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Lifecycle funds and wealth accumulation for retirement: evidence for a more conservative asset allocation as retirement approaches

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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. © 2010 Academy of Financial Services. All rights reserved.

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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 TDFs are on track to accumulate $1.1 trillion in assets by 2012 (Shidler, 2008). This

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investment style has been promoted as a simple solution for retirement savers to invest 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. However, 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. TDFs may confuse investors because there are no clear guidelines, and equity allocations for some TDFs 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% to 65%. Noting a 2010 retirement TDF that lost more than 40% 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 TDFs 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. Two studies reaching this conclusion, in particular, are Schleef and Eisinger (2007) and Basu and Drew (2009). Another study that compares lifecycle and fixed investment strategies is Pang and Warshawsky (2008), though these authors provide a more nuanced conclusion by emphasizing the potential safety provided by lifecycle funds that must be compared against the higher expected returns of a riskier investment strategy. Relatedly, though the paper does not consider lifecycle funds, Poterba, Rauh, Venti, and Wise (2005) provide a detailed analysis of the stochastic wealth distribution resulting from several fixed investment strategies. These studies and others will be discussed in greater detail in the following section.

Our study aims to expand on the studies that compare lifecycle and fixed asset allocation strategies during the accumulation phase of a worker's career by more carefully quantifying the tradeoff between the larger expected returns of aggressive fixed strategies and the potential safety provided by lifecycle strategies. In this regard, our approach is most similar to Poterba et al. (2005), though we extend their approach by including lifecycle funds, by including stochastic simulations for three financial assets (stocks, bonds, and bills) rather than just stocks, by ranking various asset allocation strategies according to their expected utility for various risk aversion coefficients, and by also providing a backtest of the different strategies using the historical data.

Our findings tend to provide some support for the use of TDFs. 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 TDFs. A risk averse individual, however, may have a different goal, such as minimizing the risk of suffering from extreme hardships in retirement.

After comparing details of the stochastic wealth distributions provided by different asset allocation strategies, we introduce a utility function to 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. This conclusion must be tempered, though, by the lack of understanding about the precise way that people may evaluate the utility of their wealth, by the consideration that if individuals have other sources of wealth for their retirement such as Social Security and defined-benefit pensions, then they may feel more comfortable taking on greater risk in their defined-contribution pension, and also because backtesting the performance of these strategies with the historical data does allow for a rather convincing case to be made for using a fixed 100% equity allocation throughout one's career.

2. Literature review

This paper considers the accumulation phase in which an individual saves for retirement during their working years and chooses an asset allocation strategy for their portfolio in the hope of holding sufficient wealth at the targeted retirement date to enjoy a comfortable retirement. We create a probability distribution for potential wealth accumulations to compare the attractiveness of various investment strategies, particularly focusing on the relative success of lifecycle and fixed investment strategies. In this regard, our approach synthesizes several strands of the existing research literature.

First, one direction of previous research has been to focus on whether TDFs increase the probability of reaching a certain retirement wealth goal than do asset allocations that stay fixed over time. By focusing the probability of meeting a particular goal, such studies tend not to place much importance on the distribution of outcomes or the likelihood of experiencing a particularly bad outcome. 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" (p. 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 TDFs 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 (that does not represent the situation of a typical saver), Basu and Drew argue that a high equity allocation should be maintained in TDFs, 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% of the distributions from each strategy that the wealth from the lifecycle strategy is higher. However, 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 strategy performance, nor do they attempt to measure the expected utility from the various strategies, and thus they do not take the analysis far enough.

Another study that 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%, and its stock allocation at the target date is 30%. The balanced fund is invested 66% in stocks, 26.4% in bonds, and 7.6% 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.

Though they do not consider target date strategies, Poterba et al., (2005) investigate the distribution of wealth accumulations for three different fixed investment strategies (100% stocks, 50/50 for stocks and bonds, and 100% bonds), and also introduce a standard constant relative risk-aversion utility function as a way to calculate the expected utility provided by various strategies under the assumption that people will experience diminishing marginal utility as their wealth increases. As risk aversion increases, such a utility function will produce more favorable results for an investment strategy that provides protection from extremely adverse outcomes, even if its average performance falls short of what other strategies may provide. Their approach uses the actual lifetime earnings histories for a sample of real workers and also incorporates details about other sources of wealth outside of the defined-contribution pension. They find that such wealth is important, but without considering outside wealth, investors with risk aversion coefficients greater than 4.25 would prefer the bond portfolio, though in their approach the bond portfolio provides a rather unrealistic riskless real return of 2.8%.

Two other studies worth mentioning because of their use of stochastic simulations for asset returns to estimate a distribution of wealth accumulations are Lewis (2008) and Blake, Cairns, and Dowd (2001). Lewis (2008) compares the performance of different lifecycle strategies for a defined-contribution pension against the retirement wealth created by a defined-benefit pension. Blake et al. (2001) investigate the value-at-risk for defined-contribution pensions using a variety of asset-return models and asset allocation strategies. They find that asset allocation plays a more important role than the type of asset-return model, and they find evidence to favor higher equity allocations over a 40 year investment 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 that 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 that uses this more complete model of lifetime assets, though our conclusions are reached through examining only financial wealth.

3. Methodology

To consider the implications of different investment strategies, we examine the case of a hypothetical worker who is saving for retirement. We assume a 4% growth rate in nominal terms for the average wage in the economy, but for our hypothetical worker, wage growth varies according to the scaled earnings pattern developed by Clingman and Nichols (2007) for the Social Security Administration, which provides a set of ratios for the by-age average wage to the overall average wage. These scaling factors account for the fact that younger workers tend to have lower than average wages, and that wages tend to peak in ones 50s and decline gradually as one approaches age 65. We assume that the worker begins working on their 25th birthday, and retires on their 65th birthday, leading to 40 years of employment. We assume that the starting salary of this worker is $30,000, and the salary in the final year of work is $147,320, though these salary amounts are actually not important, as we will consider the wealth accumulation outcomes in terms of multiples of the worker's final salary. The worker contributes 9% of salary, which Poterba, Venti, and Wise (1998) report is the average combined employer/employee contribution rate for 401(k) plans in the United States, to their retirement savings portfolio at the beginning of each year for their 40 year career. 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 TDFs, which are shown in Fig. 1. In each case, we assume that whatever portion of the fund that is not invested in stocks will be divided 70% into bonds and 30% 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

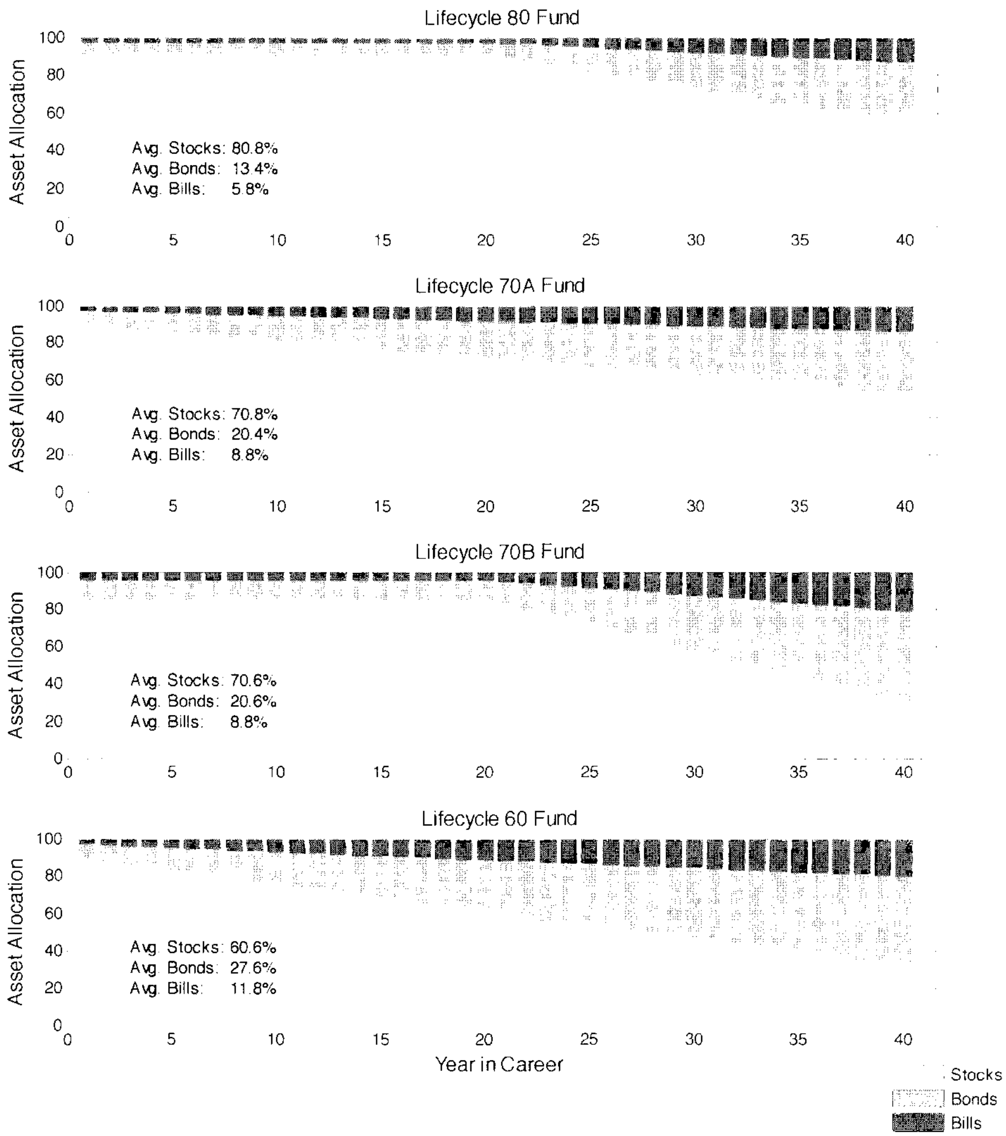

Fig. 1. Four stylized lifecycle fund asset allocations.

call this the "Lifecycle 80" fund, as its average allocation to stocks over the 40 year period is 80.8%. 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.

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%. 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 20 years and then changing quickly to a more conservative allocation at retirement. For the first 20 years, its allocation is (85,

Table 1 Summary statistics for U.S. nominal returns data, 1900–2008

	Arithmetic means	Standard deviations	Correlation coefficients		
			Stocks	Bonds	Bills
Stocks	11.2%	20.2%	1	0.0369	−0.0515
Bonds	5.5%	8.3%	0.0369	1	0.1737
Bills	4.0%	2.8%	−0.0515	0.1737	1

Source: Own calculations from Dimson, Marsh, and Staunton dataset available commercially from Morningstar and Ibbotson Associates.

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%. 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%.

We compare these TDFs with 11 fixed allocation funds that range in 10 percentage point increments from 100% stocks to 0% stocks. Again, the breakdown for the component of the portfolio not invested in stocks is 70% bonds and 30% bills. Thus, with our notation, the "Fixed 60/40" fund consists of 60% stocks, $0.7 \times 40 = 28\%$ bonds, and $0.3 \times 40 = 12\%$ bills.

We use a Monte Carlo simulation technique to create asset returns for stocks, bonds, and bills. To make the simulations, we use the historical means, standard deviations, and asset correlations for U.S. nominal returns data between 1900 and 2008 as calculated from the Dimson, Marsh, and Staunton dataset. These summary statistics are shown in Table 1, and the data are commercially available from Morningstar and Ibbotson Associates. For this historical period, stocks provided an arithmetic mean return of 11.2%, with a standard deviation of 20.2%. These high return and high risk values are contrasted with bonds (average return of 5.5% with an 8.3% standard deviation) and bills (average return of 4% with a 2.8% standard deviation). These three assets provide the potential for diversification benefits because of their low correlations, which range from −0.052 (between stocks and bills) to 0.174 (between bonds and bills). The correlation between stocks and bonds is 0.037. 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 as is done in Poterba et al., (2005):

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

in which w_i represents the wealth accumulation at retirement in each of $N = 10{,}000$ simulations. In the case that $\gamma = 1$, the utility is defined instead as the natural logarithm of wealth. This is a standard way to evaluate the utility provided by wealth (see, for instance, our earlier discussion of Poterba et al., (2005) as well as 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 for someone with only $50,000 of savings than for 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 that 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.

We must make clear at the outset, though, that knowing how individuals assess the utility provided by their wealth accumulation at the target date is a perilous task. As Poterba et al., (2005) note, an essential difficulty is knowing how people evaluate small probabilities of extremely low wealth accumulations. As well, prospect theory and behavioral finance have shown that people behave in ways not fully consistent with the assumptions of standard economic models, and someone who is particularly focused on achieving a specific wealth accumulation may gain more utility from a strategy that maximizes its chances of success, while someone who experiences loss aversion may take particular effort to lessen the risk of seeing their portfolio value drop in the period before retirement. Thus, while our expected utility approach must not be thought of as a way to provide a definitively correct utility measurement, it does at least provide a way to account for the very realistic situation of diminishing returns from wealth, which is an aspect missing in the studies comparing just the mean or median wealth accumulations or the probabilities of reaching certain goals.

Table 2

Wealth accumulation at the target date as a multiple of final salary

Strategy	Mean	5th percentile	25th percentile	Median	75th percentile	95th percentile
Lifecycle 80	18.8	5.8	10.0	14.9	22.7	44.8
Lifecycle 70A	16.0	6.0	9.6	13.5	19.4	34.2
Lifecycle 70B	15.7	6.0	9.4	13.2	19.0	34.1
Lifecycle 60	13.3	6.1	8.9	11.8	16.0	25.5
Fixed 100/0	26.1	5.1	10.6	17.9	31.3	74.1
Fixed 90/10	22.4	5.4	10.4	16.5	27.2	59.2
Fixed 80/20	19.3	5.6	10.0	15.1	23.6	46.9
Fixed 70/30	16.7	5.7	9.6	13.8	20.4	37.1
Fixed 60/40	14.4	5.9	9.1	12.5	17.6	29.1
Fixed 50/50	12.5	5.9	8.6	11.3	15.0	23.1
Fixed 40/60	10.9	5.9	8.1	10.1	12.9	18.4
Fixed 30/70	9.5	5.7	7.5	9.1	11.0	14.7
Fixed 20/80	8.3	5.5	6.8	8.0	9.4	12.0
Fixed 10/90	7.3	5.0	6.1	7.1	8.2	10.2
Fixed 0/100	6.4	4.4	5.4	6.2	7.3	9.1

4. Results

Our comparison of lifecycle and fixed asset allocations begins with Table 2, which shows characteristics of the distributions for wealth accumulation at retirement, expressed as multiples of final salary. For each of the four lifecycle strategies and 11 fixed strategies, we consider the mean and median wealth accumulations, as well as the 5th, 25th, 75th, and 95th percentiles. Because the average expected returns for stocks are 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 26.1 times final salary, which represents \$3.85 million. Allocating no assets to stocks, however, results in a mean accumulation of only 6.4 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.

Because the wealth accumulations are lognormally distributed, the means are larger than the medians, which represent the wealth accumulation with a 50% chance for a smaller accumulation and a 50% 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 17.9 times final salary, and the Fixed 0/100 fund producing a median accumulation of 6.2 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 fifth percentile of outcomes. Here we can observe that the four lifecycle strategies mostly enjoy higher accumulations than any of the fixed strategies, though in general the fifth 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 bad outcomes.

Fig. 2 provides a closer inspection of the bad luck simulation outcomes, in which at least one of the shown strategies produces a wealth accumulation of less than 10 multiples of final salary. In the top part of the figure, the Lifecycle 80 strategy is compared to the Fixed 100/0 strategy, and these cases represent 26.1% of all simulations. Here we can see the downside protection provided by the lifecycle strategy, as points above the 45 degree line represent 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. Particularly when the Fixed 100/0 strategy produces less than six multiples of final salary, for instance, we find that the lifecycle strategy provides up to about 50% more, and these are the situations where the marginal utility from additional wealth will be high. Though weaker, the same generally trend can be found in the bottom part of the figure comparing the Lifecycle 80 strategy to the Fixed 80/20 strategy, in which the bad outcomes shown represent 26.8% of the simulations. Fig. 2 only shows visual evidence, but the utility function will allow us to quantify the potential value of this downside protection.

Before quantifying these tradeoffs, Fig. 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% 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. However, at some point, a crossover occurs in which enjoying a bigger chance to achieve greater wealth requires a more aggressive strategy.

That said, there are essentially two different ways to consider this figure. First, for the perspective of a risk averse investor, suppose someone wishes to find a strategy that provides the highest wealth with a 95% probability. The results are quite close in this range, but only the Lifecycle 60 strategy provides more than six multiples of final earnings with 95% probability. As for strategies which can provide at least 5.8 multiples of wealth with 95% probability, we find that all four lifecycle strategies achieve this, as well as the Fixed 60/40, Fixed 50/50, and Fixed 40/60 strategies. If someone wishes to have more wealth with a 95% probability, it will require a higher contribution rate or a longer working career. As for the case in which someone wishes to have a 90% probability for achieving a particular wealth accumulation, the four lifecycle strategies provide more than seven multiples of final salary, while none of the fixed strategies can provide this much.

As desired wealth accumulations increase and the probability of success falls, strategies maintaining a higher equity allocation eventually take over to provide the highest chance for success. At 8.3 multiples of final earnings, the Fixed 100/0 strategy overtakes the Lifecycle 80 strategy to provide the highest probability of success at just over 83%. This leads to a second way to interpret the figure, which is from the perspective of a risk neutral investor that

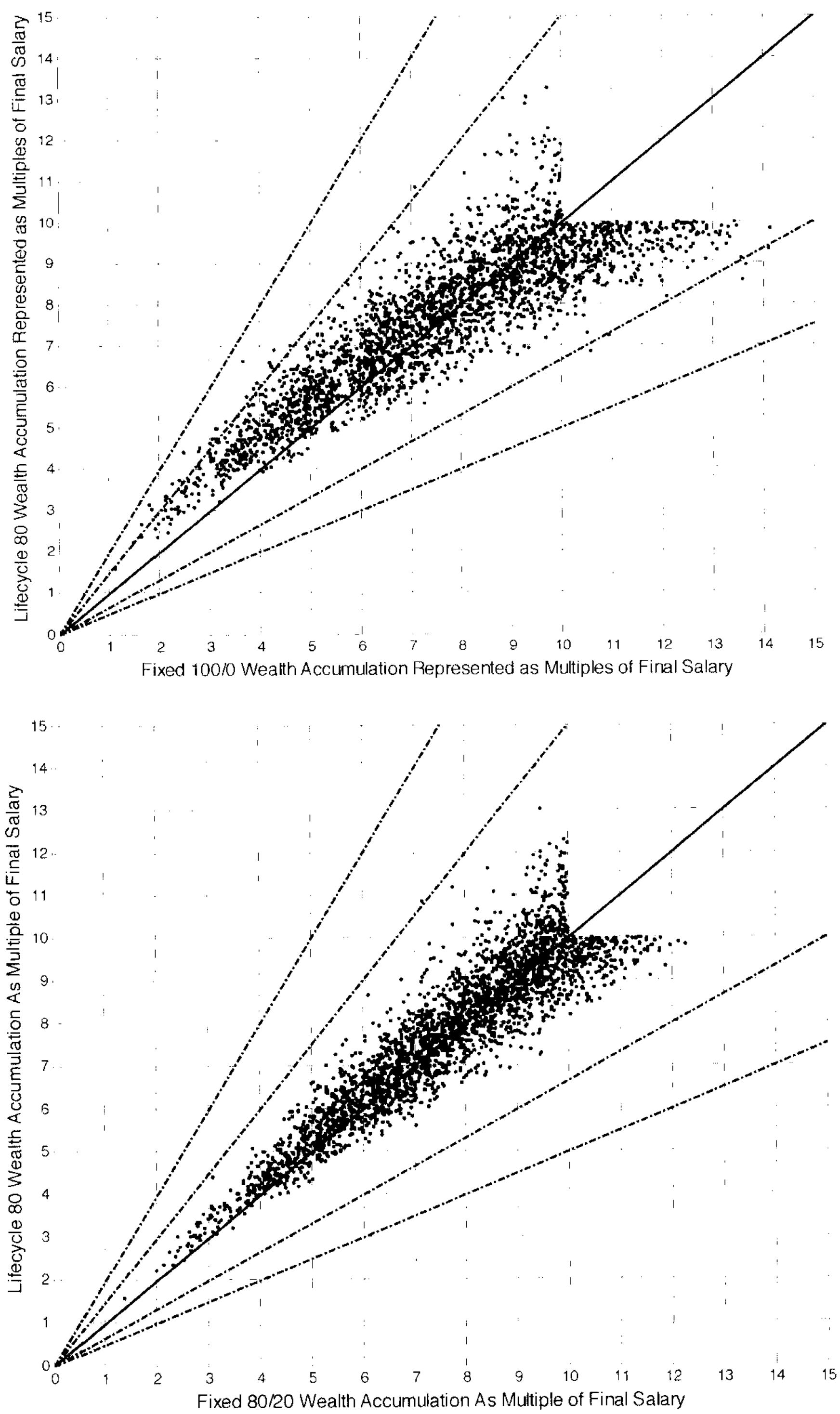

Fig. 2. Comparing paired wealth accumulations when at least one strategy provides less than 10 times final salary.

is more similar to the Schleef and Eisinger (2007) approach. For instance, if the objective is to find the strategy that provides the best chance to accumulate 20 times final salary, then the Fixed 100/0 strategy would be viewed as best, as it provides a 44% chance of success, while

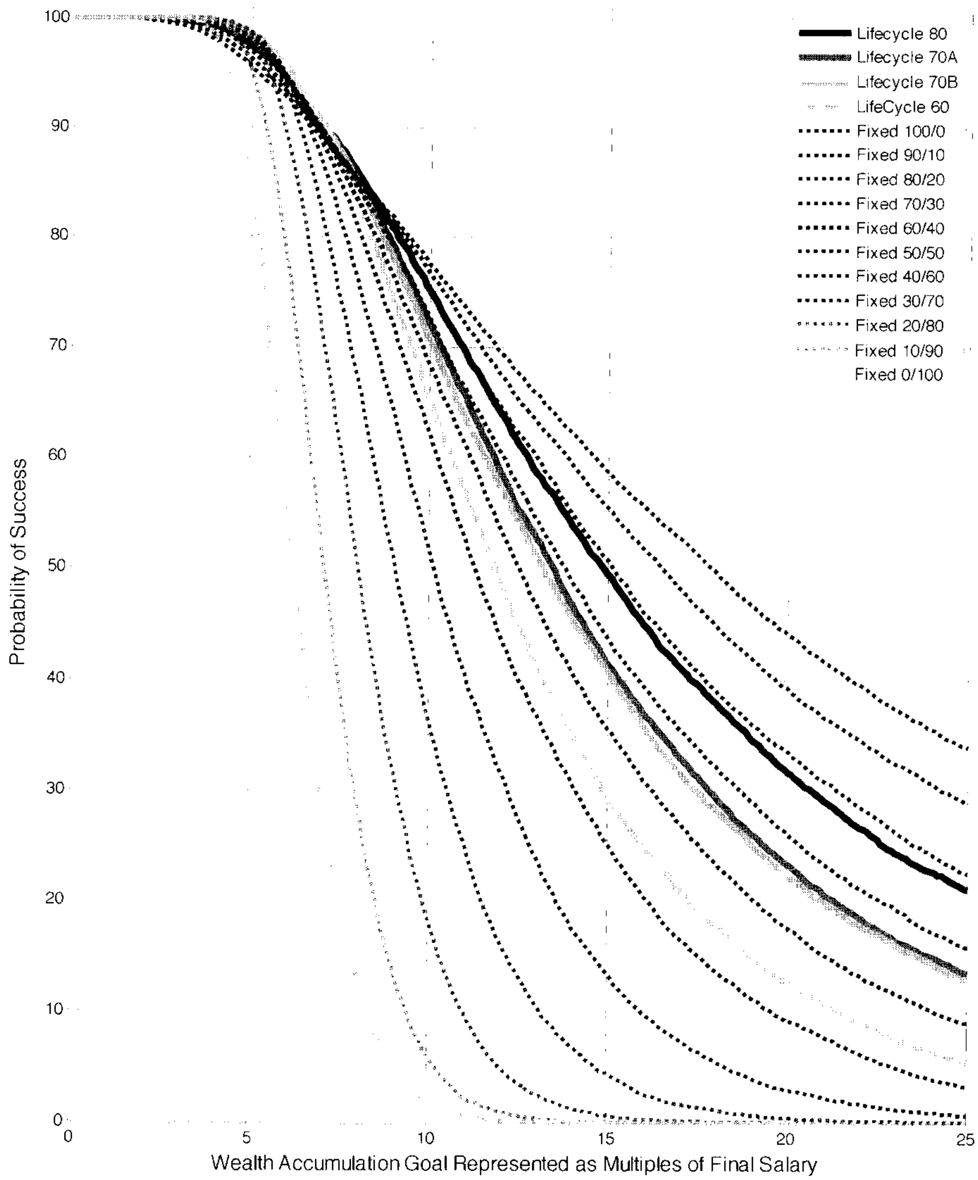

Fig. 3. Probability of achieving different target-date wealth accumulation goals.

the Lifecycle 80 strategy provides just a 32% chance of success. At these higher wealth accumulations, the probabilities for success are ordered based on the weighted average allocation to stocks over the worker's career, and the fixed strategies with very lower stock allocations have virtually no chance for success.

We show Fig. 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 their 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

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

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 a particular goal. We also described how the figure could be interpreted by a risk averse investor, and our next table considers risk aversion in the utility function to measure the expected utility of the wealth accumulation distributions.

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 two or below, an investor can maximize their expected utility by maintaining a 100% 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 three and seven. Most interesting of all, investors with risk aversion coefficients of four or 4.5 would actually prefer any of the four lifecycle funds to any of the 11 fixed allocation funds. For an investor with risk aversion of five, meanwhile, expected utility is maximized with the Lifecycle 60 fund, followed in order by the Lifecycle 70B, Lifecycle 70A, and Fixed 50/50 funds. The Lifecycle

60 fund maximizes expected utility for risk aversion coefficients up to seven. Then, the Fixed 30/70 fund maximizes utility for coefficients of eight or nine, the Fixed 20/80 maximizes utility for a coefficient of 10, and for higher coefficients shown in the table, maximum utility is provided by the Fixed 10/90 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 conservative investors as well. Though given our earlier discussion about the difficulty of measuring the utility of wealth accumulations, 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 a valuable and possibly desirable asset allocation strategy for retirement savings.

A caveat worth mentioning with regard to our findings is that a straightforward investigation of how these asset allocation strategies would have performed using the historical record does provide a relatively strong case for the Fixed 100/0 asset allocation strategy. We assume the same 40 year career for the hypothetical worker, with working beginning each year between 1900 and 1969. This leads to retirement dates between 1940 and 2009. The only difference for each of these workers is that the asset returns experienced throughout their careers match the historical returns of that period. To provide an idea about these outcomes, Fig. 4 compares the Lifecycle 80 strategy to the Fixed 100/0 strategy and to the Fixed 80/20 strategy. In all but six of the 70 historical periods, the Fixed 100/0 strategy provides more wealth than the Lifecycle 80 strategy. The exceptions are for someone retiring at the beginning of 1940 through 1943, 2003, and 2009. The most recent financial crisis resulted in the best relative performance for the lifecycle approach, as the Lifecycle 80 strategy would provide a wealth multiple of 21.9 at the start of 2009, compared to a multiple of 17.4 for the Fixed 100/0 strategy. In the other cases, the differences were less than one multiple of final salary. As for the comparison to the Fixed 80/20 strategy, the results are mixed. The Lifecycle Strategy would have provided more wealth for someone retiring at the start of 1940 to 1943, 1971 to 1989, 1991, and 2003 to 2009. By looking at this historical record alone, it may be hard to make a case against maintaining one's wealth solely in stocks, but the stock market performance in the United States during the 20th century may be hard to replicate in the future, and our previous results do show that even when basing simulations on the asset returns from this period, a risk averse investor may still prefer lifecycle strategies.

5. 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% of salary we assume, more aggressive strategies will tend to provide a higher probability for reaching their goal. However, 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

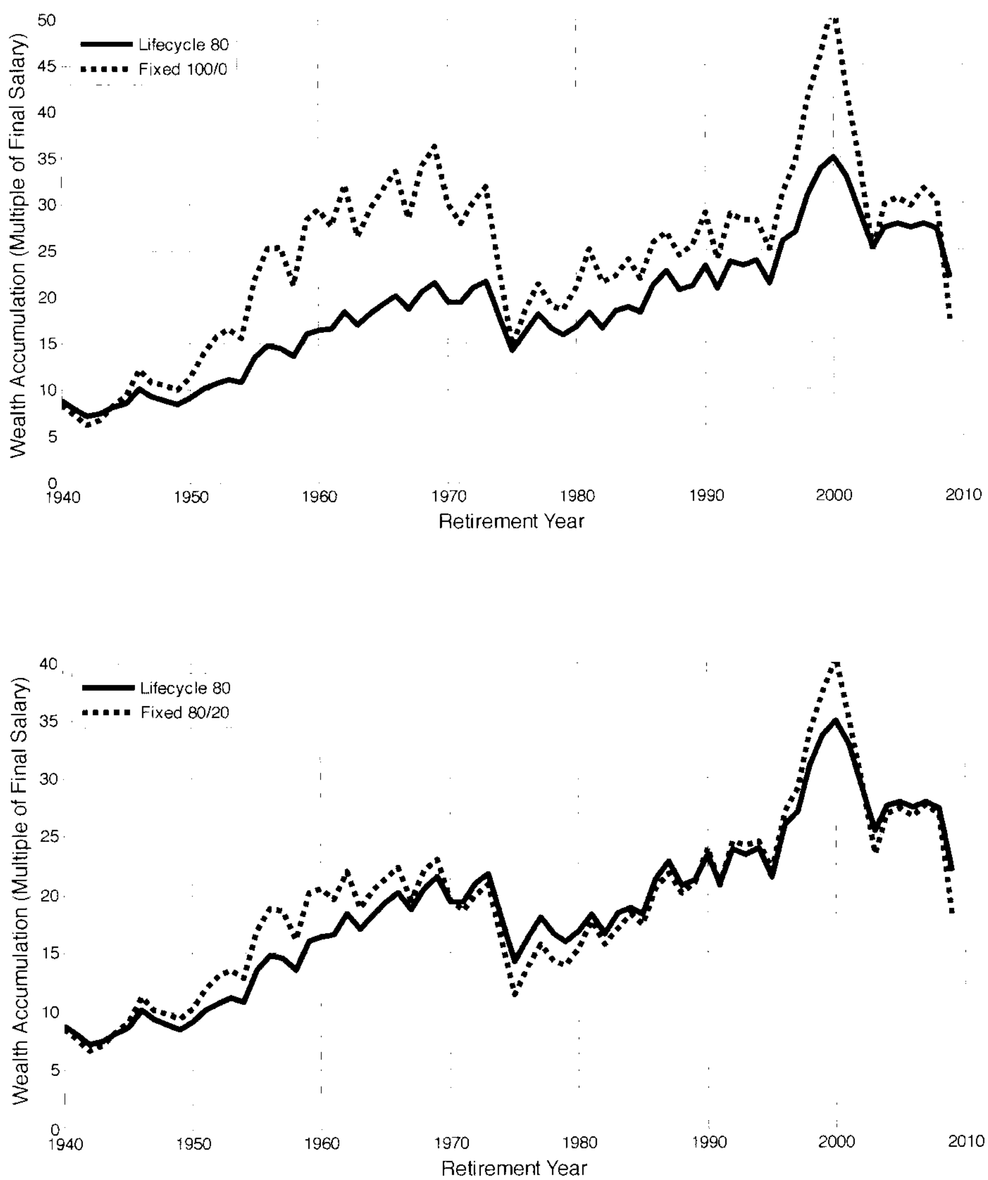

Fig. 4. Historical simulation: Target-date wealth accumulation as a multiple of final salary.

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. While we do note caveats with the use of a utility function, these findings lead us to question the conclusion of 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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