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A more appropriate framework for evaluating retirement portfolios

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Executive Summary

This brief provides a brief introduction to Modern Portfolio Theory, the standard approach for evaluating an investment portfolio. It then proposes a different framework for evaluating retirement portfolios.

Introduction

The accumulation phase of retirement is very different from the spending phase, and retirees face numerous challenging risks. This calls for exploring a different approach for evaluating the effectiveness of a retirement portfolio that is to be used throughout a person's entire lifetime. In this brief, we'll discuss a more appropriate framework for evaluating retirement strategies and then compare three different strategies.

The Disconnect Between Investment and Retirement Strategies

One of the key misunderstandings that we see in the market today is the idea that effectiveness of a retirement strategy should be analyzed just as you would an investment strategy. Our concern is that these are two very different concepts with very different desired outcomes. Individuals in their early thirties with a lifetime of investing ahead of them may be able to afford to take substantial risks with part of their portfolios in the hopes of substantial returns because time and future contributions are on their side. But someone who is well into retirement with no more contributions coming in and a different time horizon must view his/her retirement portfolio in another way.

Before explaining our proposed framework for analyzing different retirement strategies, let's begin by discussing how the financial industry typically analyzes investment portfolios.

Analytical Framework for Investment Strategies

Throughout the industry, the most commonly used framework for analyzing investment portfolios is Modern Portfolio Theory. This framework was introduced by Harry Markowitz in 1952 (for which he later received the Nobel Prize in economics). Markowitz had the key insight that a single asset's risk and return should not be viewed in isolation. Instead, the entire portfolio's risk-return characteristics should be examined. In other words, we must take into account the interaction between different components of a portfolio and how they work together.

This approach led us to the understanding of the potential benefits of diversification: how using a combination of assets that may perform differently from one another under various market conditions may help reduce the risk of a portfolio. In this framework, risk is measured as the volatility—the ups and downs—of portfolio returns and reward is measured as the portfolio's expected return.

Chart 2.1 is a hypothetical representation of the potential risk and reward for different asset classes, with risk shown along the horizontal axis and reward shown along the vertical axis. Among the five asset classes shown, the asset class with the highest risk and highest reward potentials—Emerging Market equities—can be found in the upper right part of the graph, and the asset class with the lowest risk and lowest reward—Aggregate Bonds—can be found in the lower left part of the graph.

In addition, using different combinations of these asset classes, we can identify the efficient frontier—the set of optimal portfolios that offers the highest potential return for a defined level of risk or the lowest risk for a given level of potential return. The efficient frontier of optimal portfolios would lie somewhere along the green line depicted in the chart. Note that portfolios containing combinations of several asset classes may extend the efficient frontier beyond that of a single asset class.

Chart 2.1—Risk-Reward Potential for Different Asset Classes

This chart is representative of general asset classes and is not intended to predict or project performance of any specific investment. Investments that are riskier have the potential for higher returns over time than investments with less risk. However, riskier investments also have a greater likelihood of losing money. Past performance is not indicative of future results.

Why Modern Portfolio Theory is inappropriate for retirement portfolios

Although Modern Portfolio Theory can be a useful and effective way to analyze investment portfolios, it is not an appropriate way to analyze retirement strategies. This is because the goals of a portfolio that is investing for retirement are not the same as the goals of a portfolio subject to periodic withdrawals during retirement. There are also additional risks that individuals will need to address during retirement,[1] such as:

- **Sequence of returns risk:** the risk of having poor investment returns in the early years for a portfolio subject to withdrawals
- **Longevity risk:** the risk of outliving retirement savings and
- **Inflation risk:** the risk of income not keeping up with inflation and the resulting loss of purchasing power.

Modern Portfolio Theory's use of volatility of returns as the primary risk measure does not capture the full extent of these risks.

The framework we believe is better for analyzing retirement strategies is one that we first encountered in the 2012 paper "An Efficient Frontier for Retirement Income" by Wade Pfau, PhD. This framework extends Modern Portfolio Theory by revising the risk-reward metrics based on the two competing objectives for retirement strategies:

1. Satisfying spending goals and
2. Preserving financial assets.

When presented with these two goals, there is a cost to turning retirement savings into guaranteed lifetime income such as through an annuity. Although annuity income can be used to help satisfy spending goals throughout a retiree's lifetime, it will usually come at the cost of a lower amount of financial assets that are available for other purposes.

Methodology and Metrics

Using financial planning software along with reasonable assumptions, we can run thousands of Monte Carlo simulations to calculate the risk-reward characteristics of virtually any retirement strategy. The Monte Carlo analysis creates a series of different scenarios, assuming different rates of return, inflation and other market factors and allows us to evaluate a range of possible outcomes.

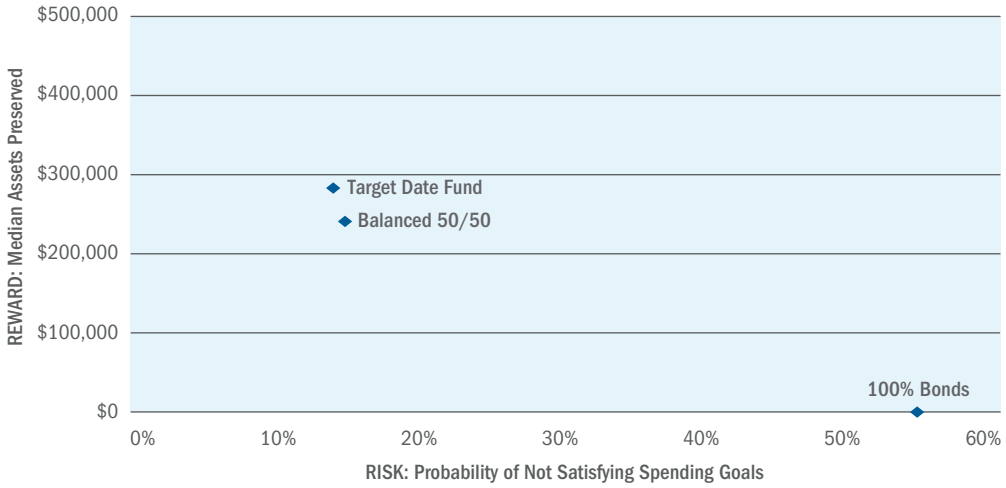
The metric we use to measure risk is the probability, or likelihood, that income goals will not be met. This is calculated simply as the number of simulations in which income goals were not met divided the total number of simulations that were run. The metric we use to measure reward is median assets preserved. This is calculated by determining the remaining amount of assets in the retirement portfolio at the time of death for each of the thousands of simulations and then taking the median of the values.

Note that although this metric is calculated at the time of death, it is meaningful for all participants, not just those with a desire to leave a bequest to their heirs. A higher level of reward within this framework means more assets will be available for a bequest or for flexible or emergency spending purposes during retirement.

RISK: The probability of not meeting spending goals

REWARD: The median bequest, a measure of available assets during retirement

Chart 2.2—Risk-Reward Characteristics for Different Retirement Strategies



See methodology on page 6.

Evaluating Three Sample Retirement Strategies

For a simple illustration of how this approach works, let's look at Chart 2.2. Here we show three different retirement strategies for a person who starts saving for retirement at age 35, makes contributions to a retirement portfolio until he/she retires at age 65, and then withdraws money to pay for retirement expenses from this retirement portfolio until his/her death.

The retirement strategies illustrated are (1) a 100% bond allocation, (2) a 50/50 balanced fund allocated to stocks and bonds, and (3) a typical target date fund that has a glide path with a high equity allocation in the early years which gradually declines as the individual ages.

100% Bond: High risk and low reward

100% bonds

Let's start with the 100% bond allocation. Similar to Aggregate Bonds in Chart 2.1, a retirement strategy invested entirely in bonds will have a low level of reward. However, a 100% bond allocation is also quite risky within this new framework.

While bonds are relatively less volatile than equities, when used exclusively in a retirement portfolio during an individual's working years, the retirement portfolio's returns are severely depressed. In a large number of Monte Carlo simulations, once the individual reaches retirement age there are likely not enough assets to satisfy spending goals. In other words, there is a high probability that the accumulation will not generate enough income to meet retirement expenes.

50%Equity/50%Bond: Potentially lower risk and higher reward than 100% Bond

Balanced fund

Next, let's look at the balanced 50/50 portfolio allocation. Having a 50% equity allocation throughout the individual's lifetime has the potential to both reduce risk and increase reward when compared with the 100% bond allocation. Interestingly, a balanced fund is also eligible to be a Qualified Default Investment Alternative based on the Pension Protection Act, and viewed within this framework, a retirement strategy using a simple balanced 50/50 fund may provide for rather good outcomes.

Target Date Fund: Potentially lowest risk and highest reward of the 3 retirement strategies shown here

Target date funds

Finally, let's examine the target date fund. For the 35 year old individual used in our example, this retirement strategy is marked by a high equity allocation (much higher than 50%) at the outset, which declines over time as he/she nears retirement. We found that this retirement strategy to be the most effective among the three. It potentially provides for the lowest risk as well as the highest reward.

The illustration in Chart 2.2 validates the view of the majority of retirement plan sponsors who use target date funds as the default investment for employees' retirement accounts. Furthermore, it indicates that this analytical framework for retirement strategies provides logical and intuitive results.

Conclusion

In conclusion, by comparing retirement strategies within this newer framework, we are better able to determine which strategy has the ability to potentially better meet a retirement investor's needs both to and through retirement.

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Methodology

The information discussed in Chart 2.2 compares the outcomes for a 100% bond allocation, a 50/50 balanced fund between stocks and bonds, and a typical target date fund (TDF). This comparison is provided for educational purposes only to help you understand and evaluate various options. You are solely responsible for evaluating and acting upon the education and information contained in this comparison. This is not a recommendation by TIAA of a particular investment strategy. Nothing in this illustration is an offer to buy, sell or hold securities or other investments. Past performance is no guarantee of future results. The hypothetical projections included within this comparison do not include fees and expenses of the investments modeled which can materially impact returns.

This comparison evaluates retirement income strategies using Monte Carlo analysis, which is a statistical modeling technique that forecasts a set of future outcomes based on the variability or randomness associated with historical occurrences. This approach is used to determine the probability or likelihood of a particular outcome based on a range of potential investment outcomes. This analysis is not a guarantee, prediction or projection of any particular result, and actual results may vary materially. Results may vary with each use and over time. A Monte Carlo analysis is performed by running each investment alternative against 10,000 hypothetical financial market scenarios. This simulation is designed as an alternative to using constant rates of inflation and constant investment returns during each year of the analysis. To project estimated income and assets over a stated time frame, Monte Carlo simulations use estimated returns for each asset class, as well as an estimated inflation rate. Each of the options presented are run through the same series of simulations, allowing comparisons to be made between them. The Annuity 2000 merged gender mortality table with one year setback was used to model mortality, and asset returns were modeled stochastically assuming a multivariate lognormal distribution using Morningstar's 2019 capital market assumptions (CMAs). Morningstar provides a term structure on expected returns based on supply-driven building blocks. This means that there are three sets of expected returns: (1) for years 0-10, (2) for years 11-20, and (3) for years 21+. The first two investment horizons (0-10 years and 11-20 years) are conditional upon the current market environment, whereas the last horizon (years 21+) is independent of any given market environment and more geared towards a very long investment horizon. The forward looking volatilities and the correlation matrix remain the same for all three horizons. Inflation is determined through a stochastic process and it is modeled using a multivariate lognormal distribution and correlations to other asset classes. In the simulations, yearly inflation can range from negative (deflation) to double-digit inflation. In this illustration, all dollar amounts are stated in real (today's) dollars.

Contribution Assumption: During the accumulation phase when the participant is still working it is assumed that the individual contributes $5,000 each year (adjusted for inflation on an annual basis) before reaching an assumed retirement age of 65.

Retirement Expense Assumption: During the retirement phase which begins at the assumed retirement age of 65, the amount of retirement expense needs that must be covered by the retirement nest egg is $14,000 each year (adjusted for inflation on an annual basis).

Target Date Fund: The target date represents an approximate date when investors may plan to begin withdrawing from the model. The glide path utilized is typical of target date funds and is shown in the table on the next page in 5-year age increments. The allocation at age 75 is the final allocation and was used for all ages over 76.

These asset allocation guidelines are intended to serve as an educational tool and should not be deemed to be investment advice. A participant's circumstances are unique and each participant needs to assess his or her own situation and consult with an investment advisor to receive more personalized advice. There is no guarantee that asset allocation reduces risk or increases returns.

TIAA Lifecycle Index Funds

Years to Retirement	Age (Retire at 65)	U.S. Equity	Intl Equity	Fixed Income	TIPS	Short-Term Fixed Income	Total Equity	Total Fixed Income
45	20	66.5%	28.5%	5.0%	0.0%	0.0%	95.0%	5.0%
40	25	65.7%	28.1%	6.2%	0.0%	0.0%	93.8%	6.2%
35	30	64.7%	27.8%	7.5%	0.0%	0.0%	92.5%	7.5%
30	35	63.9%	27.4%	8.7%	0.0%	0.0%	91.3%	8.7%
25	40	63.0%	27.0%	10.0%	0.0%	0.0%	90.0%	10.0%
20	45	57.4%	24.6%	18.0%	0.0%	0.0%	82.0%	18.0%
15	50	51.8%	22.2%	26.0%	0.0%	0.0%	74.0%	26.0%
10	55	46.2%	19.8%	30.0%	2.0%	2.0%	66.0%	34.0%
5	60	40.6%	17.4%	34.0%	4.0%	4.0%	58.0%	42.0%
0	65	35.0%	15.0%	38.0%	6.0%	6.0%	50.0%	50.0%
-5	70	31.5%	13.5%	39.0%	8.0%	8.0%	45.0%	55.0%
-10	75	28.0%	12.0%	40.0%	10.0%	10.0%	40.0%	60.0%
-15	80	28.0%	12.0%	40.0%	10.0%	10.0%	40.0%	60.0%
-20	85	28.0%	12.0%	40.0%	10.0%	10.0%	40.0%	60.0%
-25	90	28.0%	12.0%	40.0%	10.0%	10.0%	40.0%	60.0%
-30	95	28.0%	12.0%	40.0%	10.0%	10.0%	40.0%	60.0%

Note: The figures above represented a hypothetical target date fund glide path, based on the TIAA-CREF Lifecycle Index Funds strategic allocations based on an assumed retirement age of 65.

As with all mutual funds, the principal value of a Lifecycle Fund isn't guaranteed at any time, including at the target date, and will fluctuate with market changes. The target date approximates when investors may plan to start making withdrawals. However, you are not required to withdraw the funds at that target date. After the target date has been reached, some of your money may be merged into a fund with a more stable asset allocation. Lifecycle Funds share the risks associated with the types of securities held by each of the underlying funds in which they invest. In addition to the fees and expenses associated with the Lifecycle Funds, there is exposure to the fees and expenses associated with the underlying mutual funds.

[1] For more information, please refer to the Briefs Supplement: Major Risks in Retirement.

Please note that no strategy can eliminate or anticipate all market risks and losses can occur.

You should consider the investment objectives, risks, charges and expenses carefully before investing. Please call 877-518-9161 or go to TIAA.org/prospectuses for current product and fund prospectuses that contain this and other information. Please read the prospectuses carefully before investing.