GLIDEPATH STRATEGIES FOR RETIREMENT FUNDS: BOON OR BOONDOGGLE?

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ABSTRACT

It is well documented that American workers, as a whole, are behind in saving for retirement. Ample research from behavioral science suggests that this is in part due to the fact that they are generally ill-suited to making the sound investment decisions necessary to prepare for a secure retirement. The latest purported panacea for this problem is the target date fund. These mutual funds, which have emerged as a staple in 401(k) plans over the past few years, employ a strategy whereby one can invest in a single diversified "fund of funds" portfolio with a "target date" corresponding to his estimated retirement year. The investor can then rest easy with his 401(k) plan on autopilot as the fund manager gradually adjusts the asset allocation and rebalances the asset mix to reduce portfolio risk appropriately as the individual's retirement date approaches. Essentially, the fund managers follow a glidepath strategy that systematically reduces the equity component of the asset allocation and increases the bond component as the individual ages and approaches retirement. Upon reaching the target date, the funds attain their final allocations as pre-determined by prospectus. This final allocation is typically on the order of 50:50 stocks:bonds, and is presumed and perceived to be an ideal balance for workers upon retirement.

The attraction to a single diversified portfolio corresponding to one's retirement date that becomes more conservative over time is obvious. However, recent research pertaining to the withdrawal phase of the investment lifecycle has questioned the effectiveness of such glidepath strategies post-retirement. With that in mind, this paper examines whether the glidepath strategies employed in popular target date funds are more effective during the accumulation phase of the investment life cycle or, alternatively, whether investors' interests might be better served by maintaining a constant allocation throughout one's working life. To do this, we applied a bootstrapping analysis to prototypical glidepath and constant allocation models over 40, 30, 20, and 10 year retirement horizons. Consistent with the aforementioned withdrawal analysis research, the results indicate that constant allocation models tend to deliver superior risk-adjusted returns relative to the glidepath models during the accumulation phase as well. In addition to challenging the effectiveness of target date funds as a retirement savings tool, the findings of this paper may have important implications on how investors save and invest for retirement, as they suggests that (1) the presumption of a single "ideal" final retirement allocation (e.g., 50:50) may be flawed, and (2) equity weightings considerably higher than 50% may be appropriate for some investors at retirement.

I. Introduction

Prior to the Employer Retirement Investment Security Act of 1974, the corporate retirement plan landscape was dominated by institutionally-managed defined benefit pension plans. By empowering employees to make their own savings and investment decisions, the introduction of defined contribution plans, particularly 401(k) plans, was hailed as great benefit for American workers. Since the first 401(k) plan was adopted in 1979, the shift away from defined benefit plans to 401(k)s has been dramatic. Today, defined benefit plans are only a small segment of the total plan market, and there are more 401(k) plans than all other types of qualified retirement plans combined. Unfortunately, as much as individual investors appear to value having control over investing for their long term retirement security, abundant research from behavioral economics suggests that they are not very good at it. Specifically, numerous studies have found that, despite the importance of this financial objective, investors spend very little time planning for retirement and, as a group, they seem remarkably naïve and heuristic in their investment selections (Bernartzi and Thaler (2007); Goetzmann, Massa, and Rouwenhorst, (2007)).

Over the years, various changes and innovations have been introduced to try to improve plan participant investment results, including restricting investors' ability to purchase company stock in 401(k) plans and increasing the number of fund choices and fund classifications available to plan participants. While most of these modifications produced limited success, the introduction of so-called "lifestyle" mutual fund portfolios in the late 1990s was thought to represent a positive step forward. Lifestyle funds are typically broadly diversified "funds of funds" portfolios with asset allocations designed to correspond to risk-based fund names such as, "Conservative", "Balanced", "Moderate", "Growth" and "Aggressive". While the fund sponsor oversees the fund allocations and handles the periodic rebalancing functions, lifestyle portfolios generally maintain a constant stock:bond allocation over time. The basic principle behind the introduction of lifestyle funds is that they offer investors a broadly diversified, sophisticated, professionally managed portfolio in a single investment choice that matches their risk tolerances and stages in life. According to the Investment Company Institute's 2008 Mutual Fund Factbook, from 1996 through 2007 the number of lifestyle funds grew from 21 to 502 and assets grew from less than $1 billion to more than $238 billion. Most importantly, anecdotal evidence suggests that investors who elect lifestyle funds tend to outperform investors who self-direct. For instance, annual reviews conducted by 401(k) sponsor John Hancock of its own plans regularly find that plan participants who invest in lifestyle portfolios tend to outperform participants who pick their own fund allocations by a sizeable margin.

More recently, however, a different type of fund of funds portfolio has supplanted the lifestyle fund concept as a panacea for improving individual investors' retirement savings strategies. These mutual funds are commonly referred to as "lifecycle" or "target date" portfolios with the target date intended to roughly correspond to the investors' anticipated retirement dates. In contrast to their lifestyle fund cousins, target date funds readjust their asset allocations and risk profiles over time. Essentially, the fund managers follow a glidepath strategy that systematically reduces the equity component of the asset allocation and increases the bond component as the individual ages and approaches retirement. Upon reaching the target date, the funds attain their final allocations as pre-determined by prospectus. This final allocation is typically on the order of 50:50 stocks:bonds, and is presumed and perceived to be an ideal, conservative balance for workers upon retirement. The attraction to a single diversified portfolio that becomes more conservative over time and that corresponds to one's retirement date is obvious. Assets in target date funds have grown from $15 billion in 2002 to more than $183 billion at the end of 2007 (ICI 2008 Mutual Fund Factbook). These funds received a notable boost in 2006 when the Department of Labor approved target date funds as a qualified default option for plan participants who are automatically enrolled in employer-sponsored plans and/or who fail to make an investment election. In 2007, target date fund assets grew by a remarkable 61% versus a 26% increase in lifestyle fund assets. 2007 also marked the first year in which net new cash flows into target date funds surpassed flows into lifestyle funds (ICI 2008 Mutual Fund Factbook).

In light of rising popularity of target date funds, a primary purpose of this paper is to evaluate whether the glidepath retirement accumulation strategy they employ is, in fact, superior to the constant allocation strategy employed in lifestyle fund models. The motivation for this study comes from recent research pertaining to retirement income sustainability, including the authors' own work, which finds glidepath withdrawal strategies to be inferior to constant allocation withdrawal strategies. To compare the two retirement accumulation methods, we applied a bootstrapping analysis to prototypical glidepath and six constant allocation models over 40, 30, 20, and 10 year retirement horizons. Consistent with the aforementioned withdrawal analysis research, the results indicate that constant allocation models tend to deliver superior risk-adjusted returns relative to the glidepath models during the accumulation phase as well. In addition to challenging the effectiveness of target date funds as a retirement savings tool, our findings may have important implications on how investors save and invest for retirement. Specifically, this paper dispels the presumption of a single "ideal" final retirement allocation (e.g., 50:50). It also suggests that equity weightings considerably higher than 50% may be appropriate for some investors at retirement. Lastly, this paper serves as a step toward unifying current academic theory pertaining to the withdrawal phase of the investment lifecycle with theory regarding the accumulation phase.

The following section of this paper provides a brief introduction to related research on this subject. Section III presents our methodology, Section IV provides a more detailed discussion of our results and their practical implications. Section V places our findings in the context of current economic circumstances, attempts to unify our findings with withdrawal phase research, and concludes the paper.

II. Literature Review

Given their recent emergence, there is a relative paucity of published academic research pertaining directly to target date mutual funds. There are, however, a number of published studies that address the effectiveness of glidepath strategies in general. Blanchett (2007) applied bootstrapping simulations to compare four different glidepath withdrawal models and a single constant allocation strategy in an effort to determine an optimal retirement allocation and distribution strategy. Although the author expected the glidepath strategies to boost sustainability, the study instead found the constant allocation strategy to be most effective. The author concluded that, “a balanced static allocation, such as 60% equity and 40% fixed income/cash, is likely one of the most efficient portfolio allocations for retirees.

Similarly, Spitzer and Singh (2007) applied bootstrapping analysis to a range of retirement portfolio withdrawal strategies including glidepath (“stocks first”), constant allocation (“rebalancing”), and “bonds first”. Counter to public perception and standard financial planning practice, the authors found that the bonds first approach offered the highest probability of sustainability. This strategy may be thought of as a “reverse glidepath” as the equity allocation in the portfolio actually increases throughout retirement as the bond portion is spent down first. In concluding the paper the authors note, “The current trend in retirement planning uses life-cycle funds, which change portfolio allocation as a function of the age of the retiree – the older the retiree, the smaller the proportion of the portfolio in stocks. If minimizing shortfall risk is the retiree’s ultimate goal, these results suggest that the life-cycle strategy – at least during the withdrawal phase – needs additional empirical justification.”

In a subsequent 2008 Financial Services Review paper, Spitzer and Singh pursued this concept further by specifically examining the effectiveness of target date funds’ glidepath strategies after retirement (i.e., after the retirement date has been reached). The authors found that investors who leave their money in target date funds after the date has been reached can typically expect the funds asset allocation to follow one of two glide paths – one which descends rapidly from an approximately 50:50 allocation to a 25:75 allocation 10-15 years into retirement or one which follows that asset allocation path more gradually over approximately 30 years. Through bootstrapping simulations the authors concluded that, “a fixed 50/50 stock/bond portfolio unambiguously out-performs the target date funds, regardless of methodology employed. In light of this evidence, these funds, should revisit their asset allocation strategy.

Liu, Chang, De Jong, and Robinson (2008), expanded upon Spitzer and Singh’s 2007 paper by examining the impact of including multiple asset classes on withdrawal sustainability and by considering a wider range of withdrawal rates and time horizons. The paper also compared a constant allocation withdrawal strategy to a bonds first withdrawal strategy. The results found very little difference in the probabilities of sustainability between the constant allocation and bonds first withdrawal strategies for shorter time horizons and for withdrawal rates of 5% or less. However, for 25-30 year withdrawal periods and withdrawal rates of 6% or higher, the analysis confirmed the superiority of the bonds first withdrawal strategy. The authors noted that this has important implications on retirement planning because many investors who are approaching retirement are behind in saving for retirement may require high withdrawal rates. The paper also concludes that there does not appear to be a single optimal (i.e., highest probability of sustainability) initial retirement allocation, but rather there seems to be a continuum that moves toward higher equity allocations as both the desired withdrawal rate and anticipated life expectancy increase.

Other related research includes Cooley, Hubbard and Walz (1999); Ameriks, Veres, and Warshawsky (2001), Guyton (2004), and Guyton and Klinger (2006). All of these papers focus on retirement income sustainability, and are not directly concerned with either target date funds or glidepath models. However, they are germane to this discussion because each concludes that higher withdrawal rates over long retirement life expectancies require initial portfolio allocations at and throughout retirement of at least 50% equities.

As noted in the introduction, this paper represents an extension of the research that has been done pertaining to glidepath strategies during the withdrawal phase by evaluating the model's effectiveness during the accumulation phase of investors' lives.

III. Data and Methodology

Our sample period runs from January 1970, which corresponds to the inception of the MSCI EAFE Index, to December 2008, which represents 39 years or 468 months of data. We use monthly total return data on the S&P 500 Index, the Russell 2000 Index, the MSCI Index, and 10–year U.S. Treasury bonds as available from CRSP and Datastream. Since the Russell 2000 Index was not established until 1978, we use the total return data for the bottom quintile market cap stocks in the NYSE Index as our proxy for small and mid–cap stocks for 1970 to 1978, following Siegel (2007). As our measure of inflation, we use the monthly CPI–U rates available from the Bureau of Labor Statistics website. For our risk–free alternative portfolio, we use the monthly total returns on three-month Treasury Bills as available in the FRED economic database on the website of the Federal Reserve Bank of St. Louis.

Using the model proposed in Liu, Chang, De Jong, and Robinson (2008) for our broadly diversified equity portfolio, the equity component for both the Target Fund and the Lifestyle Funds consists of 45% S&P 500 Index, 30% Russell 2000 Index, and 25% MSCI EAFE Index. This equity portfolio generally replicates the core structure of the equity portion of many practitioner–designed modern portfolio theory based models. It is qualitatively the same as the model chosen by Guyton (2004) and the typical structure of the target maturity and lifecycle "fund of funds" mutual fund portfolios. When combined with 10–year Treasury bonds for the fixed income component, this four asset portfolio will be used to compare the accumulation phase of pre–retirement portfolios of our Target Fund with its decreasing equity weight over time to various Lifecycle Funds with fixed equity vs. bond weights ranging from 100% equity, 0% bonds for an aggressive style to 50% equity, 50% bonds for a conservative style.

As the number of Target Date funds has proliferated, some variation in the glidepath strategies has emerged. Broadly speaking, however, the longest target dates (typically 40 years) begin with approximately a 90% equity, 10% bond allocation and gradually shift in towards an allocation in the neighborhood of 50% equity, 50% bonds at retirement. For example, both Vanguard's Target Retirement Funds and T. Rowe Price's Retirement Funds maintain a 90% equity, 10% bond allocation from 40 years prior to retirement until 25 years prior to retirement, and then decrease the equity weights in a linear pattern to reach an allocation of 50% equity, 50% bonds at retirement. Fidelity's Freedom Funds glidepath is more concave, as the funds gradually shift from a 90% equity, 10% bond allocation at 40 years prior to retirement to an 80% equity, 20% bond allocation at 20 years prior to retirement, and then rapidly shift to an allocation of 50% equity, 50% bonds at retirement. Our model Target Fund begins at a 90% equity, 10% bond allocation at 40 years prior to retirement and then follows a gentle glidepath to reduce its equity weight and increase its bond weight by 1% each year, arriving at a 50% equity, 50% bond allocation at retirement.

Our Lifestyle Funds maintain a constant equity and bond allocation over the entire pre–retirement accumulation phase, with the bond portion invested in 10 year Treasury Bonds and (1 – bond weight) invested in our Diversified Equity Portfolio. We model aggressive, moderate, and conservative lifestyle funds by using six different sets of equity and bond weights. We consider Lifestyle Funds with the following allocations ranging from aggressive to conservative: 100% equity and 0% bonds, 90% equity and 10% bonds, 80% equity and 20% bonds, 70% equity and 30% bonds, 60% equity and 40% bonds, and 50% equity and 50% bonds. Both our Target Fund and our Lifestyle Funds are rebalanced annually to maintain the target equity vs. bond weights, as well as the Diversified Equity Portfolio weights of 45% invested in the S&P 500 Index, 30% invested in the Russell 2000 Index, and 25% invested in the MSCI EAFE Index. The summary statistics of all kinds of portfolios are reported in Table 1.

Our analysis assumes that $1,000 is invested in the accumulation portfolio at the beginning of each month during the sample period, with the four fund proportions determined by the beginning of the year weights for the bond and equity components. For the purposes of this analysis, we assume that the portfolio is held in a tax-deferred account (i.e., tax considerations are irrelevant to the results). We do not account for advisory fees.

With the 1970 to 2008 total return data, we apply a bootstrapping algorithm to each of the seven asset allocation models for retirement accumulation horizons of 10, 20, 30, and 40 years. We run 5,000 bootstrapping simulations for each scenario.[1] Our bootstrapping algorithm draws months randomly with replacement from our 468 months of data. To maintain the normal cross–sectional correlations, the monthly returns for our 10 year Treasury Bond Index, our three equity indices, and the monthly inflation rate are drawn together from the same randomly selected month in our bootstrapping accumulation analysis. To compare the Target Fund to the six Lifestyle Funds, we compute the mean and standard deviation of the accumulated portfolio value at the retirement date, as well as the median and various quintiles. To compare the seven retirement accumulation portfolios on a risk–adjusted basis, we compute a dollar based Sharpe Ratio which is defined as:

[1] Our results are robust to the different number of bootstrapping simulations. We have experienced 1000, 2500, 5000, and 10000 simulations, and got qualitatively similar results. Please refer to our Table 3.

$$\text{Sharpe Ratio} = \frac{Mean\_Risky\_Accumulated\_Balance - Risk\_Free\_Accumulated\_Balance}{Standard\_Deviation\_of\_the\_Accumulated\_Balance},$$

where the risk–free accumulated balance is computed using the average 3-month Treasury Bill rate over our sample period, which is 5.8068% on an annualized basis. We combine this average Treasury Bill rate with our $1,000 monthly investments to obtain the risk–free accumulated balances for the designated years prior to retirement.

IV. Implications and Results

The output reported in Table 2 illustrates that for all for retirement horizons, there is at least one constant allocation model with a higher risk adjusted return and higher mean and median expected portfolio values than the corresponding glidepath model. Specifically, at the 40 year time horizon the 70:30 constant allocation model has a nearly identical Sharpe Ratio as the glidepath model, but considerably higher expected portfolio values across the mean, median and all probability percentiles. At the 30 year retirement horizon, the 60:40 constant allocation model has a higher Sharpe Ratio and higher expected portfolio values. At the 20 year retirement horizon, both the 60:40 constant allocation model is again superior, thought the 50:50 allocation model also has a higher sharp ratio and higher projected portfolio values than the glidepath model. At 10 years, the four constant allocation models ranging from 50:50 to 80:20 all have higher Sharpe Ratios and higher expected portfolio values at every percentile than the glidepath model. Thus, for each of the above-referenced constant allocation models, investors would be likely to experience higher portfolio values at retirement for the same or lower amount of risk relative to the corresponding glidepath model.

While it should be noted that, in reality, the glidepath strategies employed in most Target Date funds are more sophisticated than the simple linear progression represented in this paper, these results do at least cast some doubt on whether the glidepath approach is truly superior to a constant allocation accumulation strategy. Stated differently, while investing in a portfolio that gradually becomes more conservative over time may make investors feel better, it is not clear that such a strategy offers the highest probability of achieving one's retirement goals.

The results for the 10 year period are a bit surprising and may have counterintuitive implications as well. The notion that an investor who is beginning to save with a retirement date just 10 years away might be better served (i.e., attain better risk adjusted returns) by investing in a constant allocation model with an 80% equity weighting than with a glidepath model that begins with a 60:40 allocation and declines to a 50:50 allocation at retirement seems to run directly counter to public perception of how people should invest as they approach retirement. However, as presented in Table 2, the 80:20 model has a higher sharpe ratio and higher portfolio values at every percentile. Similarly, it is also observed that, while the 100% and 90:10 constant allocation models never have higher Sharpe Ratios than the glidepath model, these two allocation models have higher portfolio values for all percentiles of including the 20th and above. Thus, it may be said that despite their higher risk, at least 80% of the time investors who choose to invest in constant allocation models comprised of at least 90% stocks will arrive at retirement with greater accumulated retirement savings than investors who choose the glidepath model. According to the analysis this is true across all four retirement horizons from 10-40 years. The obvious implication of this is that investors who are far behind or late in saving for retirement may be wise to eschew more conservative target date and even more conservative constant allocation models in favor of much higher equity weighted portfolios. Faced with the possibility of either working longer or having a lower standard of living in retirement, investors who take this gamble may be viewed as rational in light of the high probability of success and, conversely, the fairly low probability of catastrophic failure compared to more conservative alternatives.

In making this point, it is important to note that the $1,000 per month savings rate illustrated in this analysis is not realistic for most investors. In fact, according to the Employee Benefit Research Institute, the median annual retirement savings amount in the United States among workers born between 1946 and 1964 (the highest earning demographic) is just $2,750 ($229/month). Were we to scale down Table 2 to match this demographic, the dollar amounts illustrated would not be nearly as robust, and it would be clear in absolute terms at the mean and median benchmarks that most American workers are not on track to accumulate sufficient savings at retirement to generate enough income based upon reasonable inflation-adjusted withdrawal rates to sustain them through a normal retirement life expectancy.

V. Discussion and Conclusion

The financial crises of 2008 and 2009 delivered a body–blow that has brought financial institutions, global corporations, financial experts and investors to their proverbial knees. For the vast majority of American investors, the precipitous decline in the stock market was neither anticipated nor hedged against. Not surprisingly, dramatic declines in retirement savings of both workers and retirees have led many investors to question whether they should have any equity exposure at all. Thus, the suggestion that investors who are approaching retirement should perhaps have higher equity weightings than dictated by common glidepath portfolios may understandably be met with some skepticism. Although they may seem controversial in the context of current economic circumstances, the findings of this paper are, in fact, generally consistent with other research that has been done on retirement income sustainability during the withdrawal phase of the investment lifecycle. Inherent in this research is an understanding that the two biggest risks investors face in retirement are serial returns risk (the risk of premature depletion of assets due to sharply negative returns early in retirement) and longevity risk (the risk of depleting ones assets due to a longer than expected lifetime). With respect to mitigating these risks, this research has produced the following insights:

(1) For investors whose initial required withdrawal rates upon retirement are relatively low (i.e., 4-5%) or less, the probability of long term (20+ year) sustainability regardless of portfolio allocation is quite high, even through such sharply negative periods as we are experiencing today. For investors who may require higher initial withdrawal rates to maintain their standards of living, the highest probabilities of sustainability for any given retirement life expectancy beyond 20 years tend to be found in portfolios with higher equity weightings. While this may expose the retiree to greater serial returns risk, the probabilities of sustainability are nonetheless higher. (Cooley, Hubbard, and Walz, (2002), Spitzer and Singh (2007), Liu, Chang, De Jong, and Robinson (2008))

(2) The “ideal” (i.e., highest probability of success) initial retirement allocation for required withdrawal rates above 4% likely lies somewhere between 50% and 75% equities, and appears to migrate toward higher equity allocations as both withdrawal rate and retirement life expectancy increase. (Spitzer and Singh (2007))

(3) Portfolios that follow a glidepath strategy (i.e., decreasing equity and increasing bond allocations) during retirement tend to have lower probabilities of sustainability than portfolios that maintain a constant stock:bond allocation. Further, portfolios that follow a bonds first withdrawal strategy (i.e., increasing equity allocation throughout retirement) seem to have the higher probabilities of sustainability than either constant allocation or glidepath withdrawal strategies.[2] (Spitzer and Singh (2007), Blanchett (2007), Liu, Chang, De Jong, and Robinson (2008))

These related research findings cast doubt on the wisdom of any accumulation strategy that brings all investors to a single asset allocation at retirement. As a practical matter, it seems illogical that an investor who has followed a glidepath strategy to a 50:50 allocation at retirement might then be required to immediately increase his equity allocation to a 60:40 or 70:30 allocation to accommodate an optimal withdrawal strategy. Since this paper has shown that constant allocation models may produce higher risk-adjusted returns for investors throughout the retirement savings accumulation phase than glidepath models, it seems more practical and advisable for investors to simply select a constant allocation model ranging between 60:40 and 80:20 stocks:bonds and to maintain this allocation until retirement.[3] Upon retirement, investors will likely have more accumulated savings than they would have under a glidepath strategy, and

[2] The initial reliance on the bond portion of the portfolio for income may account for the higher probabilities of success under this model, since spending down the bonds may enable investors ride out negative returns early in retirement (i.e., mitigate or avoid serial returns risk).

[3] Model selection would likely depend upon individual risk tolerance and whether the investor believes he his on track for or behind in saving for retirement.

the allocation at retirement will likely be closer to their required optimum as they enter the withdrawal phase.

To summarize, in comparing a glidepath model to various constant allocation models over a range of retirement accumulation periods, a primary goal of this paper has been to shed light on whether the surge in popularity of target date funds in 401(k) plans is justified. Insofar as the broad diversification and disciplined rebalancing strategies employed in these funds represent an improvement over the haphazard heuristic tendencies of investors who would otherwise self-direct their retirement allocations, it is probably safe to say that target date funds have been a boon to investors. However, to the extent that the widespread adoption of target date funds represents a shift away from constant allocation “lifestyle” fund portfolios, this study suggests that the selection of target date funds may be sub-optimal. In addition, by exposing the inconsistencies in the glidepath model as a retirement planning strategy and by illustrating the superior risk-adjusted returns of the constant allocation models, this paper may also represent an important step toward bridging the gap between retirement accumulation planning and lifetime income sustainability in the withdrawal phase of the investment lifecycle.

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Table 1: Descriptive Statistics for Monthly Returns
(Sample Period: January 1970 - December 2008)

	S&P 500	Russell 2000	EAFE	10 Year Treasury	CPI - U	Diversified Equity	3 Month T-Bills
Mean	0.008621	0.014197	0.008830	0.007280	0.003693	0.010346	0.004839
Median	0.011085	0.013295	0.010172	0.006329	0.003169	0.013553	0.004446
Maximum	0.168113	1.241756	0.178742	0.099993	0.018100	0.472837	0.013583
Minimum	-0.215795	-0.322896	-0.202386	-0.066819	-0.016718	-0.223936	0.000025
Std. Dev.	0.044801	0.106568	0.048748	0.023544	0.003375	0.051621	0.002428
Skewness	-0.479119	4.194221	-0.345869	0.350977	0.126968	1.211972	0.871036
Kurtosis	5.236080	45.366240	4.302156	4.242956	7.089190	17.864200	4.310469

Lifestyle Four Asset Portfolio

	Bonds 10%	Bonds 20%	Bonds 30%	Bonds 40%	Bonds 50%
Mean	0.010039	0.009733	0.009426	0.009120	0.008813
Median	0.012261	0.011209	0.010329	0.008730	0.008244
Maximum	0.426422	0.380007	0.333592	0.287178	0.240763
Minimum	-0.195858	-0.167780	-0.146391	-0.129562	-0.112734
Std. Dev.	0.046810	0.042142	0.037670	0.033473	0.029669
Skewness	1.211460	1.198288	1.163917	1.095763	0.978487
Kurtosis	17.370770	16.609010	15.462370	13.797850	11.535910

Notes:

(1) The Diversified Equity Portfolio consists of 45% invested in the S&P 500 Index, 30% invested in the Russell 2000 Index, and 25% invested in the MSCI EAFE Index.
(2) The Lifestyle Four Asset Portfolios consist of a constant bond to equity allocation with the bond portion invested in the 10 year Treasury Bonds and (1 - bond weight) invested in the Diversified Equity portfolio.
(3) Since the Russell 2000 Index started in 1978, we use the bottom quintile, by market capitalization, of NYSE stocks as our proxy for small and midcap stocks from 1970 to 1978 as suggested by Siegel (2007).
(4) The start of our sample in 1970 corresponds with the inception of the MSCI EAFE Index for our international equity portfolio.

Table 2: Portfolio Accumulated Balances after Investing $1,000 Per Month

Years to Retirement	Percentile	Target Fund	Lifestyle Funds: Constant Stock:Bond Allocation 100%:0%	90%:10%	80%:20%	70%:30%	60%:40%	50%:50%
40 Years	Maximum	$93,224,429	$250,338,154	$228,899,926	$123,633,950	$64,469,900	$89,854,939	$53,337,395
	80th	$12,140,367	$18,886,880	$17,631,785	$15,000,921	$13,398,694	$11,785,398	$10,343,637
	60th	$8,341,065	$10,960,838	$10,356,405	$9,571,642	$8,838,800	$8,133,925	$7,495,316
	Median	$7,059,035	$8,587,776	$8,413,324	$7,897,405	$7,489,726	$7,017,052	$6,586,075
	40th	$6,052,246	$6,959,344	$6,801,533	$6,610,600	$6,291,218	$6,134,941	$5,785,773
	20th	$4,233,108	$4,128,667	$4,280,079	$4,328,706	$4,289,397	$4,442,374	$4,310,679
	Minimum	$1,043,585	$325,990	$539,914	$825,603	$852,584	$1,319,209	$1,198,669
	Mean	$8,901,851	$13,679,477	$12,473,605	$10,636,795	$9,483,064	$8,617,084	$7,658,886
	Std. Dev.	$6,685,624	$16,299,080	$13,868,382	$9,378,764	$7,149,085	$5,945,886	$4,361,097
	Sharpe Ratio	1.0474	0.7228	0.7625	0.9316	1.0608	1.1298	1.3207
30 Years	Maximum	$23,807,095	$73,080,616	$30,852,664	$29,393,641	$21,973,318	$18,073,660	$12,040,619
	80th	$3,672,996	$5,305,744	$5,097,924	$4,437,230	$4,101,482	$3,701,870	$3,396,772
	60th	$2,739,370	$3,416,264	$3,342,732	$3,073,301	$2,926,016	$2,778,724	$2,616,392
	Median	$2,398,234	$2,837,715	$2,781,172	$2,638,333	$2,529,480	$2,459,889	$2,351,533
	40th	$2,108,175	$2,362,240	$2,355,536	$2,274,566	$2,191,089	$2,186,076	$2,104,443
	20th	$1,588,215	$1,563,144	$1,607,738	$1,624,296	$1,615,221	$1,659,158	$1,649,785
	Minimum	$475,981	$238,295	$281,789	$407,405	$342,197	$635,154	$597,102
	Mean	$2,769,978	$3,866,011	$3,635,639	$3,237,429	$3,018,933	$2,811,906	$2,608,586
	Std. Dev.	$1,565,105	$3,666,699	$2,891,993	$2,230,442	$1,894,739	$1,520,429	$1,215,604
	Sharpe Ratio	1.1482	0.7890	0.9207	1.0153	1.0799	1.2096	1.3456
20 Years	Maximum	$4,236,577	$11,130,334	$10,022,915	$5,618,821	$8,720,794	$4,066,487	$2,994,907
	80th	$1,030,290	$1,413,924	$1,362,135	$1,244,368	$1,180,227	$1,107,019	$1,035,269
	60th	$839,297	$1,015,309	$981,199	$952,166	$916,532	$878,346	$843,795
	Median	$762,584	$873,484	$864,745	$845,452	$823,102	$810,816	$776,173
	40th	$696,798	$756,456	$761,887	$753,745	$738,479	$736,277	$711,781
	20th	$569,119	$554,195	$570,468	$582,601	$580,895	$595,234	$589,650
	Minimum	$229,436	$122,406	$169,393	$182,922	$228,684	$258,042	$294,887
	Mean	$821,975	$1,063,433	$1,021,127	$955,104	$911,590	$875,727	$829,402
	Std. Dev.	$313,641	$740,683	$615,889	$489,881	$429,728	$352,929	$295,027
	Sharpe Ratio	1.1739	0.8231	0.9212	1.0233	1.0653	1.1955	1.2731
10 Years	Maximum	$492,627	$1,003,718	$931,165	$753,064	$660,397	$708,905	$467,759
	80th	$236,080	$300,050	$284,485	$279,075	$268,090	$259,640	$250,722
	60th	$207,106	$241,025	$234,682	$231,862	$228,076	$223,004	$219,494

Median	$196,215	$218,356	$215,746	$215,504	$212,428	$210,033	$207,554
40th	$185,976	$198,814	$199,986	$199,819	$198,893	$198,167	$197,480
20th	$164,373	$162,279	$166,338	$170,494	$171,553	$173,857	$174,936
Minimum	$95,412	$60,734	$61,861	$87,510	$98,854	$96,173	$102,610
Mean	$202,295	$237,545	$232,344	$228,348	$223,327	$219,077	$214,448
Std. Dev.	$46,167	$95,119	$83,988	$72,151	$63,476	$55,265	$46,978
Sharpe Ratio	0.8521	0.7842	0.8261	0.9063	0.9511	1.0155	1.0961

Notes:

(1) The Diversified Equity Portfolio consists of 45% invested in the S&P 500 Index, 30% invested in the Russell 2000 Index, and 25% invested in the MSCI EAFE Index.

(2) The Lifestyle Four Asset Portfolios consist of a constant bond to equity allocation with the bond portion invested in the 10 year Treasury Bonds and (1 - bond weight) invested in the Diversified Equity portfolio.

(3) Since the Russell 2000 Index started in 1978, we use the bottom quintile, by market capitalization, of NYSE stocks as our proxy for small and midcap stocks from 1970 to 1978 as suggested by Siegel (2007).

(4) The start of our sample in 1970 corresponds with the inception of the MSCI EAFE Index for our international equity portfolio.

(5) $1,000 is invested in the accumulation portfolio at the beginning of each month during the sample period, with the proportions determined by the beginning of the year weights for the bond and equity components.

(6) The Target Fund follows a glidepath that increases the portfolio weight in bonds by 1% each year and decreases the portfolio weight in equities by 1% each year. The Target Fund is 90% equities and 10% bonds 40 years prior to retirement, 80% equities and 20% bonds 30 years prior to retirement, 70% equities and 30% bonds 20 years prior to retirement, 60% equities and 40% bonds 10 years prior to retirement, and 50% equities and 50% bonds at retirement.

(7) All portfolios are rebalanced annually to maintain the target equity vs. bond weights as well as the diversified equity weights listed in Note (1).

(8) A risk-free accumulation balance is computed using the average 3-month Treasury bill rate over our sample period, which is 5.8068% on an annualized basis. Combining this average interest rate with our $1,000 investment results in

Years to Retirement	Risk-Free Accumulated Balance
40 Years	$1,899,287
30 Years	$972,869
20 Years	$453,795
10 Years	$162,957

(9) Our Sharpe Ratio is computed as (Mean Accumulated Balance - Risk-Free Accumulated Balance) / Standard Deviation of the Accumulated Balance, as computed for the designated number of years prior to retirement.

(10) The bootstrapping algorithm samples with replacement from the 468 months of data from January 1970 to December 2008. To maintain the normal cross-sectional correlations, the monthly returns for our 10 year bond index, our 3 equity indices, and our monthly inflation rate are drawn together from the same randomly selected month with our bootstrapping algorithm.

Table 3: Target Fund Portfolio Accumulated Balances after Investing $1,000 Per Month

Years to Retirement	Percentile	Number of Bootstrap Samples 10,000	5,000	2,500	1,000
40 Years	Maximum	$111,315,043	$93,224,429	$64,962,622	$70,832,752
	80th	$12,355,367	$12,140,367	$11,891,200	$12,527,676
	60th	$8,348,594	$8,341,065	$8,314,796	$8,663,176
	Median	$7,098,008	$7,059,035	$7,096,318	$7,460,058
	40th	$6,051,275	$6,052,246	$6,078,538	$6,401,644
	20th	$4,212,761	$4,233,108	$4,224,923	$4,327,520
	Minimum	$986,238	$1,043,585	$1,037,428	$1,270,376
	Mean	$8,907,606	$8,901,851	$8,699,707	$9,166,581
	Std. Dev.	$6,608,803	$6,685,624	$6,167,138	$6,991,933
	Sharpe Ratio	1.0605	1.0474	1.1027	1.0394
30 Years	Maximum	$24,120,929	$23,807,095	$12,177,169	$18,111,275
	80th	$3,638,500	$3,672,996	$3,622,981	$3,767,530
	60th	$2,684,726	$2,739,370	$2,677,492	$2,723,913
	Median	$2,375,791	$2,398,234	$2,359,717	$2,380,078
	40th	$2,093,922	$2,108,175	$2,099,414	$2,100,731
	20th	$1,583,578	$1,588,215	$1,577,416	$1,521,273
	Minimum	$464,103	$475,981	$636,977	$677,281
	Mean	$2,743,424	$2,769,978	$2,707,214	$2,769,590
	Std. Dev.	$1,563,520	$1,565,105	$1,446,844	$1,629,177
	Sharpe Ratio	1.1324	1.1482	1.1987	1.1028
20 Years	Maximum	$3,688,578	$4,236,577	$3,816,117	$3,155,577
	80th	$1,037,850	$1,030,290	$1,025,697	$1,006,829
	60th	$840,438	$839,297	$834,550	$831,857
	Median	$767,176	$762,584	$751,848	$762,923
	40th	$699,311	$696,798	$686,077	$695,282
	20th	$576,111	$569,119	$570,542	$578,123
	Minimum	$209,449	$229,436	$266,616	$246,254
	Mean	$828,356	$821,975	$825,850	$813,856
	Std. Dev.	$319,352	$313,641	$329,490	$302,301
	Sharpe Ratio	1.1729	1.1739	1.1292	1.1911
10 Years	Maximum	$1,113,436	$492,627	$431,485	$416,373
	80th	$235,287	$236,080	$236,987	$235,241
	60th	$206,609	$207,106	$204,892	$207,772
	Median	$195,789	$196,215	$193,556	$197,584
	40th	$186,038	$185,976	$184,552	$187,923
	20th	$165,471	$164,373	$164,504	$166,176
	Minimum	$96,036	$95,412	$103,964	$103,312
	Mean	$202,516	$202,295	$202,030	$202,496
	Std. Dev.	$46,417	$46,167	$45,952	$44,160
	Sharpe Ratio	0.8523	0.8521	0.8503	0.8953

Notes: Independent bootstrapping samples of various sizes are drawn using our Target Funds, as defined in Table 2, to show the robustness of our results using 5,000 bootstrap samples.