Practical Applications of

Toward Determining the Optimal Investment Strategy for Retirement

Practical Applications
Portfolio Management Research

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Overview

In ***Toward Determining the Optimal Investment Strategy for Retirement***, from the summer 2019 edition of ***The Journal of Retirement***, **Javier Estrada (IESE Business School)** and **Mark Kritzman** (**Windham Capital Management** and **MIT**) propose a new measure for evaluating retirement investing strategies: the coverage ratio. This metric is meant to replace the standard failure rate, which, the authors note, has two important shortcomings. First, it does not differentiate between failures that occur earlier as opposed to later in the retirement period, although most retirees would be much more averse to a strategy that fails earlier. Second, it does not acknowledge that most retirees would derive satisfaction from leaving a surplus as a bequest.

The coverage ratio and its associated kinked utility function address both of these limitations. The authors then apply this utility function to both historical and simulated data to determine optimal investment strategies. For the historical results, the optimal asset allocation is highly aggressive, with an average allocation of 91% to stocks. For the simulated results, the optimal asset allocation was more conservative and varied in accordance with conventional wisdom: i.e., investors should increase stock allocation as expected returns rise, standard deviations of returns fall, and retirement period becomes longer.

Practical Applications

- **The failure rate does not provide sufficient information about the success of retirement investing strategies.** It does not distinguish between time of failure (early vs. late in retirement), nor does it account for surpluses to be left as bequests.
- **Investors should instead use the *coverage ratio*, a new measure developed by the authors.** The framework proposed, consisting of the coverage ratio and a kinked utility function, assumes that

Key Definitions

Failure rate

Failure rate is a measure of the ability of a retirement investment strategy to support projected spending through an individual's retirement. It is the fraction of all (historical or simulated) retirement periods considered in which a strategy fails to support spending through the end of retirement. A key shortcoming of the failure rate is that it assumes investors are indifferent between running out of money early in retirement or running out later. It also fails to account for potential surpluses that could be applied toward a bequest.

Risk premium

Risk premiums reflect the expected excess return in exchange for the perceived difference in risk between two investments. Ideally, risk premiums offer positive returns on average and are largely independent of one another. Examples include the equity risk premium (the difference between equity returns and cash), size premium (the difference in returns on small-cap equities versus large-cap equities), and momentum premium (the difference in returns on high-momentum equities versus low-momentum equities).

Portfolio rebalancing

Portfolio rebalancing is the process of adjusting asset weights to maintain target weights that maintains the asset allocation strategy and helps to achieve excess returns via diversification.

investors have a greater aversion to failure earlier in retirement and would ideally like to leave assets behind for heirs or charities.

- **Optimal stock allocation varies in accordance with conventional wisdom.** Investors should increase stock allocation as expected returns rise, standard deviation of returns decreases, and retirement period becomes longer.

Discussion

Estrada and Kritzman examined optimal investment strategies for retirement. Before analyzing such strategies, however, they first discussed the shortcomings of the standard evaluation metric, the *failure rate*, and proposed a new one: the *coverage ratio*. The coverage ratio provides a more nuanced understanding of the performance of retirement investment strategies by more harshly penalizing failure early in the retirement period and rewarding the presence of a surplus to be given as a bequest. The authors use the coverage ratio and a kinked utility function to evaluate various stock allocations across both historical and simulated data. They find that historically high equity risk premiums since 1900 rewarded highly aggressive stock allocations across several global markets. Evaluation of the simulated data, on the other hand, revealed greater utility in more conservative stock allocations that varied according to expected returns, standard deviations of returns, and length of retirement period.

> "We believe that our framework for determining the optimal retirement investment strategy is conceptually appealing and empirically reasonable. We also believe that it is superior to a simplistic framework based solely on the limited information provided by the failure rate."
>
> ***—Toward Determining the Optimal Investment Strategy for Retirement***

THE COVERAGE RATIO AND ITS UTILITY FUNCTION

The framework proposed, consisting of the coverage ratio and a kinked utility function, offers important improvements over the failure rate. First, it acknowledges that failure early in retirement and failure late in retirement are not equal. Second, it reflects the

satisfaction retirees gain from leaving behind a surplus as a bequest. Third, it weights the negatives of failure more strongly than the positives of leaving a surplus. The authors argue that these traits of the coverage ratio–based analysis more accurately reflect the attitudes that investors hold toward their retirement investing strategies.

> "[I]nvestors are much more likely to be displeased with outcomes that fall short of fully supporting retirement spending than pleased with outcomes that generate surpluses."
>
> ***—Toward Determining the Optimal Investment Strategy for Retirement***

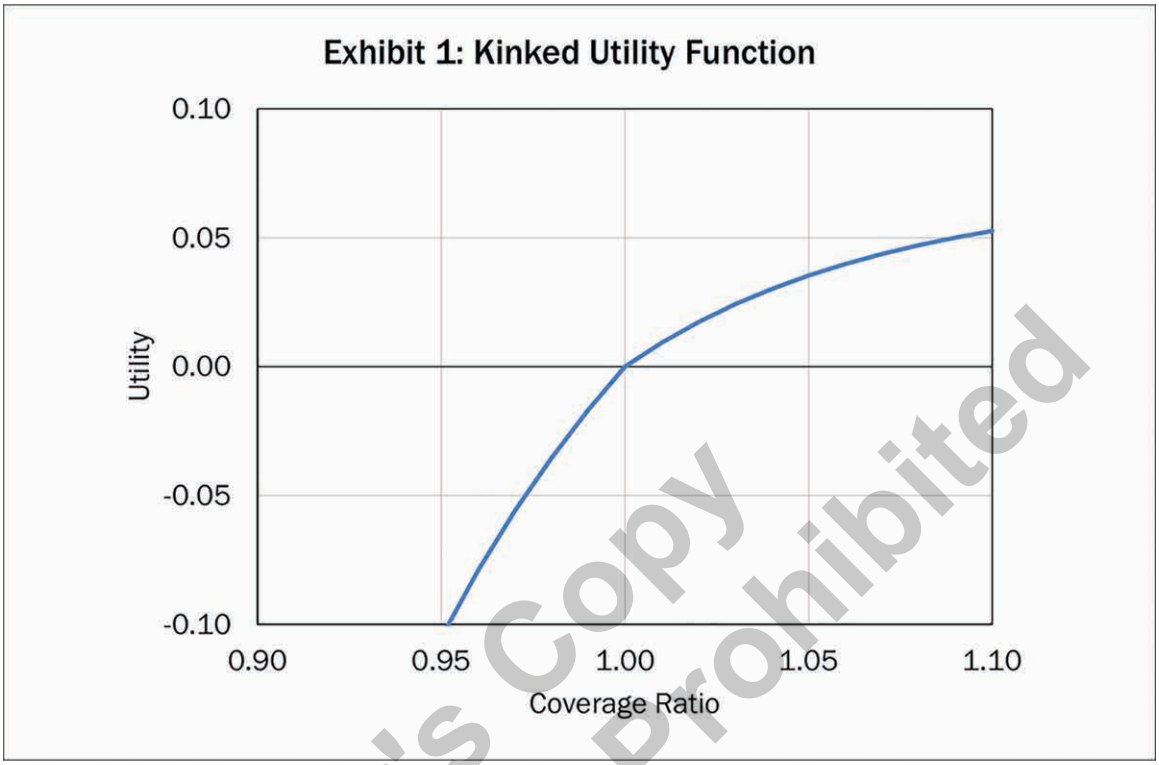
The coverage ratio itself is simply the number of years of inflation-adjusted withdrawals sustained by the strategy divided by the length of the retirement period. A coverage ratio of less than 1 indicates failure, while a coverage ratio of greater than 1 indicates the presence of a surplus.

However, the coverage ratio alone does not account for the inequality in preferences regarding failures and surpluses. To reflect this asymmetry, the authors propose a kinked utility function incorporating a coefficient of risk aversion (γ) when the coverage ratio is higher than 1 and a linear penalty coefficient (λ) when the coverage ratio is less than one. The values of these coefficients determine the slope: higher γ indicates that utility increases more slowly as the coverage ratio increases, while higher λ indicates a greater penalty for spending shortfalls. A graph of this utility function is shown in Exhibit 1.

The general form of the utility function accurately represents the strong negatives associated with failure and the relatively weaker positives associated with surplus. However, the authors note that there are no universally appropriate values for the coefficients γ and λ.

EVALUATING INVESTMENT STRATEGIES

The authors next use the coverage ratio and utility function to evaluate different investment strategies across historical and simulated data. Analysis of the historical data revealed a preference for very aggressive investment strategies: a stock allocation of 91%, on average. However, the retirement periods in the historical data



were not independent of each other, which may have impacted the results. In the analysis of the simulated data, on the other hand, optimal stock allocations were significantly lower and roughly followed conventional wisdom. In other words, optimal stock allocations increased as expected returns increased, standard deviations of returns decreased, and expected retirement period increased.

The historical analysis drew on international data from several overlapping 30-year retirement periods from 1900 to 2014. It included 11 annually rebalanced stock allocations from 100% to 0%, with the balance invested in bonds. Each portfolio was evaluated using the coverage ratio and the kinked utility function. As previously stated, the optimal allocations in the historical data were highly aggressive across multiple markets and values of γ and λ. Indeed, in more than half the markets, the optimal strategies featured 100% stock allocation. Moreover, even for high values of both coefficients, the optimal strategy never dipped below 80% stock allocation. However, the authors note that these findings may be a result of atypical historical market conditions (i.e., an unusually high equity risk premium during the sample period) and the effects of the overlapping 30-year retirement periods on both the performance of stocks relative to bonds and the independence of the data.

The analysis of the simulated data, on the other hand, avoids several of the shortcomings of the historical data. The format of the analysis retained the same 11 annually rebalanced stock allocations over 30 years. However, the authors were able to manipulate the simulated data by holding the mean and standard deviations of bond returns steady while those statistics for stocks varied. They also added retirement horizons of 5, 10, and 20 years to the analysis.

Evaluation of the simulated data revealed more conservative—and intuitive—optimal investment strategies. Overall, the optimal stock allocation was much lower when the means and standard deviations of returns were lower than those in the historical data. The authors note that investors who are skeptical that historical returns will continue into the future may find this guidance more helpful. Additionally, stock allocations varied intuitively across the different hypothetical scenarios: investors should increase stock allocations as expected returns increase and become more uniform and decrease stock allocations for retirement periods that are expected to be shorter. These findings reflect conventional wisdom surrounding retirement investing.

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