U.S. Treasury Futures 2.0

Practical Applications

January 2018

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Agenda

1 Review Basics

2 CS#1-2: Basis Trading

3 CS#3: Invoice Spreads

4 CS#4-5: Duration adjustment

5 CS#6 Yield curve management

6 Review and Questions

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Review Basics

The Delivery Process:

Position Day

3-Day delivery process

Optionality

Invoice amount

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Review Basics

Contract specs:

Each has its own “basket”

Contract Scale Factor

Delivery days (dates)

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Review Basics

Conversion Factors (CF):

Used in invoicing at delivery

Used in calculating basis

Allow for relative value analysis

“Eyes” through which the contract “sees” basket

Theoretical price at which security yields 6%

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Review Basics

Basis:

Exchange for Physical (EFP)

Action on the cash side

Carry, cost of carry

Net basis

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Review Basics

Repo:

Large part of Dealer operations

Part of cost of carry

Contributes to Net Basis

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Review Basics

Cheapest-to-deliver (CTD):

Most economically efficient to deliver

Contract most closely correlated to CTD

BPV of CTD used in calculating hedge ratios

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Review Basics

Measuring Risk:

Modified Duration

Basis Point Value (BPV)

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Case study #1: Basis Trading

Mechanics

A spread between a cash Treasury and a UST futures contract.

“Action” on the cash side of spread, i.e. Buying the basis means buying cash selling futures, Selling the basis means selling cash and buying futures.

The amount of futures contracts determined by par amount and CF of issue.

Transacted “ex-pit” and executed via EFP.

Quoted and actively traded on broker screens.

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Case study #1: Basis Trading

Can be used to swap from cash to futures or futures to cash.

Example: Dealer owns too many current OTR 10-Years. You own Treasury futures but want OTR 10s. You agree to swap cash for futures by executing a basis trade.

Step 1: Price the basis. It should be either tightly quoted or easily calculated from cash and futures quotes.

	Coupon	Maturity	Price	Size
10Y	2.250	11/15/2027	98-17+ / 18	30x10

Assume TNH8 quoted 133-110 bid offered at 133-115, 1500 per side.
The 2.250% 11/15/2027 have a CF of 0.7314.

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Case study #1: Basis Trading

Calculate the basis based on inputs:

Convert futures to decimal, then multiply by CF.
Bid side = 133-110 = 133.34375 x 0.7314 = 97.52761875
Offer side = 133-115 = 133.359375 x 0.7314 = 97.53905

Convert cash to decimal, then subtract converted futures.
Bid side = 98-17+ = 98.546875 – (offer) 97.53905 = 1.007825
Convert back to 1/32s = 1.007825 = 32.25 or 32-1/4 ticks (1/32s)

Convert cash to decimal, then subtract converted futures.
Offer side = 98-18 = 98.5625 – (bid) 97.52761875 = 1.03488125
Convert back to 1/32s = 1.03488125 = 33.11 or 33-1/8 ticks (1/32s)

So the market for the basis should be 32 / 33+ or tighter.

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Case study #1: Basis Trading

Execute, buy 10mm 2.250% 11/15/2025 basis
At 32-1/2 ticks (1/32); you agree to a futures price of 133-115; now write up the trade:

Convert 133-115 to decimal then multiply by CF.
133-115 = 133.359375 x 0.7314 = 97.53905
Convert the basis level to decimal then add to converted futures
32-1/2 = 1.015625 + 97.53905 = 98.554675
Write up your buy side:
Purchase 10mm 2.250% 11/15/2025 at 98.554675
Write up sell side:
Sold 73 (0.7314 x 100) TNH8 at 133-115

Dealer writes up opposite spread trade, same prices, both report EFP.

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Basis Trading

A delivery eligible US Treasury security's CF is not necessarily the proper dollar weighted hedge ratio.

$$CF \neq HR$$

It is the appropriate hedge ratio for the CTD security of that contract.

Trading any other eligible security on a conversion factor basis includes "tail risk" and becomes more of a market directional trade.

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Case study #2: Basis Trading

A Tale of Two Basis

Ultra Ten Year and Classic Ten Year U.S. Treasury futures contracts have a few (maximum of three) securities that are eligible to deliver into both contracts.

This allows us to see the affects of price and yield curve movement on the basis of the same U.S. Treasury note with the same conversion factor (CF) versus two different contracts.

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Case study #2: Basis Trading

A Tale of Two Basis

Example:

June 1, 2016 the most recently auctioned U.S. Treasury 10-Year note (OTR) is the 1-5/8% 5/15/2026 which settled at a price/yield of 98-03 (1.6409%).

The TYU6 (Classic Ten) same day settled 129-175
The TNU6 (Ultra Ten Year) same day settled 140-260

The conversion factor (CF) for the 1-5/8% 5/15/26 is 0.6867 for both futures contracts.

Data source: Bloomberg and CME Group

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Case study #2: Basis Trading

A Tale of Two Basis

Example:

Given the inputs we can calculate the basis for the 1-5/8% 5/15/26 versus both futures contracts.

$Basis = P_{cash} - P_{(futures \times CF)}$

June 1:

$Basis_{TYU6} = 98.09375 – (129.546875 \times 0.6867) = 292.0$ (1/32s)

$Basis_{TNU6} = 98.09375 – (140.8125 \times 0.6867) = 44.5$ (1/32s)

Data source: Bloomberg and CME Group

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Case study #2: Basis Trading

A Tale of Two Basis

By July 8 yields on U.S. Treasuries had fallen as a result on global economic and political considerations.

1-5/8% 5/15/2026 now price/yield 102-14 (1.3583), a 47.8 bps drop in yield.

The TYU6 (Classic Ten) same day settled 133-255
The TNU6 (Ultra Ten Year) same day settled 147-095

Apply these new inputs to the basis formula.

Data source: Bloomberg and CME Group

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Case study #2: Basis Trading

A Tale of Two Basis

July 8:

1-5/8% 5/15/2026 now price/yield 102-14 (1.3583)

Basis = P_{cash} - $P_{(futures\ x\ CF)}$

$Basis_{TYU6}$ = 102.4375 – (133.796875 x 0.6867) = 338.0 (1/32s)

$Basis_{TNU6}$ = 102.4375 – (147.296875 x 0.6867) = 41.5 (1/32s)

What happened?

Data source: Bloomberg and CME Group

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Case study #2: Basis Trading

A Tale of Two Basis

June 1	July 8
1-5/8% vs. TYU6 = 292.0 basis	**= 338.0 basis, 46.0 (1/32) higher**
1-5/8% vs. TNU6 = 44.5 basis	**= 41.5 basis, 3.0 (1/32s) lower**

TNU6 tracked its CTD issue, 1-5/8% 2/15/2026, which is only 3-month shorter in maturity than the 1-5/8% 5/15/2026.

TYU6 tracked its CTD issue, 1-3/4% 5/15/2023, which is **3-YEARS** shorter in maturity than the 1-5/8% 5/15/2026.

The different contracts are currently tracking different CTDs resulting in different implied BPVs and modified durations. A CF weighted basis trade is NOT a dollar weighted HR.

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Case study #2: Basis Trading

A Tale of Two Basis

June 1	July 8
1-5/8% vs. TYU6 = 292.0 basis	= 338.0 basis, 46.0 (1/32) higher
1-5/8% vs. TNU6 = 44.5 basis	= 41.5 basis, 3.0 (1/32s) lower

The versus TYU6 basis trade was long 10mm cash Treasuries with an initial BPV of $896 per million face value. 10mm x $896 = $8,960 risk long

The conversion factor of 0.6867 calls for selling 69 TYU6 per 10mm. 69 TYU6 based on the CF adjusted BPV of the CTD is = $5,853 risk short

This was a *bullish* trade not market neutral.

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Case study #2: Basis Trading

A Tale of Two Basis

June 1	→	July 8
1-5/8% vs. TYU6 = 292.0 basis		= 338.0 basis, 46.0 (1/32) higher
1-5/8% vs. TNU6 = 44.5 basis		= 41.5 basis, 3.0 (1/32s) lower

The versus TNU6 basis trade was long 10mm cash Treasuries with an initial BPV of $896 per million face value. 10mm x $896 = $8,960 risk long

The conversion factor of 0.6867 calls for selling 69 TNU6 per 10mm. 69 TYU6 based on the CF adjusted BPV of the CTD is = $9,032 risk short

This was closer to dollar neutral. Why the loss of 3.0 (1/32s)?

Yield curve. The slope between 2/2026 and 5/2026 steepened by 1.4 bps, which cheapened 5/2026 versus the 2/2026 CTD. That's roughly 3-4 (1/32s).

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Case study #3: Invoice Swap Spreads

An Invoice Spread is a spread trade between a CME Group US Treasury futures contract and a forward starting IRS.

The spread is designed to capture the relative value, or difference in sovereign US credit versus commercial credit expressed by IRS rates.

“Buying” or going long this spread involves buying US Treasury futures and Paying Fixed on the corresponding IRS.

- **Paying Fixed on the IRS is in contrast to receiving fixed on the US Treasury security that will ultimately be delivered in to the futures contract.**

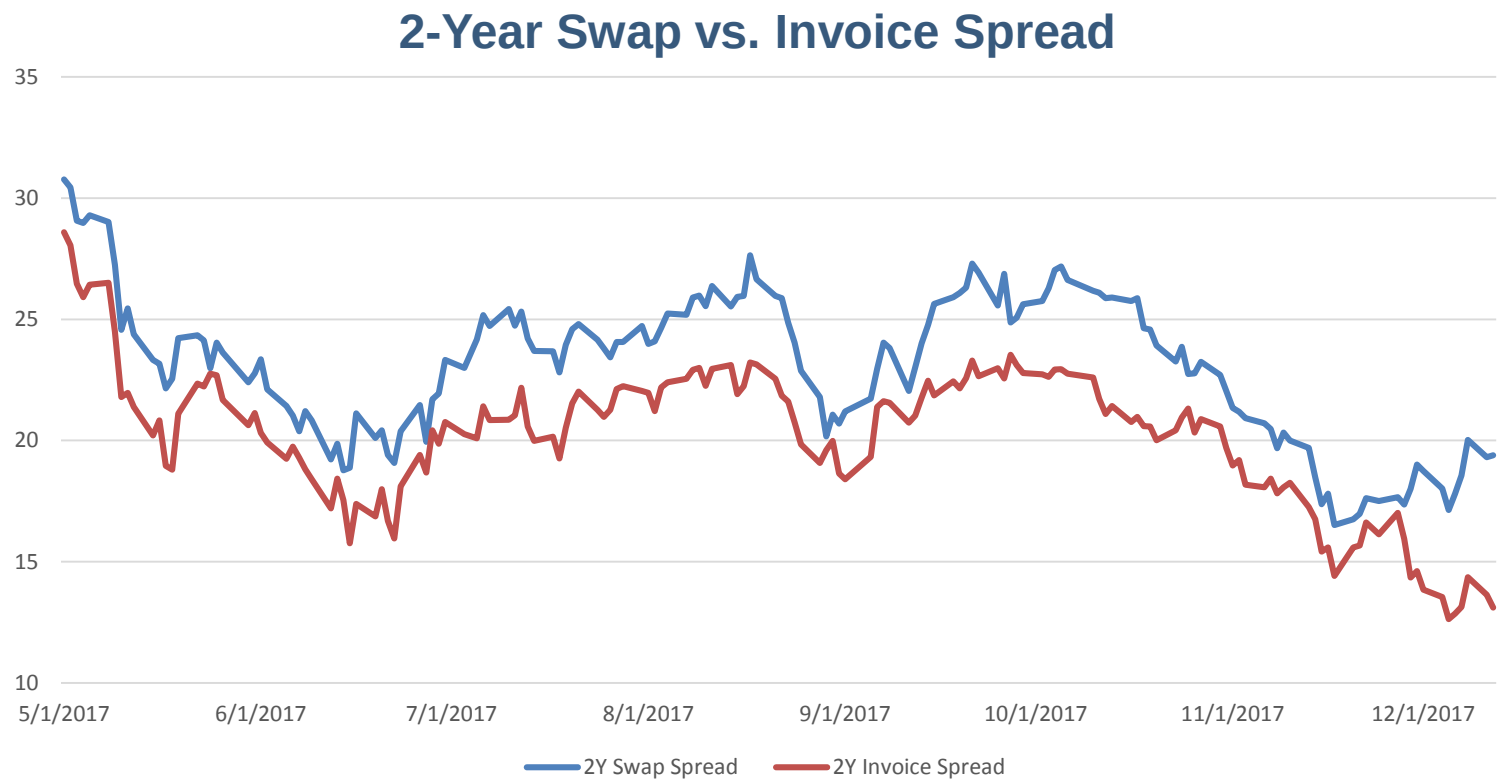
“Selling” or going short the spread involves selling US Treasury futures and Receiving fixed on the corresponding IRS.

Longs anticipate the yield relationship to widen, shorts anticipate it to narrow.

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Case study #3: Invoice Swap Spreads

Exposure to the swap spread, using futures in place of cash securities



Data Source: Bloomberg

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Case study #3: Invoice Swap Spreads

Calculation of the spread begins with an understanding of a US Treasury futures contract's "cheapest-to-deliver" or CTD security.

Generally each US Treasury futures contract has one or sometimes two underlying Treasury security/ies that are most efficient for the short to deliver into the contract at expiry.

This security is usually the one with the lowest 'net basis' or tightest conversion factor adjusted price spread to the futures price.

US Treasury futures tend to trade like their CTD securities.

An Invoice Spread's IRS leg maturity date is matched to the corresponding futures contract's CTD security's maturity date.

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Case study #3: Invoice Swap Spreads

Calculation of an Invoice Spread:

Step 1: identify futures contract's CTD security.

Step 2: Calculate the BPV and implied forward yield of the futures based on its CTD security.

Step 3: Calculate the yield spread between futures and the forward starting IRS.

Step 4: Calculate the hedge ratio (HR) based on each leg's BPV.

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Case study #3: Invoice Swap Spreads

Example: December 14, 2017

TUH8 = 107-045 (107 and 4-1/2 1/32s)
Implied Forward Yield = 1.942%
BPV per $200,000 = $43.00

IRS rate = 2.075%
$10 million BPV = $1,948.10

Invoice Spread = $Yield_{irs} – Yield_{futures}$

2.075 – 1.942 = 0.133 or 13.3 bps.

HR = $BPV_{risk} \div BPV_{futures}$

HR = 1948.10 ÷ 43.00 = 45 TUH8 contracts
45 TUH8 = 10mm IRS.

Data Source: Bloomberg and CME Group

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Measuring Risk

Basis point value (BPV) …

- **Change in monetary value for 1 basis point (0.01%) change in yield**
- **Often quoted in $'s per $1 million face value of security**
- **Also known as "dollar value of 01" (DV01), or "value of a basis point" (VBP)**

	Face Value			
Days	**$500,000**	**$1 MM**	**$10 MM**	**$100 MM**
1	$0.14	**$0.28**	$2.78	$27.78
7	$0.97	**$1.94**	$19.44	$194.44
30	$4.17	**$8.33**	$83.33	$833.33
60	$8.33	**$16.67**	$166.67	$1,666.67
90	$12.50	**$25.00**	$250.00	$2,500.00
180	$25.00	**$50.00**	$500.00	$5,000.00
270	$37.50	**$75.00**	$750.00	$7,500.00
360	$50.00	**$100.00**	$1,000.00	$10,000.00

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Measuring Risk

Duration …

- **Macauley's duration = average weighted maturity of cash flows (coupons, principle) discounted to Present Value (PV)**

- **Modified duration = % price change per 1% yield change**

On-the-Run Treasuries
(12/15/2017)

	Coupon	Maturity	Duration	BPV / mm
2-Yr Note	1-3/4%	11/30/2019	1.907	$191
5-Yr Note	2%	11/30/2022	4.682	$465
7-Yr Note	2-1/8%	11/30/2024	6.415	$635
10-Yr Note	2-1/4%	11/15/2027	8.808	$873
30-Yr Bond	2-3/4%	11/15/2047	20.304	$2,055

Source: Bloomberg

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Managing Duration

Fixed income portfolio impacted by rising/falling rates

Modified Duration has traditionally been used as a way of measuring portfolio risk.

A portfolio with modified duration = 4.0 years may lose 4% if rates increase 100 basis points (1.00%)

Asset managers may target portfolio duration to a performance benchmark or "bogey"

OR, may extend (shorten) duration in anticipation of falling (rising) rates … enhancing returns or "alpha"

If interest rates expected to decline	➔	**Extend portfolio duration in anticipation of price advance**
If interest rates expected to advance	➔	**Reduce portfolio duration in anticipation of price decline**

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Managing Duration

Contract **UST 5-Year Note** MAR 2018 116.065 Date 12/13/2017

$100,000 Notional Repo Rate 1.31 # Days 112

Coupon	Maturity	Price/32s	YTM	BPV/100K	Mod Dur	CF	Basis/32s	Carry	Net Basis
1.750	5/31/2022	98.1100	2.141	41.96	4.26	0.8453	3.75	4.40	-0.64
1.750	6/30/2022	98.0750	2.160	42.67	4.31	0.8426	10.29	4.45	5.84
1.875	7/31/2022	98.2275	2.169	43.54	4.38	0.8446	18.10	5.52	12.58
1.625	8/31/2022	97.1850	2.168	43.96	4.48	0.8324	27.22	3.24	23.98
1.875	9/30/2022	98.2000	2.178	44.96	4.54	0.8394	34.69	5.55	29.14
2.000	10/31/2022	99.0600	2.176	45.86	4.61	0.8417	44.14	6.83	37.30
2.000	11/30/2022	99.0475	2.182	46.58	4.69	0.8392	52.18	6.75	45.43

Data Source: Bloomberg and CME Group

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Managing Duration

US Treasury futures can be used to adjust duration.

$$HR = [(D_{target} - D_{current}) / D_{current}] \times (BPV_{port} \div BPV_{futures})$$

Where:

D_{target} = revised targeted duration
$D_{current}$ = current duration
BPV_{port} = basis point value of the current portfolio
$BPV_{futures} = BPV_{CTD} \div CF_{CTD}$

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Case study #4: Managing Duration

Single contract overlay

Example: Long $100 million U.S Treasury portfolio with an average modified duration of 6.0 years, and a BPV of $600 per million. The PM is concerned rates may rise. How many contracts should she sell to adjust the duration from 6.0 to 4.5 years?

Step 1: Identify which contract to use
Step 2: Identify that contract's CTD issue
Step 3: Calculate contract's CF adjusted BPV
Step 4: Calculate HR

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Case study #4: Managing Duration

Single contract overlay

Step 1: Identify which contract to use

Contract	Coupon	Maturity	Net Basis	BPV/100K	CF	BPV/cf	Mod Dur
TUH8	1.625%	12/31/2019	0.162	39.90*	0.9283	42.98	1.99
FVH8	1.750%	12/31/2022	-0.645	41.96	0.8453	49.64	4.26
TYH8	2.250%	11/15/2024	-0.341	63.43	0.8006	79.23	6.36
TNH8	2.250%	8/15/2027	0.633	85.09	0.7367	115.50	8.57
USH8	4.500%	2/15/2036	1.212	169.14	0.8375	201.96	13.02
ULH8	3.750%	11/15/2043	-0.581	204.89	0.7080	289.39	17.31

The contract with a duration close to your targeted duration is generally the best for a single contract overlay.

For this example we will use the FVH8 as its duration is closest to our 4.5 year target.

*$200,000 contract factor

Data Source: Bloomberg and CME Group

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Case study #4: Managing Duration

Single contract overlay

Step 2: Identify that contract's CTD issue

Contract **UST 5-Year Note** MAR 2018 116.065 Date 12/13/2017

$100,000 Notional Repo Rate 1.31 # Days 112

Coupon	Maturity	Price/32s	YTM	BPV/100K	CF	Basis/32s	Carry	Net Basis
1.750	5/31/2022	98.1100	2.141	41.96	0.8453	3.75	4.40	-0.64
1.750	6/30/2022	98.0750	2.160	42.67	0.8426	10.29	4.45	5.84
1.875	7/31/2022	98.2275	2.169	43.54	0.8446	18.10	5.52	12.58
1.625	8/31/2022	97.1850	2.168	43.96	0.8324	27.22	3.24	23.98
1.875	9/30/2022	98.2000	2.178	44.96	0.8394	34.69	5.55	29.14
2.000	10/31/2022	99.0600	2.176	45.86	0.8417	44.14	6.83	37.30
2.000	11/30/2022	99.0475	2.182	46.58	0.8392	52.18	6.75	45.43

Step 3: Calculate contract's CF adjusted BPV

BPVcontract = BPVctd ÷ CFctd

BPVcontract = $41.96/ 0.8453 = $49.64 per $100,000 face amount

Data Source: Bloomberg and CME Group

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Case study #4: Managing Duration

Single contract overlay

Step 4: Calculate Hedge Ratio

$$HR = [(D_{target} - D_{current}) / D_{current}] \times (BPV_{port} \div BPV_{futures})$$

$$HR = [(4.5 - 6.0) / 6.0] \times (60000 / 49.64)$$

$$HR = -0.25 \times 1208.70$$

HR = -302.18 or Sell 302 FVH8 contracts to adjust portfolio's duration from 6.0 to 4.5 years.

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Case study #4: Managing Duration

Single contract overlay

Shortening duration in anticipation of higher rates

If yields rise by 100 basis points, portfolio value may decline by 4.5% or $4.5 million

But this is preferable to 6% or $6.0 million decline if duration unadjusted

$1.5 million or 150 basis points (1.50%) represents “alpha” or enhanced return

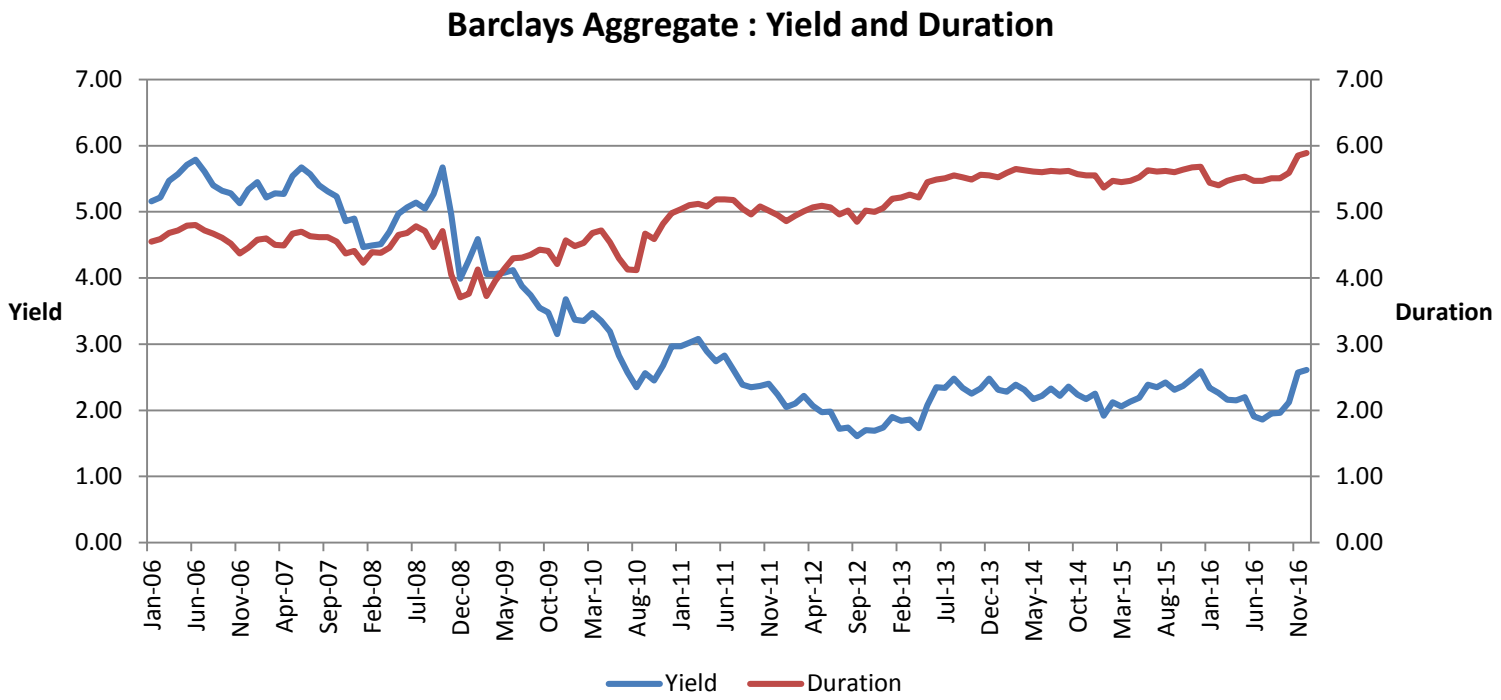
Sell 302 Five-year T-note futures ➔ **Reduces portfolio duration from 6.0 to 4.5 years**

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Case Study #5: Key Target Duration Adjustment

Multiple contract overlay

One consequence of the long bull market in interest rates is the steady extension of portfolio and benchmark bond index duration.



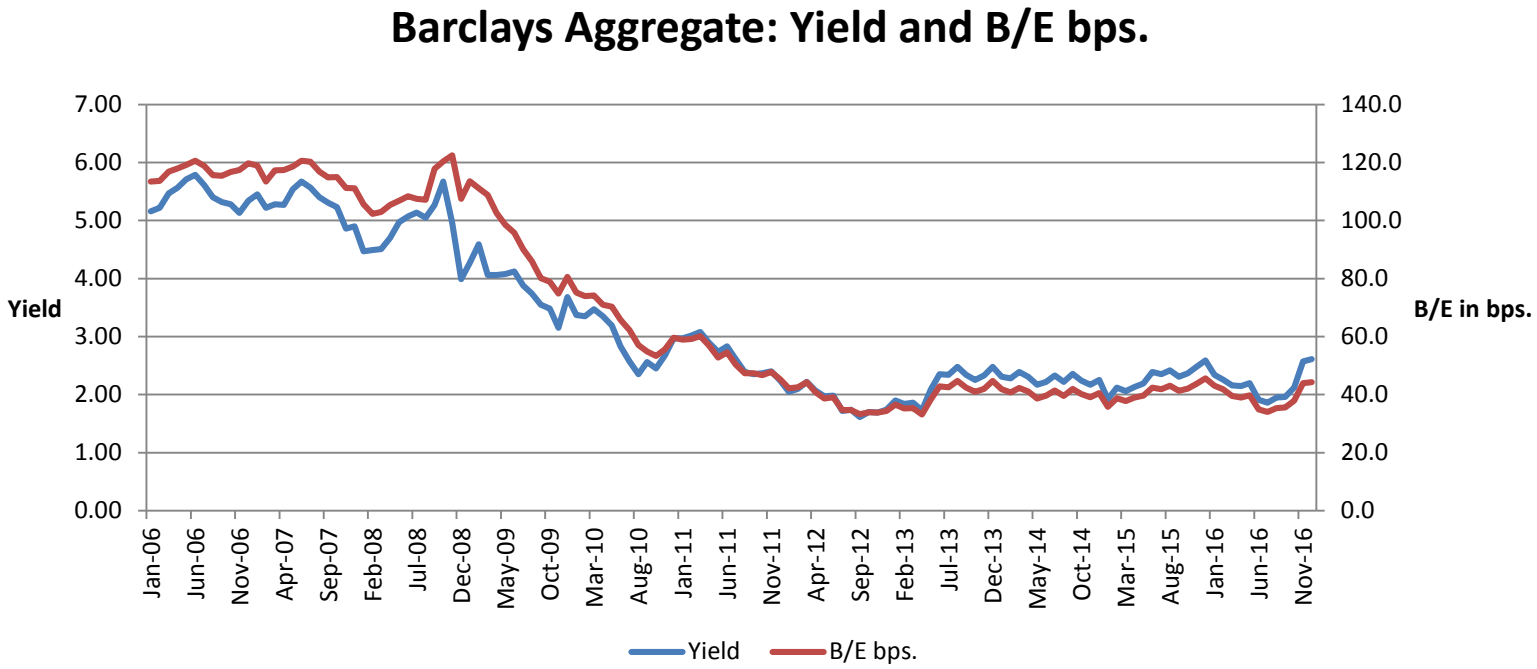
Source: Bloomberg

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Case Study #5: Key Target Duration Adjustment

Multiple contract overlay

Higher duration portfolios and benchmarks in an historically low interest rate environment has caused the "break-even" rate to move lower and closer to current interest rate levels.



Source: Bloomberg and CME Group

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Case Study #5: Key Target Duration Adjustment

Multiple contract overlay

Assume you are a portfolio manager with $10 Billion USD exposure to U.S. interest rates. The portfolio is diversified across the yield curve and is benchmarked to a bond index.

If provided with the current portfolio and the new benchmark weightings can the PM use CME Group U.S. Treasury futures to adjust the portfolio closer to the benchmark?

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Case Study #5: Key Target Duration Adjustment

Multiple contract overlay

Assume this is the current portfolio by maturity tranche.

Tranche	Yield	Modified Duration (years)	DV01 (per $1mm face value)	Position (in $1mm face value)	Aggregate DV01
1-3 years	0.591%	1.97	$197.00	2,055	$404,835
3-5 years	0.905%	4.75	$473.00	1,925	$910,525
5-7 years	1.188%	6.44	$643.00	1,900	$1,221,700
7-10 years	1.374%	8.77	$855.00	1,650	$1,410,750
10+ years	2.042%	19.56	$1925.00	2,470	$4,754,750
		8.82		$10 billion	$8,702,560

Data source: Theoretical, CME Group

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Case Study #5: Key Target Duration Adjustment

Multiple contract overlay

This table shows the benchmark's targeted duration by tranche.

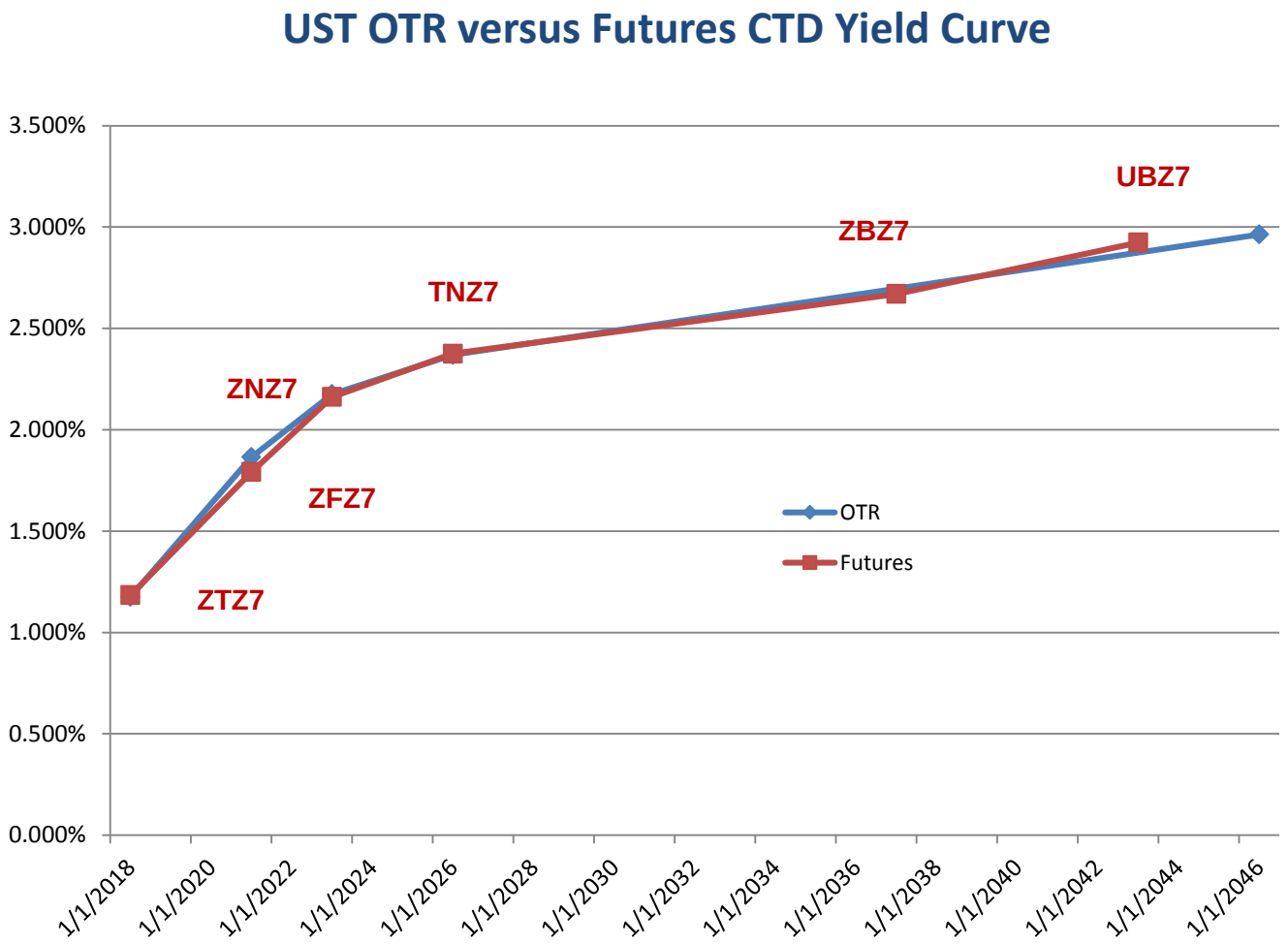
Tranche	Benchmark Duration	Duration Adjustment
1-3 years	1.92	-0.025
3-5 years	3.85	-0.189
5-7 years	5.66	-0.121
7-10 years	7.91	-0.098
10+ years	16.24	-0.170
	7.81	

To determine the proper adjustment, or hedge ratios, we need to know more about the futures contracts.

Data Source: Citi Yieldbook and CME Group

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Case Study #5: Key Target Duration Adjustment



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Case Study #5: Key Target Duration Adjustment

Multiple contract overlay

CME Group CTD Analysis

*adjusted for $200,000 notional

U.S. Treasury Contract	CTD Issue (Dec-2016)	Modified Duration (CTD)	DV01 (per contract)
2-Year	1-3/8% 9/30/2018	1.80	$39.15*
5-Year	1-1/8% 2/28/2021	4.11	$48.64
10-Year	2-1/2% 8/15/2023	6.10	$76.75
Ultra Ten Year	1-5/8% 5/15/2026	8.66	$116.18
Long Bond	5% 5/15/2037	13.89	$209.89
Ultra Bond	3-1/8% 2/15/2042	17.22	$277.38

Step #1: Identify each contract's CTD issue and ascertain its BPV (DV01).

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Case Study #5: Key Target Duration Adjustment

Multiple contract overlay

Step #2: Determine duration adjustments needed for each tranche.

Tranche	Dcurrent	Dtarget	Dadjustment	Aggregate DV01
1-3 years	1.97	1.92	**-0.025**	$404,835
3-5 years	4.75	3.85	**-0.189**	$910,525
5-7 years	6.44	5.66	**-0.121**	$1,221,700
7-10 years	8.77	7.91	**-0.098**	$1,410,750
10+ years	19.56	16.24	**-0.170**	$4,754,750
	8.82	**7.81**		$8,702,560

Duration adjustment (DA) = $(D_{target} - D_{current}) \div D_{current}$

For example, 1-3 years DA = (1.92 – 1.97) / 1.97 = -0.025

The negative result shows we need to reduce duration and sell futures contracts.

Data Source: Citi Yieldbook and CME Group

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Case Study #5: Key Target Duration Adjustment

Multiple contract overlay

Step #3: Incorporate the DA factor into the HR calculation.

Tranche	BPV risk	BPV contract	DA factor	HR = (Risk ÷ contract) x DA	Contract (Globex code)
1-3 years	$404,835	39.15	-0.025	**-259**	ZT
3-5 years	$910,525	$48.64	-0.189	**-3,538**	ZF
5-7 years	$1,221,700	$76.75	-0.121	**-1,926**	ZN
7-10 years	$1,410,750	$116.18	-0.098	**-1,190**	TN
10+ years	$4,754,750	$277.38	-0.170	**-2,914**	ZB

Hedge ratio (HR) = (BPV risk ÷ BPV contract) x DA

For example, 1-3 years, HR = (404,835 ÷ 39.15) x -0.025 = -259

The negative result shows we need to reduce duration and sell futures contracts.

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Case Study #5: Key Target Duration Adjustment

Multiple contract overlay

How does this hedge perform in a rate rising environment?

Using time period 14 October – 23 November 2016 as a test case. Overlaps the U.S. General Election (Nov 8-9) and subsequent rise in US rates.

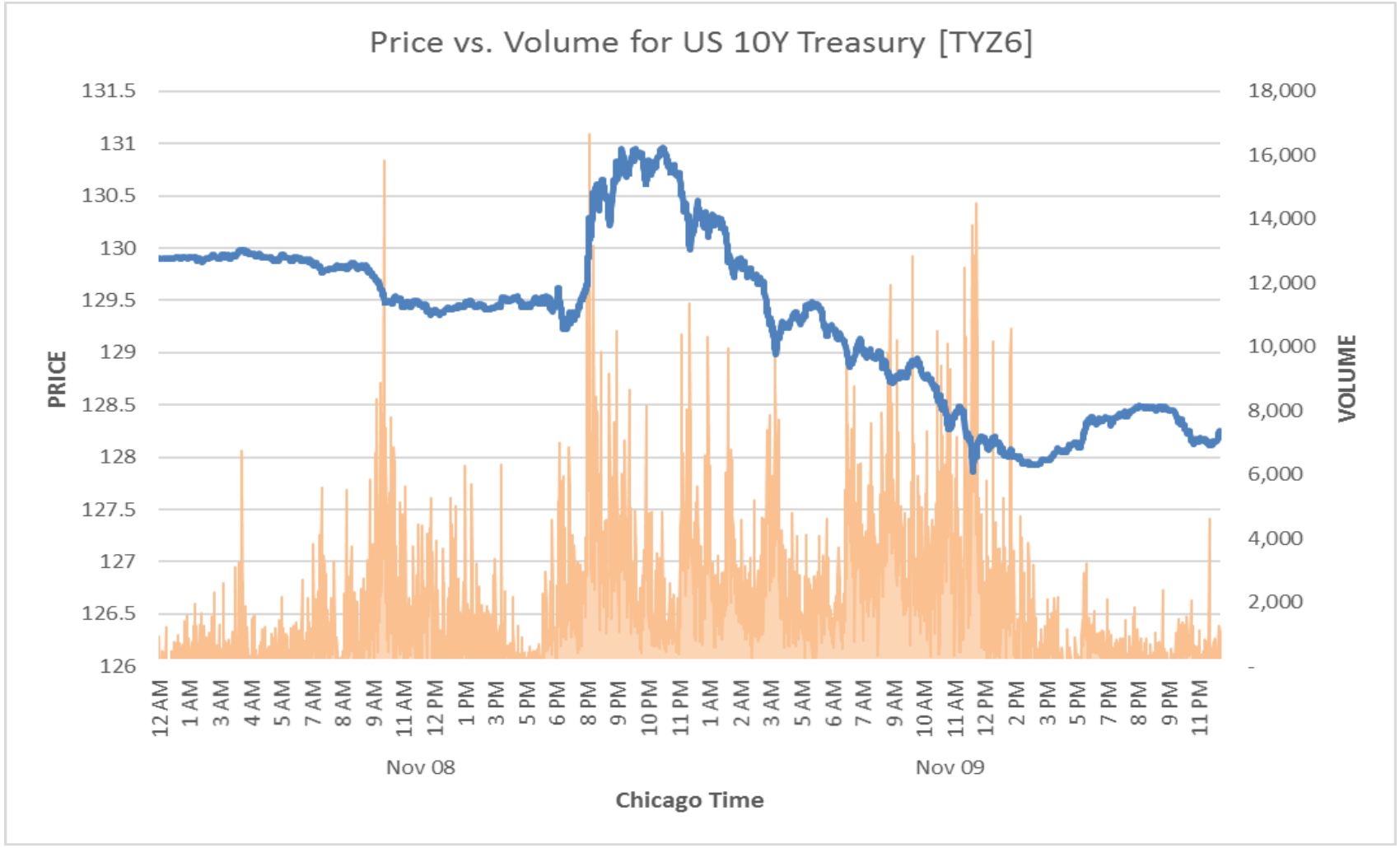
We will use on-the-run (OTR) US Treasury securities as surrogates for the portfolio tranches.

Tranche	OTR Treasury	10/14 Price/yield	11/23 Price/yield	Change P&L
1-3 years	3/4% 9/30/2018	99-265 / 0.837%	99-11 / 1.108%	-$ 9,953,906
3-5 years	1-1/8% 9/30/2021	99-07 / 1.287%	96-21 / 1.851%	-$40,906,250
5-7 years	1-3/8% 9/30/2023	98-19 / 1.591%	95-01 / 2.158%	-$86,687,500
7-10 years	1-1/2% 8/15/2026	97-10 / 1.799%	92-16 / 2.369%	-$79,406,250
10+ years	2-1/4% 8/15/2046	93-19 / 2.559%	84-18 / 3.042%	-223,071,875
		Unadjusted portfolio	**Total =**	**($440,025,781)**

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Case Study #5: Key Target Duration Adjustment

Multiple contract overlay



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Case Study #5: Key Target Duration Adjustment

Multiple contract overlay

How does this hedge perform in a rate rising environment?

Compare with the futures Key Rate Duration (KRD) overlay.

Tranche	Contract (Globex code)	Hedge Ratio (contracts)	10/14 Price	11/23 Price	Change P&L
1-3 years	ZT	-259	109-01	108-19+	$218,531
3-5 years	ZF	-3,538	120-26+	118-11	$8,789,719
5-7 years	ZN	-1,926	129-27+	125-11+	$8,667,000
7-10 years	TN	-1,190	141-29+	135-01+	$8,181,250
10+ years	ZB	-2,914	176-19	161-29	$42,799,375
				Total =	**$68,655,875**

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Case Study #5: Key Target Duration Adjustment

Multiple contract overlay

How does this hedge perform in a rate rising environment?

($440,025,781) + $68,655,875 = ($371,369,906) net loss

The $371 million loss is reasonable as it represents the rough equivalent of a 7.42 duration portfolio (versus target of 7.81) for a roughly 50.0 basis point move higher in rates.

The futures hedge effectively reduced the duration by 1-year reducing the portfolio losses by $68 million.

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Managing Yield Curve Exposure

Some yield curve strategies are based on forecasting the type of yield curve shift, then implementing an appropriate strategy to profit from the forecast.

Three typical types of yield curve shifts:

- **Parallel shifts**
- **Shifts and twists**
- **Shifts with humpedness**

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Managing Yield Curve Exposure

Traditionally three methods:

Bullet = all bonds similar maturities

Barbell = concentrated longs on with short and long dated maturities

Ladder = evenly stacked, scheduled maturities

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Managing Yield Curve Exposure



Source: FRED Economic Data, St. Louis Fed

Constant 10-Year yield minus constant 2-Year yield, as a spread.

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Case Study #6: Managing Yield Curve

Change in slope

Buy the curve anticipating a steepening.
Use 2-Year versus 10-Year spread, a.k.a. the TUX spread.
Buying TUH7 and Selling TNH7 (Ultra-Ten Year) expressing a steepening bias.

Sell the curve anticipating a flattening.

How to weight this spread?

Spread Ratio (SR) = $BPV_{10\text{-}Year} \div BPV_{2\text{-}Year}$

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Case Study #6: Managing Yield Curve

Change in slope

Example: Mid-summer 2017 PM believes anticipated FOMC rate hikes may contribute to a flattening of the yield curve. She decides to sell 2-Years and buy 10-Years using futures contracts.

Step 1 = Identify which contracts to use.
Step 2 = Identify each contract's CTD issue.
Step 3 = Calculate each contract's BPV.
Step 4 = Calculate SR based on BPVs.

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Case Study #6: Managing Yield Curve

Change in slope

Step 1 = Identify which contracts to use.
Step 2 = Identify each contract's CTD issue.
Step 3 = Calculate each contract's BPV.

TUZ7* ctd = 1-1/4% 9/30/2019, BPV = $48.41,* ytm = 1.455%

TNZ7 ctd = 2-3/8% 5/15/2027, BPV = $120.42, ytm = 2.283%

Difference in ytm = 0.828%, or 82.8 bps.

*** Remember TUH5 has a $200,000 face amount.**

Data Source: Bloomberg and CME Group

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Case Study #6: Managing Yield Curve

Change in slope

Step 4 = Calculate SR based on BPVs.

Spread Ratio (SR) = $BPV_{10\text{-Year}} \div BPV_{2\text{-Year}}$
SR = 120.42 / 48.41
SR = 2.4875, or roughly 5:2 TU/TN

PM decides to trade at CME ratio of 3:1

June 30, 2017
Sold 3000 TUZ7 at 107-3075
Bought 1000 TNZ7 at 134-17
Implied yield spread = 82.8 bps

Data Source: Bloomberg and CME Group

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Case Study #6: Managing Yield Curve

Change in slope

December 14, unwind.

TUZ7 at 107-1075, implied yield = 1.816%
TNZ7 at 134-15, implied yield = 2.340%

Yield curve = 52.4 bps, 30.4 flatter.

TUZ7 from 107-3075 to 107-1075 = 20.00 ticks lower
20 ticks x $62.50 per tick x 3000 contracts = $3,750,000 gain

TNZ7 from 134-17 to 134-15 = 2.00 ticks lower
2 ticks x $31.25 per tick x 1000 contracts = ($62,500) loss

3,750,000 – 62,500 = $3,687,000 gain

Why? The yield curve flattened. 30.4 bps of TNZ7 ~ $3,500,000

Data Source: Bloomberg and CME Group

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Margin offsets:

Advantage to using futures

Spread positions generally reflect lower market risk and therefore require lower margin requirements.

Bought 1000 TNZ7 and Sold 3000 TUZ7.
What is the margin required?

Margin	delta	side	Credit	MM
TN	1	A	55%	$2,200
TU	3	B		$ 550

((2200 x 1000) + (550 X 3000) x 0.45) = $1,732,500

$1,732,500 margin required as spread versus…

…outright legs = $3,850,000.

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Margin offsets: US Treasury Inter-Commodity Spreads

http://www.cmegroup.com/trading/interest-rates/intercommodity-spread.html

IMPLIED TREASURY & MAC SWAP SPREADS--BASED ON MARCH 2018 FUTURES CONTRACTS				
Spread Name	Futures Contract Legs	Price Ratio*	Leg Quanity Ratio*	External Name*
TYT	2-Year T- Note vs. 3-Year T-Note	1.6667**	5:3	TYT 05-03 H8**
TFY	2-Year T- Note vs. 5-Year T-Note	2.0000**	1:1	TFY 01-01 H8**
TUF	2-Year T- Note vs. 5-Year T-Note	2.5000**	5:4	TUF 05-04 H8**
TAF	2-Year T- Note vs. 5-Year T-Note	3.0000**	3:2	TAF 03-02 H8**
TUT	2-Year T-Note vs. 10-Year T-Note	4.0000**	2:1	TUT 02-01 H8**
TUX	2-Year T- Note vs. Ultra 10-Year T-Note	6.0000**	3:1	TUX 03-01 H8**
TUB	2-Year T-Note vs. T-Bond	10.0000**	5:1	TUB 05-01 H8**
TUL	2-Year T-Note vs. Ultra T-Bond	16.0000**	8:1	TUL 08-01 H8**
TOF	3-Year T- Note vs. 5-Year T-Note	1.6000**	4:5	TOF 04-05 H8**
TUN	3-Year T-Note vs. 10-Year T-Note	2.6667**	4:3	TUN 04-03 H8**
TYX	3-Year T- Note vs. Ultra 10-Year T-Note	4.0000**	2:1	TYX 02-01 H8**
TOB	3-Year T-Note vs. T-Bond	7.0000**	7:2	TOB 07-02 H8**
TOU	3-Year T-Note vs. Ultra T-Bond	10.0000**	5:1	TOU 05-01 H8**
FIT	5-Year T-Note vs. 10-Year T-Note	1.6667	5:3	FIT 05-03 H8
FYN	5-Year T-Note vs. 10-Year T-Note	1.0000	1:1	FYN 01-01 H8
FYT	5-Year T-Note vs. 10-Year T-Note	1.5000	3:2	FYT 03-02 H8
FIX	5-Year T- Note vs. Ultra 10-Year T-Note	2.5000	5:2	FIX 05-02 H8
FOB	5-Year T-Note vs. T-Bond	4.0000	4:1	FOB 04-01 H8
FOL	5-Year T-Note vs. Ultra T-Bond	6.0000	6:1	FOL 06-01 H8
NON	10-Year T-Note vs. Ultra 10-Year T-Note	1.0000	1:1	NON 01-01 H8
TEX	10-Year T-Note vs. Ultra 10-Year T-Note	1.5000	3:2	TEX 03-02 H8
NBY	10-Year T-Note vs. T-Bond	1.0000	1:1	NBY 01-01 H8
NOB	10-Year T-Note vs. T-Bond	3.0000	3:1	NOB 03-01 H8
NOL	10-Year T-Note vs. Ultra T-Bond	4.0000	4:1	NOL 04-01 H8
NCB	Ultra 10-Year T-Note vs. T-Bond	2.0000	2:1	NCB 02-01 H8
NUB	Ultra 10-Year T-Note vs. Ultra T-Bond	2.5000	5:2	NUB 05-02 H8
BOB	T-Bond vs. Ultra T-Bond	1.5000	3:2	BOB 03-02 H8
BUB	T-Bond vs. Ultra T-Bond	1.0000	1:1	BUB 01-01 H8
FNU	5-Year MAC Swap vs. 10-Year MAC Swap	2.0000	2:1	FNU 02-01 H8

*Leg quantity and price ratios are subject to change. Highlighted ratios are unchanged from prior quarterly expiration. **Price ratios of spreads involving 2-Year and 3-Year T-Notes are doubled to account for larger notional size ($200K) in the price changes of the spreads. However, the ratio of the TYT is not doubled because the contracts have the same notional size.

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Review & Questions

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Thank you

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