

“An Optimizing Framework for the Glide Paths of Lifecycle Asset Allocation Funds”

by

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Abstract

In choosing a glide path strategy for asset allocation over their working lives, retirement savers face a tradeoff between the higher expected wealth provided by strategies that maintain or increase equity holdings over time, against the greater potential security offered from shifting into more conservative assets. We quantify this tradeoff with an expected utility framework for our simulated distribution of target date wealth accumulations under a variety of lifecycle, fixed, and contrarian glide path strategies. We find justification for the lifecycle strategy for savers with very reasonable amounts of risk aversion, and we also provide guidance about utility-maximizing glide paths.

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1. Introduction

Since the Pension Protection Act of 2006 added them as a default option for employer defined-contribution pension plans, lifecycle or target-date funds (TDFs) have experienced rapid growth in their popularity and use. Szmolyan (2008) predicts that TDFs will grow to represent 35 percent of the \$7.8 trillion in assets under management for defined-contribution pension plans in 2015, a growth from 3 percent of assets in 2006. The lifecycle asset allocation strategy involves allocating a greater proportion of one's assets to equities during the early period far away from the target date, and automatically shifting to more conservative assets, such as bonds and bills, as the target date approaches. This investment style has been promoted as a simple solution for retirement savers to invest their savings with a hands-off approach. But beyond this vague general definition, there is little agreement about what is the proper glide path for TDFs to shift over time from aggressive to conservative assets.

Especially, as a result of the financial crisis, the lifecycle approach has received criticism for not being conservative enough and for being confusing to investors. The US Senate (2009) found in 2008 that the equity holdings in 2010 TDFs ranged from 24 percent to 68 percent, indicating that the TDF label does not tell the whole story. Noting a 2010 retirement TDF that lost more than 40 percent of its value in 2008, Senator Herb Kohl is pushing for greater regulation of TDFs to provide more disclosure to investors and to restrict their equity holdings near the target date (Halonen, 2009). These recent issues notwithstanding, academic studies including Schlee and Eisinger (2007) and Basu and Drew (2009) have criticized TDFs for not being aggressive enough. Such studies argue that maintaining a higher allocation to equities near retirement improves the chances of having a larger wealth accumulation to enjoy. Basu and Drew (2009) even argue that contrarian strategies which increase, rather than decrease, equity holdings near retirement would provide a superior performance for investors.

In this letter, we seek to provide some clarification to these issues. Our contribution is to more carefully quantify the tradeoff between the larger expected wealth accumulations of strategies which maintain or increase equity holdings near retirement against the potential safety provided by lifecycle strategies. The lifecycle strategy can potentially do a better job of safeguarding wealth near retirement, reducing the likelihood of extremely small, but also extremely large, wealth accumulations. We investigate this tradeoff with an expected utility framework. We estimate the expected utility from a large variety of lifetime asset allocation strategies for savers with a variety of attitudes toward risk in order to determine which strategies will maximize the expected utility over the distribution of target date wealth accumulations. We find justification for the lifecycle strategy and also provide guidance about the best glide paths for those with various attitudes toward risk.

2. Methodology

To examine the implications of different investment strategies on the expected utility of savers with varying attitudes toward risk, we consider the case of a hypothetical worker who is saving for retirement. This worker starts with a salary of \$40,000 which grows by

4 percent in nominal terms each year during a 40 year long career. We can think of this worker as beginning work on their 25th birthday, and retiring on their 65th birthday. The worker contributes 9 percent of their salary to their retirement savings portfolio at the beginning of each year for their 40 years of work. The portfolio is rebalanced without considering tax implications or transaction costs at the end of each year to maintain the targeted asset allocation.

We will investigate a variety of glide path strategies. Four parameters will define the glide path: (1) initial allocation to stocks (ranging in 10 percentage point increments from 0 to 100 percent); (2) number of years the initial asset allocation is maintained (1, 10, 20, or 30 years); (3) number of years before the target date that the target date asset allocation is achieved (0, 5, 10, 15, 20, or 25 years); (4) target date allocation to stocks (ranging in 10 percentage point increments from 0 to 100 percent). During the interim period of changing asset allocations, the glide path shifts linearly. The breakdown for the component of the portfolio not invested in stocks is 70 percent in bonds and 30 percent in bills. After removing redundant cases, we are left with 2,211 different 40-year glide paths. These include traditional lifecycle allocations, allocations that are fixed over the entire period, and contrarian allocations that increase equity exposure over time.

// Table 1 About Here //

We use Monte Carlo simulations to create asset returns for stocks, bonds and bills. The historical means, standard deviations, and asset correlations we use to parameterize the simulations are those for US nominal returns data between 1900 and 2000 from Dimson, Marsh, and Staunton (2002), updated through 2004, as shown in Table 1. We simulate 10,000 scenarios, each of which consists of returns for the three assets over a 40-year period, using a multivariate lognormal distribution for the assets. Our simulated asset returns closely match the historical parameters including the arithmetic returns, geometric returns, standard deviations, and correlations. With these simulated returns, we calculate the wealth accumulations for our hypothetical worker under the 2,211 glide path strategies.

For each strategy, we use the distribution of simulated target date wealth accumulations to estimate the expected utility using a standard constant relative risk-aversion utility function:

$$E[U(w)] = \sum_{i=1}^N \left(\frac{1}{1-\gamma} w_i^{1-\gamma} \right) \quad (1)$$

in which w_i represents the wealth accumulation at retirement in each of $N=10,000$ simulations. In the case that $\gamma=1$, the utility is defined instead as the natural logarithm of wealth. This is a standard way to evaluate the utility provided by wealth (Ibbotson, *et al.*, 2007). A fundamental interpretation of γ in the utility function is that it represents the coefficient of risk aversion. A value of zero represents risk neutrality, while increasingly positive values indicate increasing risk aversion. In surveying the literature, Azar (2006) finds general agreement that the realistic range for risk aversion is between one and five.

We estimate the expected utility for each strategy as the mean utility from the 10,000 simulations and then rank the investment strategies based on their expected utilities.

3. Results

Figure 1 provides our main results. It shows the glide path strategies that maximize expected utility for risk aversion coefficients ranging from 1 to 10 using a constant relative risk aversion utility function for total wealth accumulated at retirement (a spreadsheet with the rankings for all 2,211 glide paths is available on request). For a wide range of reasonable risk aversion coefficients, a fundamental message is that most investors are likely to prefer lifecycle strategy to either fixed strategies or contrarian strategies.

// Figure 1 About Here //

Certainly, an investor who is aggressive enough will not need a lifecycle fund. For risk aversion coefficients of 1 or 2, an investor can maximize their expected utility by maintaining a 100 percent fixed allocation to stocks throughout their career. But for those with greater risk aversion, lifecycle strategies will maximize utility. Interestingly, for all the risk aversion coefficients we consider, the initial allocation to equities is 100 percent. As risk aversion increases, this high equity allocation adjusts quickly to a more conservative target allocation, as the target allocation is often achieved 10 or 15 years before the target date. For $\gamma=3$, the initial equity allocation is held for 20 years before gliding to 70 percent five years before retirement. For $\gamma=4$ or $\gamma=5$, which represent the most commonly used default options in academic studies, the initial allocation is held for 10 years and the final allocation to equities is 50 percent. The target allocation to equities is 40 percent for $\gamma=6$, and for larger coefficients the target allocation is 30 percent.

4. Conclusions

We find that savers with very reasonable amounts of risk aversion will enjoy higher expected utility from using lifecycle strategies. The ranges of target allocations we find match the variety offered by various fund managers mentioned in the introduction. Some differences we find from status quo fund offerings are that initial equity allocations should always be 100 percent and final equity allocations should not be too low, as even risk averse investors can enjoy higher expected utility with some equities. For conservative approaches, the target date allocation should be achieved well before the target date. Contrarian strategies that increase equity allocations over time do not perform as well.

Presently, each fund manager generally only offers one type of TDF, as the differences in target date allocations are seen across different firms, not within the same firm. Our findings suggest that more effort should be made within firms to provide a range of TDFs for investors with various risk attitudes, which would also integrate with other important considerations such as the nature of a worker's human capital, their planned withdrawal rate during retirement, or their access to other sources such as Social Security and defined-benefit pensions. More fine-tuning is necessary, but we generally find that risky,

moderate, and conservative lifecycle funds could have target date equity allocations of about 70, 50, and 30 percent, respectively. The lifecycle strategy is justified, but room for improvement exists, and educating defined-contribution pension participants about these issues will be vital to ensuring that they can find strategies which suits their tastes and circumstances.

References

- Azar, S. A. (2006) Measuring relative risk aversion, *Applied Financial Economics Letters*, **2**, 341—45.
- Basu, A. K. (2008) *Essays on Asset Allocation Strategies for Defined Contribution Plans*, Ph.D. dissertation, Queensland University of Technology, Australia.
- Basu, A. K. and Drew, M. E. (2009) Portfolio size effect in retirement accounts: What does it imply for lifecycle asset allocation funds? *The Journal of Portfolio Management*, **35**, 61—72.
- Dimson, E., Marsh, P. and Staunton, M. (2002) *Triumph of the Optimists: 101 Years of Global Investment Returns*, Princeton University Press, USA.
- Halonen, D. (2009) Feds taking aim at target-date funds, *Pensions & Investments*, June 1.
- Ibbotson, R. G., Milevsky, M. A., Chen, P. and Zhu, K. X. (2007) *Lifetime Financial Advice: Human Capital, Asset Allocation, and Insurance*, The Research Foundation of the CFA Institute, USA.
- Schleef, H. J. and Eisinger, R. M. (2007) Hitting or missing the retirement target: Comparing contribution and asset allocation schemes of simulated portfolios, *Financial Services Review*, **16**, 229—43.
- United States Senate Special Committee on Aging (2009) Target Date Retirement Funds – Preliminary Findings. Available at: <http://www.aging.senate.gov/letters/targetdatedoladdendum.pdf>
- Szmolyan, N. (2008) The Remaking of the DC Market, Presentation at the Employee Benefits Research Institute 62nd Policy Forum. Available at: <http://ebri.org/pdf/programs/policyforums/may2008/7-Smolyan.ppt>

Table 1
Summary Statistics for US Nominal Returns Data, 1900 - 2004

	Arithmetic Means	Standard Deviations	Correlation Coefficients		
			Stocks	Bonds	Bills
Stocks	11.6%	20.0%	1	0.1020	-0.0830
Bonds	5.3%	8.2%	0.1020	1	0.2130
Bills	4.1%	2.9%	-0.0830	0.2130	1

Source: Basu (2008)

Figure 1

**Glide Path Strategy to Maximize Expected Utility of Target Date Wealth
for Various Risk Aversion Coefficients (γ)**

