



Panel B: All Equity Funds



Source: Morningstar DirectSM and authors' calculations.

Expense ratios have been decreasing for investors, which we see as a good thing. As Exhibit 12 demonstrates, though, the shift to passive has been faster in some Morningstar Categories (e.g., Large Blend) than others. There has been significant media coverage (and acceptance) of index investing.

We believe investors today are more likely than ever to seek out low-cost investment options, therefore the assumed low benefit is zero. The average investor, though, who may not be as familiar with the potential benefits associated with low-cost investing, and the benefit is assumed to be 20 bps. The high benefit is assumed to be 60 bps.

Investment Quality

Investment quality is somewhat of an abstract concept, but can generally be thought of as the expectation that the investment will outperform its benchmark over time on some type of risk-adjusted basis. There is a considerable body of literature that suggests it is difficult to do this over longer periods, especially to identify outperformers before the outperformance occurs (i.e., without the benefit of hindsight). We believe that the vast majority of attributes investors (and even financial advisors) tend to focus on have very little, if any, meaningful relationship with future performance.

Therefore, we believe it is important for investors (and financial advisors) to use some type of outcomes-based metric when selecting investments. If the approach to selecting funds is that “it has outperformed historically” this is likely not a good justification for selecting the investment. Advisors can hopefully help reduce client bias with respect to selecting investments; however, many advisors are often subject to the same biases as investors (i.e., selecting a mutual fund based entirely on past performance).

There are a variety of metrics that attempt to measure the quality and likelihood of an investment outperforming in the future. The Morningstar Analyst Rating™ is one example. It is a summary expression of one of Morningstar Research Services LLC’s manager research analyst’s forward-looking analysis of a fund. The analysts assign the ratings on a five-tier scale with ratings of Gold, Silver, and Bronze reflecting the analyst’s conviction in a fund’s prospects for outperformance relative to its benchmark or peer group, plus Neutral and Negative ratings. Of course, a variety of other metrics exist.

Another example would be “active share,” introduced by Cremers and Petajisto (2009), which measures how much an investment fund differs from an index by comparing the holdings of the fund with the holdings of the index. This is important since, if you are going to pay extra for active management, you want to be sure the investment is being actively managed and not hugging a benchmark.

It is difficult to assign a potential benefit to investment quality. For shrewd investors who use low-cost strategies like index funds, the benefit of investment quality is likely to be zero. Even for less-sophisticated investors who rely entirely on metrics such as past performance, the potential benefit of selecting higher quality funds is likely muted, given the uncertainty surrounding the decision, and is assumed to be 30 bps. For the average investor, the assumed

potential benefit is assumed to be 10 bps, with the financial advisor debiasing the client and explaining how to potentially invest more intelligently.

Tax Considerations

Investors with monies in taxable accounts should consider the impact of taxes when selecting investments. We have already discussed the potential benefits of locating investments in the most tax-appropriate account. In this section, we discuss the underlying investments.

While investors can determine when they buy or sell a single stock, many investments, such as mutual funds, are pass-through vehicles, whereby the portfolio manager makes trades that can be taxable even though the investor is holding the fund for the long term.

The primary focus for most mutual fund portfolio managers is total return, not after-tax return. There are relatively few incentives for a portfolio manager to minimize taxes. For example, a portfolio manager who has held a stock for 360 days that has appreciated significantly who believes the stock is likely to underperform may immediately sell the security. While this may (potentially) improve the total return of the portfolio, holding the investment for an additional week would transform the gain from short-term to long-term, significantly increasing the after-tax rate of return for an investor who owns that security in a taxable account.

This becomes a more significant issue the more the portfolio manager trades the portfolio. Ignoring the more explicit costs associated with trading (e.g., commissions and bid/ask spreads), the more the portfolio trades, the greater the likelihood the investor will be taxed more.

To demonstrate the potential impact of taxes on realized returns, we used historical data from Morningstar DirectSM on distributions from U.S. large-cap equity funds from 2010 to 2016. We divided funds into active and passive, then estimated how the tax efficiency differed across management type. We found that turnover¹⁷ for index funds was 10%, with 95% of capital gains being long-term and 95% of dividends being qualified. In contrast, the average turnover for actively managed mutual funds was 35%, with 70% of capital gains being long-term, and 90% of dividends being qualified. Based on this information, index funds appear to be more tax-efficient because they tend to have lower turnover rates and their realized income and gains are taxed at a more favorable rate for many investors.

To estimate the potential impact of these differences in tax efficiency, we simulate after-tax returns on a portfolio of U.S. large-cap stocks at three levels of tax efficiency. The first level of tax efficiency we call "Tax Efficient," which is based on the attributes for index funds

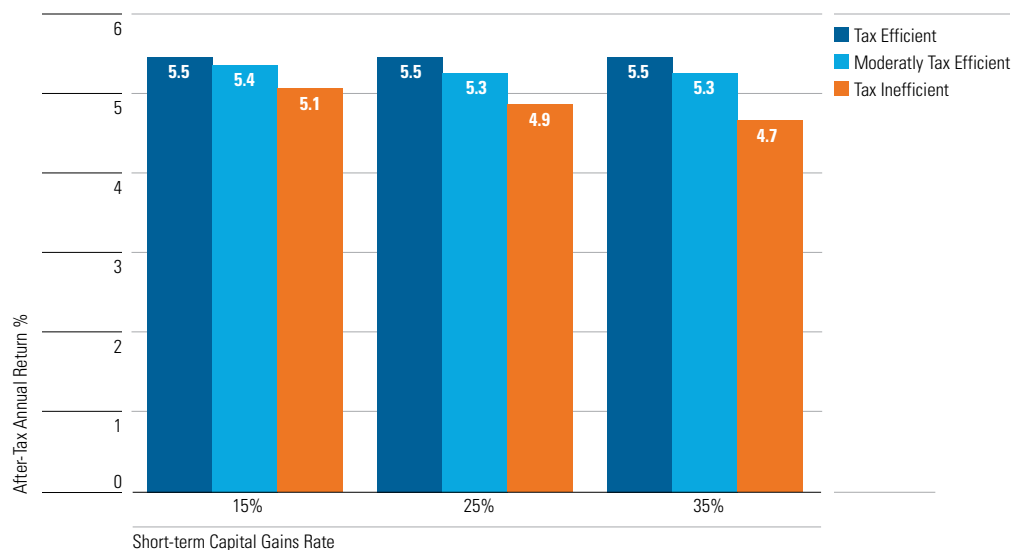
¹⁷ Turnover is obviously an imperfect measure of gain realization but it tracks somewhat closely to a more advanced analysis we conducted and therefore is used as the gain realization metric for simplicity purposes.

discussed previously. The second level, “Moderately Tax Efficient,” is based on the attributes for active funds described previously. For the third level, “Tax Inefficient,” we assume a turnover rate of 100%, where 50% of all capital gains are long-term, and 75% of all dividends are qualified. We assume long-term capital gains rates are 15% for all scenarios. We assume short-term tax rates of 15%, 25%, or 35%.

We derive the expected return and standard deviation on U.S. large-cap equities from the expected returns on U.S. large value equities and U.S. large growth equities presented in Appendix 1. This gives us an expected annual return of 6.9% with a standard deviation of 16.3%. We assume an income return (i.e., dividend yield) of 2% with a standard deviation of 1%. The remainder of the return (excluding the income return) is the price return. We assume all income returns (dividends) are realized annually, where the tax split (between short-term and long-term) is based on the relative tax efficiency of that scenario.

Only a portion of the price return is realized annually (based on turnover), and again the tax split is based on the relative tax efficiency of that scenario. Taxes are assumed to be paid from the portfolio on an ongoing (annual) basis. Any unrealized gains are realized when the investment is liquidated at the end of a 20-year investment period. Our results are determined based on the average compound rate of return over a 5,000 run Monte Carlo simulation. Exhibit 13 describes the resulting after-tax returns for the three scenarios.

Exhibit 13 Impact of Investment Tax Efficiency on Realized (After-tax) Returns



Source: Authors' calculations.

The larger the difference between long-term and short-term tax rates, the greater the potential benefit of purchasing a tax-efficient investment in a taxable account. The difference is most pronounced for the Tax Inefficient Portfolio with a 35% short-term capital gains rate. There are two reasons for this: First, the more frequently gains are realized, the lower the compound rate of return (since the account is assumed to pay the realized taxes annually, reducing the compound growth rate). Second, since the tax rate is higher for realized short-term capital gains (35%), than for long-term capital gains (15%), there is a significant cost to being tax-inefficient.

From this analysis, we conclude that investors who have the appropriate knowledge and ability to make decisions in taxable accounts on their own (e.g., buy index funds) would realize little to no benefit from working with a financial advisor. Investors who purchase actively managed investments, or any other tax-inefficient vehicle, could realize a significant benefit from financial advice investment selection for a taxable portfolio. We assume the benefit to be 60 bps. For the average investor, we assume the benefit to be 15 bps, which is the approximate return impact difference from a tax-efficient and moderately tax-efficient investment assuming a short-term capital gains rate of 25%.

When Should the Portfolio Be Revisited?

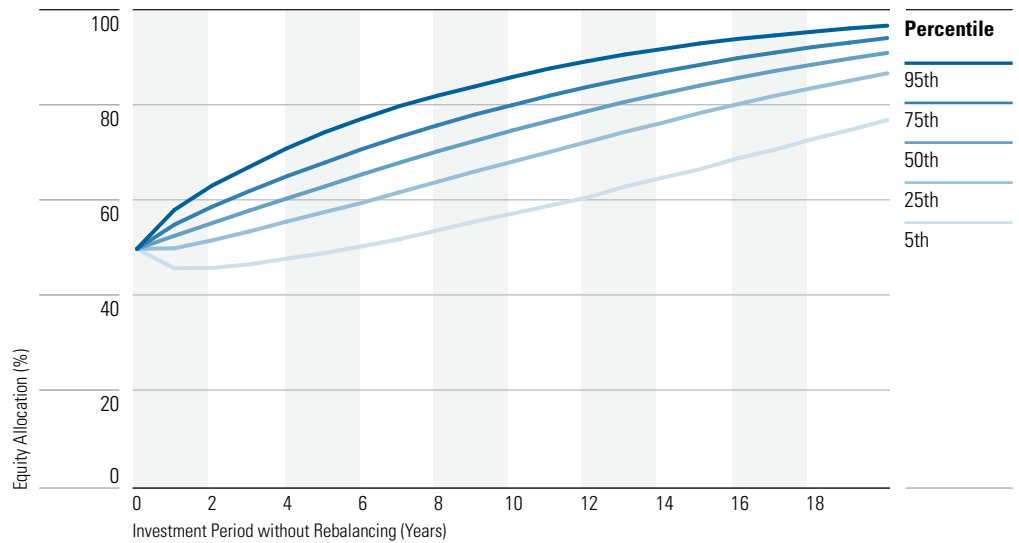
After a portfolio has been constructed, a variety of ongoing decisions will likely need to be made. These include rebalancing, staying invested for the long-term, and tax-loss harvesting. We address these three issues in this section.

Rebalancing

Since the return of the underlying asset classes will vary from expectations, the portfolio will likely deviate from its target allocation, especially over longer periods. One common method to realign the portfolio to help ensure it continues to be consistent with its risk target is rebalancing. A portfolio may be rebalanced at regular time intervals (quarterly, annually) or when allocations pass defined limits (a 15% target has grown past 18% or below 12%, for example).

We estimate the potential benefit from ensuring the portfolio remains consistent with the risk objective of the investor regardless of approach used. If the risk target changes, so should the portfolio.

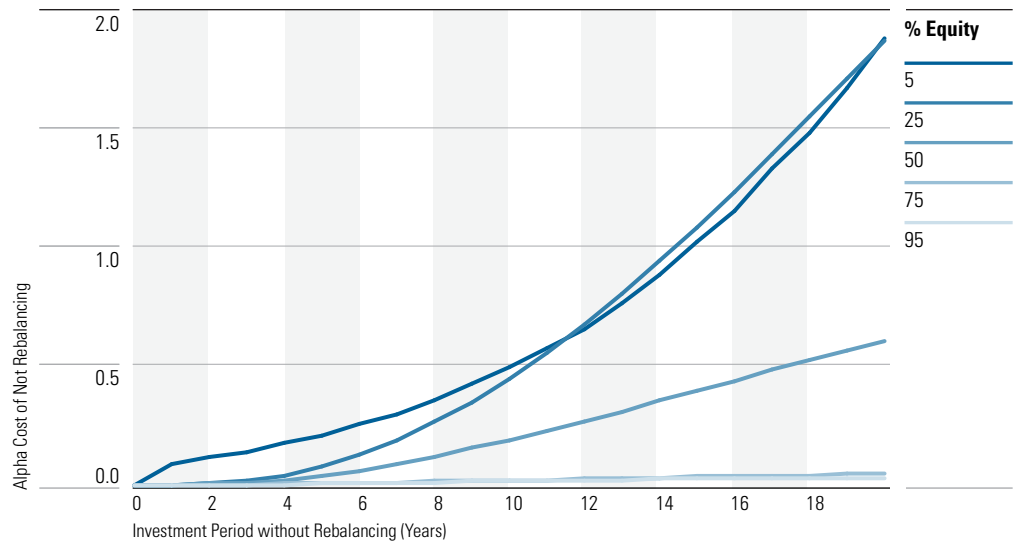
Assuming equity returns outpace bond returns over time, equities will likely claim an ever-increasing portion of a portfolio if not kept in check. Exhibit 14 illustrates this. We created this exhibit by running a 5,000-trial Monte Carlo simulation of an initial portfolio of 50% equities and 50% cash, using the return assumptions presented in Appendix 1. The exhibit shows the distribution of equity allocations over time if the portfolio is never rebalanced.

Exhibit 14 How the Equity Allocation of Portfolio That is Not Rebalanced Changes Over Time

Source: Authors' calculations.

In Exhibit 14, we see that the equity allocation may be expected to increase from 50% initially to a median of 63% by the fifth year. Even the 95th percentile result—that is, the path with the weakest distribution of equity returns—is only slightly lower than the initial allocation at the fifth year (at 49% equities) and above it by the 10th year. Equity allocations would grow faster in higher returning periods; this would result in more wealth, but also a more aggressive portfolio that may no longer be consistent with the investor's risk.

We estimated the cost of these differences using the utility model that we used earlier when we analyzed the appropriate risk level. Here again we estimated the "cost" associated with being invested in a portfolio that is different from the target allocation (here we use 50% equities). Exhibit 15 presents the results of this analysis, averaged by year, for five initial equity allocations: 5%, 25%, 50%, 75%, and 95%.

Exhibit 15 The Alpha Cost of Not Rebalancing

Source: Authors' calculations.

The costs associated with not rebalancing increase for longer investment durations and for more conservative portfolios. This should not be that surprising given that the likelihood of the portfolio drifting away from its target increase over time, and given that lower starting equity allocations have more room to grow than strategies with higher starting equity allocations.

Since many solutions rebalance automatically, especially prepackaged solutions such as balanced funds with a given risk target, we assume that the benefit of rebalancing in the low benefit case is 0 bps. For the high benefit case, we assume that the benefit of rebalancing is 10 bps, which would be for a relatively conservative investor. For the average case, we assume 5 bps, which is partially driven by behavioral effects, and is touched on in the next subsection, which is on keeping the investor focused on the long term.

Staying Invested for the Long-Term

The Nobel prize-winning economist Paul Samuelson once said, “[i]nvesting should be more like watching paint dry or watching grass grow. If you want excitement, take \$800 and go to Las Vegas.” This quote speaks of the relatively unglamorous aspect of what it takes to potentially be a successful long-term investor, which involves keeping calm even when markets are not. Also, Greenwich Associates founder Charles Ellis (1975) has described investing as a “loser’s game,” where those who do well succeed by avoiding errors. He regards individual investors as being relatively poor market timers, investing in stocks after they have done well and selling after they have done poorly (i.e., buying high and selling low). Weber (2012) demonstrates this by looking at data on the trades of individual investors from

2008 to 2012 and finds that those who made a single exchange in their account trailed their allocation benchmarks by 104 bps annually while those who refrained from any activity beat their allocation benchmark by 33 bps annually, a difference of 137 bps. Kinneil (2016) frequently suggests we need to “mind the gap” between the returns investors realize (i.e., dollar-weighted return) when compared to the stated performance of the fund (i.e., the time-weighted return). The difference in the two return series cannot be entirely attributed to market timing, but to some extent it appears to be definitely behavioral.

To demonstrate how timing decisions may affect investors, we obtained monthly data on mutual fund total assets and net monthly flows from Morningstar DirectSM over the period December 1990 to December 2016. (We selected this start date because the data before this period is at quarterly frequency). This gives us 26 years of monthly data to analyze. The dataset covers 60,488 funds over the entire period.

We calculate both the “Investor Return” and the “Total Return.” As defined by Morningstar, Inc.,¹⁸ Investor Return is the internal rate of return on beginning total net assets, all intermediate cash flows (measured monthly), and ending total net assets. As a dollar-weighted return, Investor Return measures how the average investor fared over the respective period taking into account cash inflows and outflows. We recommend readers who are interested in learning more about the calculation to review Morningstar’s methodology document.

Total Return is just the conventional time-weighted return, also known as the compound rate of return and the geometric mean return. The Total Return reflects a buy-and-hold strategy, and is the return figure widely disseminated by mutual fund companies when presenting performance. We calculate the Total Return from the performance data.

The way that the Investor Return calculation incorporates cash flow data makes Investor Return reflect the true (asset-weighted) opportunity set of investments and incorporates appropriate fees into the measure. Therefore, any differences between Investor Return and Total Return is the result of cash flow timing differences, and not the opportunity set.

We calculated Investor Return and Total Return for some of the largest individual Morningstar Categories over the period, as well some broad asset classes. For the categories, the assets and net flows were calculated monthly based on all mutual funds that have that respective category for the month. For the broad asset classes, the assets and flows across all funds were aggregated monthly. Exhibit 16 presents the annualized Investor Return, the annualized Total Return, and the gap between the two.

¹⁸ <https://corporate.morningstar.com/us/documents/MethodologyDocuments/MethodologyPapers/InvestorReturnMethodology.pdf>

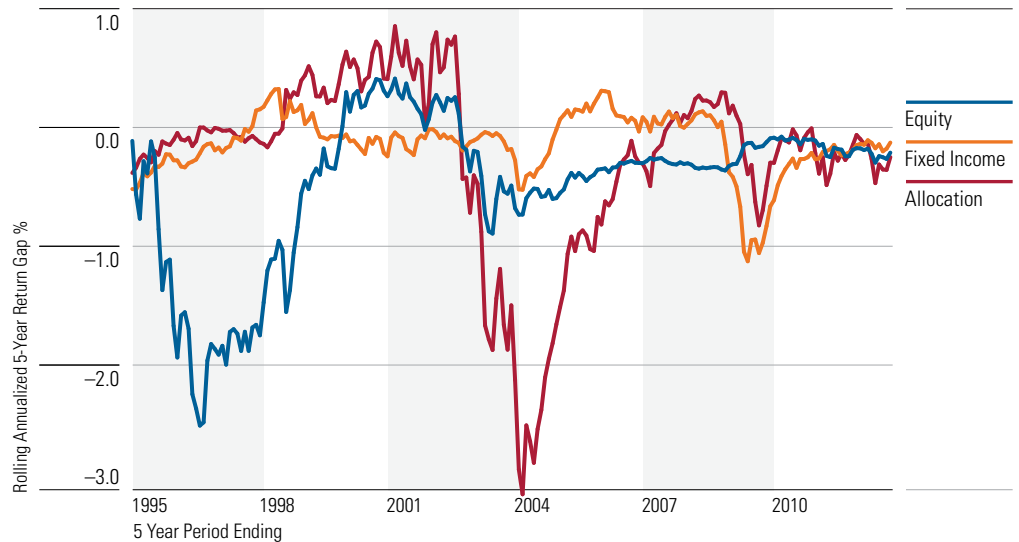
Exhibit 16 Minding the Gap: January 1991-December 2016

	Investor Return	Total Return	"Gap"
Morningstar Category			
Large Growth	10.04	12.94	-2.90
Large Blend	8.09	9.48	-1.39
Large Value	9.36	10.16	-0.80
Foreign Large Blend	2.79	5.03	-2.25
World Stock	8.01	9.90	-1.90
Intermediate-Term Bond	5.25	6.72	-1.47
Intermediate Government	7.06	6.46	0.60
Broad Asset Class			
Equity	7.13	8.69	-1.56
Fixed Income	4.80	6.09	-1.28
Allocation	6.61	8.43	-1.82

Source: Morningstar DirectSM and authors' calculations.

For each category (except Intermediate Government) and for all of the broad asset classes, the investor return was lower than the total return, by approximately 150 bps on average. This suggests that the returns investors have realized have been significantly lower than total returns achieved by the funds they invest in. While the average gap has been 150 bps, it has varied significantly over time.

Exhibit 17 provides a different perspective on return gaps, and includes the rolling five-year annualized gap for each of the three broad asset class (Equities, Fixed Income, and Allocation) over the period. Note that the annualized rolling five-year gaps were much lower than the annualized gaps over the whole period, at -0.32%, -0.16%, and -0.23%, respectively. This suggests that while dollar-weighted Investor Returns have been lower than Total Returns, the differences have not been that significant historically (e.g., have been quite a bit lower than the 300+ bps gap estimate noted by DALBAR 2015). This is not to suggest advisors cannot add value helping investors stay the course, just that the potential benefit of staying invested may be overstated. This is especially true if advisors are subject to the same behavioral market timing problems as the average investor.

Exhibit 17 Rolling Annualized 5-Year Return Gap for Various Broad Asset Classes

Source: Morningstar DirectSM and authors' calculations.

Investors who use a professionally managed investment option tend to be much more passive and are therefore more likely to realize returns that are closer to the total return. For example, Vanguard (2016) noted that while 9% of all participants traded in their accounts in 2015, that figure was only 2% for participants holding a single target-date fund. Fidelity¹⁹ notes similar statistics, where only 1% of participants with all their assets in a target-date fund or managed accounts made an investment change over the past 12 months versus 13% of all 401(k) investors. This is important given the rise of default investments in target-date funds, which should hopefully reduce the return gap for investors.

Regardless of investor-type, working with some type of financial advisor is likely to result in higher returns, especially among investors who would likely invest for the long-term on their own. We assume that even for investors who would not benefit significantly from financial advice, their returns could be 10 bps higher with guidance. This is obviously lower than values estimated previously, but some investors with the fortitude to stay the course are unlikely to be as affected by poor timing decisions. In contrast, investors who have strong behavioral biases may likely benefit by more than 100 bps per year (for our purposes, we assume it to be 100 bps). For the average investor, we assumed this benefit to be 50 bps, which, while considerably lower than the "behavioral coaching" estimated benefit of 150 bps by Kinniry et al. (2014), is more in line with historical differences in investor returns and total returns.

There are a variety of important tools and approaches advisors can use to help investors

¹⁹ <https://www.fidelity.com/about-fidelity/employer-services/2016-q2-retirement-analysis>

make better long-term investment decisions, especially those that create pre-commitment statements, such as investment policy statements. See Wendel (2017) for additional insights into the behavioral aspects of creating better strategies for investors.

Tax-Loss Harvesting

Taxes are an important consideration when locating investments in various accounts, selecting the investments to purchase, and potentially determining which investments to sell over time. One approach that can potentially increase an investor's effective rate of return (by minimizing tax drag) is tax-loss harvesting (TLH). Constantinides (1983) shows that an optimal strategy is always to postpone gains and realize losses immediately. TLH allows an investor to do this. While wash sale rules restrict purchases of an identical security within 30 days, making TLH harvesting slightly more difficult, the significant proliferation of investment vehicles such as ETFs make it possible to purchase different securities that may in fact be almost identical to the security being sold.

The benefits of TLH have varied significantly over time. Using a complex series of calculations on a portfolio of 500 securities, Arnott, Berkin, and Yie (2001) estimated the median approximate alpha benefit of TLH to be approximately 50 bps. These findings are similar to those of Kitces (2014),²⁰ who demonstrates how the assumptions surrounding the analysis can significantly impact the results. For example, in scenarios that assume small market declines, lower tax rates, and lower returns, the potential benefits of TLH are low. He concludes that the benefits tend to be less than 50 bps (say 25 bps). Other research that has been featured more prominently, especially in marketing, is by Wealthfront,²¹ which suggests that the potential benefit ranges from 65 bps to over 200 bps (although they summarize their findings with an alpha of 1.55 bps).

We believe the alpha equivalents realized by most investors from TLH are likely to be lower than numbers estimated by Arnott, Berkin, and Yie (2001) and Kitces (2014), since for the vast majority of investors, TLH results in deferral of taxes, not a permanent savings. Additionally, many advisors implement portfolios using packaged investments (e.g., mutual funds), not individual securities (which is the approach taken by Arnott, Berkin, and Yie, 2001). Mutual funds (and even ETFs) also have aspects that further limit the potential benefit of the TLH strategy (e.g., you can potentially realize gains from a mutual fund based on the portfolio manager's trades).

Assuming that tax rates are the same at the time of TLH as at the eventual distribution time, the benefit of TLH would be based entirely on the future growth in the tax savings for the year it was harvested. This is likely to be small, but not zero, for advisors managing taxable

²⁰ <https://www.kitces.com/blog/evaluating-the-tax-deferral-and-tax-bracket-arbitrage-benefits-of-tax-loss-harvesting/>

²¹ <https://research.wealthfront.com/whitepapers/tax-loss-harvesting/>

portfolios. This potential benefit also applies only to monies that are invested in equities in a taxable account. Therefore, we assume that the potential benefit is zero for investors who would receive a low benefit from a financial advisor, 50 bps for the high-benefit case (based on the research by Arnott, Berkin, and Yie 2001), and only 10 bps for the average investor (again, this would apply only to the equity portion in the taxable portfolio, so it is unlikely to apply to the majority of a client's wealth).

The Total Value of a Gamma-Efficient Portfolio

In this section, we combine the results from each of the previous sections to provide some general insight as to the potential value of a gamma-efficient portfolio. Exhibit 18 summarizes our estimates of gamma for each aspect of portfolio-related decisions that we considered.

Exhibit 18 The Combined Value of an Efficient Investment Strategy

Question	Benefit of Financial Advice		
	Low	Average	High
Why Invest at All?	0.05	0.30	1.00
Which Type of Account May Be Best?	0.10	0.25	0.50
What is an Appropriate Risk Level?	0.10	0.40	1.00
What Asset Classes Should be Considered?	0.00	0.20	0.60
How Does the Risk of the Goal Affect the Portfolio?	0.05	0.20	0.50
What Investments to Implement With?	—	—	—
Investment Cost	0.00	0.20	0.60
Investment Quality	0.00	0.10	0.30
Tax Considerations*	0.00	0.15	0.60
When Should the Portfolio be Revisited?	—	—	—
Rebalancing	0.00	0.05	0.10
Investing for the Long-term	0.10	0.50	1.00
Tax Loss Harvesting*	0.00	0.10	0.50
Total	~.4	~2	Significant

Source: Authors' calculations.

* Will not be relevant for many investors and even if so, only for a portion of the investible assets.

The combined results suggest there is a significant potential benefit from financial advice, depending on the overall financial sophistication of the investor and the complexity of their accounts and needs. An investor who can't or doesn't attend to these facets of investing with a knowledgeable, detail-oriented approach may be able to benefit from professional advice more than someone who does. Note that each investor may fall into different categories for each of the questions—that is, he or she may benefit greatly from help on determining the appropriate risk level, benefit somewhat from advice on costs, and benefit not at all from tax advice. Knowledge or discovery of an investor's capabilities, preferences, and needs is paramount.

Conclusions

The financial advisory profession has evolved considerably over time. While most financial advisors still focus on building efficient portfolios for clients, the scope of services is becoming increasingly holistic: helping a client accomplish their financial goals. We originally introduced gamma to quantify the value of more intelligent financial planning decisions, especially the potential benefits of working with a financial advisor. In this paper, we expanded on the concept of gamma and explored the potential value of an efficient portfolio process.

We found that through prudent advice, advisors have the ability to add value that can be equivalent to a boost in investment returns of approximately 2% for an average investor. However, that figure will vary significantly by client and advisor.

Our estimate is based on a framework of seven questions an investor should consider during the portfolio construction process. Completing this process properly is far more comprehensive than simply selecting a few mutual funds.

The benefits derived from portfolio planning advice is likely to be offset by costs, to some degree. As long as the advisor provides comprehensive, high-quality portfolio planning services for a reasonable fee, though, our results suggest that the investor is likely to be better off. Providing other financial planning services, such as savings guidance, pension optimization, insurance planning, withdrawal planning, etc., could result in even more value for the client. Taken together, the available benefits calculated here and in our previous work suggest there are significant potential benefits from working with a financial advisor. ■■

Works Cited

Amromin, Gene, 2002. "Portfolio Allocation Choices in Taxable and Tax-Deferred Accounts: An Empirical Analysis of Tax-Efficiency". Available at SSRN: <https://ssrn.com/abstract=302824>.

Arnott, Robert D. Andrew L. Berkin, and Jia Ye. 2001. "Loss Harvesting: What's It Worth to the Taxable Investor?" *Journal of Wealth Management*, vol. 3, no. 4 (Spring):10–18

Barber, Brad and Odean, Terrance. 2003. "Are Individual Investors Tax Savvy? Evidence from Retail and Discount Brokerage Accounts." *Journal of Public Economics*, vol. 88: 419– 442.

Blanchett, David M., and Paul Kaplan. 2013. "Alpha, Beta, and Now... Gamma." *The Journal of Retirement*, vol. 1, no. 2: 29-45.

Blanchett, David M., and Philip U. Straehl. 2015. "No Portfolio Is An Island." *Financial Analysts Journal*, vol. 71, no. 3: 15-33.

Constantinides, George M. 1983. "Capital Market Equilibrium with Personal Tax." *Econometrica*, vol. 51, issue 3: 611-636.

Cremers, K.J. Martijn, and Antti Petajisto. 2009. "How Active is Your Fund Manager? A New Measure that Predicts Performance." *Review of Financial Studies*, vol. 22, no. 9: 3329-3365.

Dalbar. 2015. "Dalbar's 21st Annual Quantitative Analysis of Investor Behavior: 2015 Adviser Edition." White Paper.

Dammon, Robert M., Chester S. Spatt, and Harold H. Zhang. 2004. "Optimal Asset Location and Allocation with Taxable and Tax Deferred Investing." *The Journal of Finance*, vol. 59, no. 3: 999-1037.

Ellis, Charles, D. 1975. "The Loser's Game." *The Financial Analysts Journal*, vol. 31, no. 4: 19-26.

Envestnet. 2015. "Capital Sigma: The Return on Advice." Envestnet White Paper.

Kinnel, Russel. 2016. "Mind the Gap 2016." Morningstar White Paper.
<http://advisor.morningstar.com/advisorregistrationpages/Login.aspx?url=http://advisors.morningstar.com/advisor/t/115631283/mind-the-gap-2016.htm>

Kinniry, Francis M., Colleen M. Jaconetti, Michael A. DiJoseph, and Yan Zilbering. 2014. "Putting a Value On Your Value: Quantifying Vanguard Advisor's Alpha." Vanguard White Paper. <https://www.vanguard.com/pdf/ISGQVAA.pdf>.

Merrill Lynch. 2016. "The Value of Personal Financial Advice." White Paper. <https://olui2.fs.ml.com/Publish/Content/application/pdf/GWMOL/GWIMCIOValueofanAdvisorWhitepaper.pdf>.

Shoven, John B., and Clemens Sialm. 2004. "Asset Location In Tax-deferred and Conventional Savings Accounts." *Journal of Public Economics*, vol. 88, no. 1: 23-38.

Vanguard. 2016. "How America Saves." Vanguard White Paper.

Weber, Stephen M., 2013, "Most Vanguard IRA Investors Shot Par by Staying the Course: 2008–2012." Vanguard White Paper.

Wendel, Stephen. 2017. "A Behavioral Approach to Risk Tolerance." Morningstar White Paper.

Disclosures

©2017 Morningstar Investment Management LLC. All Rights Reserved. The Morningstar name and logo are registered marks of Morningstar. These materials are for information and/or illustrative purposes only. This presentation includes proprietary materials of Morningstar Investment Management. Reproduction, transcription or other use, by any means, in whole or in part, without the prior, written consent of Morningstar Investment Management is prohibited.

The information, data, analyses, and opinions presented herein do not constitute investment advice; are provided as of the date written and solely for informational purposes only and therefore are not an offer to buy or sell a security; and are not warranted to be correct, complete or accurate. Past performance is not indicative and not a guarantee of future results.

This white paper contains certain forward-looking statements. We use words such as “expects”, “anticipates”, “believes”, “estimates”, “forecasts”, and similar expressions to identify forward looking statements. Such forward-looking statements involve known and unknown risks, uncertainties and other factors which may cause the actual results to differ materially and/ or substantially from any future results, performance or achievements expressed or implied by those projected in the forward-looking statements for any reason.

Monte Carlo is an analytical method used to simulate random returns of uncertain variables to obtain a range of possible outcomes. Such probabilistic simulation does not analyze specific security holdings, but instead analyzes the identified asset classes. The simulation generated is not a guarantee or projection of future results, but rather, a tool to identify a range of potential outcomes. The Monte Carlo simulation is hypothetical in nature and for illustrative purposes only. Results may vary with each use and over time.

The results from the simulations described within are hypothetical in nature and not actual investment results or guarantees of future results.

This should not be considered tax or financial planning advice. Please consult a tax and/or financial professional for advice specific to your individual circumstances.

Morningstar® Retirement ManagerSM is offered by Morningstar Investment Management LLC and is intended for citizens or legal residents of the United States or its territories. The investment advice delivered through Morningstar Retirement Manager is provided by Morningstar Investment Management LLC, a registered investment adviser and subsidiary of Morningstar, Inc. The Morningstar name and logo are registered marks of Morningstar, Inc. Investment advice generated by Morningstar Retirement Manager is based on information provided and limited to the investment options available in the defined contribution plan. Projections and other information regarding the likelihood of various retirement income and/or investment outcomes are hypothetical in nature, do not reflect actual results, and are not guarantees of future results. Results may vary with each use and over time.

Investment research can produced and issued by Morningstar, Inc. or subsidiaries of Morningstar, Inc. including, but not limited to, Morningstar Research Services LLC, registered with and governed by the U.S. Securities and Exchange Commission.

The Morningstar Analyst RatingTM is not a credit or risk rating. It is a subjective evaluation performed by the manager research analysts of Morningstar. Morningstar evaluates funds based on five key pillars, which are process, performance, people, parent, and price. Analysts use this five pillar evaluation to determine how they believe funds are likely to perform over the long term on a risk-adjusted basis. They consider quantitative and qualitative factors in their research, and the weighting of each pillar may vary. The Analyst Rating scale is Gold, Silver, Bronze, Neutral, Negative. A Morningstar Analyst Rating of Gold, Silver, or Bronze reflect an Analyst’s conviction in a fund’s prospects for outperformance. Analyst Ratings are continuously monitored and reevaluated at least every 14 months. For more detailed information about Morningstar’s Analyst Rating, including its methodology, please go to <http://corporate1.morningstar.com/AnalystRating/>.

The Morningstar Analyst Rating should not be used as the sole basis in evaluating a mutual fund. Morningstar Analyst Ratings involve unknown risks and uncertainties which may cause Morningstar’s expectations not to occur or to differ significantly from what we expected.