

### What is a Hedge Ratio?

Hedge ratio measures how closely plan assets and liabilities move in response to a parallel shift in interest rates.

#### CONVERSATIONAL LDI HEDGE RATIO DEFINITION



At a 100% hedge ratio, the plan is fully hedged. For illustration purposes, let's assume the plan's starting assets and liabilities are the same value. At a 100% hedge ratio, assets and liabilities have the same sensitivity to interest rate changes. This means that, as interest rates move up or down, assets and liabilities change by the same amount. This ignores the effects of convexity (which I know is an absolutely blasphemous thing to say as fixed income manager) but it allows us to simplify things for illustrative purposes.

If the hedge ratio is under 100%, the plan is underhedged. This means assets are less sensitive than liabilities to changes in interest rates. If rates fall, a plan's liabilities increase by more than assets, which leads to a fall in funded status. Conversely, if rates rise, the funded status increases. So, a sponsor may tactically choose to be more underhedged if they believe we are in a rising rate environment.

The opposite is true if the plan is overhedged and the hedge ratio is over 100%. With assets more sensitive than liabilities to changes in interest rates, funded statuses improve under a falling rate environment.

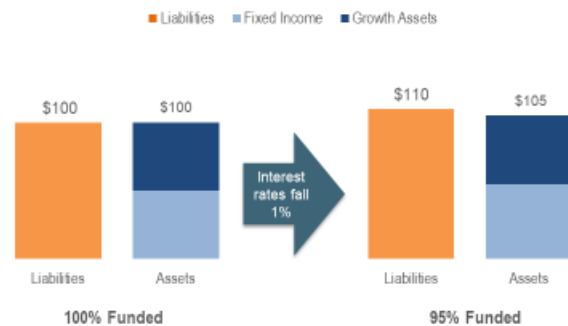
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### CONVERSATIONAL LDI HEDGE RATIO EXAMPLE

#### EXAMPLE:

- Liability duration = 10 years
- Fixed Income duration = 10 years
- Allocation to fixed income = 50%
- Hedge Ratio = 50%



It may help to see an example with specific numbers. Let's assume we have a fully funded plan with \$100 in assets and liabilities. Liability and fixed income durations are both ten years. Duration is a measure of how sensitive liabilities and assets are to interest rate changes. Roughly speaking, duration is the percent change for every one-percent change in interest rates. So, a liability duration at ten years means that, for every one percent change in discount rate, liabilities change by ten percent. However, with only 50 percent allocated to fixed income, the total asset duration is only five years. This means that for every one percent change in interest rates, assets only change by five percent. We will dig into the specific hedge-ratio formula shortly, but this example results in a hedge ratio of 50%.

If interest rates fall by one percent, liabilities increase by \$10 to \$110. Assets, which have a shorter duration, only increase by \$5 to \$105. As a result, the funded status declines from 100% to 95%. This example highlights why sponsors in the early stages of their LDI journeys, with smaller allocations to fixed income, usually seek to extend the duration in their fixed income book beyond their liability duration.

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#### CONVERSATIONAL LDI HEDGE RATIO FORMULA

$$\text{HEDGE RATIO} = \text{Funded Status (\%)} \times \text{Allocation to Fixed Income (\%)} \times \frac{\text{Duration of Fixed Income}}{\text{Duration of Liabilities}}$$

#### CONSIDERATIONS TO INCREASE HEDGE RATIO:

- Increase allocation to fixed income
- Extend duration of fixed income
- Contributions
- Pension risk transfer
- Plan amendment
- Change in actuarial assumptions

And here is the mathematical formula for hedge ratio. Hedge ratio is equal to the funded status times the allocation to fixed income times the duration of fixed income over the duration of liabilities.

Generally speaking, the goal under an LDI strategy is to gradually increase the hedge ratio as the plan progresses towards its end state. The rationale is to limit interest rate risk as funded status improves.

This formula highlights the levers that can be pulled to improve hedge ratios. Hedge ratio can be improved by increasing the funded status, the percent allocated to fixed income, or the duration of fixed income. Because liability duration is in the denominator, decreasing the liability duration increases the hedge ratio.

Arguably, the easiest levers to pull to immediately raise the hedge ratio are to increase the percent allocated to fixed income or extend the duration of fixed income. Funded status can be increased a number of ways, via: contributions, strong asset performance, favorably priced pension risk-transfer activity, or lowering the liability value. The liability duration can be shortened perhaps through a change in actuarial assumptions.