"Lifecycle Funds and Wealth Accumulation for Retirement: Evidence for a More Conservative Asset Allocation as Retirement Approaches"

by

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Abstract

A line of recent studies cast doubt on the efficacy of the lifecycle investment strategy, which calls for switching into a more conservative investment portfolio as retirement approaches, as a suitable way to provide for the retirement needs of workers with defined-contribution pensions. After comparing simulation outcomes for lifecycle and fixed asset allocation strategies, we determine that the lifecycle strategy can be justified even in a framework including only financial wealth. We find that investors with very reasonable amounts of risk aversion may prefer the lifecycle approach, despite the tendency for aggressive fixed allocation strategies to produce larger expected wealth.

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1. Introduction

Since the Pension Protection Act of 2006 added them as one of three default options for employer defined-contribution pension plans, lifecycle or target-date funds (TDFs) have experienced rapid growth in their popularity and use. A Financial Research Corporation report notes that they grew from $8.2 billion in assets at the end of 2000 to $183 billion at the end of 2007 (Halonen, 2009). A report from Cerulli Associates in October 2008 indicates that they are on track to accumulate $1.1 trillion in assets by 2012 (Shidler, 2008). This investment style has been promoted as a simple solution for retirement savers to invest their savings with a hands-off approach.

The lifecycle asset allocation strategy involves allocating a high proportion of one's assets to equities during the early period far away from the target date, and gradually shifting to more conservative assets, such as bonds and bills, as the target date approaches. But beyond this vague general definition, there is little agreement about what constitutes an appropriate asset allocation for TDFs at different points of time before the target date. Especially, as a result of the financial crisis, this investment approach has received criticism for not being conservative enough. Target-date funds may confuse investors because there are no clear guidelines, and equity allocations for some target-date funds were thought to be too high for soon-to-be retirees. In 2008, Morningstar reported a range in equity allocations for 2010 TDFs from 29 percent to 65 percent. Noting a 2010 retirement target-date fund 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 concerns notwithstanding, some academic studies have criticized target-date funds for not being aggressive enough. Such studies argue that maintaining a higher allocation to stocks near retirement improves the chances of having a larger wealth accumulation to enjoy in retirement. For instance, Schleef and Eisinger (2007) use a Monte Carlo simulation and find that four different stylized TDFs provide an equal or lesser chance of reaching a retirement wealth target than does a constant 70/30 allocation to stocks and corporate bonds. They define shortfall risk as the probability of not accumulating as much as the predetermined wealth goals, and with this criterion they provide justification for keeping a high equity allocation near the target date, in contrast with the approach of lifecycle funds. They note that "the data suggest that the presumed advantages of minimizing equity allocations over time is a dubious one" (page 242).

With a different source for their justification, Basu and Drew (2009) also argue that reducing equity allocations as retirement approaches is counterproductive to the retirement saving goals of typical individual investors. They attribute this to the portfolio size effect, an idea stemming from Shiller (2005) indicating that most of the portfolio growth for an individual will occur late in their career when there is more absolute wealth that can take advantage of capital gains. Basu and Drew (2009) argue that this leads target-date funds to switch to conservative assets at

precisely the wrong time, missing the main chance for asset growth as the target date approaches. Instead, unless an investor has already saved a sufficient amount to finance a comfortable retirement (which does not represent the situation of a typical saver), Basu and Drew argue that a high equity allocation should be maintained in target date funds, a conclusion opposite to the conventional wisdom. They obtain these results by comparing stylized lifecycle strategies to contrarian strategies that become more aggressive, rather than less aggressive, as the target date approaches.

Basu and Drew (2009) do consider risk as well. They examine various percentiles of the wealth distributions from their lifecycle and contrarian strategies. The question is how risk averse someone would need to be to prefer the target-date approach, and Basu and Drew conclude that the degree of risk aversion would be extreme and unrealistic. This is because they compare the cumulative distribution of wealth accumulations for the two investment strategies separately and then make the argument that it is only in the bottom 10 to 15 percent of the distributions from each strategy that the wealth from the lifecycle strategy is higher. But this compares good outcomes with good outcomes, and bad outcomes with bad outcomes. They do not consider the interactions between the lifecycle and contrarian investment strategies, and thus they do not take the analysis far enough.

Another study which compares a lifecycle and fixed strategy is Pang and Warshawsky (2008). They consider two of the qualified default investment alternatives of the Pension Protection Act of 2006: a lifecycle fund and a balanced fund. Each is defined in terms of the average allocations for these respective approaches offered by various fund managers in the marketplace. The lifecycle fund begins 40 years before the target date with a stock allocation of 88 percent, and its stock allocation at the target date is 30 percent. The balanced fund is invested 66 percent in stocks, 26.4 percent in bonds, and 7.6 percent in bills. Pang and Warshawsky provide the most nuanced analysis thus far, noting that while the balanced fund produces larger expected wealth, the lifecycle fund does a better job of safeguarding wealth near retirement.

In this regard, our study is most similar to Pang and Warshawsky, though our contribution to the literature is to provide a more careful quantification of the tradeoff between the larger expected returns of aggressive fixed strategies and the potential safety provided by lifecycle strategies. Our findings will tend to support the use of target date funds. We argue that it is important to focus on more than just meeting a particular goal for retirement. The simulation approaches used by studies such as Schleef and Eisinger (2007) and Basu and Drew (2009) provide an entire distribution of wealth outcomes, and researchers have an opportunity to take advantage of all this information. The basic issue is this: For someone whose goal is to maximize their mean or median wealth accumulations at their retirement date, then it is clear from historical trends that the best chance for success is to maintain a high equity allocation near retirement, in contrast with the general philosophical approach of target-date funds. A risk averse individual, however, may have a different goal, such as minimizing the risk of suffering from extreme hardships in

retirement. Making a "Hail Mary" pass to achieve a wealth accumulation goal by keeping a high allocation to equities may not be appropriate for a risk averse investor. By only focusing on the probability of meeting the goal, Schleef and Eisinger (2007) ignore this point.

We argue it is more helpful to examine the relative performance of the lifecycle strategies and the fixed allocation strategies across the simulations. After expanding from previous papers to make these comparisons, we will then quantify the degree of risk aversion necessary for an investor to enjoy higher expected utility from lifecycle strategies. We find that investors with very reasonable amounts of risk aversion may prefer the lifecycle approach, despite the tendency for aggressive fixed allocation strategies to produce larger expected amounts of wealth.

2. Literature Review

Different studies have investigated the asset allocation of TDFs both in the accumulation phase before the target date, as well as in the distribution phase after the target date. For studies looking at the accumulation phase, the focus has tended to be on whether TDFs increase the probability reaching a certain retirement wealth goal than do asset allocations that stay fixed over time. We considered some accumulation phase studies above. For an example of a similarly constructed distribution phase study, Spitzer and Singh (2008) conclude that a fixed 50/50 stock/bond strategy outperforms target-date strategies by providing a lower chance of running out of funds during a 30-year retirement period.

Other recent studies, meanwhile, justify the increasingly conservative allocations of TDFs on the basis of considering all aspects of wealth, including financial assets and human capital. This approach is summarized in Ibbotson, Milevsky, Chen, and Zhu (2007). Human capital represents the present discounted value of future labor earnings, and to the extent that labor earnings are less volatile than the stock market, and otherwise not highly correlated with the stock market, young workers already have large wealth holdings in human capital which behaves more like a bond. For diversification purposes, this justifies a larger stock allocation when workers are young, and a smaller stock allocation when workers approach retirement and have shifted most of their wealth from human capital to financial assets. Kyrychenko (2008) extends these models to include housing and private business ownership as well as human capital, and finds that the lifecycle strategy maintains its justification with these additional nonfinancial assets. As we find evidence in support of the lifecycle strategy, our findings fit into the literature which uses this more complete model of lifetime assets, though our conclusions are reached through examining only financial wealth.

2. Methodology

To consider the implications of different investment strategies, we examine 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, and with these assumptions the salary in the final year of work is $186,654.64. These salary amounts are actually not important, though, as we will consider the wealth accumulation outcomes in terms of multiples of the worker's final salary. The worker contributes 9 percent of 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 create four stylized target-date funds, which are shown in Figure 1. In each case, we assume that whatever portion of the fund that is not invested in stocks will be divided 70 percent into bonds and 30 percent into bills. The first lifecycle fund, which is modeled after the T Rowe Price Retirement Funds, maintains a stocks, bonds, and bills allocation of (90 / 7 / 3) for the first 20 years, and then gradually glides in a linear fashion to (55, 31.5, 13.5) by the target date. We call this the "Lifecycle 80" fund, as its average allocation to stocks over the 40 year period is 80.8 percent. We must note, though, that because the portfolio size will tend to grow over time, the weighted average allocation to stocks will tend to be smaller than the simple mean as the allocation to stocks is less in the later years when the portfolio size is larger.

// Figure 1 About Here //

Next, the "Lifecycle 70A" fund experiences a gradual decline away from stocks over the entire 40 year period. The fund begins with an allocation for stocks, bonds, and bills of (90 / 7 / 3), but after the first year it begins descending to its target date allocation of (52.5, 33.25, 14.25). Its average stock allocation over the 40 year period is 70.8 percent. Meanwhile, the "Lifecycle 70B" fund is more conservative than Lifecycle 80, but provides the same general pattern of keeping the initial high equity allocation for twenty years and then changing quickly to a more conservative allocation at retirement. For the first 20 years, its allocation is (85, 10.5, 4.5). Then, after a rapid descent in the final 20 years, it reaches an allocation of (30, 49, 21) by its target date. This fund is roughly similar to the MFS Lifetime Funds, and its average stock allocation is 70.6 percent. Finally, our "Lifecycle 60" fund starts at (90 / 7 / 3) and gradually declines over the 40 years to (32.5, 47.25, 20.25) by the target date. Its average stock allocation is 60.6 percent.

We compare these TDFs with eleven fixed allocation funds which range in 10 percentage point increments from 100 percent stocks to 0 percent stocks. Again, the breakdown for the component of the portfolio not invested in stocks is 70 percent bonds and 30 percent bills. Thus, with our notation, the "Fixed 60/40" fund consists of 60 percent stocks, 0.7 x 40 = 28 percent bonds, and 0.3 x 40 = 12 percent bills.

// Table 1 About Here //

We use a Monte Carlo simulation technique to create asset returns for stocks, bonds and bills. To make the simulations, we use the same historical means, standard deviations, and asset

correlations for US nominal returns data between 1900 and 2000 from Dimson, Marsh, and Staunton (2002), updated through 2004. These values are provided in Basu (2008) and are shown in Table 1. For this historical period, stocks provided an arithmetic mean return of 11.6 percent, with a standard deviation of 20 percent. These high return and high risk values are contrasted with bonds (average return of 5.3 percent with an 8.2 percent standard deviation) and bills (average return of 4.1 percent with a 2.9 percent standard deviation). These three assets provide the potential for diversification benefits due to their low correlations, which range from -0.083 (between stocks and bills) to 0.213 (between bonds and bills). The correlation between stocks and bonds is 0.102. We simulate 10,000 scenarios, each of which consists of returns for the three assets over a 40 year career, using a multivariate lognormal distribution for asset returns (or, more specifically, one plus the asset return), standard deviations, and correlations. 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 with the four lifecycle funds and eleven fixed allocation funds.

Most of our analysis then consists of comparing the wealth accumulations under different investment strategies. After providing this comparative analysis, we then estimate the expected utility from different strategies using a standard constant relative risk-aversion utility function:

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

in which w_i represents the wealth accumulation at retirement in each of N=10,000 simulations. In the case that γ=1, the utility is defined instead as the natural logarithm of wealth. This is a standard way to evaluate the utility provided by wealth (see, for instance, the review and analysis provided in Ibbotson, Milevsky, Chen, and Zhu (2007); Milevsky (2006); and Azar (2006)).

Utility provides a more enriched way to compare investment strategies than does just comparing the accumulated wealth. This is because a useful way to interpret the utility function is that it accounts for the diminishing returns from wealth that people experience. An extra $10,000 of savings will tend to provide more utility to someone with only $50,000 of savings than to someone with $500,000 of savings. In this framework, larger values for γ indicate that the investor experiences relatively less gains in utility as their wealth increases, compared to the case with a lower value for γ.

Another equally important and more fundamental interpretation of γ in the utility function is that it represents the coefficient of risk aversion, providing a measure of an individual's attitude toward risk taking. 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. The majority of

studies use a value in this range, and where there is a disagreement, it is generally among those who believe that risk aversion is even greater. We calculate the expected utility for each strategy as the mean utility from the 10,000 simulations and then rank the investment strategies based on the expected utility they provide for various risk aversion coefficients. This approach provides a quantitative way to consider the tradeoff between the higher expected wealth those more aggressive strategies provide and the greater security against bad outcomes than more conservative strategies provide. The greater the degree of risk aversion, the more importance the individual will place on the potential security provided by a more conservative strategy. The utility function provides a formal way to evaluate these tradeoffs.

3. Results

Our comparison of lifecycle and fixed asset allocations begins with Table 2, which shows characteristics of the distributions for wealth accumulations at retirement, expressed as multiples of final year salary ($184,654.64). For each of the 4 lifecycle strategies and 11 fixed strategies, we consider the mean and median wealth accumulations, as well as the 5^{th}, 25^{th}, 75^{th}, and 95^{th} percentiles. Because the average expected returns for stocks is larger than for bonds or bills, the average wealth accumulations naturally increase as the stock allocation increases. For the Fixed 100/0 fund, the mean wealth accumulation is 21.5 times final salary, which represents $3.97 million. Allocating no assets to stocks, however, results in a mean accumulation of only 4.5 times final salary. The means for the lifecycle strategies fall a little below the fixed strategies with the same average stock allocation. This is reasonable to expect, since as we indicated, the actual weighted average allocation to stocks in lifecycle funds will vary between simulations, but will tend to be smaller than the simple average because portfolios will tend to be larger near retirement when stock holdings are less. Essentially, the mean wealth accumulations are ranked by the weighted lifetime expected portfolio returns.

// Table 2 About Here //

Because the wealth accumulations are lognormally distributed, the means are larger than the medians, which represent the wealth accumulation with a 50 percent chance for a smaller accumulation and a 50 percent chance for a larger accumulation. These median values are also ordered with respect to the weighted lifetime stock allocation, with the Fixed 100/0 fund producing a median wealth accumulation of 14.6 times final salary, and the Fixed 0/100 fund producing a median accumulation of 4.4 times final salary. Again, the medians for the lifecycle strategies are close to the corresponding fixed allocation strategies. The same general patterns apply for other percentiles in the table except for the 5^{th} percentile of outcomes. Here we can observe that the four lifecycle strategies all enjoy higher accumulations than any of the fixed strategies, though in general the 5^{th} percentile accumulations are all relatively close to one another. This is the first instance we see that the lifecycle funds may provide some protection from extremely bad outcomes.

// Figure 2 About Here //

Figure 2 provides a contour map of the wealth accumulations at retirement for several different pairs of strategies. It shows the relative performance of different strategies for each of the 10,000 simulations. In order to better examine the area where most points lie, any wealth accumulations above 25 times final salary were re-assigned this value when making the figure. Above the 45 degree line are situations in which the lifecycle strategy on the y-axis provides a larger wealth accumulation at the target date than the fixed strategy on the x-axis, while the opposite is the case for points below the 45 degree line. The Lifecycle 80 strategy is compared with the Fixed 80/20 strategy, then the Lifecycle 70A strategy is compared with the Fixed 70/30 strategy, and then the Lifecycle 80 strategy is compared with the Fixed 100/0 strategy.

The same general trends are found in each part of the figure. These include, first, that more than half of the observations fall below the 45 degree line, as with all of these pairs there is a higher probability that the fixed strategy provides a larger wealth accumulation than the lifecycle strategy. For instance, with the Lifecycle 80 and Fixed 80/20 strategies, the lifecycle strategy provides more wealth 44.2 percent of the time, and the fixed strategy provides more wealth 55.8 percent of the time. In the second and third cases, the fixed strategies provide more wealth 63.1 and 84.1 percent of the time, respectively. But the next feature to note in each of these cases is that the area with low wealth accumulations tends to show that the lifecycle strategy provides more wealth. Whenever both strategies produce less than 5 times the final salary, the lifecycle strategy tends to do better than the fixed strategy. This illustrates the potential security provided by the lifecycle strategy. A third feature, on the other hand, is that when the strategies provide large wealth accumulations, the fixed strategy tends to provide greater wealth than the lifecycle strategy. This is most obvious in the bottom part of the figure, as the Fixed 100/0 strategy produces a long tail of wealth accumulations over 25 times final salary which match Lifecycle 80 accumulations that are generally in the range between 15 and 25 times final salary. A final characteristic noted from this figure is that the most likely wealth accumulation points do tend to occur near the 45 degree line in the range between 5 and 10 times final salary. By comparing the relative performance of different lifecycle and fixed strategies, we find that the area above the 45 percent line is potentially important and so it is worthwhile to quantify whether the potential insurance provided by the lifecycle strategy is worth sacrificing some of the potentially larger gains of the fixed strategies.

// Figure 3 About Here //

Before quantifying these tradeoffs, Figure 3 provides a different way to compare strategies by showing their probability of meeting various target date wealth accumulation goals. The goal is defined as arriving at retirement with at least as much wealth as is represented by the multiple of final salary shown on the x-axis. As described, these results assume a constant 9 percent savings rate over 40 years. Saving more or working longer would naturally shift these curves to the right,

as working or saving less would shift them to the left. The actual wealth goal for an individual will depend on personal circumstances, including factors such as access to Social Security or other defined-benefit pensions, retirement spending goals, and so on. For a given savings plan, though, conservative investment strategies provide higher probabilities of achieving lower levels of wealth. But at some point a crossover occurs in which enjoying a bigger chance to achieve greater wealth requires a more aggressive strategy.

The lifecycle funds provide a higher probability of success for wealth accumulation goals up to about 5 to 5.5 times final salary. This range is where the crossovers occur such that more ambitious wealth goals require aggressive fixed strategies. At these crossover points, the various strategies provide more than a 90 percent chance of success, though by this point the success rates of the most conservative fixed strategies have fallen dramatically. The figure shows how the success rates decline as the retirement wealth goal increases, and it also provides comparisons between the lifecycle and fixed strategies. To provide some idea of these comparisons, consider a retirement wealth goal of 15 times final salary. The best chance for success (which is just under 50 percent) comes from the Fixed 100/0 fund. The results are then ordered based on the weighted average allocation to stocks over the worker's career. The Fixed 90/10 fund provides a 43 percent chance for success, followed by the Fixed 80/20 fund with 37 percent. The Lifecycle 80 fund is next with a 35 percent chance of success, and these success rates continue to decline until the Fixed 0/100 fund, which has virtually no chance for success.

We show Figure 3 because it provides a style of comparison used by Schleef and Eisinger (2007) to justify maintaining more aggressive strategies near the target date. The findings of Schleef and Eisinger (2007) follow from this type of figure, as they note that for high retirement wealth targets, the fixed strategies provide a higher chance for success than their four stylized lifecycle strategies. Because their wealth accumulation goals were high enough, the fixed strategies with high equity allocations could outperform the lifecycle strategies, the same as is seen in our figure. But they define risk using these types of probabilities, arguing that the lifecycle strategies are riskier because they provide a lower probability of achieving some particular goal. Our next table will attempt to demonstrate why this is not a sufficient definition for risk.

// Table 3 About Here //

The analysis behind Figure 3 contains an underlying assumption that the goal of the retirement saver is to maximize their overall wealth. Next, we explore more about the possibility that the retirement saver wants protection from bad outcomes, such as not having sufficient savings to finance their retirement. In this case, savers may be willing to forgo extreme wealth if it provides a better chance to avoid extreme hardships as well. Likewise, they may not be focused only on meeting a particular numerical wealth goal. In this regard, Table 3 presents our most important findings. It provides the rankings for expected utility produced by the various investment strategies for numerous risk aversion coefficients, using a constant relative risk

aversion utility function for total wealth accumulated at retirement. While a coefficient of zero represents risk neutrality, a coefficient of one is typically viewed as an aggressive investor. Moderate investors may have risk aversion from three up to five, and values of five and higher represent conservative investors. As reviewed in Azar (2006), a large number of studies treat four or five as a reasonably typical baseline risk aversion coefficient for actual investors. With these values in mind, a fundamental message from this table is that lifecycle strategies are quite viable.

Certainly, an investor who is aggressive enough will not have a need for the lifecycle strategy. Table 3 shows that for risk aversion coefficients at 2 or below, an investor can maximize their expected utility by maintaining a 100 percent fixed allocation to stocks through the duration of their career. Beyond this point, we find that one of the lifecycle strategies will maximize utility for investors with risk aversion coefficients between 3 and 10. Most interesting of all, investors with risk aversion coefficients of 4.5 or 5 would actually prefer any of the four lifecycle funds to any of the 11 fixed allocation funds. For an investor with risk aversion of 5, which is often used as a baseline representing a typical mildly-conservative investor, expected utility is maximized with the Lifecycle 70A fund, followed in order by the Lifecycle 70B, Lifecycle 60, and Lifecycle 80 funds. Only then do fixed allocation strategies enter the rankings: 60/40, 70/30, 80/20, 50/50, and so on. The Lifecycle 60 fund maximizes expected utility for risk aversion coefficients shown in the table between 5.5 and 10. The table then jumps to a risk aversion coefficient of 15, and for this value and beyond expected utility is maximized with the Fixed 20/80 fund. These investors are quite conservative and the Lifecycle 60 fund will be too aggressive for their tastes, though it is reasonable to think that a more conservative lifecycle fund could also be fashioned to maximize the utility of these extremely conservative investors as well. We have found that even for mild degrees of risk aversion, the potential ability of the lifecycle strategy to protect wealth near the target date makes it valuable and preferable for savers.

4. Summary and Conclusions

Retirement savers may have a certain goal in mind for how much wealth they aim to accumulate by their retirement date. Unless this goal is relatively modest, or the person has otherwise already saved much more than the 9 percent of salary we assume, more aggressive strategies will tend to provide a higher probability for reaching their goal. But this is not the whole story. A saver who cannot otherwise increase their savings rate or delay their retirement may accept that the goal will not necessarily be reached. It is a somewhat arbitrary number anyway. What becomes important is to find an appropriate tradeoff between expected wealth accumulation at the target date and protection against big losses for the already accumulated wealth. Our use of a utility function reflects this point, and we have found that savers with very reasonable amounts of risk aversion will enjoy higher expected utility from using the lifecycle strategies instead of fixed allocation strategies. This leads us to disagree with the findings in papers such as Schleef and Eisinger (2007) and Basu and Drew (2009), which put more emphasis on the greater wealth

generating abilities of strategies that maintain higher equity allocations near retirement. In this regard, our findings are consistent with, and lend greater support to research which finds justification for the lifecycle strategy by considering both financial and nonfinancial assets.

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Figure 1
Four Stylized Lifecycle Fund Asset Allocations

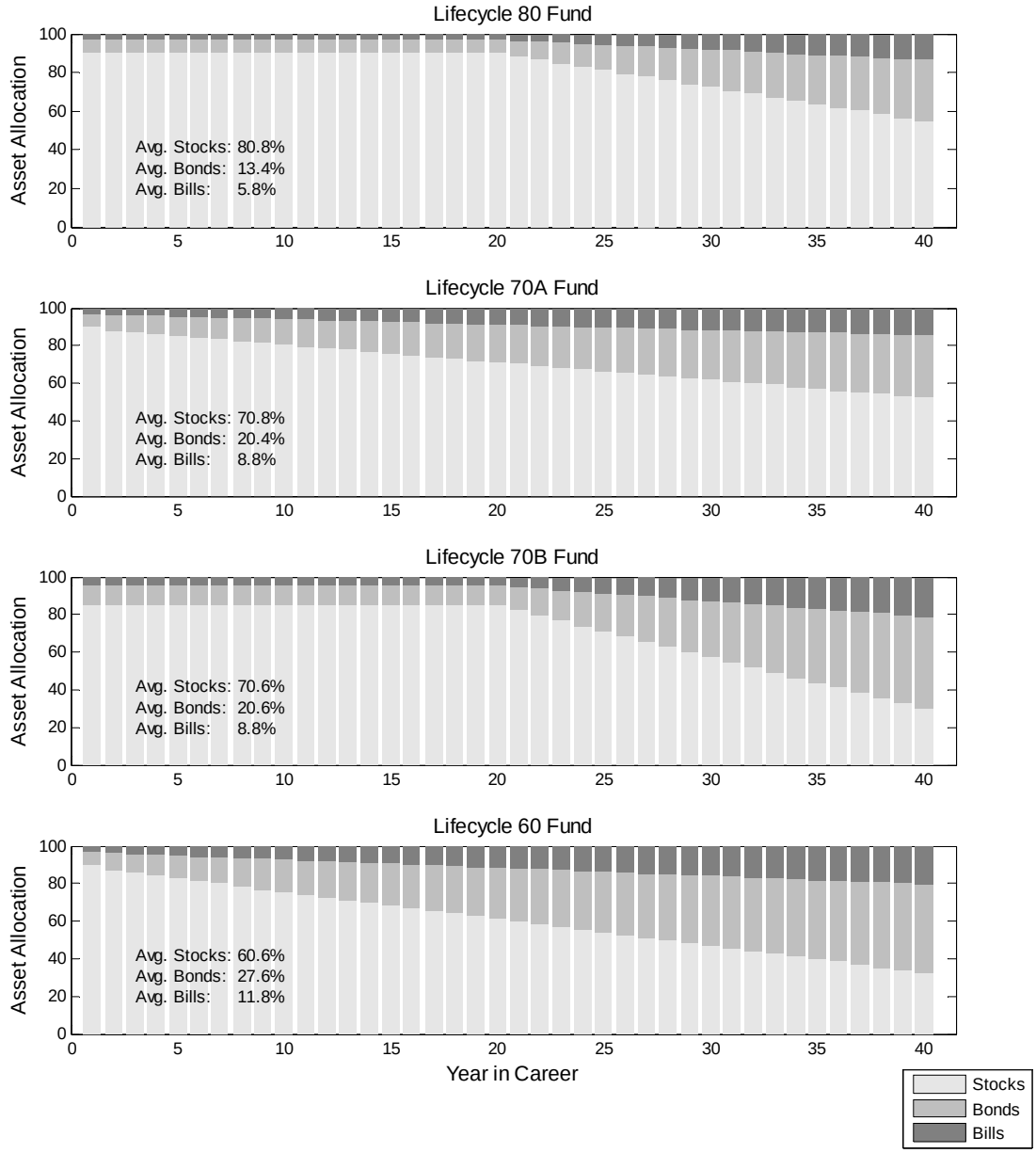
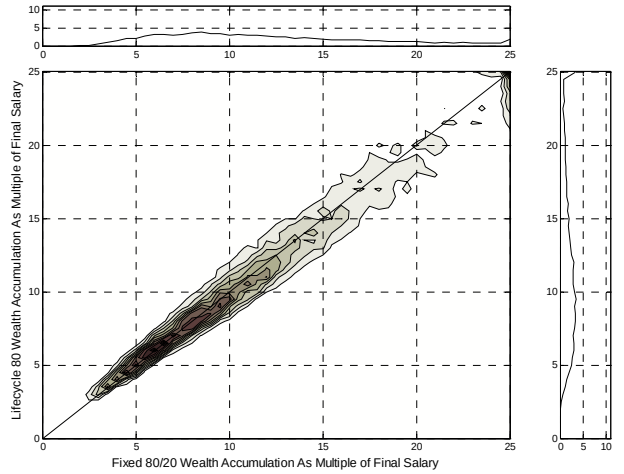
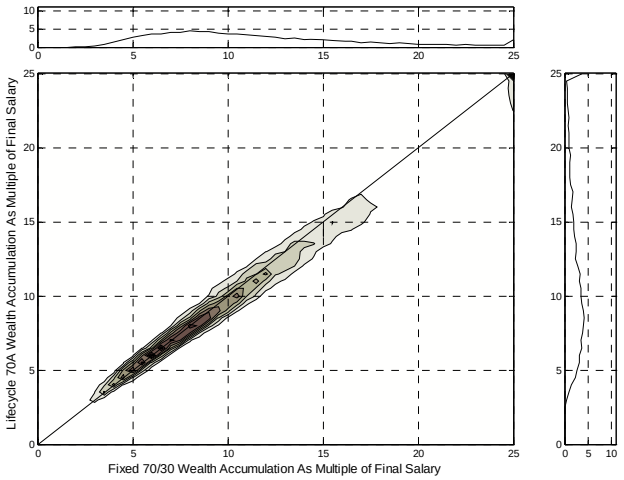


Figure 2
Contour Plots of Target Date Wealth Accumulations for Different Paired Strategies





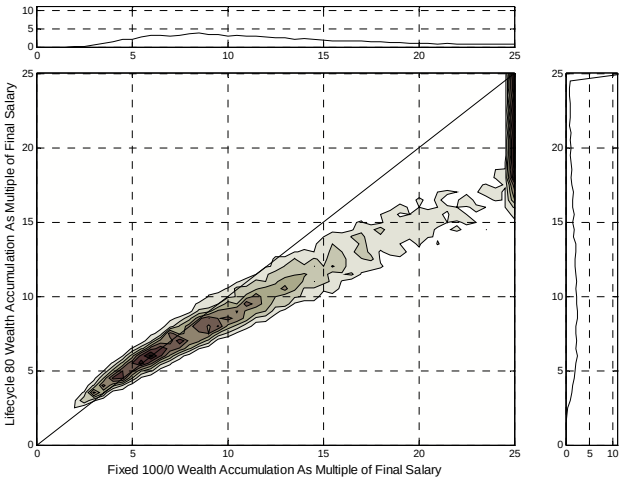


Figure 3
Probability of Achieving Different Target Date Wealth Accumulation Goals

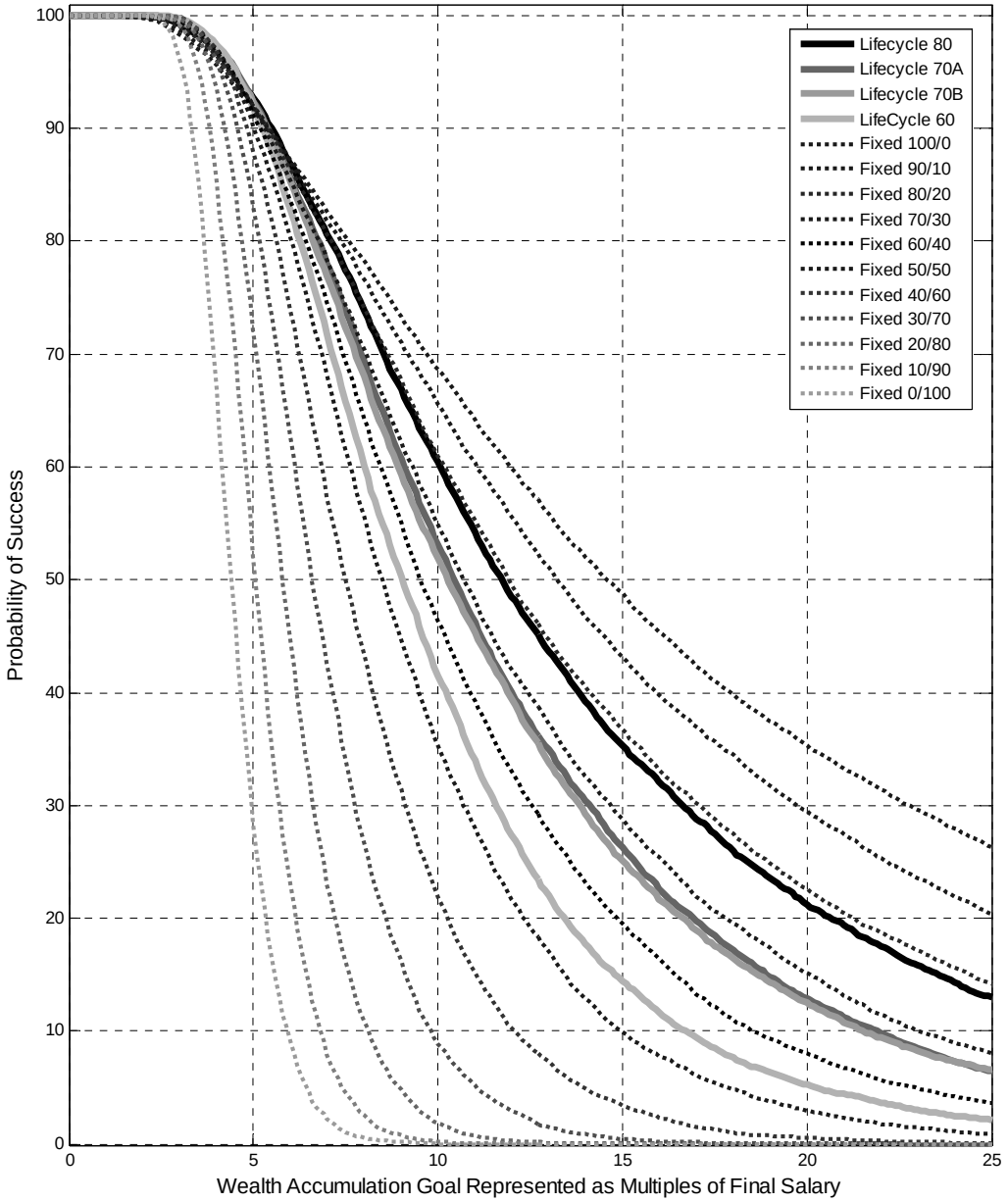


Table 1

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)

Table 2

Wealth Accumulation at the Target Date as a Multiple of Final Salary

Strategy	Mean	5th %tile	25th %tile	Median	75th %tile	95th %tile
Lifecycle 80	15.0	4.5	7.9	11.8	18.4	36.3
Lifecycle 70A	12.5	4.6	7.4	10.5	15.4	27.7
Lifecycle 70B	12.4	4.5	7.2	10.3	15.0	27.4
Lifecycle 60	10.3	4.5	6.7	9.0	12.4	20.3
Fixed 100/0	21.5	4.2	8.7	14.6	25.8	60.8
Fixed 90/10	18.2	4.3	8.3	13.2	22.2	47.7
Fixed 80/20	15.4	4.4	7.9	11.9	18.9	37.6
Fixed 70/30	13.1	4.4	7.4	10.7	16.1	29.3
Fixed 60/40	11.1	4.4	7.0	9.5	13.6	22.9
Fixed 50/50	9.5	4.4	6.5	8.5	11.5	17.9
Fixed 40/60	8.1	4.3	5.9	7.5	9.7	13.9
Fixed 30/70	7.0	4.1	5.4	6.6	8.1	11.1
Fixed 20/80	6.0	3.9	4.9	5.8	6.9	9.0
Fixed 10/90	5.2	3.5	4.4	5.1	5.9	7.4
Fixed 0/100	4.5	3.1	3.8	4.4	5.1	6.4

Table 3

Rankings of Expected Utility for Various Risk Aversion Coefficients

Strategy	0	1	2	3	3.5	4	4.5	5	5.5	6	7	8	9	10	15	20	30	40
Lifecycle 80	4	4	3	1	1	1	3	4	6	7	8	9	9	10	11	11	11	11
Lifecycle 70A	6	6	6	5	2	2	1	1	3	3	5	6	7	7	8	8	8	8
Lifecycle 70B	7	7	7	7	5	3	2	2	2	2	2	4	5	6	7	7	7	7
Lifecycle 60	9	9	9	9	9	6	4	3	1	1	1	1	1	1	4	5	5	5
Fixed 100/0	1	1	1	3	7	10	11	12	13	13	14	15	15	15	15	15	15	15
Fixed 90/10	2	2	2	2	4	8	9	10	11	12	13	13	14	14	14	14	14	14
Fixed 80/20	3	3	4	4	3	5	7	8	9	10	11	12	12	13	13	13	13	13
Fixed 70/30	5	5	5	6	6	4	5	6	7	8	9	10	11	11	12	12	12	12
Fixed 60/40	8	8	8	8	8	7	6	5	4	5	6	7	8	8	9	9	9	9
Fixed 50/50	10	10	10	10	10	9	8	7	5	4	3	3	4	5	6	6	6	6
Fixed 40/60	11	11	11	11	11	11	10	9	8	6	4	2	2	3	3	4	4	4
Fixed 30/70	12	12	12	12	12	12	12	11	10	9	7	5	3	2	2	2	2	2
Fixed 20/80	13	13	13	13	13	13	13	13	12	11	10	8	6	4	1	1	1	1
Fixed 10/90	14	14	14	14	14	14	14	14	14	14	12	11	10	9	5	3	3	3
Fixed 0/100	15	15	15	15	15	15	15	15	15	15	15	14	13	12	10	10	10	10