

# **Default Investment Options in Defined Contribution Plans: A Quantitative Comparison**

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April 10, 2008

## **Abstract**

With the passage of the Pension Protection Act of 2006 and the Department of Labor regulation regarding qualified default investment alternatives, automatic enrollment and default investments featuring more equities are likely to become more popular. This analysis compares the investment performance of a balanced fund and a lifecycle fund, using average asset allocations observed on the market. Simulations show that the balanced fund is more likely to outperform the lifecycle fund, but its more aggressive approach also leaves plan participants vulnerable to losses as retirement approaches. The lifecycle fund is better at safeguarding wealth in a downward market, while still doing a reasonable job of building wealth. The typical lifecycle fund, however, with a large cash position at retirement, forgoes hedging opportunities for the purchase of immediate life annuities. Neither fund is a sure win over the near-risk-free Treasury Inflation-Protected Securities.

**Key words:** Balanced and Lifecycle Funds, Qualified Default Investment Alternatives (QDIAs), Defined Contribution Plans, Pension Protection Act

**JEL classifications:** G11, G18, G23, J32, D14

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## **Default Investment Options in Defined Contribution Plans: A Simple Comparison**

Employers increasingly provide retirement benefits to their employees through defined contribution (DC) plans. To build up enough wealth for a secure retirement, workers must save regularly and invest wisely. Automatic enrollment and effective default investments can help with both.

Until now, many employers have avoided these arrangements, fearing a conflict with state law or the legal ramifications of making investment decisions on behalf of plan participants. The Pension Protection Act of 2006 (PPA) and regulations from the U.S. Department of Labor have assuaged many of those concerns, so automatic enrollment and default investments featuring more equities are likely to become more popular.<sup>1</sup>

Will plan participants be better off or worse off by selecting or defaulting into one investment strategy versus another? The DOL regulation has three types of “qualified default investment alternatives.” This article compares the investment performance of two of them — a balanced fund and a lifecycle fund, using average asset allocations observed on the market.<sup>2</sup> They are evaluated as well against the near-risk-free Treasury Inflation-Protected Securities (TIPS).

According to the simulations, the balanced fund is slightly more likely to outperform the lifecycle fund, but its more aggressive approach also leaves plan participants more vulnerable to losses when they are least likely to be able to afford them — as retirement

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<sup>1</sup>The PPA creates a new safe harbor for employers to adopt certain automatic enrollment arrangements in 401(k)s for eligible employees. The DOL subsequently issued regulations governing “qualified default investment alternatives”, which essentially encourage larger holdings of equities that are riskier than bonds but have a higher expected rate of return. The plan fiduciary is relieved of the liability for any loss when such a qualified alternative is implemented, if the plan participant fails to make investment elections. See Watson Wyatt (2006a), for instance, for a discussion.

<sup>2</sup> The study on a “managed account,” the third alternative in the DOL proposal, is left for future research because the associated fees complicate the comparison of investment performance.

approaches. The lifecycle fund is better at safeguarding wealth in a downward market, while still doing a reasonable job of building wealth. Because it shifts assets to cash at retirement, the typical lifecycle fund, however, forgoes hedging opportunities for the purchase of immediate life annuities. Sponsors may want to keep this in mind when shopping for a lifecycle fund.

### **Default Investment Strategies: Balanced vs. Lifecycle Funds**

A lifecycle fund — also called a target-date fund — holds a diversified mix of stocks and bonds. As the participant gets closer to retirement, the asset mix shifts away from riskier stocks and becomes more conservative.<sup>3</sup> These collective funds do not accommodate individual risk tolerance, specific preferences or worker characteristics. Lifecycle funds have mushroomed in recent years, with their assets increasing from \$5.5 billion in 2000 to well over \$150 billion in 2007 (Poterba *et al.* 2006; TIAA-CREF 2007). In a recent Watson Wyatt survey, most of the responding DC plan sponsors preferred the lifecycle fund as the default investment option (Watson Wyatt 2006c).

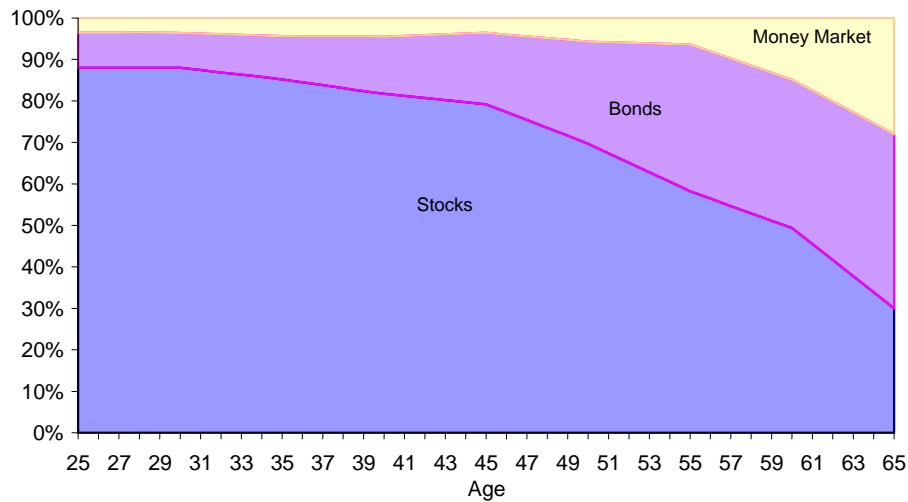
The hypothetical lifecycle fund in our analysis is invested in U.S. equities, government bonds and a money market. It parallels the average asset allocations of target-date funds currently on the market, with interpolations and extrapolations between their target years as necessary to generate a complete asset trajectory for ages 25 to 65. The fund assigns larger equity allocations for longer investment horizons, gradually shifting toward a more conservative asset mix as the participant ages. Graphically shown in Figure 1, the

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<sup>3</sup> Inclusion of other asset classes such as real estate would complicate the modeling but should not alter the key findings in this analysis.

lifecycle fund starts at age 25 with 88 percent in equities, 8.4 percent in government bonds and 3.6 percent in cash, and ends at age 65 with 30 percent in equities, 42 percent in bonds and 28 percent in cash.

Figure 1. Asset Allocations of Lifecycle Funds



Source: Poterba *et al.* (2006). Interpolations and extrapolations are made between the fund target years.

A balanced fund, on the other hand, maintains a constant mix of equity and fixed-income instruments, which does not vary by age or target retirement date. Asset allocations are consistent with average or typical investors' preferences for risk and capital appreciation. This analysis considers a balanced fund with the following constant asset allocation: 66.0 percent in equities, 26.4 percent in government bonds and 7.6 percent in a money market.

This was the weighted average asset allocation in the 15 largest balanced funds on the market at the end of 2006.<sup>4</sup>

A conservative portfolio, with all assets fully invested in long-term Treasury Inflation-Protected Securities (TIPS), is a highly risk-averse investment strategy.

### **Capital Appreciation and Preservation: Findings from Simulations**

Our analysis considers a hypothetical, prototypical DC plan participant. She earns \$40,000 at age 25 and receives 4 percent annual raises in real terms until her earnings peak at age 50 and remain flat until she retires at age 65. The combined employer and employee contribution to the retirement account is 6 percent of annual pay. Somewhat less typically (but convenient for computation), there are no plan leakages or service breaks. Results are not sensitive to alternative assumptions regarding earnings and contribution profiles, particularly if plan leakages or service breaks equally randomly apply to balanced and lifecycle funds. The investment strategies are evaluated in terms of the amount of retirement wealth accrued and the attendant level of risk.<sup>5</sup>

As stochastic asset returns imply a wide range of possible terminal wealth outcomes, we ran a large number of simulations (100,000 times) of retirement wealth at age 65. We based estimates of the underlying asset returns on historical data, assuming that future returns will behave similarly. Between 1960 and 2004, the average real return (i.e., subtracting actual inflation) on long-term government bonds was 2.6 percent per annum,

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<sup>4</sup> These fifteen funds exclude income funds because they have objectives other than for retirement wealth accumulation; we also exclude target-date funds. Data source: [www.morningstar.com](http://www.morningstar.com), December, 2006.

<sup>5</sup> For simplicity, this analysis ignores the tax rate differentials between equity and bond holdings, which may imply tax arbitrage opportunities and may affect the optional location choice of equities and bonds between taxable and tax-deferred accounts. See Dammon *et al.* (2004), for instance.

with a standard deviation of 10.1 percent. For the same period, the average annual real equity return was 5.8 percent, with a standard deviation of 15.6 percent, based on the S&P Composite Stock Price Index. The money market return was 2.2 percent on average, with a standard deviation of 2.6 percent (Shiller 2000).<sup>6</sup> The average TIPS rate was 2.2 percent for 2003-05,<sup>7</sup> which is applied to the conservative portfolio in the simulations; this assumes its continued availability in the future and no reinvestment risk on interest earnings. A vector autoregressive (VAR) model is estimated to capture co-movements of asset returns. The estimated coefficients and variance-covariance matrix are embedded into the stochastic simulations.<sup>8</sup>

Contributions to the worker's plan totaled approximately \$202,000. The TIPS investment generates retirement wealth of \$301,000. In 95 percent of the outcomes at age 65, the balanced fund realizes between \$166,000 and \$1.4 million, and the lifecycle fund realizes between \$174,000 and \$1.3 million. The extreme values are theoretically possible but unlikely outcomes.

Table 1 ranks realized retirement wealth, with decile 1 corresponding to the lowest tenth of the values and decile 10 corresponding to the highest tenth. The "mean" is the simple average of all the values, and the "standard deviation" measures volatility — how widely these values are spread. Generally, mean calculations are sensitive to extreme values. As a more robust indicator, the "median" identifies the most likely case — the middle

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<sup>6</sup> U.S. historical asset returns are geometric means based on Shiller (2000), with data updated at [www.irrationalexuberance.com](http://www.irrationalexuberance.com).

<sup>7</sup> The long-term average TIPS rate was based on the unweighted average bid yields for all TIPS with remaining terms to maturity of more than 10 years. Source: <http://www.federalreserve.gov>.

<sup>8</sup> The Technical Appendix, available from the authors upon request, gives details about the VAR estimation and stochastic simulations.

outcome, in which half of the outcomes are better and half are worse. The median value is less skewed by extremes.

Table 1. Terminal Wealth (\$1000) at Age 65 for a Long-Career Worker in a DC Plan: Comparing Balanced and Lifecycle Funds

Decile	<u>Median</u>		<u>Mean</u>		<u>Standard Deviation</u>	
	Balanced Fund	Lifecycle Fund	Balanced Fund	Lifecycle Fund	Balanced Fund	Lifecycle Fund
1	\$194.5	\$200.7	\$187.8	\$194.9	\$32.7	\$30.0
2	260.5	263.3	260.1	262.9	17.3	15.3
3	313.9	312.6	313.4	312.7	16.1	13.9
4	363.9	360.4	364.3	360.5	16.1	13.9
5	417.9	410.9	418.2	411.0	17.7	15.4
6	479.0	468.3	479.5	467.7	20.9	17.8
7	553.3	537.0	553.8	536.7	26.2	22.4
8	650.8	627.8	652.5	627.9	36.7	31.0
9	796.0	764.7	802.7	769.2	64.6	53.7
10	1136.2	1082.4	1254.6	1194.1	439.2	362.3
Overall	\$447.5	\$438.6	\$528.7	\$513.8	\$359.8	\$303.4

Source: Authors' simulations.

Given the same steady flow of contributions, investment returns are higher in the balanced fund than in the lifecycle fund 53 percent of the time. The two funds yield overall median values of \$448,000 and \$439,000, respectively. The balanced fund has more wealth-creation potential than the lifecycle fund, as shown in Table 1 for most deciles. This is because balanced funds hold more equities (with a higher expected return) later in the worker's career, when the portfolio is large.

However, the lifecycle fund outperforms the balanced fund in terms of capital preservation when the market is down, as indicated by the first two deciles in Table 1. For this reason, the balanced fund — despite its higher expected return — may not be the optimal investment strategy for individuals, whose investment horizon shrinks as they age. In the near-retirement years, a small percentage swing in investment returns could mean a large amount of wealth lost.

This is worth an illustration. Suppose a 55-year-old investor has accumulated \$250,000 and is pondering investment strategies for the next 10 years.<sup>9</sup> On average, the portfolio grows larger over time thanks to investment returns and annual contributions, but so do potential ups and downs, because even small changes in annual returns can become large losses (or, more hopefully, gains). Increased exposure to the more volatile equities entails a larger standard deviation. Most outcomes fall in the range of the mean plus and minus one standard deviation. With the standard deviation expressed as a multiple of the annual contribution in Figure 2 for each investment strategy for ages 55-65, one can see that the possible loss magnifies with age, possibly becoming unaffordable.

For example, at age 65, the expected (average) wealth of the balanced fund via 10-year investment is \$483,000. But a standard-deviation-equivalent loss of \$192,000 would require 30 annual contributions (\$6,400 yearly from ages 50 to 65) to make up the loss. How likely is this to happen? The chance is roughly 15 percent.

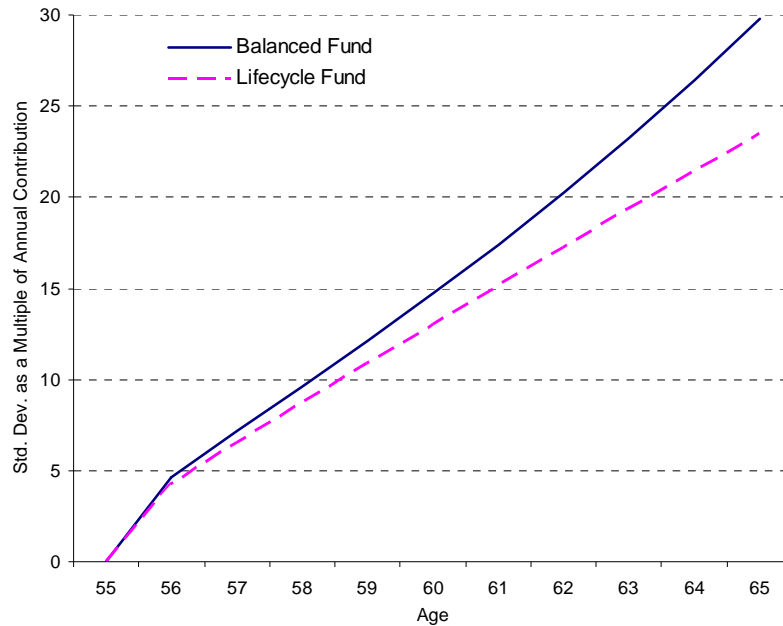
For the lifecycle fund, at age 65, the average wealth via 10-year investment is \$453,000. A standard-deviation equivalent loss of \$147,000 would require 23 annual contributions to make up the loss. Again, the chance of this happening is roughly 15 percent.

At age 65, the balanced fund has a 7 percent chance of falling short of its initial value at 55, despite contributions, while the lifecycle fund has a 5 percent chance of doing so. In such circumstances, a TIPS investment outperforms.

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<sup>9</sup> \$250,000 is approximately the median value of the two funds at age 55. The lifecycle fund generates slightly higher but more volatile wealth by 55 due to its larger equity holdings.

Figure 2. A Comparison of Investment Risk near Retirement



Source: Authors' simulations

As a side note, the balanced fund has traditionally been a part of defined benefit (DB) plan management. It may be a reasonable approach for a well-funded DB plan accruing increasing benefits for a stable or growing workforce, assuming the long-lived plan sponsor is risk tolerant. Pooling investment risk across time makes guaranteed benefits feasible for DB plans. In DC plans, however, individual participants shoulder the downside risks. Note, however, that the risk-pooling feature in DB plans may be useless in the unlikely but possible event of a plan sponsor's catastrophic losses or bankruptcy. Put differently, a plan sponsor that wants to minimize risk, or whose DB plan is frozen or serves a predominantly retired population, should consider an investment strategy that matches the fixed nature of underlying liabilities (Watson Wyatt, 2007).

Consideration for “human capital” lends support to the idea that the equity share of retirement accumulations should decline with age. Human capital, regarded as the net present value of future wages, usually carries less risk than equity and is more comparable to a bond. For a tolerable risk exposure, larger equity holdings at a younger age complement the large human capital bond, whereas smaller equity holdings at an older age reflect the declining value of human capital (see Bodie *et al.* 1992). The growing popularity of lifecycle funds is evidence of their appeal and sensibility. For an individual with much riskier than average human capital, however, particularly if it is positively correlated with equities, the optimal lifecycle asset allocations should probably vary from those shown in Figure 1.

The average lifecycle fund, however, has an often-neglected weakness. Recall that the fund shifts rapidly to money market at the end of the investment horizon. If the DC plan participant decides to purchase an immediate life annuity (a necessary product for insurance against longevity risk), assuming such a large cash position implies fewer hedging opportunities, leaving the individual vulnerable to considerable volatility in annuity prices arising from changing interest rates (Soares and Warshawsky, 2004; Watson Wyatt, 2006b). Bonds would be a better choice to hedge such risks.

Returning to the wealth accumulation comparison, many individuals are risk averse, which means that a secure income flow — even if the lower risk also holds the value lower — offers considerable appeal. The simulations reveal that both funds have a nontrivial chance — approximately 22 percent of the time — to accumulate less value than the TIPS investment. In terms of capital preservation, neither fund can guarantee a

sure win over TIPS or a happy ending.

## **Conclusion**

This brief analysis compares a balanced fund with a lifecycle fund, which are two of the DOL's regulated qualified default investment alternatives for DC plans. The simulations show that, while the balanced fund is more likely to outperform the lifecycle fund in terms of long-term capital appreciation, it also increases the risks to plan participants in their near-retirement years. The lifecycle fund, while doing a reasonable job of wealth creation, also does a better job of mitigating the downside risk.

The average lifecycle fund, however, may expose participants to the risk imposed by volatility in life annuity prices arising from changing interest rates. Employers may want to look for a better hedging design when selecting a lifecycle fund. Overall, lifecycle funds are a reasonable approach for DC plan participants who want to generate wealth but minimize risk toward the end of their careers. By adjusting the equity share for age and human capital (earnings) prospects, the lifecycle approach offers a sensible and simple way to combine stocks and fixed-income options into a single fund.

With the employer shift toward DC plans, more workers are relying on 401(k) plans as their primary source of retirement income outside of Social Security. The stakes are high, and retirement portfolios deserve special consideration and careful management. When designing or selecting default investment options, sponsors should thoroughly consider the investment implications of the above analysis, as well as specific participant

characteristics, such as wage patterns, risk tolerance, demographic characteristics and whether there is also a DB plan.

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