CME Group Interest Rate Overview

Eurodollar Futures: Foundational Concepts

January 2017

Disclaimer

Futures trading is not suitable for all investors, and involves the risk of loss. Futures are a leveraged investment, and because only a percentage of a contract's value is required to trade, it is possible to lose more than the amount of money deposited for a futures position. Therefore, traders should only use funds that they can afford to lose without affecting their lifestyles. And only a portion of those funds should be devoted to any one trade because they cannot expect to profit on every trade. All references to options refer to options on futures.

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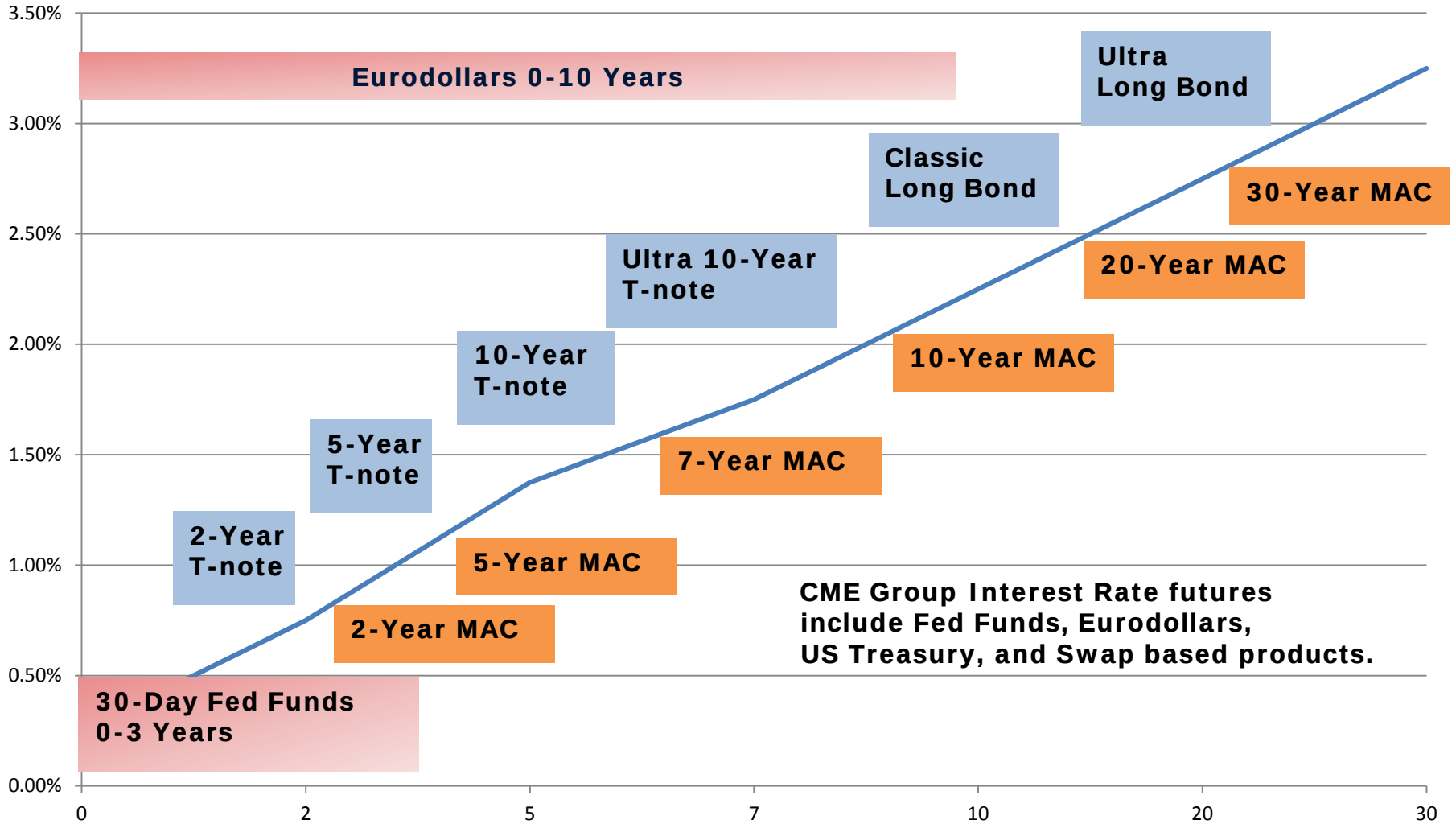
All matters pertaining to rules and specifications herein are made subject to and are superseded by official Exchange rules. Current rules should be consulted in all cases concerning contract specifications.

CME Group Interest Rate Products



CME Group Short-Term Interest Rates (STIRs)

Fed Fund Futures: Monthly contract based on 30-day average Fed Funds rate.
Contracts extend out 36 consecutive months (3-years).

Eurodollar Futures: Quarterly and monthly serial contracts based on 3 month LIBOR rate.
40 Quarterly contracts extend out 10-years.

Both contracts are financially (cash) settled.

Options on Eurodollars are also deeply liquid.

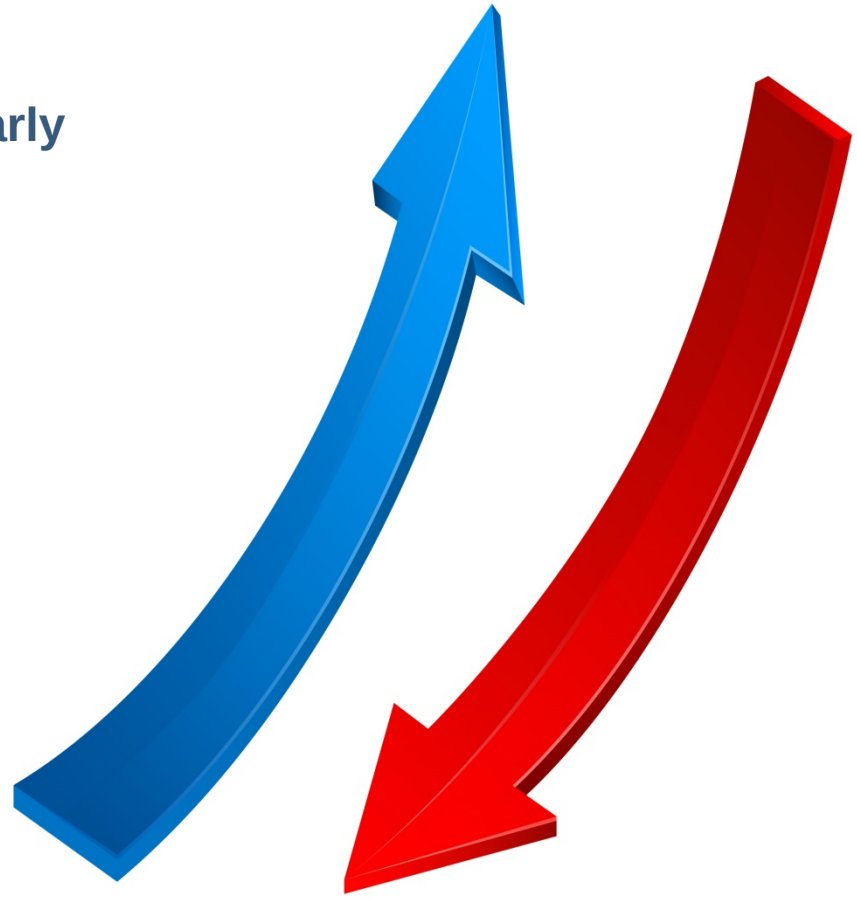
What is an IMM quote?

Developed by IMM Division of CME in early 1980's converts a yield to a price.

Price moves inversely to yield, rates go up-price goes down.

Designed to allow financial instruments that traditionally traded in yield to trade as a price, more like commodities.

100 - yield = Price
100 – 0.2550 = 99.7450



What is an IMM date?

Standard dates for expiration and settlement of certain CME Group futures contracts.

March 2018 IMM Dated Futures Contract Schedule						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	3
4	5	6	7	8	9	10
11	12 **LTD: ED, FX, & MAC Swaps**	13	14	15 **Third Wednesday**	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Last trading day (LTD) is generally the second London business day preceding the third Wednesday of a quarterly contract month.

FX, ED, and MAC Swap futures on IMM Date schedule.

London Interbank Offered Rate (LIBOR)

Markets developed in London in 1960's.

Represent USD denominated deposits held outside the U.S. banking system.

LIBOR succeeded "Prime Rate" in 1970's as the U.S. short-term rate benchmark.

First interest rate swap (IRS) created in 1981 between IBM and the World Bank.

Rates now administered by ICE Benchmark Administration.

Eurodollar Futures

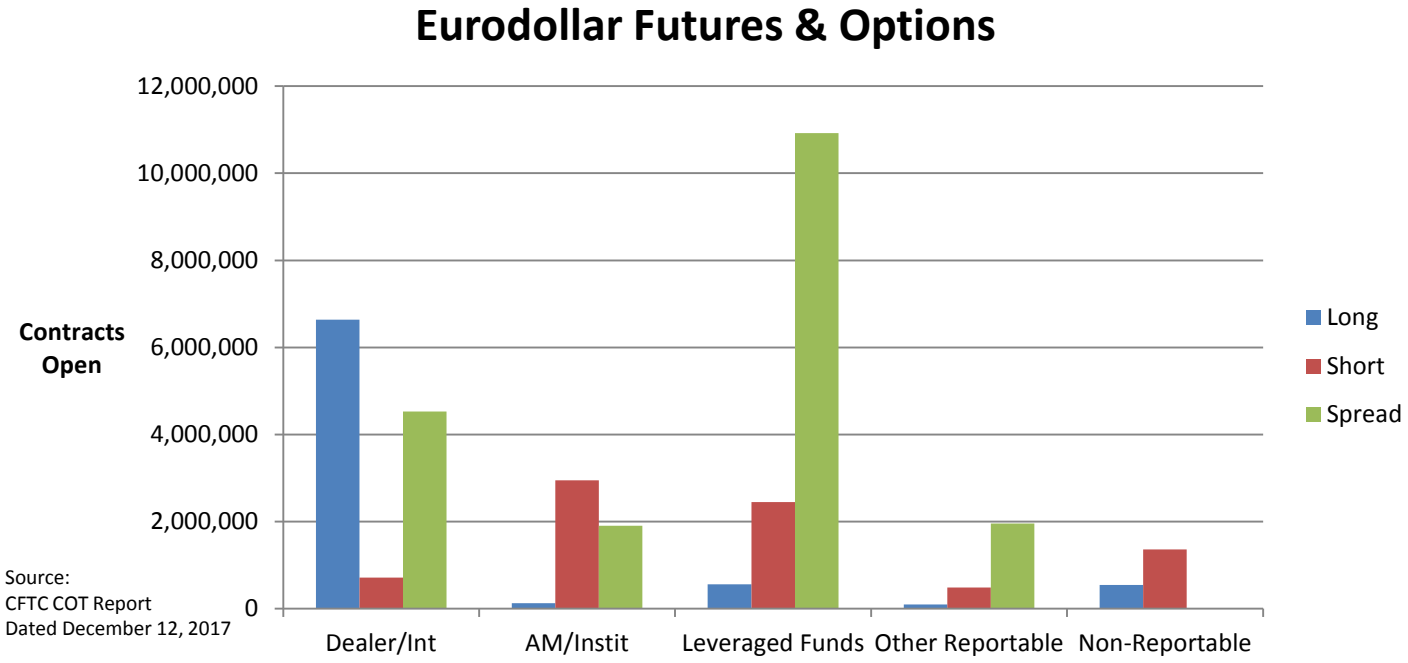
Most active short-term interest rate futures worldwide:

- **The first cash settled futures contract**
- **Launched December 1981, market growth facilitated by interplay vs. interest rate swap (IRS) markets**

2017 YTD US Dollar IRS ADV	
LCH D2C+D2D	1,156,888,344,318
CME	80,652,522,427
Total USD IRS	**1,237,540,866,745**

2017 YTD Eurodollar Penetration of USD IRS	
Eurodollar Futures Average Daily Notional	3,123,166,433,333
USD IRS Daily Notional	1,237,540,866,745
ED Futures as % of USD IRS	**252%**
USD IRS as % of ED Futures	**40%**

Eurodollar Futures



CFTC COT Report: Breaks Open Interest data in reporting categories:

1. **Dealer / Intermediary**
2. **Asset Manager / Institutional**
3. **Leveraged Funds**
4. **Other Reportable**

http://www.cmegroup.com/tools-information/quikstrike/commitment-of-traders-interest-rates.html

Eurodollar Futures

Underlying Instrument	Eurodollar interbank rate having approximately $1 million principal value, for a three-month term to maturity, for spot settlement on the 3rd Wednesday of the contract month.
Delivery Months	Nearest 40 months in March Quarterly cycle plus nearest 4 months not in March Quarterly cycle.
Price Basis	IMM price points: 100 minus three-month London interbank offered rate for spot settlement on the 3rd Wednesday of Delivery Month. One interest rate basis point (0.01 price points) equals $25 per contract.
Tick Size	One-half basis point (0.005) = $12.50; except in nearby month, tick is one-quarter basis point (0.0025) =$6.25
Last Trading Day	Second London business day before 3rd Wednesday of Delivery Month.
Delivery Standard	Three-month US Dollar ICE LIBOR as set on last trading day for spot (T+2) settlement on 3rd Wednesday of Delivery Month, rounded to the fourth decimal place.

Eurodollar Futures

Delivery Method	Cash settlement, by mark-to-market to Final Settlement Price.	
Trading Hours	CME Globex: 5pm to 4pm Chicago time, Sunday-Friday Trading of expiring contracts terminates at 11am London time on Last Trading Day.	
Position Accountability	10,000+ contracts	
Reportable Positions	850+ contracts	
Block Trade Thresholds	Nearest 20 March Quarterly Delivery Months and all Delivery Months Not in March Quarterly cycle:	Farthest 20 March Quarterly Delivery Months:
RTH (7am to 4pm)	4,000+ contracts	1,000+ contracts
ATH (4pm to 12am)	1,000+ contracts	250+ contracts
ETH (12am to 7am)	2,000+ contracts	500+ contracts

Eurodollar Futures

Final Settlement Price: cash settlement, by mark-to-market to ICE Benchmark Administration's 3-month LIBOR rate.

Example: December 2017 Quarterly contract,
December 18, 2017 (LTD)
ICE LIBOR 3-month rate = 1.62548
CME rounds to 4th decimal = 1.6255
(when 5th decimal is "5" round up)

Settlement Price 100- rate = 100- 1.6255 = 98.3745

Final Settlement Price GEZ7 = 98.3745

Eurodollar Futures

Basis point value (BPV):

BPV = $1,000,000 x (days/360) x 0.01%
= $1,000,000 x (98/360) x 0.01%
= $27.22

BPV = $1,000,000 x (days/360) x 0.01%
= $1,000,000 x (84/360) x 0.01%
= $23.33

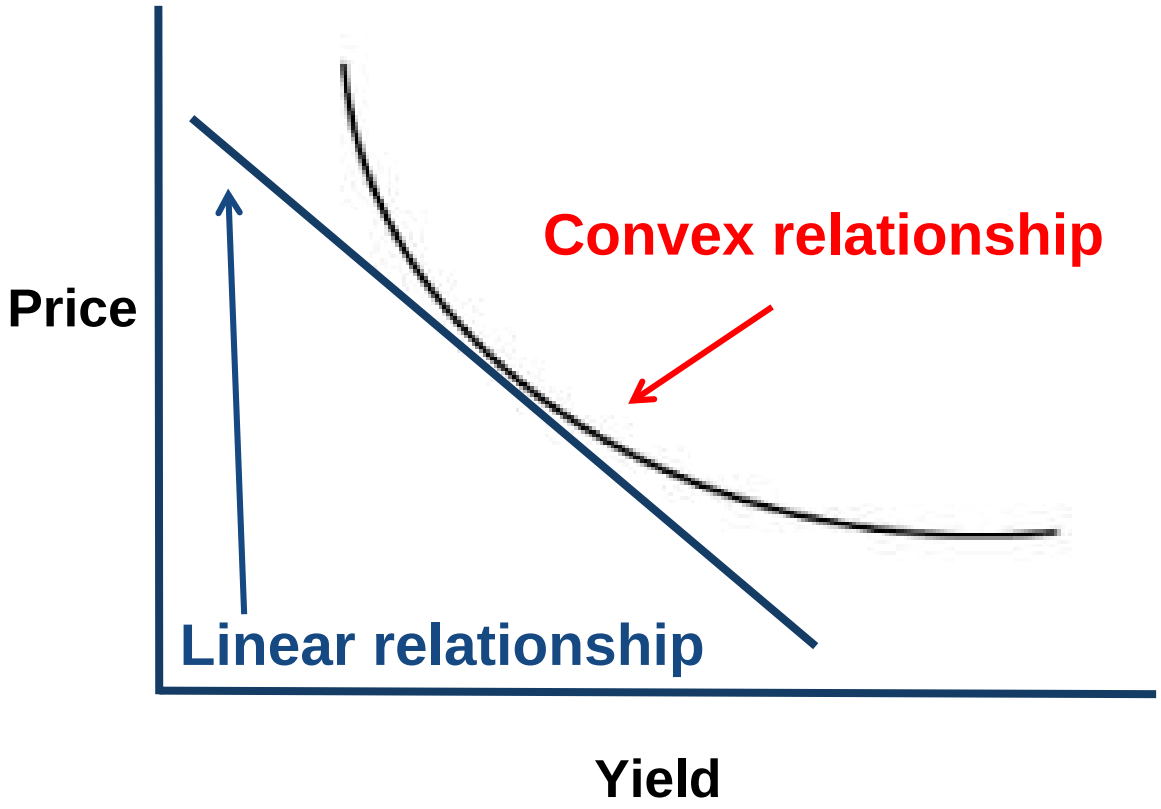
BPV = $1,000,000 x (days/360) x 0.01%
= $1,000,000 x (90/360) x 0.01%
= $25.00

The BPV of a Eurodollar contract is constant, at $25.00, regardless of where it sits on the curve.

Eurodollar Futures

Convexity bias:

Eurodollar futures price exhibit a linear relationship to yield – a 0.01 change in yield always results in a 0.01 change in price.



Interest rate sensitivity of traditional fixed income instruments depends on both prevailing level of rates and term to expiry and is described as convex.

Eurodollar Futures

Convexity bias:

Eurodollar futures are defined so that its response to interest rate changes is linear. The contract's BPV with respect to its reference forward three-month interest rate is always $25.

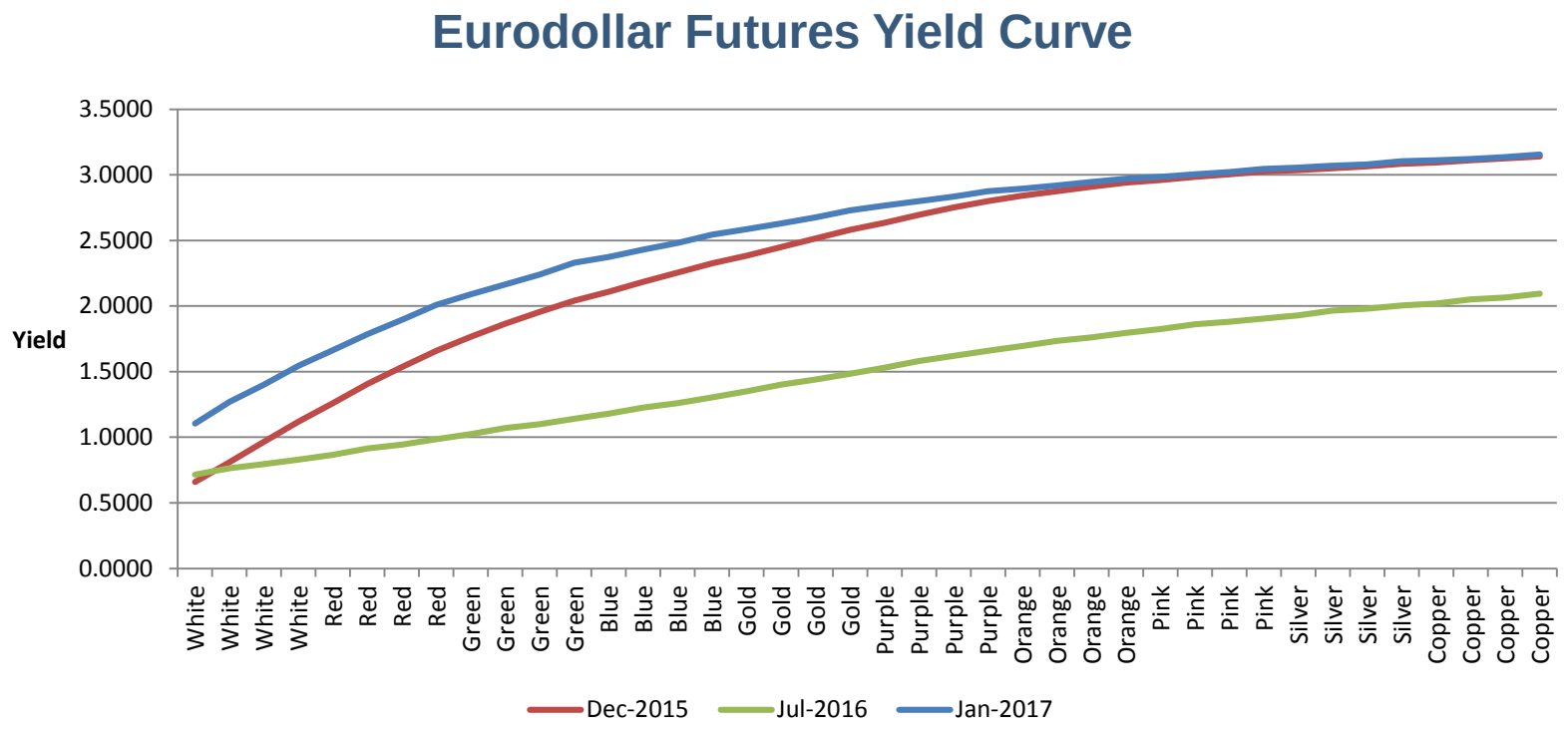
The Eurodollar futures buyer does not enjoy the benefit of being an owner of convexity, therefore Eurodollar futures are priced (yields) at a discount (rate) to the hypothetical forward rate curve.

Therefore Eurodollar futures contracts are systematically higher than their corresponding cash market forward curve. The difference, or basis, is also known as the convexity bias correction.

Eurodollar contract rate = "true" FRA forward rate + convexity bias correction

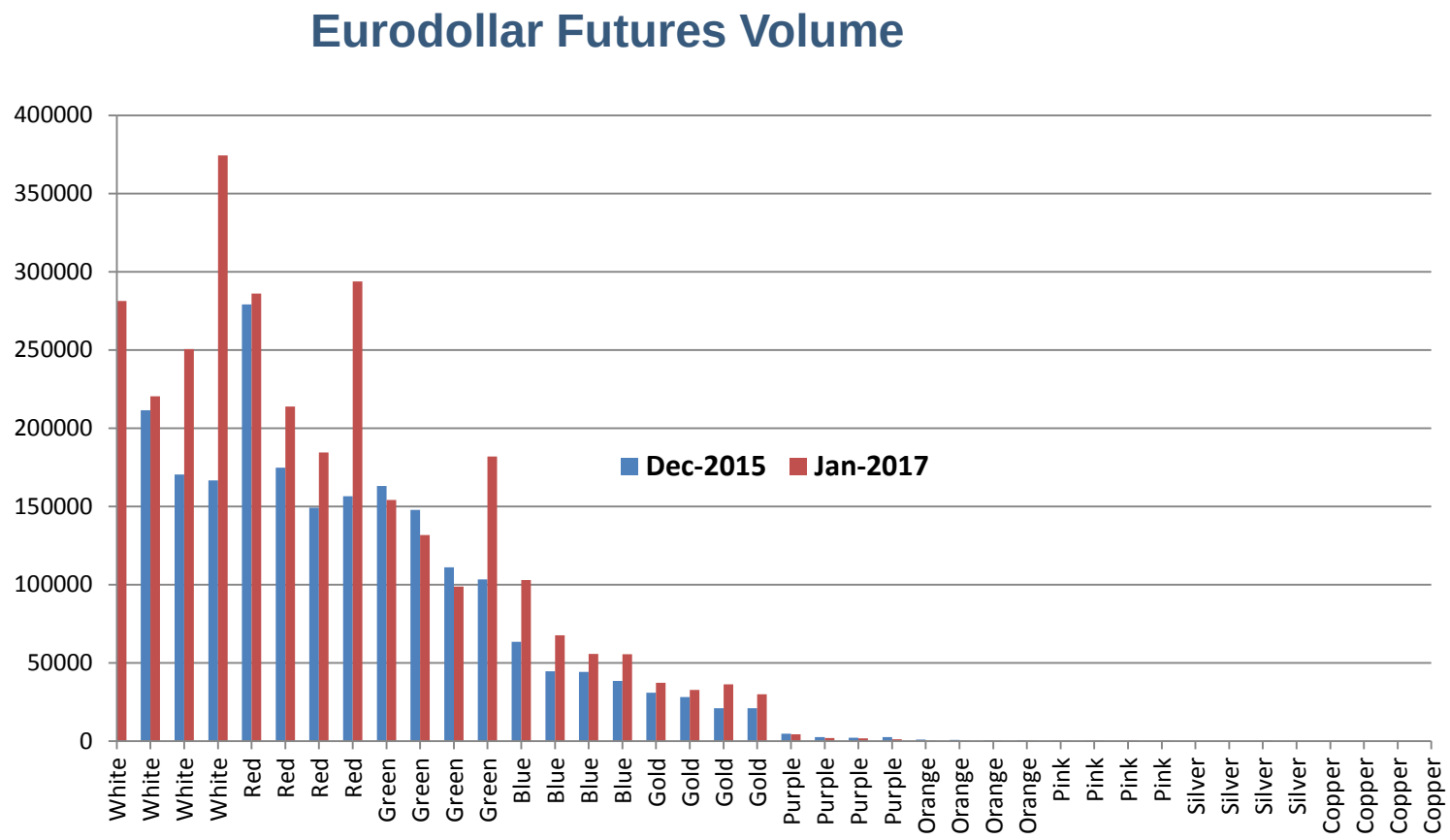
Eurodollar Futures

Yield Curve



Eurodollar Futures

Volume distribution



Eurodollar Futures

Mirror of Yield Curve

Outright (Individual) Contracts

- Years 1 – 10, 40 quarterly contracts plus 4 serial contracts

Spreads

- Simultaneous purchase and sale of contracts in different months: Calendar spreads, butterflies, condors, etc.
- Spread traders provide a great deal of liquidity in the Eurodollar contracts

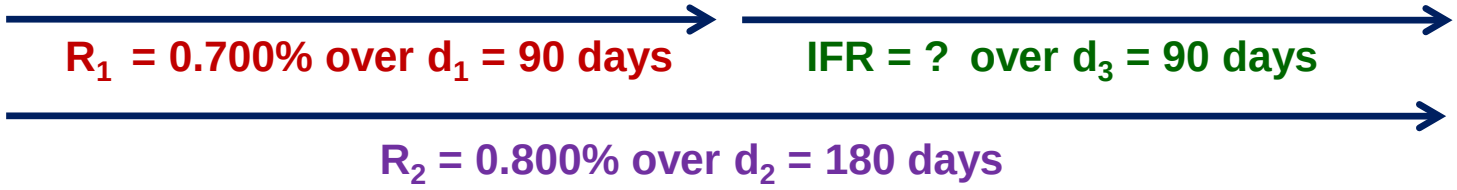
Strips

- The purchase or sale of two or more consecutive quarterly futures expirations

Eurodollar Futures

Mirror of Yield Curve

Implied forward rate (IFR) …



May be calculated as:

$$IFR = \frac{[1 + R_2 (d_2/360)]}{(d_3/360)[1 + R_1 (d_1/360)]} - \frac{1}{(d_3/360)}$$

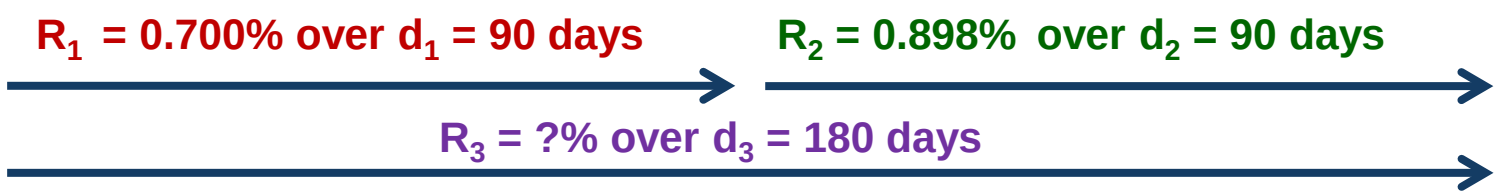
$$= \frac{[1 + 0.008 (180/360)]}{(90/360)[1 + 0.007 (d_1/360)]} - \frac{1}{(90/360)}$$

$$= 0.898\%$$

Eurodollar Futures

Mirror of Yield Curve

Check the logic… at what 180 day *rate* would an investor be ambivalent compared to the 90 day plus 90 day rate of return?



interest earned (i) = \$1mm x Rate (R) x (days/360)

i_1 = \$1000000 x 0.007 x 0.25 = \$1,750.00

I_2 = \$1001750 x 0.00898 x 0.25 = \$2,248.93

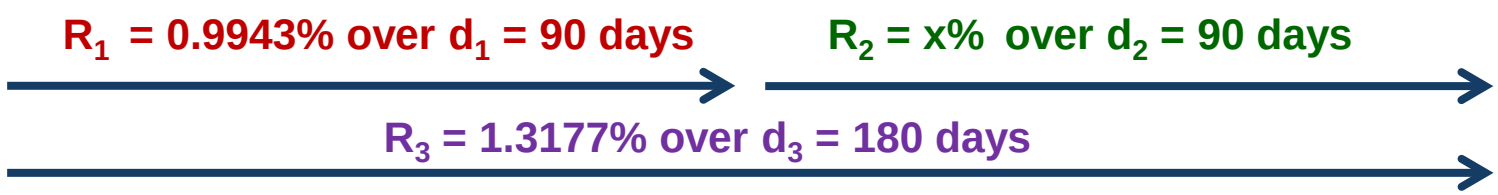
$$\text{Rate} = \frac{i \times (360/180)}{\$1mm}$$

Rate = (3998.93 x 2) ÷\$1mm = 0.007997 or 0.800%

Eurodollar Futures

…at what 6-month *rate* would an investor be ambivalent compared to the 3-month plus 3-month rate of return?

On 19 December 2016 3-mo LIBOR = 0.9943% and 6-mo LIBOR = 1.3177%



Solving according to formula the implied forward 3-month rate = 1.6370%

interest earned (i) = \$1mm x Rate (R) x (days/360)

i_1 = \$1,000,000 x 0.009943 x 0.25 = \$2,485.75

I_2 = \$1,002,485.75 x 0.014675 x 0.25 = \$4,102.67

$$\text{Rate} = \frac{i \times (360/180)}{\$1mm}$$

Rate = (6,588.42 x 2) ÷\$1mm = 0.01317684 or 1.3177%

Packs and Bundles

Many hedging and trading strategies call for the purchase or sale of Eurodollar futures in “strips,” or sequences of consecutive contract delivery months.

CME Eurodollar Packs & Bundles provide an alternative to cumbersome and potentially risky individual contract execution.

Packs:
The simultaneous purchase or sale of one each of a series of four Eurodollar futures with consecutive quarterly delivery months.

Bundles:
The simultaneous purchase or sale of one each of a series of eight or more Eurodollar futures with consecutive quarterly delivery months.

Packs and Bundles

Bundle = buy/sell in consecutive deferred months

- 1-, 2-, 3-, 4-, 5-, 6-, 7-, 8-, 9- & 10-year
- *E.g.*, "red" bundle = 1st 8 quarterly futures

Pack = buy/sell 4 consecutive quarterlies

- *E.g.*, "green" pack = 4 quarterlies 3 years out

Quoted as average change of all futures in pack or bundle since prior settlement

- *E.g.*, +2.5 basis points, -6 basis points, …
- Prices assigned to legs after trade concluded

Packs and bundles "color coded"

Packs and Bundles

Pack: Constructed to represent a series of four consecutive quarterly Eurodollar futures.

Quoted in 1/4th of one basis point (0.01%) increments.

Priced as a reference to average change in value of all Eurodollar futures included in Pack.

Term	Color Code	Comprised of	BPV
1-Year	White	1st 4 quarterlies	$100
2-Year	Red	5th-8th quarterlies	$100
3-Year	Green	9th-12th quarterlies	$100
4-Year	Blue	13th-16th quarterlies	$100
5-Year	Gold	17th-20th quarterlies	$100
6-Year	Purple	21st-24th quarterlies	$100
7-Year	Orange	25th-28th quarterlies	$100
8-Year	Pink	29th-32nd quarterlies	$100
9-Year	Silver	33rd-36th quarterlies	$100
10-Year	Copper	37th-40th quarterlies	$100

Example: Assume a White Pack, the first 4 quarterlies, have net price changes from previous day of +2, +2, +3, and +3 ticks. The Pack would be quoted and priced +2.5 because (2+2+3+3) ÷ 4 = +2.5, or up 2.5 ticks.

Packs and Bundles

Bundles: A purchase or sale of one each of a series of consecutive quarterly Eurodollar futures.

May be constructed with any quarterly but typically with the first quarterly contract. Quoted in 1/4th of one basis point (0.01%) increments.

Priced as a reference to average change in value of all Eurodollar futures included in Pack.

Term	Color Code	Comprised of	BPV
1-Year	White	1st 4 quarterlies	$100
2-Year	Red	1st 8 quarterlies	$200
3-Year	Green	1st 12 quarterlies	$300
4-Year	Blue	1st 16 quarterlies	$400
5-Year	Gold	1st 20 quarterlies	$500
6-Year	Purple	1st 24 quarterlies	$600
7-Year	Orange	1st 28 quarterlies	$700
8-Year	Pink	1st 32 quarterlies	$800
9-Year	Silver	1st 36 quarterlies	$900
10-Year	Copper	1st 40 quarterlies	$1,000

Example: Assume a Red Bundle , the first 8 quarterlies, have net price changes from previous day of (+2, +2, +2, +2 Whites) and (+3, +3,+3,+3 Reds) ticks. The Bundle would be quoted and priced +2.5 because (2+2+2+2) + (3+3+3+3) ÷ 8 = +2.5, or up 2.5 ticks.

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