

Pension Series

Avoid the Agg Drag

For plan sponsors that wish to de-risk, the Agg may not be the solution

- Some defined benefit pension plan sponsors that have not begun to de-risk are hesitant to shift out of Agg-based fixed income allocations toward longer-duration mandates in the current environment, citing the specter of rising interest rates.
- Lengthening the duration of the existing fixed income portfolio can immediately lower surplus risk, without the need to reduce the allocation to growth assets.
- The Agg's duration and composition mean it isn't well suited to track a long-duration liability that is discounted based on high-quality corporate bonds.
- Even ignoring the liability, a long-duration strategy may actually outperform the Agg if interest rates do not rise by as much as or as fast as is already priced into the yield curve.

Perhaps the first, and arguably easiest, step for defined benefit plan sponsors that wish to de-risk is to lengthen the duration of their existing fixed income portfolio. Many plan sponsors have taken this first step and are now exploring more customized liability-driven investing (LDI) solutions.¹ However, plan sponsors that have embraced LDI in theory but have held steadfast to their traditional core, Agg²-based fixed income allocations are hesitant to lengthen duration in the current environment. This research note addresses the question these plan sponsors most often ask: Why lengthen duration if rates are going to rise? Further delaying action may subject plans to the “Agg drag,” a potential

¹ For a more comprehensive view of our liability-driven investing insights, please see our recent reports *Constructing a Liability Hedging Portfolio: A Guide to Best Practices for US Pension Plans*, 2014, and *Pension De-Risking in a Low-Rate Environment—A Better Solution*, 2011.

² The Barclays US Aggregate Bond Index is a widely used benchmark for the US investment-grade fixed income market.



drag on the expected return of the overall investment portfolio, at a higher level of surplus risk, than a long-duration strategy.

There are three main reasons to support substituting the Agg for a longer-duration strategy, even if it turns out to be ahead of a rising rate environment. First, lengthening duration immediately reduces surplus risk, without the need to reduce the allocation to growth assets. Second, because of its relatively short duration and sizable exposure to securitized products, the Agg is not an effective liability hedge compared with long-duration indexes. Finally, even ignoring the liability, rising rates *do not* automatically translate into lower returns on long-duration bonds versus short-duration bonds over time horizons most relevant to plan sponsors.

Lower Surplus Risk

A key objective of de-risking is to reduce surplus risk—the volatility of the funded status—as funded status improves. One of the largest sources of surplus risk in a pension plan is the mismatch between the interest rate sensitivity of the plan assets and its liability, which can be quantified by the hedge ratio:

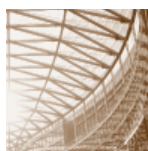
$$\frac{\text{Funded Status (\%)} \times \text{Liability Hedge Allocation (\%)} \times \text{Liability Hedge Duration}}{\text{Liability Duration}}$$

The hedge ratio measures the degree to which the liability hedging portfolio protects against a decline in interest rates, with a lower ratio leaving the plan more exposed to interest rate risk. Consider a plan with a hedge ratio of 20%.

If interest rates decline, the protection provided by the liability hedging portfolio would be only 20% of the increase in the liability, resulting in a decline in funded status.

As the formula suggests, sponsors have two ways to increase the hedge ratio and therefore reduce surplus risk. First, sponsors can raise the allocation to an existing Agg-based fixed income portfolio. However, any additional allocation to the liability hedging portfolio must come from reducing the allocation to growth assets, which could lead to a decrease in the total portfolio's expected return. Alternatively, sponsors can maintain the same level of fixed income allocation, but lengthen duration. This option not only reduces surplus risk, but also does not require a shift away from potentially higher-return growth assets.

Some plan sponsors have delayed de-risking altogether, intentionally favoring a low hedge ratio to avoid missing out on the benefit in funded status if interest rates rise. However, lengthening duration would still likely leave the hedge ratio under 100%, as only a portion of the plan's total assets are allocated to fixed income (and if the plan is underfunded, the hedge ratio is lower still). As long as the hedge ratio is less than 100%, the funded status would still *improve* if rates rise, as the liability will drop by more than the liability hedging portfolio. Following a year like 2013, which saw impressive asset gains and rising rates, decreasing surplus risk by lengthening asset duration is a relatively quick first step to help lock in the improvement in funded status.



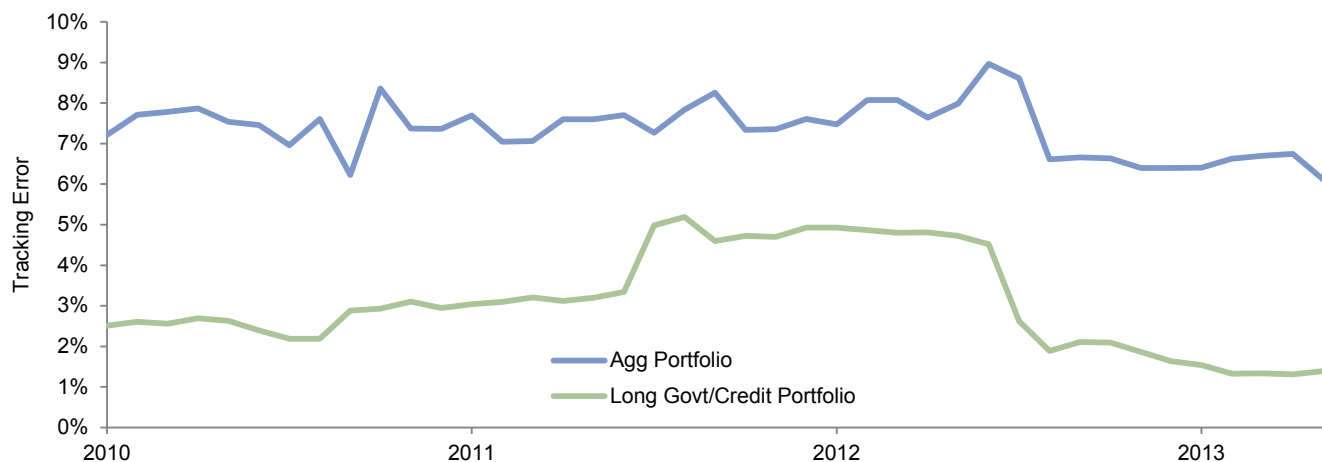
Better Liability Tracking

A typical private defined benefit plan's liability has a duration of approximately 13 years and is discounted by rates based on high-quality corporate bonds. As a hedge for a plan's liabilities, the Agg suffers from two structural drawbacks. First, its relatively low duration of 5.5 years makes it less sensitive to interest rate movements than the liability, which is particularly harmful when interest rates decline. Second, as of March 31, 2014, only 23% of the Agg was invested in corporate bonds, the physical instruments that most closely mimic the liability exposure. A full 31% was invested in securitized products (mostly mortgage-backed securities), which exhibit negative convexity as rates fall, a property that is not found in traditional non-callable corporate bonds upon which the liability discount rate is based. One example of a long-duration fixed income benchmark is the Barclays Long

Government/Credit Index, which as of March 31, 2014, had a duration of approximately 14 years, with 51% of the index in corporate bonds and no exposure to securitized products.

Figure 1 displays the tracking error—the standard deviation of the difference in returns—for a portfolio invested entirely in either the Agg or the Long Government/Credit Index relative to a hypothetical liability with a duration of approximately 14 years. A lower tracking error indicates that the return pattern more closely follows the liability. As shown, the tracking error of the Long Government/Credit Index was on average 4.3 ppts below that of the Agg from 2011 through the present.

Figure 1. Tracking Error of the Agg and the Long Government/Credit Index vs a Hypothetical Liability
December 31, 2010 – April 30, 2014



Long Duration: Higher Rates ... Higher Returns?

A common objection to lengthening duration is the belief that if interest rates rise, a long-duration index would underperform the Agg and therefore impair funded status. However, if interest rates do not rise by as much as or as fast as is already priced into the yield curve, the Agg will actually drag down performance relative to a long-duration index.³ Figure 2 shows the relative total return of the Long Government/Credit Index versus the Agg for hypothetical parallel shifts in the March 31, 2014, yield curve over various time frames. The rows represent the magnitude of the parallel shift, while the columns represent the length of time over which that shift happens.

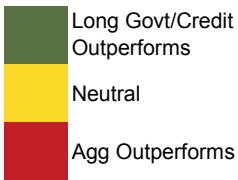
As Figure 2 shows, factoring the passage of time into any consideration of bond total

³ We explain the theory behind this result in the Appendix.

returns is critical. If rates rise both dramatically and rapidly, the Agg may outperform the long-duration index, while if the rise is more gradual, the long-duration index may outperform the Agg. To benefit from maintaining the Agg given a belief that interest rates will rise, a plan sponsor must be correct with respect to not only the shift's magnitude, but also its time horizon. In addition, this example only considered the impact of a parallel move in the yield curve, which is almost never the case in practice. If the yield curve flattens such that short-term rates rise more rapidly than long-term rates (as current forward rates suggest), the advantage to using a long-duration index may be even greater. Should the yield curve remain steep, long-maturity bonds will benefit from "rolling down the yield curve," or being discounted at progressively lower rates as time passes.

Figure 2 considered returns from an asset-only perspective, but holding the Agg and waiting for

Figure 2. Relative Return of Long Government/Credit Index vs the Agg for Various Yield Curve Shift Scenarios

	Time Horizon of Parallel Yield Curve Shift					
	1 Year	2 Years	3 Years	4 Years	5 Years	
-50 bps	6.8%	9.5%	12.1%	14.5%	17.6%	
Unchanged	1.8%	4.4%	7.0%	9.3%	12.4%	
+50 bps	-2.4%	0.0%	2.4%	4.7%	7.9%	
+100 bps	-6.0%	-3.9%	-1.6%	0.6%	3.7%	
+150 bps	-9.2%	-7.3%	-5.2%	-3.0%	0.0%	
+200 bps	-12.0%	-10.4%	-8.4%	-6.3%	-3.4%	

interest rates to rise also has an ongoing cost relative to the liability. Because of the currently steep yield curve, interest rates on short-term bonds are well below rates on long-term bonds, meaning that relative to the long-duration liability, holding the Agg is a negative carry position. In other words, as time passes, the annual coupon yield earned from the Agg is lower than the annual interest expense accrued by the liability. As a result, in the absence of any interest rate movements, funded status would gradually erode over time by holding the Agg. Table 1 shows the coupon yields of the Agg and the Long Government/Credit Index as of March 31, 2014, as well as a proxy for a typical liability discount rate, which is used to compute pension interest expense.

Because the coupon yield on the Agg is approximately 1% below the liability discount rate, that return must be made up from elsewhere in the portfolio just to stay even in funded status terms. In contrast, some longer duration indexes carry a higher coupon yield that can not only exceed the liability's interest expense, but also provide a cushion against the potentially larger capital loss if rates rise quickly. In theory, an active long-duration manager may be able to add alpha over and above the index, providing additional protection.

Forecasting interest rates is notoriously difficult and to choose between a short- or long-duration strategy on the basis of total return requires a precise interest rate view. Despite the pervasive belief that rates would continue to rise in 2014, the ten-year treasury rate fell from 3.0% to 2.7%

Table 1. Coupon Yields
As of March 31, 2014

Index	Coupon Yield
Agg	3.3%
Long Government/Credit	5.3%
Citigroup Pension Liability Index	4.4%

during the first quarter alone. One factor among many that may prevent long-term rates from rising rapidly is the excess demand for long-duration investment-grade bonds from de-risking pension plans. As of the end of 2013, the total asset base of private defined benefit pension plans was \$3 trillion, according to Investment Company Institute. Meanwhile, in 2013 the total issuance of investment-grade corporate bonds ten years or more in maturity was almost ten times smaller, at \$335 billion, according to Dealogic. The excess demand may accelerate as more fully funded plans increase their allocation to long-duration fixed income, keeping long-term rates and spreads low. The key takeaway is that the path to higher expected rates may be volatile and take far longer than expected, costing plans in the Agg in the meantime.



Conclusion

Plan sponsors waiting to take the first step in de-risking may still benefit from moving to long duration now instead of waiting for rates to rise. Moving away from the Agg may result in lower surplus risk—locking in some of the funded status gains from 2013 and the first half of 2014—without the need to increase the allocation to fixed income. This lower risk does not necessarily come at the expense of lower returns, as the Agg may underperform a long-duration index if interest rates do not rise by as much as or as quickly as is already priced into the yield curve. Plan sponsors that do not make the shift to long duration may experience lower expected returns at a higher level of surplus risk—a classic symptom of the Agg drag. ■



Appendix: Forward Rates as Breakeven Rates

Conventional wisdom suggests that long-duration bonds should perform worse than short-duration bonds if interest rates rise. However, to earn a higher total return from a short-duration strategy relative to a long-duration strategy over a given time horizon, rates across the yield curve must rise above those implied by the forward curve within the expected time horizon. This is a significantly higher hurdle to climb than the initial belief that “rates rising” is enough.

To illustrate these points, we will compare the returns offered by a short-duration bond (five-year maturity) with those of a long-duration bond (30-year maturity) over a one-year period. We will assume both bonds are risk-free with 5% annual-pay coupons. The “textbook” approach to valuing these bonds demonstrates why prices fall as interest rates rise:

$$Price_{5\text{-year}} = \frac{5}{(1+r)} + \frac{5}{(1+r)^2} + \dots + \frac{105}{(1+r)^5}$$

$$Price_{30\text{-year}} = \frac{5}{(1+r)} + \frac{5}{(1+r)^2} + \dots + \frac{105}{(1+r)^{30}}$$

Assuming the yield (or discount rate) (r) is equal to the coupon rate of 5%, both of these bonds will be initially priced at par (\$100). If there is an instantaneous shift in yields, with investors suddenly demanding 6% to own both five- and 30-year bonds, then both bonds will re-price downward, as prices move inversely to yields. In this scenario, the five-year bond would fall 4.3%,

while the longer-duration 30-year bond would fall 13.8%. Given this, if an investor holds a strong view that r is going to rise, it seems that he would never wish to own the 30-year bond. This simple analysis ignores two key elements: the yield curve and the passage of time.

The initial assumption that both five- and 30-year bonds yield 5% implies a flat yield curve. In reality, the yield curve is typically upward sloping, as it is today, with five-year yields of 1.73% and 30-year yields of 3.56% as of March 31, 2014. To obtain the correct price, each cash flow should be discounted at the r corresponding to the same maturity point on the yield curve¹ to obtain the price. Because the two bonds above are relatively more sensitive to different segments of the yield curve (five- and 30-year), predicting that “rates will rise” requires a more holistic view on the movement of the entire yield curve.

Second, instead of comparing only the price return given an instantaneous change in *yields*, we should contrast the total return (including coupon return and price return) of each of these bonds over a specified time horizon. In this example, we will choose one year as the comparison period, but similar reasoning can

¹ We should technically use Treasury spot rates, not the yield curve rates, for all coupon-bearing Treasuries (those longer than one year in maturity). Spot rates, also called the “term structure of interest rates,” are the theoretical yields on zero-coupon Treasuries that can be derived from the yield curve. However, for simplification and no material impact on the results, we will simply use the yield curve rates and the term “yield curve” instead of “spot rate curve.”

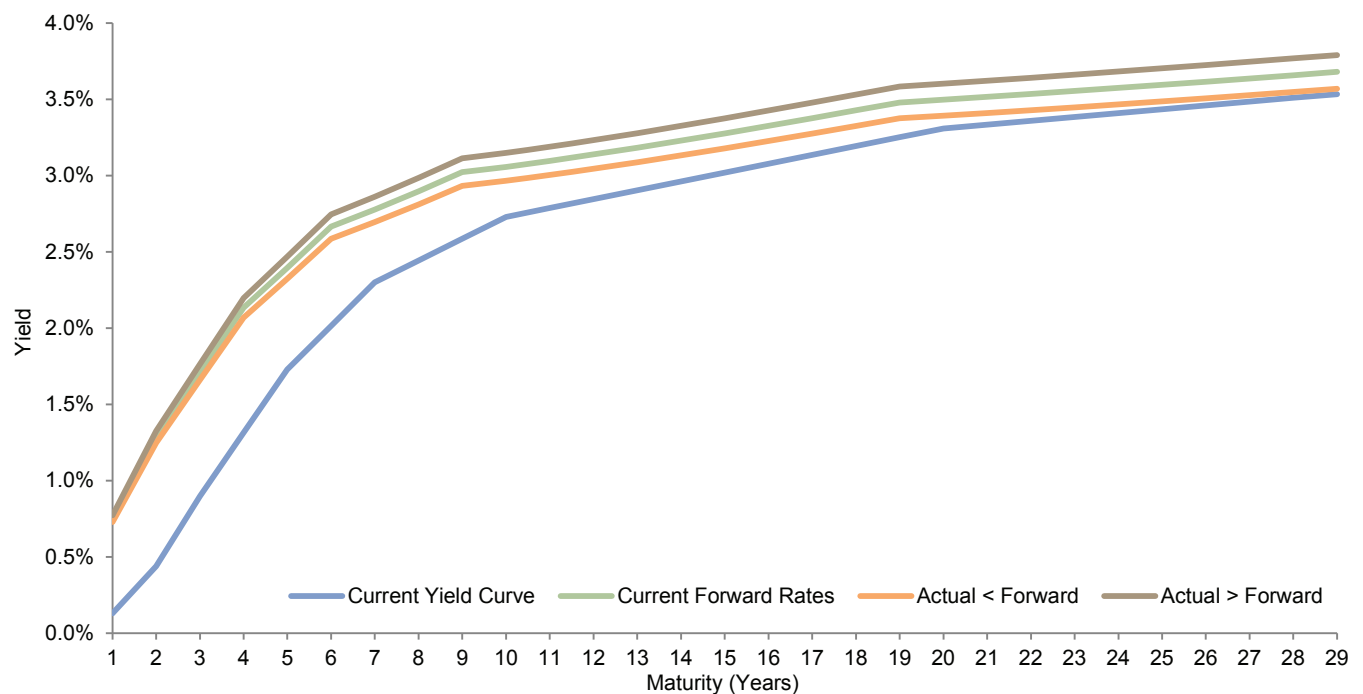


be applied to longer or shorter horizons. While we cannot know what the yield curve will look like in a year, we can calculate what prices, and thus total returns, will be given an assumption of future yields. What may be overlooked is the initially surprising result that even if all rates on the yield curve rise over the next year, an investor may still earn a higher return from the 30-year bond than from the five-year bond. How can this be?

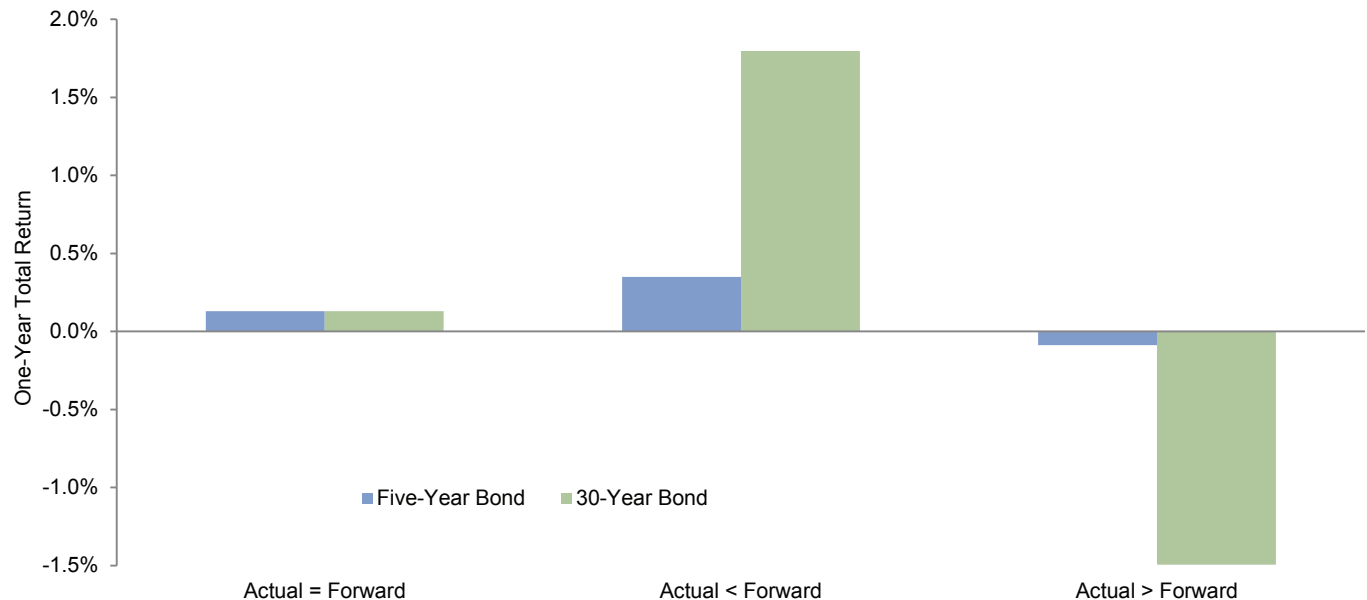
Because the current yield curve is upward sloping, a certain level of rate increases in the future is already “priced into” current bonds. Using current rates, we can derive what the

yield curve would need to look like one year from today to earn the same return from our five- and 30-year bonds. These “breakeven” rates are called one-year forward rates, and we show them using the March 31, 2014, yield curve in Appendix Figure 1. The forward curve lies entirely above today’s yield curve by a significant amount (an average of 75 bps in the one- to five-year tenors). Putting this into context, if rates in one year are higher than the current forward rates, the shorter-duration five year bond will outperform the 30-year bond. Conversely, if future rates stay below the forward curve, the 30-year bond will do better as its higher coupon offsets the duration loss.

Appendix Figure 1. Current Yield Curve and Possible One-Year Shifts
As of March 31, 2014



Appendix Figure 2. Total Return of Five-Year vs 30-Year Bonds for Each Scenario
As of March 31, 2014



In Appendix Figure 2 we show changes in yield and performance for five- and 30-year bonds for three scenarios of yield curve changes over the year:

- ◆ **Actual = Forward.** The yield curve rises to the exact levels of today's forward curve.
- ◆ **Actual < Forward.** The yield curve rises to levels 3% below today's forward curve at each maturity.
- ◆ **Actual > Forward.** The yield curve rises to levels 3% above today's forward curve at each maturity.

Each of these scenarios allowed for a non-parallel shift (a “flattening”) in the yield curve and each resulted in a strong rise in rates over one year. However, as shown in Appendix Figure 2, the 30-year bond performs at least as well as the five-year bond even if the entire yield curve rises, as long as it does not rise above the implied forward rates. Therefore, when choosing between short- and long-duration strategies based on a belief that future rates will rise, investors need to be precise about which rates, by how much, and when—relative to the forward curve. ■



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Exhibit Notes

Tracking Error of the Agg and the Long Government/Credit Index vs a Hypothetical Liability

Sources: Barclays and Citigroup Global Markets.

Note: Tracking error is calculated as the rolling one-year annualized standard deviation.

Relative Return of Long Government/Credit Index vs the Agg for Various Yield Curve Shift Scenarios

Sources: Barclays and Citigroup Global Markets.

Note: Results calculated using Barclays POINT as of March 31, 2014.

Current Yield Curve and Possible One-Year Shifts

Source: US Treasury.

Note: The Actual < Forward and Actual > Forward denote a 3% deviation from the Actual.

Total Return of Five-Year vs 30-Year Bonds for Each Scenario

Source: US Treasury.

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