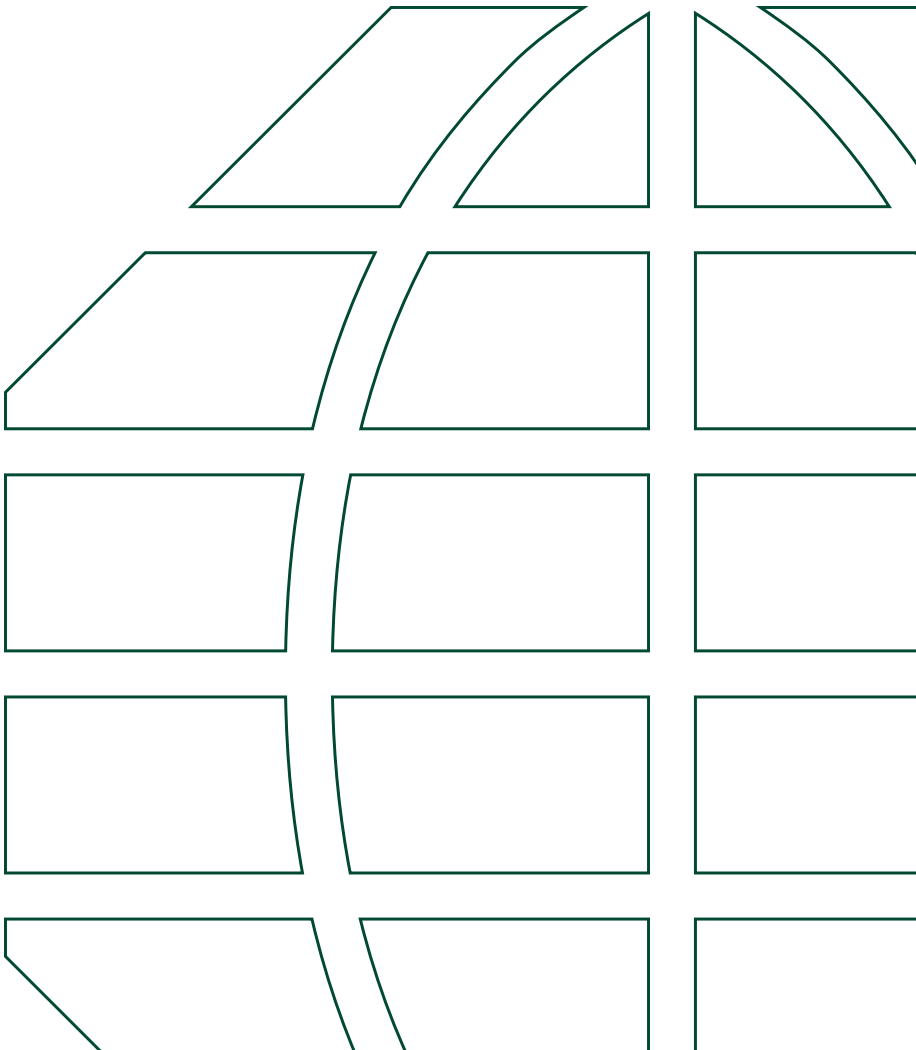
CME Group
A CME/Chicago Board of Trade/NYMEX Company

RESEARCH AND PRODUCT DEVELOPMENT

A Simple Treasury Duration Adjustment



The specter of rising interest rates can give nightmares to managers of fixed-income portfolios. The soothing balm in this case is not a glass of warm milk, but a lower duration target achieved with U.S. Treasury futures contracts.

When rising interest rates create a challenge for even the most skillful fixed-income managers, U.S. Treasury futures provide a means to efficiently adjust your portfolio's interest rate sensitivity. For example, your portfolio may be targeting a U.S. Treasury benchmark that has a 5-year duration. Facing the prospect of rising yields, you would prefer to lower it to a 4-year duration, which could reduce your portfolio's exposure to loss while retaining the possibility of outperforming your benchmark. And once you have achieved the shorter duration, rising yields will pose less of a threat to your sleep.

Alternative Approaches

There are a number of ways to retarget your portfolio duration. One way to shorten portfolio duration is by replacing the longer-dated cash securities with shorter-dated securities. Alternatively, you can sell U.S. Treasury futures, and with contracts listed at CME Group on 2-Year, 5-Year and 10-Year T-Notes and 30-Year T-Bonds, you should easily be able to target your needs. Among the many advantages of using futures for duration adjustments are lower transaction costs and greater flexibility. In particular, you can unwind a futures position quickly should the need arise. The same cannot always be said for positions in cash Treasury securities.

The simplest way to shorten duration with futures is to sell the required number of contracts in one futures maturity – for example, by selling 10-Year T-Note futures. However, a more effective way to sell a year's worth of duration may be to apportion your position across all four futures maturities. This will allow you to hit your duration target no matter how the yield curve shifts.

What Yield Curve Shifts Can Do to a Portfolio

Fixed-income managers must be cognizant of the effects that changes in the yield curve can have on their portfolios. Suppose you have a $100 million par portfolio of Treasury securities. For simplicity, assume this miniature portfolio holds the four securities that were on-the-run when the data was recorded. Exhibit 1 shows the relevant initial market conditions.

Exhibit 1:
Initial Market Conditions

Treasury Security		Yield	Duration (Years)	Full Price ($1 million par)	DV01
2-Year	3% of Feb 2008	3.92%	2.41	$977,500.00	$235.68
5-Year	3 7/8% of May 2010	4.00%	4.32	$994,403.85	$429.88
10-Year	4% of Nov 2012	4.08%	6.24	$995,291.67	$621.47
30-Year	8 1/8% of May 2021	4.41%	9.96	$1,419,666.67	$1,413.73

Given these durations, you can purchase $17 million par of the 2-year note, $52 million par of the 5-year note, $24 million par of the 10-year note and $7 million par of the 30-year bond to arrive at your 5-year weighted average target duration for the portfolio. Exhibit 2 shows this portfolio configuration.

The values in the "Weight" column are the result of multiplying the durations by the full prices. The weighted average duration, then, is the result of dividing the sum of the weights by the sum of the full prices (511,700,000 ÷ 102,160,000 = 5.0088).

Exhibit 2:
A Portfolio to Target a 5-Year Duration

Treasury Security		Duration (Years)	Position ($1 million par)	Price	Full Price (Position x Price)	DV01 (Position)	Weight
2-Year	3% of Feb 2008	2.411	17	97-24 (97.75)	$16.618 M	$4,006.56	$40.05 M
5-Year	3 7/8% of May 2010	4.323	52	99-14 (99.44)	$51.709 M	$22,353.76	$223.54 M
10-Year	4% of Nov 2012	6.244	24	99-17 (99.53)	$23.887 M	$14,915.28	$149.15 M
30-Year	8 1/8% of May 2021	9.958	7	141-31 (141.969)	$9.938 M	$9,896.11	$98.96 M
	Portfolio	5.0088	100		$102.160 M	$51,171.71	$511.70 M

Exhibit 3 illustrates the effects on this portfolio under two different scenarios:

Scenario 3A: A 20 basis point (bp) parallel shift of the Treasury yield curve.
Scenario 3B: A more realistic yield curve flattening.

Exhibit 3:
How Two Yield Curve Shifts Affect the Portfolio

Scenario A: 20 Basis Point Parallel Shift

Treasury Security		DV01 (Position)	Yield Change (bps)	Result
2-Year	3% of Feb 2008	$4,006.56	+20 bps	(-$80,131.20)
5-Year	3 7/8% of May 2010	$22,353.76	+20 bps	(-$447,075.20)
10-Year	4% of Nov 2012	$14,915.28	+20 bps	(-$298,305.60)
30-Year	8 1/8% of May 2021	$9,896.11	+20 bps	(-$197,922.20)
	Portfolio	$51,171.71		(-$1,023,434.20)

Scenario B: Yield Curve Flattening

Treasury Security		DV01 (Position)	Yield Change (bps)	Result
2-Year	3% of Feb 2008	$4,006.56	+30 bps	(-$120,196.80)
5-Year	3 7/8% of May 2010	$22,353.76	+20 bps	(-$447,075.20)
10-Year	4% of Nov 2012	$14,915.28	+10 bps	(-$149,152.80)
30-Year	8 1/8% of May 2021	$9,896.11	+5 bps	(-$49,480.55)
	Portfolio	$51,171.71		(-$756,905.35)

Note that while the 20 bp yield increase in Scenario 3A will cause the portfolio to lose $1,023,434.20, the more realistic yield curve flattening of Scenario 3B will cause a $756,905.35 loss.

Testing Alternative Futures Strategies

Now suppose you had elected to sell a year of duration by establishing a short position in 10-Year T-Note futures. The first step is to determine how many contracts you will need to use. A full hedge takes the duration to zero, which would make your portfolio perform the same way a cash holding would and render it completely unresponsive to yield shifts. However, since lowering the portfolio's duration to 4 years amounts to a 20 percent reduction, you only need to use 20 percent of a full hedge.

To determine the number of contracts you need, first calculate the ratio for a full hedge by dividing the portfolio's DV01 ($51,171.71) by the 10-Year T-Note futures DV01 ($69.54)[1].

$51,171.71 / $69.54 = 735.86 or 736 10-Year T-Note futures contracts

Then, calculate 20 percent of 736, which is 147 contracts:

736 x 0.2 = 147.20

Exhibit 4 shows how a duration adjustment using a single futures maturity might perform under three different scenarios:

Scenario 4A: 10-Year T-Note futures position and a 20 bp parallel yield curve shift.

Scenario 4B: 10-Year T-Note futures position and a flattening yield curve.

Scenario 4C: 5-Year T-Note futures position and a flattening yield curve.

Scenario 4A shows that given a 20 bp parallel shift, 147 10-Year T-Note futures contracts will generate a $204,448 gain. This reduces the effective loss to $818,986.60, which is 20 percent less than the $1,023,434.20 loss of the cash Treasury portfolio.

Exhibit 4:
Selling Duration with One Treasury Futures Maturity

Scenario A: 10-Year T-Note Futures Position and 20 Basis Point Parallel Shift (Up)

Futures Maturity	Futures DV01	Yield Change (bps)	Position	Result
10-Year T-Note	$69.54	+20 bps	Short 147 contracts	$204,447.60

Scenario B: 10-Year T-Note Futures Position and Yield Curve Flattening

Futures Maturity	Futures DV01	Yield Change (bps)	Position	Result
10-Year T-Note	$69.54	+10 bps	Short 147 contracts	$102,223.80

Scenario C: 5-Year T-Note Futures Position and Yield Curve Flattening

Futures Maturity	Futures DV01	Yield Change (bps)	Position	Result
5-Year T-Note	$46.60	+20 bps	Short 220 contracts	$205,040.00

While the simple 10-Year T-Note futures position performed well in the case of the 20 bp parallel shift, Scenario 4B shows that it misses the mark when the yield curve changes shape. In this case, it produces the effect of a 13.5 percent duration target reduction ($102,223.80 / $756,905.35). Obviously, a big part of the mismatch occurs because the 10-year yield moved only 10 bps. This might lead you to think that using the 5-Year T-Note futures contract would improve your results, however, as Exhibit 4C shows, it won't. This $205,040 futures gain has the effect of a 27 percent duration target reduction ($205,040 / $756,905.35), which is even further off your target than the 10-Year T-Note futures result.

Alternatively, using a combination of 2-Year, 5-Year and 10-Year T-Note futures and 30-Year T-Bond futures to sell duration at each maturity will achieve a much better result. Again, since you are targeting a duration that is 20 percent less than the current portfolio duration, at each maturity you would calculate a full hedge and then take 20 percent of that number to determine how many contracts to sell. Exhibit 5 shows the details of these calculations.

Exhibit 5:
Structuring a Synthetic Portfolio with Futures

Treasury Security		DV01 (Position)	Futures DV01	Full Hedge (Contracts)	Hedge (Contracts)
2-Year	3% of Feb 2008	$4,006.56	$49.80 ($24.90 X 2)[2]	80	16
5-Year	3 7/8% of May 2010	$22,353.76	$46.60	476	96
10-Year	4% of Nov 2012	$14,915.28	$69.54	214	43
30-Year	8 1/8% of May 2021	$9,896.11	$116.99	85	17

The next step is to compare the results of this complex futures position with the results you get using only one futures maturity. Exhibit 6 shows how the complex futures position will perform given the two different yield curve shifts.

In the case of the 20 bp parallel shift, the complex position produces a $204,989 gain. This reduces the $1,023,434.20 loss to an $818,445.20 loss. Thus, this futures position creates the effect of a 20 percent duration reduction. In the case of the more realistic yield curve flattening, the $153,222 futures gain reduces the loss from $756,905.35 to $603,683.35, again close to the effect of a 20 percent duration target reduction.

Exhibit 6:
Targeting a 4-Year Duration with Treasury Futures

Scenario A: 20 Basis Point Parallel Shift (Up)

Futures Maturity	Futures DV01	Yield Change (bps)	Position	Result
2-Year T-Note	$49.80	+20 bps	Short 16	$15,936.00
5-Year T-Note	$46.60	+20 bps	Short 96	$89,472.00
10-Year T-Note	$69.54	+20 bps	Short 43	$59,804.00
30-Year T-Bond	$116.99	+20 bps	Short 17	$39,777.00
Portfolio				$204,989.00

Scenario B: Yield Curve Flattening

Futures Maturity	Futures DV01	Yield Change (bps)	Position	Result
2-Year T-Note	$49.80	+30 bps	Short 16	$23,904.00
5-Year T-Note	$46.60	+20 bps	Short 96	$89,472.00
10-Year T-Note	$69.54	+10 bps	Short 43	$29,902.00
30-Year T-Bond	$116.99	+5 bps	Short 17	$9,944.00
Portfolio				$153,222.00

Conclusion

Clearly, the most effective duration targeting will result from the use of U.S. Treasury futures at all the maturities to which your portfolio has exposure. If your outlook indicates that this is a temporary situation, then this synthetic portfolio constructed with U.S. Treasury futures will help you target your preferred duration. When the situation normalizes, a futures position can be unwound as easily as it can be initiated.

On the other hand, if you conclude that this will be a longer-term situation, you can begin to adjust your underlying portfolio as the market creates opportunities to do so in a cost-effective way; with the futures position in place, you can afford to wait for advantageous prices in the cash market. As you eliminate unwanted securities and replace them with securities that fit in with your new goals, you can gradually lift your futures position until the portfolio make over is complete.

For more information, visit www.cmegroup.com/interestrates.

1 Technically speaking, Treasury futures do not inherently have a DV01 since they are not coupon-bearing securities. Instead, they derive it from the instrument they track (usually the cheapest-to-deliver or the on-the-run security). To move from the cash DV01 to a rough estimate of the future's DV01, simply take the cash DV01 and divide it by the conversion factor for the security.

2 2-Year T-Note futures contract has a notional value of $200,000, twice the amount of the other contracts. Therefore the DV01 is doubled.

CME GROUP HEADQUARTERS

20 South Wacker Drive
Chicago, Illinois 60606
cmegroup.com

info@cmegroup.com
800 331 3332
312 930 1000

CME GROUP GLOBAL OFFICES

Chicago **New York** **Houston**
Washington D.C. **Hong Kong** **London**
Singapore **Sydney** **Tokyo**

IR219/0/1208