CME Group Interest Rate Overview
Eurodollar Futures: Foundational Concepts

January 2017
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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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CME Group Interest Rate futures include Fed Funds, Eurodollars, US Treasury, and Swap based 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).

**Eurodollars 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

<table>
<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12 LTD: ED, FX, &amp; MAC Swaps</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15 Third Wednesday</td>
<td>16</td>
<td>17</td>
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<td>19</td>
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<td>30</td>
<td>31</td>
<td></td>
</tr>
</tbody>
</table>

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.
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

<table>
<thead>
<tr>
<th>2017 YTD US Dollar IRS ADV</th>
<th>2017 YTD Eurodollar Penetration of USD IRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCH D2C+D2D</td>
<td>Eurodollar Futures Average Daily Notional</td>
</tr>
<tr>
<td>CME</td>
<td>3,123,166,433,333</td>
</tr>
<tr>
<td>Total USD IRS</td>
<td>USD IRS Daily Notional</td>
</tr>
<tr>
<td></td>
<td>1,237,540,866,745</td>
</tr>
<tr>
<td></td>
<td>ED Futures as % of USD IRS</td>
</tr>
<tr>
<td></td>
<td>252%</td>
</tr>
<tr>
<td></td>
<td>USD IRS as % of ED Futures</td>
</tr>
<tr>
<td></td>
<td>40%</td>
</tr>
</tbody>
</table>
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

# Eurodollar Futures

<table>
<thead>
<tr>
<th><strong>Underlying Instrument</strong></th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Delivery Months</strong></td>
<td>Nearest 40 months in March Quarterly cycle plus nearest 4 months not in March Quarterly cycle.</td>
</tr>
<tr>
<td><strong>Price Basis</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Tick Size</strong></td>
<td>One-half basis point (0.005) = $12.50; except in nearby month, tick is one-quarter basis point (0.0025) =$6.25</td>
</tr>
<tr>
<td><strong>Last Trading Day</strong></td>
<td>Second London business day before 3rd Wednesday of Delivery Month.</td>
</tr>
<tr>
<td><strong>Delivery Standard</strong></td>
<td>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.</td>
</tr>
</tbody>
</table>
# Eurodollar Futures

<table>
<thead>
<tr>
<th>Delivery Method</th>
<th>Cash settlement, by mark-to-market to Final Settlement Price.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trading Hours</strong></td>
<td>CME Globex: 5pm to 4pm Chicago time, Sunday-Friday</td>
</tr>
<tr>
<td></td>
<td>Trading of expiring contracts terminates at 11am London time on Last Trading Day.</td>
</tr>
<tr>
<td><strong>Position Accountability</strong></td>
<td>10,000+ contracts</td>
</tr>
<tr>
<td><strong>Reportable Positions</strong></td>
<td>850+ contracts</td>
</tr>
</tbody>
</table>

## Block Trade Thresholds

<table>
<thead>
<tr>
<th>RTH (7am to 4pm)</th>
<th>Nearest 20 March Quarterly Delivery Months and all Delivery Months Not in March Quarterly cycle:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4,000+ contracts</td>
</tr>
<tr>
<td>ATH (4pm to 12am)</td>
<td>1,000+ contracts</td>
</tr>
<tr>
<td>ETH (12am to 7am)</td>
<td>2,000+ contracts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Farthest 20 March Quarterly Delivery Months:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000+ contracts</td>
</tr>
<tr>
<td>500+ contracts</td>
</tr>
</tbody>
</table>
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):

\[
\text{BPV} = \$1,000,000 \times \frac{\text{days}}{360} \times 0.01\%
\]

\[
= \$1,000,000 \times \frac{98}{360} \times 0.01\%
\]

\[
= \$27.22
\]

\[
\text{BPV} = \$1,000,000 \times \frac{\text{days}}{360} \times 0.01\%
\]

\[
= \$1,000,000 \times \frac{84}{360} \times 0.01\%
\]

\[
= \$23.33
\]

\[
\text{BPV} = \$1,000,000 \times \frac{\text{days}}{360} \times 0.01\%
\]

\[
= \$1,000,000 \times \frac{90}{360} \times 0.01\%
\]

\[
= \$25.00
\]

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.
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

Volume distribution

Eurodollar Futures Volume

Dec-2015  Jan-2017
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) ...

\[ R_1 = 0.700\% \text{ over } d_1 = 90 \text{ days} \]

\[ \text{IFR} = ? \text{ over } d_3 = 90 \text{ days} \]

\[ R_2 = 0.800\% \text{ over } d_2 = 180 \text{ days} \]

May be calculated as:

\[
\text{IFR} = \frac{[1 + R_2 (d_2/360)]}{(d_3/360)} \times \frac{[1+R_1 (d_1/360)]}{[1+0.007 (d_1/360)]} - \frac{1}{(d_3/360)}
\]

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

\[
= 0.898\%
\]
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?

\[ R_1 = 0.700\% \text{ over } d_1 = 90 \text{ days} \]
\[ R_2 = 0.898\% \text{ over } d_2 = 90 \text{ days} \]
\[ R_3 = ?\% \text{ over } d_3 = 180 \text{ days} \]

\[
\text{interest earned (i) } = \$1\text{mm} \times \text{Rate (R)} \times \left(\frac{\text{days}}{360}\right)
\]
\[ i_1 = \$1000000 \times 0.007 \times 0.25 = \$1,750.00 \]
\[ i_2 = \$1001750 \times 0.00898 \times 0.25 = \$2,248.93 \]

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

\[
\text{Rate} = \frac{(3998.93 \times 2)}{\$1\text{mm}} = 0.007997 \text{ or } 0.800\%
\]
...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%

\[
R_1 = 0.9943\% \text{ over } d_1 = 90 \text{ days} \quad R_2 = x\% \text{ over } d_2 = 90 \text{ days} \\
R_3 = 1.3177\% \text{ over } d_3 = 180 \text{ days}
\]

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

\[
\text{interest earned (i) } = \$1\text{mm x Rate (R) x (days/360)} \\
i_1 = \$1,000,000 \times 0.009943 \times 0.25 = \$2,485.75 \\
i_2 = \$1,002,485.75 \times 0.014675 \times 0.25 = \$4,102.67
\]

\[
\frac{i \times (360/180)}{\text{Rate} = \$1\text{mm}} \\
\text{Rate} = \frac{(6,588.42 \times 2)}{\$1\text{mm}} = 0.01317684 \text{ or } 1.3177\%
\]
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.

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

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 \((2+2+3+3) \div 4 = +2.5\), 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.

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

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 \((2+2+2+2) + (3+3+3+3) \div 8 = +2.5\), or up 2.5 ticks.
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Thank you