TARGET DATE FUND'S TRADEOFF OF EXPECTED RETURN FOR REDUCED RISK

by William J. Trainor

Peer Reviewed

William J. Trainor, Jr.(trainor@etsu.edu) is an Associate Professor of Finance, Department of Economics and Finance, College of Business and Technology, East Tennessee State University.

Abstract

Although the concept of life cycle investing has been around for 50 years, only since 1994 has the mutual fund industry dedicated funds towards this concept. Known commonly as target date funds, there are now over 170 funds from 28 fund families. Because target date funds are expected to reduce risk as retirement approaches, these funds may be buying, holding, or even selling equities during an extended market decline, and they are always selling equities in a rising market. Using bootstrapping statistical methods, this study finds that relative to maintaining a constant asset mix, target date funds reduce the standard deviation of target date wealth by up to 42 percent, while increasing the minimum expected wealth level by as much as 10 percent. However, the cost of this reduction in risk can be as much as a 21 percent decline in the expected accumulated wealth at the target date.

Introduction

The concept of life cycle investing traces its roots back to Arrow and Debreu (1954), Samuelson (1969), and Merton (1969) who examine the multi-period consumption-investment problem. In practice, the problem comes down to one of asset allocation across different stages of life. Common wisdom suggests that, as an investor approaches retirement, their asset allocation should become more conservative, as more of their lifetime wealth is concentrated in accumulated assets, as opposed to a future income stream.

For investing, a popular rule of thumb is the “100 minus age” rule (sometimes 110 or 120) where an investor subtracts their age from 100 and invests that percentage in equities, while the remaining balance is invested in bonds. This “one-size shoe fits all” rule does not take into account different risk-preferences of individuals, but the concept of reducing risk exposure as retirement approaches is considered prudent by most investors and financial planners.

The difficulty for any individual investor in implementing this strategy is that he or she must first determine the current optimal asset allocation among multiple asset classes; then consistently monitor and rebalance this allocation over time as retirement approaches. In order to make life cycle investing easier, the mutual fund industry introduced lifecycle or target-date funds beginning in 1994, (Coleman, 2007). These funds supposedly offer one-stop shopping and reduce the need for the investor to own multiple mutual funds or worry about rebalancing.

There are now over 170 life-cycle funds being offered from 28 mutual fund families with over $114 billion invested as of 2006 (Stewart, 2007). They are increasingly popular in 401k plans, and an additional $40 billion in assets has flowed into these funds in just the last two years. In fact, according to Revell (2008), almost 70 percent of 401 (k) plans now offer target date funds.

Within the mutual fund industry, there are basically two types of life-cycle funds: target-date and target-risk lifecycle funds. Target-date funds tie the asset allocation to a specific retirement date and adjust the allocation as the retirement date approaches. For example, a 2040 fund in the year 2010 may initially have 80 percent stocks and 20 percent bonds. As the year 2040 approaches, this allocation will slowly be shifted to 40 percent stocks and 60 percent bonds. The investor does not need to take any action. On the other hand, a target-risk fund maintains a particular asset allocation at all times. For instance, an aggressive fund may maintain 90 percent stocks and 10 percent bonds. As retirement approaches, it is up to the investor to move into a moderate or conservative life cycle fund.

Although target-date funds do make the decision process easier for the investor, not all target date funds are created equal. Table 1 below shows asset allocations for four funds that all have the same target date. As can be seen, the percentage of assets in the various asset categories can differ across fund families. For example, Selligman’s fund has 100 percent of the fund in equities (U.S. and International), while Fidelity only allocates 82 percent.

Table 1
Current Asset Allocations for selected 2035 Target-date Mutual Funds

Fund	U.S. Stocks	International	Bonds
Fidelity Freedom 2035	66%	16%	18%
Selligman Target Fund 2035	70%	30%	0%
T. Rowe Price Retirement 2035	66%	22%	12%
Vanguard Target Retirement 2035 Fund	72%	18%	10%

Source: Individual fund's websites and *Seeking Alpha,* 2007.

The main drawback for investors and financial planners is that the long-term risk-return characteristics of these funds are not easy to identify. This is because life cycle investing entails a declining expected return as the retirement date approaches. In general, most retirement projection calculators assume a constant expected return. Similarly, long-run wealth confidence intervals cannot be calculated by standard techniques as both the expected return and variance of these portfolios fall as the retirement date approaches.

This study addresses these two issues and explicitly identifies the cost of reducing the confidence interval over time in terms of expected retirement values. The results suggest that relative to a constant asset mix, target date funds reduce the standard deviation of target date wealth by up to 42 percent, while increasing the minimum expected wealth level by up to 10 percent. However, the cost of this reduction in risk is a decline in the expected wealth by up to 21 percent at the target date.

Data

Although there are 28 fund families offering target date mutual funds, only the target date funds from the two largest (Fidelity and Vanguard) families are examined in this study. Both Fidelity and Vanguard have target date funds ranging from income funds to a 2050 fund. Table 2 below shows the composition of these funds in five asset categories as of December 2007. The categories are U.S. stocks, international, investment grade bonds, high yield bonds, and short-term assets. In general, the compositions are roughly the same for both families, although Fidelity uses high yield bonds, and Vanguard does not.

Table 2
Fidelity and Vanguard Target Date Mutual Fund Asset Composition Percentages as of December 2007

	U.S. Stock		International		Inv. Grade Bonds		High Yield		Short-term	
Target	Fid.	Van.	Fid.	Van.	Fid.	Van.	Fid.	Van.	Fid.	Van.
2050	70	72	20	18	0	10	10	0	0	0
2040	68	72	17	18	5	10	10	0	0	0
2030	65	69	16	18	11	13	8	0	0	0
2020	54	58	13	14	25	28	7	0	1	0
2010	40	44	10	11	35	41	5	0	10	4
Income	20	24	0	6	35	45	5	0	40	25

Since these funds have very short histories, benchmark portfolios with longer historical records are used to project expected returns and standard deviations. The benchmarks used in this study for the respective asset categories listed in Table 2 are the Wilshire 5000, the Morgan Stanley Capital International (MSCI), the Lehman Brother's Aggregate Bond Index, the Credit Suisse First Boston (CSFB) High Yield Index, and the Lehman Brother's 1-3 year Treasury Index respectively. Monthly return data from January 1977 to December 2006 is used as the sample set.

Although the correlation structure is left unchanged, returns for the benchmarks are adjusted up or down to match the historical data since 1926 for stocks, bonds, and short-term securities. Although some studies have suggested that future U.S. equity returns will be less than what has been experienced in the past (IlManen, 2003), results are based on historical realizations.

Table 3 below shows the expected annualized returns and standard deviations for each target date fund. Since the expected returns and standard deviations for the Fidelity and Vanguard target date funds differ by no more than 0.2 percent, only the combined averaged results for both funds are reported.

Table 3
Projected Annualized Returns and Standard Deviations

Fund	Mean	St. Dev.
Target 2050	10.0	8.7
Target 2040	10.0	8.6
Target 2030	9.9	8.4
Target 2020	9.5	7.9
Target 2010	8.8	7.4
Income	7.3	5.8

Methodology

To forecast accumulated wealth, it is assumed the investor contributes $1 each month that grows by 4 percent each year. This number is based on the average growth in wages over the last 10 years. Contributions are only increased once a year. Each target date fund's asset allocation is expected to linearly move over time to the allocation based on the next earlier target date fund. For example, the Target 2050 fund will have the asset allocation of the Target 2010 fund in 40 years.

This last assumption is made for tractability. However, according to both Fidelity and Vanguard's target date fund's prospectuses, the target asset allocation strategy may vary for a variety of factors such as direct manager action, or whether the funds are accepting additional investments. Over short periods of time, minor changes in asset allocation are unlikely to significantly affect results.

On the other hand, systematic, longer-term changes in strategy could have greater significance. For example, an increase in equity and international exposure by two percentage points at every target date in lieu of bonds would increase both the expected wealth and risk. However, this type of change was tested, and it changed the results of this study by less than one percentage point. Therefore, the results are somewhat robust to minor changes that these funds might make in the future.

All results are based on the initial investment beginning in January 2008. Target date fund results are compared to a target risk portfolio which maintains the initial asset allocation of the target date fund. This is equivalent to holding a life-cycle fund and not changing to a lower risk fund as retirement approaches.

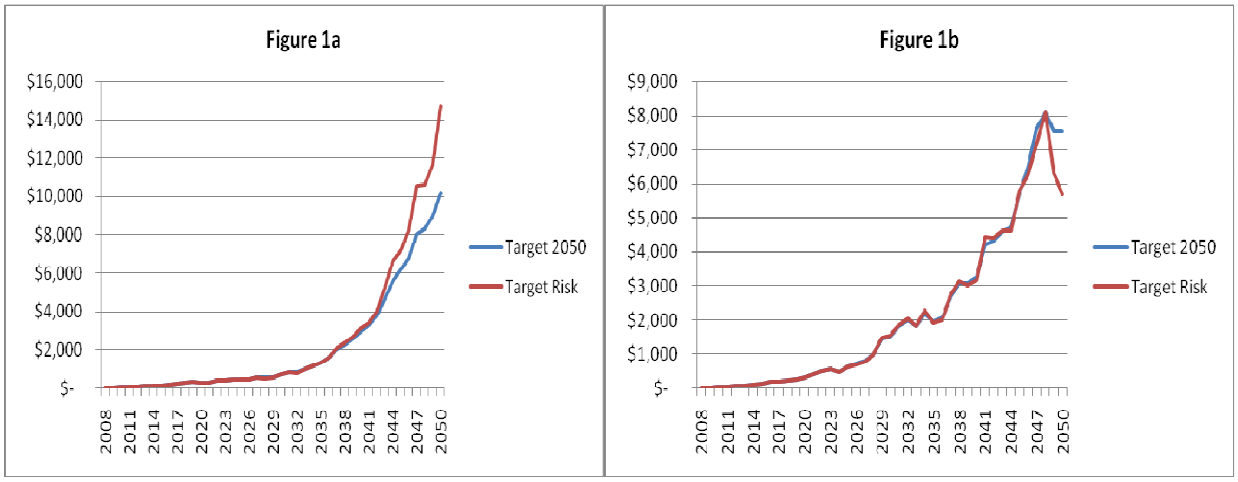
Projecting accumulated wealth levels and determining confidence intervals from investing in target date mutual funds creates a unique set of problems. In general, theoretical forecasting models assume a constant mean and variance. However, since target date funds reduce their risk exposure over time, both the expected return and variance decline, rather than remaining constant. One solution for this problem is to apply Monte Carlo or bootstrapping methods.

In this study, bootstrapping is applied. Whereas a standard Monte Carlo simulation actually creates the data, bootstrapping simply re-samples the historical data. 10,000 return paths of 504 months are created by sampling the adjusted monthly returns for each asset class over the last 30 years. The advantage of bootstrapping in this case is that the correlation matrix is maintained because the returns for one asset in any particular month are grouped with the returns for the other assets during that month. Results for both the Fidelity and Vanguard funds are calculated. Since the results for both fund families are qualitatively similar, the results are simply averaged and reported as a guide to what one might expect with a particular target date.

Results

Figures 1a and 1b below demonstrate two simulated return scenarios that illustrate the basic findings of this study. Figure 1a shows the basic expected return path. For a 2050 target fund, wealth reaches $10,000. In contrast, if an investor initially chose a target risk fund that had a similar asset allocation as the 2050 fund, such as Fidelity's Asset Manager 85 percent fund or Vanguard's Life Strategy Growth fund, wealth reaches over $14,000 at the target date. These results are close to the actual expected values of $11,597 and $14,735, respectively. Keep in mind this is per dollar of initial monthly investment. A 2050 target date fund reduces expected target date wealth by 21 percent relative to a constant asset allocation strategy. An investor who initially began by investing $1,000 a month is giving up more than $3 million in expected wealth.

Figures 1a and 1b
Possible Wealth Paths for Target 2050 and Target Risk Fund



On the other hand, Figure 1b demonstrates why it is normally considered prudent to reduce risk exposure as retirement looms. With 5 years until retirement, both the target date and target risk fund reach a value of $8,000. However, equity returns in this simulated return path declined during the last few years, reducing the wealth level of the target risk fund to less than $6,000, while the target date fund maintains most of its value. For the initial $1,000 a month investor, losing over $2 million just as one is about to retire is a risk many investors might not want to take.

Table 4 below reports the bootstrapping results for each of the target date funds, along with a corresponding target risk fund that maintains the initial asset allocation of the respective target date fund. Mean and median ending wealth levels are given at the target date along with the standard deviation of the ending wealth and a 90 percent confidence interval. Median wealth levels are given because compounded returns are lognormally distributed, and mean values are biased upwards by extremely large values which have a small probability of occurring. In fact, for long-term horizons, an investor

generally only has a 40 percent chance of attaining the "expected" value, (Trainor, 2005; Hughson, et al., 2006).

Table 4
Expected Wealth Levels for Target Date and Target Risk Funds

	Median	Mean	St. Dev.	Lower CL	Upper CL
Target Date 2050	$10,270	$11,597	$6,429	$4,688	$23,584
Target Risk 2050	$11,940	$14,735	$11,043	$4,280	$34,831
% Difference	**-14.0%**	**-21.3%**	**-41.8%**	**9.5%**	**-32.3%**
Target Date 2040	$3,562	$3,828	$1,578	$1,943	$6,791
Target Risk 2040	$4,042	$4,654	$2,689	$1,780	$9,629
% Difference	**-11.9%**	**-17.8%**	**-41.3%**	**9.2%**	**-29.5%**
Target Date 2030	$1,155	$1,200	$345	$742	$1,845
Target Risk 2030	$1,248	$1,345	$526	$693	$2,330
% Difference	**-7.5%**	**-10.8%**	**-34.3%**	**7.0%**	**-20.8%**
Target Date 2020	$311	$316	$57	$234	$418
Target Risk 2020	$320	$328	$71	$227	$457
% Difference	**-2.8%**	**-3.6%**	**-19.8%**	**3.0%**	**-8.6%**

Table 4 reveals that target date funds do indeed reduce risk compared to maintaining a fixed asset composition as measured by both the standard deviation of target wealth and by the higher lower limit. For the Target 2050 fund, the standard deviation is reduced by 41.8 percent, and the lower confidence level based on a 90 percent confidence interval is 9.5 percent higher. However, the cost of this reduction in risk is a 14.0 percent decline in the median and a 21.3 percent decline in the mean expected wealth level.

For the Target 2020 and 2030 funds, the reduction in risk continues while the expected median wealth level is 7.5 percent lower for the Target 2030 fund. An examination of the Target 2020 fund reveals that the reduction in the standard deviation of target wealth is 19.8 percent, but the lower confidence level is only 3 percent higher. The cost of this risk reduction is also much less, as there is only a 2.8 percent difference in the target date median wealth level.

Since target date funds have a stochastic expected mean and variance, it is also of interest to note the wealth characteristics within the target time period. Table 5 below reports the expected wealth levels for the Target 2050 fund along with a target risk fund that maintains the asset composition of the 2050 fund at years 2030, 2040, and 2045.

At 2030, there is only a minor difference in the two funds. The Target 2050 fund has reduced the standard deviation of wealth by 9.6 percent while giving up less than 3 percent in the expected wealth level. This result occurs since the 2030 fund has only reduced equity exposure by approximately 5 percent. By 2040, the Target 2050 fund has reduced the standard deviation of 2040 wealth by 24.0 percent and increased the

lower confidence level by 7.1 percent. The cost of this reduction in risk is 6.7 percent in the median wealth level at this point. With 5 years until the target date, the Target 2050 fund reduces the standard deviation of 2045 wealth by 33.3 percent, and it increases the lower confidence level by 9.1 percent, while the median wealth level is also reduced by 9.1 percent.

Table 5
Target Date and Target Risk Interim Wealth Levels

	Median	Mean	St. Dev.	Lower CL	Upper CL
Target Date 2050 at 2030	$1,290	$1,378	$563	$688	$2,450
Target Risk 2050 at 2030	$1,323	$1,417	$623	$668	$2,610
Difference	**-2.5%**	**-2.8%**	**-9.6%**	**2.9%**	**-6.1%**
Target Date 2050 at 2040	$3,884	$4,289	$2,127	$1,873	$8,274
Target Risk 2050 at 2040	$4,164	$4,742	$2,798	$1,749	$9,940
Difference	**-6.7%**	**-9.6%**	**-24.0%**	**7.1%**	**-16.8%**
Target Date 2050 at 2045	$6,447	$7,164	$3,806	$3,011	$14,191
Target Risk 2050 at 2045	$7,095	$8,429	$5,704	$2,760	$18,776
Difference	**-9.1%**	**-15.0%**	**-33.3%**	**9.1%**	**-24.4%**

Thus, as can be seen, most of the reduction in both risk and the expected wealth level occurs in the last 5 to 10 years before the target date. This is a critical time for most investors, as this is where investors are expected to reap the greatest increase in value of their portfolio. The results clearly show that maintaining a risky portfolio composition over these last few years yields fairly dramatic increases in expected wealth. However, this is also the period of time where an investor has the greatest amount to lose.

The April 1, 2008 *Wall Street Journal* headline sums up the possible consequences of maintaining a relatively risky portfolio up to the point of retirement in an article entitled “Americans Delay Retirement as Housing, Stocks Swoon.” It is this factor that has likely led to the dramatic growth in target date funds. The significance of loss aversion in terms of investor behavior was first pointed out by Kahneman and Tversky (1979). Regardless of what amount is attained before the retirement date, investors are loath to see their wealth reduced. For example, after the 2000 stock market crash, casual observation suggests many investors postponed retirement because the boom of the 1990’s changed their aspirations. Before this boom, these same investors likely would have been happy with the wealth accumulated even after the 2000 crash. The economic crisis of 2007/2008 is another example, as a Schwab survey of financial advisors indicates that almost 25 percent of their clients are considering working longer because of the fallout, (WSJ, 4/1/2008)

However, as investors approach retirement, mitigating a drop in wealth is likely just as important to the investor as the absolute amount attained. In this respect, target

date funds and the investment strategy behind them is an attractive alternative for many investors.

Summary

With many 401k plans adding target date funds as investment choices, it is important that investors and financial planners are well informed about the characteristics of these funds. This study has shown that target date funds do reduce risk relative to a target risk strategy that maintains a fixed asset allocation. For a 2050 target date fund, the standard deviation of ending wealth is reduced by 42 percent, while the lower bound of a 90 percent confidence interval is increased by 10 percent. The cost of this reduction in risk is a 14 percent decline in median wealth.

Since many investors begin to plan out their retirement based on their account values several years before retirement, target date funds do have a role to play. Much of the risk reduction achieved by target date funds occurs in the last 5 to 10 years. Although this is the time where the majority of the increase in investors' wealth is expected, it is also the time of greatest risk in terms of absolute changes in wealth levels. With 10 years until retirement, there is only a 4.3 percent difference in the expected wealth levels between a 2050 Target date fund and a fund that maintains the initial risky asset allocation of a 2050 fund. For an investor who wishes to limit the downside risk as retirement approaches, a target date fund provides a simple solution.

References

Arrow, K.J., and G. Debreu, (1954). Existence of an equilibrium for a competitive economy. *Econometrica*, Vol. 22, No. 3, 1954, 265–290.

Coleman, Murray, (2007). One-Stop Mutual fund Add More to Their Baskets. *MarketWatch*, March 25. Retrieved Oct. 2007, from http://www.marketwatch.com/news/story/target-date-retirement-funds-move-beyond/story.aspx?guid=%7B7BCBBE2F-5FE7-4826-B468-1559E605287F%7D

Hughson, Eric, Stutzer, M. and C. Yung, (2006). The misuse of expected returns. *Financial Analysts Journal*, Vol. 62, No. 6, pp. 88-96.

Ilmanen, A, (2003). Expected returns on stocks and bonds. *Journal of Portfolio Management*, 27(2), 2001, pp. 101-111.

Kahneman, D. and Tversky, A. (1979). Prospect theory: An analysis of decision making under risk. *Econometrica*, 47(2):263-291.

Levitz, Jennifer, (2008). Americans delay retirement as housing, stocks, swoon. *Wall Street Journal*, April 1, A1.

Merton, R., (1969). Lifetime portfolio selection under uncertainty: The continuous-time case. *Review of Economics and Statistics*, 51, 247-257.

Revell, Janice, (2008). The best new features of a rich 401(k). *Money*, May, p. 118.

Samuelson, P., (1969). Lifetime portfolio selection by dynamic stochastic programming. *Review of Economics and Statistics*, 21, 239-246.

Seeking Alpha, (2007). The irony of target-date ETFs and comparable mutual funds. Retrieved Oct. 2007 from http://seekingalpha.com/article/48995-the-irony-of-target-date-etfs-and-comparable-mutual-funds, October 5.

Stewart, J. K., (2007). Target-date retirement funds not for everyone. *Chicago Tribune*, Sept. 9.

Trainor Jr. W. J., (2005). Long-range confidence interval projections and probability estimates. *Financial Services Review*, Vol. 14, Is. 1. 73-84.

Note: Title design is by Carole E. Scott