

## INTEREST RATE PRODUCTS

# Long-Term “Ultra” Treasury Bond Futures and Liability-Driven Investment

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New Ultra T-Bond futures provide an attractive risk management solution for liability-driven pension fund managers who seek to mitigate duration mismatches between plan assets and liabilities, without disrupting asset allocation strategy.

### The Move to Liability-Driven Investment ...

Through the mid- and late 1990s, pension fund managers typically used asset-driven investment strategies to meet the funding requirements of plan liabilities. They invested in broad portfolios of assets which were benchmarked to established market indexes, and which bore little or no connection to plan liabilities. These asset-driven strategies succeeded brilliantly, as long as asset returns both exceeded established benchmarks and funded plan liabilities. Thus, by 1999 year-end, the average S&P 500 pension plan was approximately 120 percent funded.

These strategies fared less well, however, with the dramatic declines in equity prices and interest rates in the early years of this decade. Funds guided by asset-driven strategies suffered simultaneous declines in asset returns and increases in plan liabilities. By the end of 2002, the funding ratio of the average S&P 500 pension plan had plunged to about 80 percent.

Against this backdrop, liability-driven investment (LDI) strategies have come into favor, because they recognize explicitly that a plan’s ultimate goal is not to match or exceed the performance of other pension plans or market benchmarks, but to fund the pension plan’s liabilities.

### ... Exposes Gaps in Duration Exposure

Despite LDI’s rise in popularity – or perhaps because of it – plan sponsors have rediscovered that the structure of plan liabilities remains very different from a traditional fixed income portfolio. Many pension funds, for example, make core fixed income allocations in securities with modified durations between three and seven years. A typical defined benefit plan, however, may have liabilities with modified durations between 12 and 15 years. Such duration mismatches make the plan’s funding status vulnerable to interest rate volatility.

### Example

Consider a pension fund fully invested in a diversified portfolio of investment grade bonds. The bond portfolio has a market value of \$1 billion and a modified duration of five years. The DV01 of the plan’s assets – the dollar value of a uniform change of one basis point in market yields – is \$500,000.

That is, where:

- $V_A$  is the market value of the asset portfolio
- $D_A$  is its modified duration
- $DV01_A$  is its DV01
- 0.0001 is one basis point in decimal terms

$$DV01_L = D_L \times V_L \times 0.0001$$

For the example at hand,

$$\$1.2 \text{ million} = (12 \text{ years}) \times \$1 \text{ billion} \times (0.0001 \text{ per year})$$

The portfolio is structured to meet the funding requirements of the plan's liabilities. These also have a market value of \$1 billion, but they have a modified duration of 12 years and a correspondingly larger DV01 of \$1.2 million. In obvious notation:

$$DV01_A = D_A \times V_A \times 0.0001$$

In this case,

$$\$500,000 = (5 \text{ years}) \times \$1 \text{ billion} \times (0.0001 \text{ per year})$$

The gap between asset and liability DV01s means that the plan's coverage of its liabilities is highly sensitive to changes in interest rate levels. For example, if interest rates rise by one basis point in yield, the pension fund will be overfunded by \$700,000, equal to the difference between the \$500,000 loss in market value of assets and the \$1.2 million decrease in market value of plan liabilities.

As Exhibit 1 illustrates, a 100-basis point rise in yields would cause the plan to be overfunded by approximately \$70 million. With the market value of the plan's liabilities having fallen roughly \$120 million (from \$1 billion to around \$880 million), the magnitude of overfunding in relative terms would be approximately 8 percent of liabilities (equal to \$70 million/\$880 million). Conversely, a 100-basis point drop in market yields would cause the plan to be underfunded by more than 6 percent of its liabilities.

**Exhibit 1:**  
The Impact of Yield Volatility on Plan Funding

| Yield Change (BPS) | Change in Assets (\$ Millions) | Minus | Change in Liabilities (\$ Millions) | Equals | Net Funding (\$ Millions) | Net Funding (Pct of Liabilities) |
|--------------------|--------------------------------|-------|-------------------------------------|--------|---------------------------|----------------------------------|
| 100                | -50                            | -     | -120                                | =      | 70                        | 8.0                              |
| 50                 | -25                            | -     | -60                                 | =      | 35                        | 3.7                              |
| 0                  | 0                              | -     | 0                                   | =      | 0                         | 0.0                              |
| -50                | 25                             | -     | 60                                  | =      | -35                       | -3.3                             |
| -100               | 50                             | -     | 120                                 | =      | -70                       | -6.2                             |

## Solution: Duration Extension via Futures Overlay

With Ultra T-Bond futures, a straightforward futures overlay strategy permits the fund manager to rectify the imbalance between asset and liability durations. Assuming the plan charter permits use of exchange-listed derivatives, the fund manager may close the duration gap by synthetically extending the duration of plan assets through the purchase of Ultra T-Bond futures. In terms of DV01s:

$$DV01_L = DV01_A + (DV01_{\text{Futures}} \times \text{Number of Futures Contracts})$$

For this example, assume that the DV01 of the Ultra T-Bond futures is \$195 per contract which has a notional value of \$100,000. Then the appropriate scale of the duration extension overlay would be 3,590 contracts, determined by rearranging terms in the equation above:

$$\frac{(DV01_L - DV01_A)}{DV01_{\text{Futures}}} = \frac{(\$1.2 \text{ million} - \$500,000)}{(\$195 \text{ per contract})}$$

As Exhibit 2 indicates, with this synthetic duration-extension overlay, *pension assets would fluctuate by less than one percent of plan liabilities over a range of plus/minus 100 basis points.*

**Exhibit 2:**  
The Impact of Yield Volatility on Plan Funding with an Ultra Treasury Bond Futures Overlay

| Yield Change (BPS) | Change in Assets (\$ Millions) | Minus | Change in Liabilities (\$ Millions) | Equals | Net Funding (\$ Millions) | Net Funding (Pct of Liabilities) |
|--------------------|--------------------------------|-------|-------------------------------------|--------|---------------------------|----------------------------------|
| 100                | -116.3                         | -     | -120                                | =      | 3.7                       | 0.4                              |
| 50                 | -58.2                          | -     | -60                                 | =      | 1.8                       | 0.2                              |
| 0                  | 0                              | -     | 0                                   | =      | 0                         | 0.0                              |
| -50                | 64.9                           | -     | 60                                  | =      | 4.9                       | 0.5                              |
| -100               | 129.9                          | -     | 120                                 | =      | 9.9                       | 0.9                              |

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## Benefits of the Futures Overlay Strategy

The merits of an overlay strategy using Ultra Treasury Bond futures are many, especially when compared to other market alternatives such as over-the-counter interest rate derivatives or cash bonds.

### Preservation of the core asset allocation strategy

Many LDI fund managers have attempted to add duration to their portfolios by shifting into fixed income assets with longer durations, or by allocating more portfolio exposure to fixed income assets at the expense of other asset classes, or both. Adding longer duration cash bonds is apt to force the fund manager to move away from the plan's core asset allocation strategy.

By contrast, the Ultra T-Bond futures overlay enables the fund manager to adhere to the plan's core asset allocation strategy, while obtaining the desired extension of duration in the plan's asset portfolio.

### Reduction of balance sheet and income statement volatility

The futures overlay with Ultra T-Bond futures may reduce volatility in the fund's net income, by mitigating or eliminating losses related to underfunding, which would be charged to shareholder's equity.

The addition of longer duration cash bonds will add to the balance sheet. As a result, the earnings and variations in market value associated with these bonds may adversely impact shareholder's equity and thus contribute to income volatility.

### Capital efficiency

The Ultra T-Bond futures overlay would require only modest amounts of capital to be reserved against the risk of adverse market moves. In the example above, assuming the initial performance bond for a hedge position is \$3,500 per contract, the fund manager would expect to post initial margin of nearly \$12.5 million, equivalent to 1.3 percent of plan assets. Fund managers can pledge their existing Treasury or Agency securities as initial margin.

By comparison, LDI fund managers who employ overlay strategies with OTC derivatives or cash bonds will not have the benefit of paying lower performance bonds or receiving spread credits against market positions they already may have in other interest futures listed at CME Group exchanges. Depending on the creditworthiness of the LDI fund using an OTC overlay, the fund may be charged an initial collateral requirement per its ISDA Credit Support Annex. For authoritative and up-to-date information on margin requirements, please visit [www.cmegroup.com/margins](http://www.cmegroup.com/margins).

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Among its manifold benefits, the CME Clearing guarantee effectively removes the need for entering into time-consuming ISDA Master Agreements, for establishing and maintaining bilateral collateralization agreements, for posting counterparty credit surcharges, or for entering into auxiliary OTC credit default swaps to insure against counterparty failure.

### Position scalability

Given the nature of exchange-listed futures, the transactional costs of entering, liquidating, or making adjustments to an overlay position composed of Ultra T-Bond futures are low relative to various alternatives, such as OTC derivatives or often less liquid fixed-income assets. In addition, exchange-listed futures such as Ultra T-Bond futures benefit from transparent pricing, and are not susceptible to the inherent risks of delivery failure in the financing markets like cash bonds.

### Flexibility of exposure for fiduciaries

Investment managers are often prohibited from making short sales of assets, such as cash Treasury bonds. For many, however, the same plans permit holding of short open interest in exchange-listed futures contracts, such as Ultra and classic Treasury Bond Futures.

## Mind the Basis Risk

Users of futures overlay strategies must always keep basis risk in mind. For example, many pension funds discount plan liabilities with a AA corporate yield curve. Clearly, a futures overlay constructed with Ultra Treasury Bond futures, which reference U.S. Treasury credit exposure, will not correlate perfectly to AA corporate yield dynamics. Credit spread risk may either benefit or detrimentally impact the futures overlay as a direct result of fluctuations in corporate bond yields.

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For additional information,  
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