

## De-Risking Pension Funds in a Low Yield Environment

November 2015

In today's low interest-rate environment, with the likelihood of higher future interest rates on the horizon, we have evaluated portfolio allocations that seek to decrease pension fund liabilities.

Our analysis concludes:

1. In the current yield environment, there are better ways for pension funds to de-risk their portfolios than through liability-driven investments (LDI).
2. Since yields are low and likely to rise in the future, absolute return strategies are better suited to de-risk pension portfolios.
3. Pension plans using absolute return strategies would potentially have higher expected funded ratios and similar downside risks to pension plans using LDI-based strategies.

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There are a number of implementation tools a pension plan could use to reduce the volatility of its portfolio and funded status. Increasing the allocation to fixed-income assets (i.e. LDI) is a common choice that may be well justified when interest rates are at “normal” levels, with plenty of room to either increase or decrease in the future. In this interest rate environment, however, when yields are very low and the likelihood of future increases in interest rates is high, increasing fixed income allocations may not be the optimal choice. This has been the impetus for using absolute return strategies to reduce portfolio risk. Our analysis demonstrates that in the current low yield environment, absolute return strategies offer significantly higher upside potential than LDI, with similar implied downside risks. We also evaluate these investment strategies in a “normal” yield environment.

## Investment Strategies

A pension plan may choose different investment strategies to reduce portfolio risk relative to a classic 60/40 allocation, and to reduce the downside outcome of its expected funded ratio (FR). In this note, we compare three such de-risking alternatives:

1. A mild LDI tilt that would reallocate 10% of the portfolio from equities to medium-term bonds with a five-year duration;
2. A strong LDI tilt that would reallocate 10% of the portfolio from equities to long-term bonds with a 10-year duration;
3. An absolute return tilt that would reallocate 10% from equities to absolute return strategies.

In other words, we compare the two LDI alternatives that reduce equity risk by either mildly or significantly increasing the portfolio duration, with the third alternative, which trades equity risk for active management risk. While others (e.g., Kogelman et al (2014)) also have compared a mild LDI tilt with absolute return strategies, we expand the analysis to include the long-duration strong LDI tilt alternative to better illustrate why LDI is suboptimal in the current yield environment. In Table 1, we summarize the asset allocation under the three alternative portfolio strategies, as well as the major risk parameters at the asset class and portfolio levels. We present expected returns in a subsequent section, in conjunction with the yield environment assumptions.

**Table 1. Asset Class and Investment Strategy Risk Parameters**

		Asset Classes				Portfolio Risk Parameters		
		Mid-term bonds	Long-term bonds	Equities	Absolute Return	Beta	Duration	Volatility
<b>Asset Allocation</b>	60/40 Portfolio	40%	-	60%	-	0.60	2.0	9.1%
	Mild LDI tilt	50%	-	50%	-	0.50	2.5	7.3%
	Strong LDI tilt	-	50%	50%	-	0.50	5.0	7.0%
	Abs. return tilt	40%	-	50%	10%	0.54	2.0	8.1%
<b>Asset Class Parameters</b>	Beta	-	-	1	0.4			
	Alpha				2.5%			
	Duration	5	10	-	-			
	Volatility	5.0%	7.8%	17.1%	8.5%			

Source: The Rock Creek Group

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## Analytical approach

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The current environment of low-yields combined with the potential for rising rates is very different from the historical fixed income environment of past years. Consequently, using historical data for the analysis would lead to incorrect conclusions. We develop the various alternative patterns for the evaluation of interest rates, equity returns and absolute return alpha over a five-year period using 10,000 Monte Carlo simulations. More specifically, the five variables we simulate are:

- The three yield curve factors of the Nelson-Siegel yield curve model, interpreted as yield curve level, slope and curvature. For further detail see Nelson and Siegel (1987);
- U.S. equity returns;
- Absolute return pure alpha, i.e. the excess return of hedge funds over U.S. equities on a beta-adjusted basis.

We estimate a VAR(1) model of these five variables based on quarterly observations between June 1997 and March 2015, and this model provides the base structure for our Monte Carlo simulation. The historical yield curve factors were fitted on historical U.S. Treasury curves, while U.S. equities and absolute return strategies are represented by the Russell 3000 and the HFRI Fund-Weighted Index, respectively. The benefit of using VAR(1) instead of a pure random walk model is that in addition to volatilities and correlations, we can also capture how the five financial risk factors influence each other from one quarter to the next. Furthermore, the VAR(1) structure helps us express views with regards to the long-term levels of each variable as we discuss them in the next section.

Once we generate the quarterly scenarios for the risk variables, we calculate total returns for the medium-term and long-term bonds based on the Nelson-Siegel yield-curve factors. We also calculate the total return for the absolute return strategies from two components: the “beta” component, which is the result of the simulated equity returns times beta of 0.4, and the simulated pure “alpha.” In our simulation, we work with an assumption of an expected alpha of 2.5%. On the liabilities side, we assume accumulated benefit obligation (ABO)-like liabilities that we approximate with a constant 10-year duration bond. While this liability modeling assumption is clearly a simplification of the real world, the benefit of defining liabilities in such simplified terms is that we can easily compare the liability-matching characteristics of our various investment strategies.

## Scenarios: Changes in interest rates

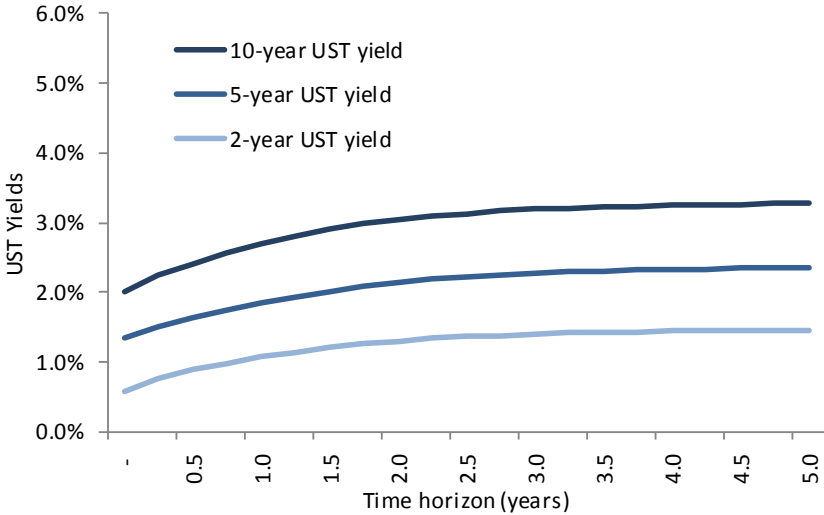
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Given the central role of the fixed-income asset class in LDI, we pay particular attention to the yield environment under which we analyze our investment alternatives. In fact, we set four yield environments, and we run a Monte Carlo simulation under all four assumptions.

1. Mild yield hike: Yields are expected to increase modestly from current levels, but remain in a relatively low yield environment. The expected yield paths under this assumption are shown in Figure 1.

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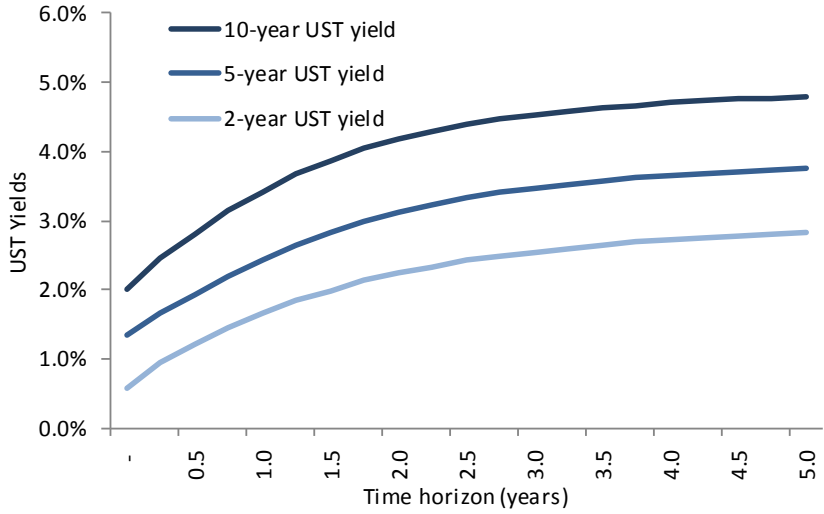
Figure 1: Mild Yield Hike



Source: The Rock Creek Group

- 2. Yield hike to “normal” levels: Yields are expected to increase from the current low levels by approximately 150-250 bps to more “normal” yield levels. The expected yield paths under this assumption are shown in Figure 2.

Figure 2: Rapid Yield Hike to “Normal” Levels

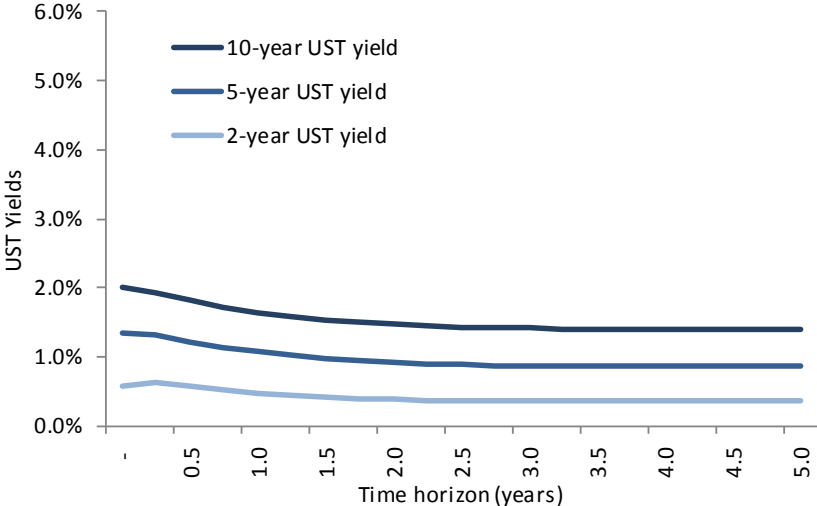


Source: The Rock Creek Group

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- 3. Yields decline: While yields are at low levels currently, we cannot exclude the possibility of further decline in case deflation sets in. The declining yield path is shown in Figure 3.

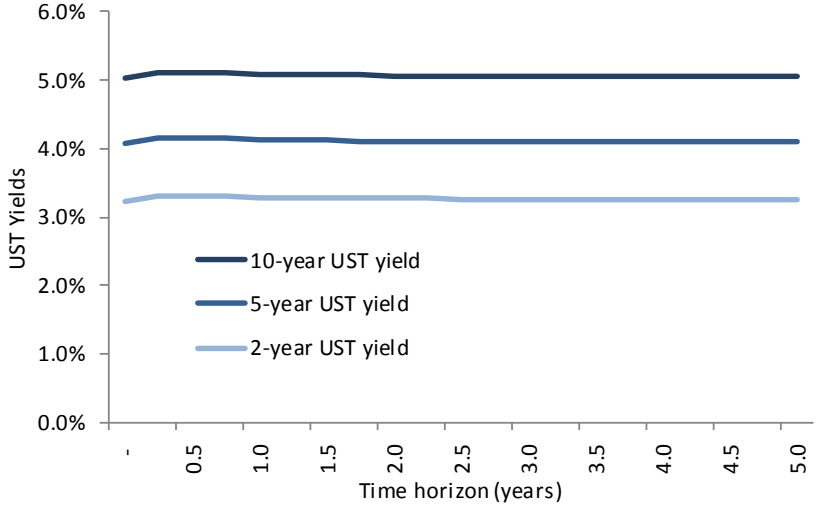
**Figure 3: Yields Decline Lower**



Source: The Rock Creek Group

- 4. Yields at normal levels: In this case, we assume that yields are already at the higher, “normal” level and that they fluctuate around these levels. This yield environment is obviously not reflective of the present but is used for comparison purposes. Our risk and return estimations would differ if yields could go higher or lower to a similar extent. The expected yield paths under this assumption are shown in Figure 4.

**Figure 4: Yields at “Normal” Levels**

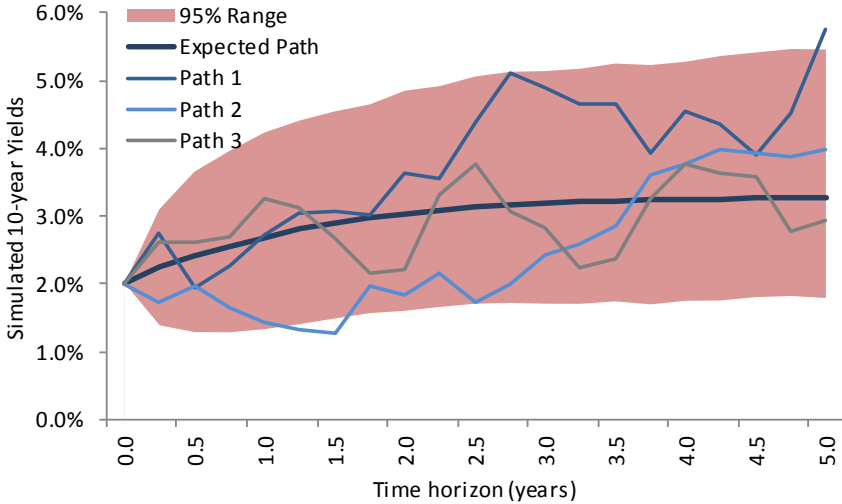


Source: The Rock Creek Group

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The discussion thus far has focused on the evaluation of expected yields in the four environments. Figure 5 reflects a few of the 10,000 Monte Carlo simulated paths, as well as the 95% range of simulated paths of the 10-year Treasury yield over the next five years in a mild yield hike environment.

**Figure 5: Simulated 10-year Yields with Mild Yield Hike Expectation**



Source: The Rock Creek Group

Table 2 translates the four yield scenarios to corresponding asset class and portfolio return expectations over a five-year horizon. Expected bond returns vary across the four distinct yield scenarios. The highest bond returns are in the “normal” scenario where initial yield levels are high and expected to vary around those levels. The lowest bond returns are in a rapid yield hike scenario where initial yields are low and bonds would suffer price depreciation in response to rising yields. Returns are better in the yield decline scenario, but are lower relative to the “normal” yield scenario given the low initial levels. Given today’s macro environment, the returns shown in the first two rows have the greatest relevance.

**Table 2. Simulated Expected Returns**

5Yr Exp. Return by Scenarios	MT Bonds	LT bonds	Equities	Abs. Return	60/40 Portfolio	Mild LDI Tilt	Strong LDI Tilt	Abs. Return Tilt
Mild Yield Hike	2.3%	1.8%	7.9%	5.3%	5.6%	5.1%	4.8%	5.4%
Rapid Hike	2.0%	0.4%	10.1%	5.9%	6.8%	6.0%	5.2%	6.4%
Yields Decline	2.2%	3.4%	5.3%	5.0%	4.1%	3.8%	4.3%	4.0%
Yields at “Normal”	5.4%	6.2%	7.1%	5.5%	6.4%	6.2%	6.6%	6.2%

Source: The Rock Creek Group

Table 3 shows the simulated asset class correlations with liabilities, measured using a quarterly time horizon. If liabilities are approximated using 10-year bonds, fixed income assets are the obvious candidates for liability matching. While absolute return strategies are not the best substitute for bonds as reflected by correlations, they are still attractive because the risk-reducing power of fixed-income

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assets is lower today than in a “normal” yield environment. This is primarily the result of the limited room for yields to decline further. Moreover, as discussed in the next section, absolute return strategies minimize the funding gap, which is more relevant than ensuring higher correlations with liabilities.

**Table 3. Simulated Asset Class Correlations**

Correlations	Liability	MT Bond	LT Bond	Equity	Absolute Ret.
Liability	1.00	0.90	1.00	-0.43	-0.32
MT Bond		1.00	0.90	-0.37	-0.31
LT Bond			1.00	-0.43	-0.32
Equity				1.00	0.79
Absolute Ret.					1.00

Source: The Rock Creek Group

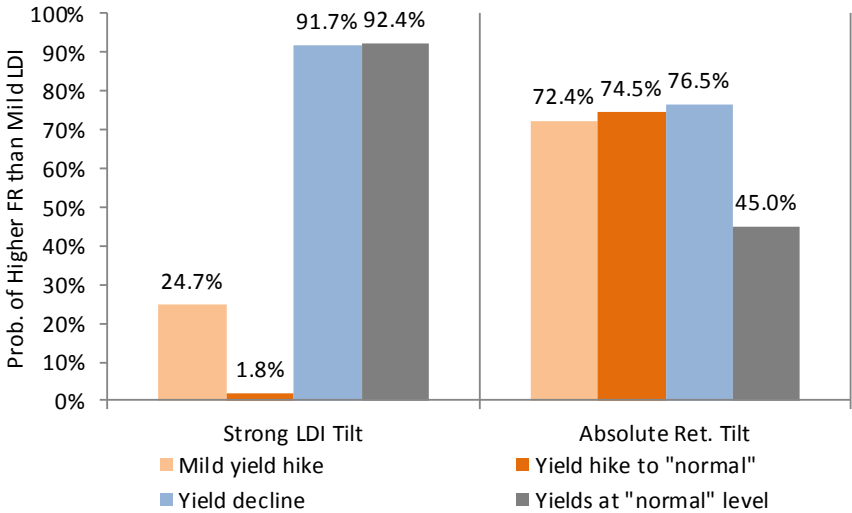
## Simulation results

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We compare a mild LDI tilt strategy to the strong LDI tilt and the absolute return tilt strategies in Figure 6. We show the probabilities of reaching higher funding ratios with these strategies compared to the mild LDI tilt strategy under the four yield scenarios. The results are striking: the strong LDI tilt strategy is supposed to provide a better liability hedge, and we can see roughly 92% chances of outperformance under the declining yield and the normal yield environment assumptions (blue and gray bars). However, this longer duration strong LDI tilt strategy has a much lower probability of outperformance under the mild or rapid yield hike scenarios. On the other hand, the absolute return tilt strategy has close to a 75% probability of having a higher funding ratio than the mild LDI tilt strategy under all four scenarios. In other words, absolute return strategy tilt outperforms the mild LDI tilt by 75% in the three yield scenarios that reflect today’s yield levels. This means that the absolute return strategy more consistently outperforms a mild LDI tilt than a strong LDI tilt does, so long as we have a low starting yield environment, as we do today.

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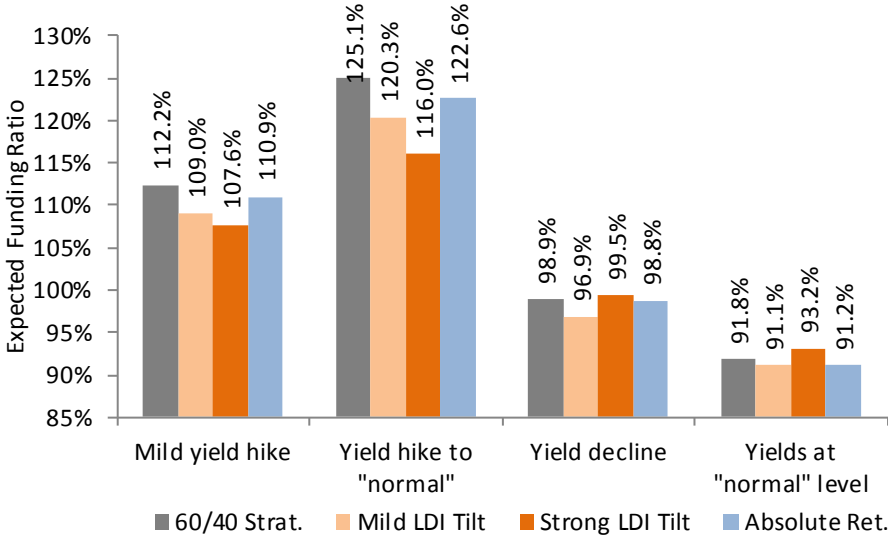
**Figure 6: Probability of Reaching Higher FR Relative to the Mild LDI Tilt Strategy**



Source: The Rock Creek Group

Assuming an initial funding ratio of 90%, we compare the expected funding ratios of five years from now across all four portfolio strategies in Figure 7. We find that the strong LDI tilt strategy would offer the lowest expected funding ratios if yields are expected to increase either mildly or rapidly from current levels, whereas the absolute return tilt strategy would rank second behind the 60/40 strategy. Under the declining yield or normal yield level conditions, expected funding ratios are much closer to each other, with strong LDI leading ahead of the other strategies.

**Figure 7: Expected Funding Ratios (5-Year; Current FR=90%)**



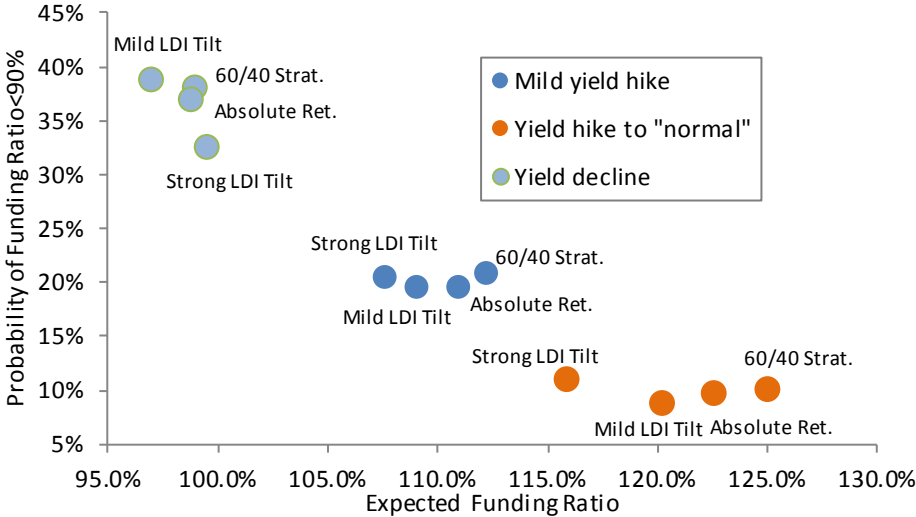
Source: The Rock Creek Group



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In Figure 8 we combine expected funding ratios with the estimated risk of reaching a funding ratio below 90% five years from now. In this chart we only show the results that are relevant for the current yield levels, i.e. the mild and rapid yield hike as well as the declining yield scenarios. In both rising yield scenarios, the strong LDI tilt strategy ranks at the bottom while the absolute return tilt strategy arises as a lower risk strategy. The exception certainly is the yield decline scenario. In that case, strong LDI would offer the highest best risk-return trade-off, but absolute return strategy would still offer the second lowest probability of the funding ratio falling below 90%.

**Figure 8: Expected Funding Ratio vs. Probability of FR<90% (5-year; Current FR=90%)**

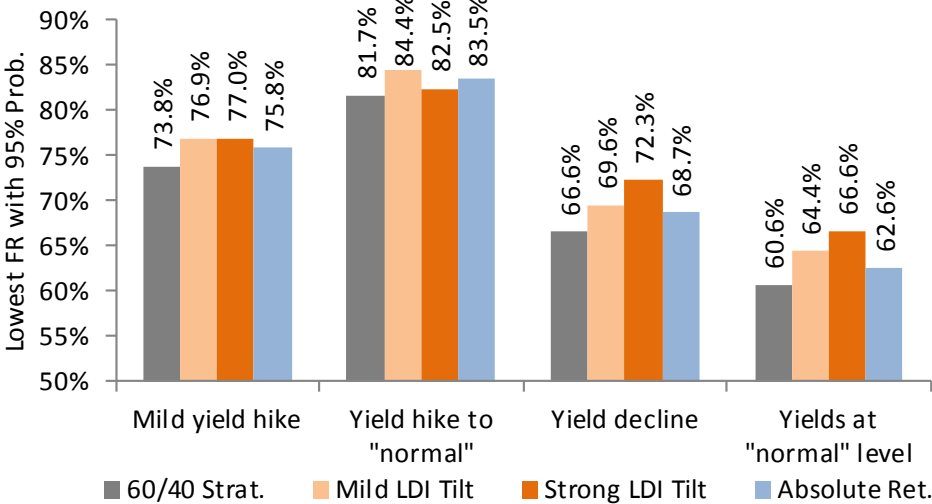


Source: The Rock Creek Group

To focus more on the downside risk, we compare the lowest funding ratios that we expect with 95% probability five years from now. Strong LDI tilt would clearly be the lowest-risk alternative in a normal yield environment, when yield levels are high and have an equal likelihood of increasing or decreasing, or if we explicitly expect a future declining trend for current yields. At the same time, while all three de-risking strategies mitigate risk relative to the 60/40 strategy, the downside risk levels across these strategies are flat under the mild and rapid yield hike scenarios. In fact, the absolute return tilt strategy has a better downside risk profile than the strong LDI tilt strategy under the rapid yield hike assumption.

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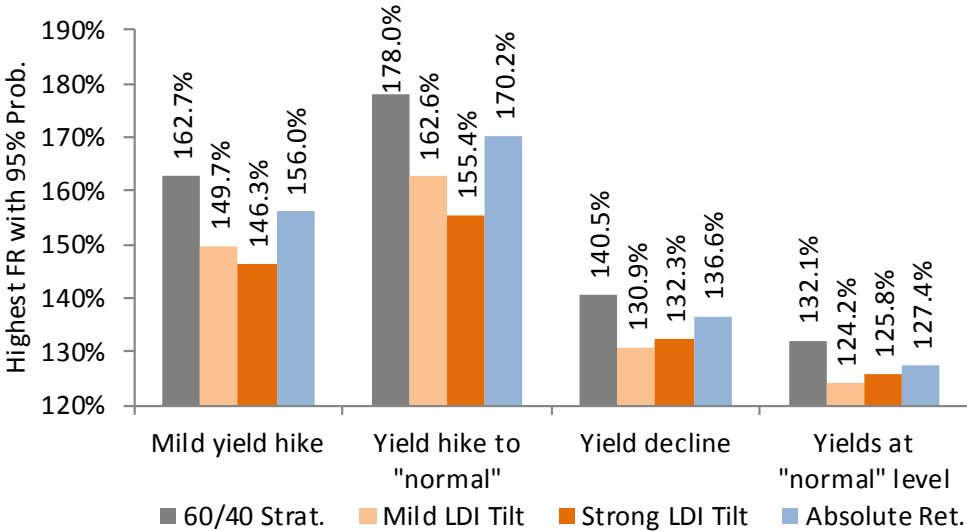
**Figure 9: Funding Ratios with 95% Probability (5-year; Current FR=90%)**



Source: The Rock Creek Group

On the opposite end, as shown in Figure 10, the upside potential is the lowest for the “Strong LDI” if yields are expected to rise, whereas the “Absolute Return Tilt” strategy takes the second rank after 60/40 again.

**Figure 10: Highest Funding Ratios with 95% Probability (5-year; Current FR=90%)**



Source: The Rock Creek Group

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## Conclusion

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Based on our forward-looking quantitative analysis, we believe that pension funds have to carefully think about how de-risk their portfolios in the current yield environment. Since yields are low, have very limited room to rally and are expected to rise in the future, absolute return strategies offer better risk/return trade-offs. A strong LDI strategy requires a strong bearish view on the economy, or high conviction of declining yield trends over the coming years.

The expected funding ratio resulting from absolute return strategies would be higher than what can be achieved with LDI-based strategies if rates are increasing mildly or rapidly, while the downside risks would be very similar. For comparison, we also show these statistics under the assumption of already being in a normal yield environment. In such circumstances, LDI clearly performs better and delivers the intuitively expected results. Right now, however, we are not yet in a normal yield environment. If we believe that yields are just about to start moving towards normal levels, investors must take care to select an investment strategy capable of weathering this transition period.

## References

Kogelman, S. et al (2014): Pension Plan De-Risking: Is LDI the Only Option? KKR Prisma, June 2014

Cosgrave, R. (2014): Funding Gap-Driven Investing (FGDI), Pacific Alternative Asset Management Company

LeGraw, C. (2015): De-risking Goes beyond Interest Rate Risk: The Case for Dynamic Asset Allocation in and LDI Solution, GMO White Paper

Nelson, C. W., Siegel, A. F. (1987): Parsimonious Modeling of Yield Curves, The Journal of Business, Volume 60, Issue 4

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