SOFR & €STR Discounting Transition Process For Cleared Swaps

Q2-2020
SOFR Price Alignment & Discounting Transition

CME Group has worked with market participants and industry groups to develop a plan for transitioning price alignment and discounting for USD OTC cleared swaps from the daily Effective Federal Funds Rate (EFFR) to SOFR

**Scope:** Cleared US Dollar interest rate swap products at CME (IRS, OIS, FRAs, Basis, ZCS, Swaptions)
- CME SOFR index swaps are excluded from the transition as they are already using SOFR discounting and price alignment
- CME believes market practitioners should continue to evaluate a future date for transitioning additional IRS currencies that contain a US Dollar-funding component, taking into consideration potential impacts on adjacent FX forward and cross-currency swap markets

**Transition Date:** Close of Business October 16, 2020

**Process:** CME will conduct a standard end-of-day valuation cycle utilizing EFFR discounting and upon completion of this initial cycle, CME will then conduct a special cycle in which positions will be valued with SOFR discounting

**Cash Adjustment:** To neutralize the value transfer from the change to SOFR discounting, CME will process a cash adjustment that is equal and opposite to the NPV change on each trade in all accounts

**Re-Hedging Process:**
- By changing the discounting curve, CME effectively moves the discounting risk of all participants from EFFR to SOFR
- To mitigate re-hedging costs CME will book a mandatory series of EFFR/SOFR basis swaps to participants' accounts
- These basis swaps will approximately restore participants back to their original discounting risk profile at the portfolio level, and will be booked at closing curve levels ($0 NPV)

**Auction:** On Monday October 19th, CME will facilitate an auction for participants looking for an efficient way to unwind their basis swaps
SOFR Discounting Transition - Participant Elections

CME Will Seek the Following Information From Participants Prior to October 2020:

1. Whether firms wish to participate in the auction (by legal entity or position account)
   - Default behavior: Client is not participating in the auction
   - CME will require a legal agreement to be completed in order to participate in the auction
   - As part of the legal agreement, clients will acknowledge a CME-defined maximum loss level that will determine whether or not the auction is successful

2. Whether clients wish to receive either basis swaps, or pairs of fixed/float swaps for the mandatory Re-hedging Process
   - Default behavior: client receives basis swaps
SOFR Testing and Readiness Timelines

Indicative Impact Analysis: Currently Available

CME can provide indicative impacts from the discounting transition for existing cleared portfolios based on data for a pre-selected date

1. Change in NPV on a trade level (Cash Adjustment)
2. Discounting Risk Sensitivities by Tenor – portfolio and/or at the individual trade level
3. Resulting Basis Swaps from Re-hedging Process
4. Historical descriptive statistics of the EFFR/SOFR basis

CME plans to periodically refresh data used to conduct such analysis going forward

To receive this information, please send an email with the CME position account ID to CMEOTCAnalysis@cmegroup.com

UAT Environment: August 26, 2020

Firms can leverage CME’s UAT testing environment to align operational processing ahead of the transition based on data firms input to our environment. In this, CME intends to provide:

- Trade Register
- Margin Report
- PAA Report
- Discounting Transition Report showing SOFR based NPVs and Cash Adjustment Amounts
- SOFR Discounting Sensitivities

In the weeks leading up to the transition, CME plans to provide the Discounting Transition Report in a production environment for testing
€STR Price Alignment & Discounting Transition

Please be advised that CME will be delaying the €STR Discounting and Price Alignment Transition for cleared EUR interest rate swap products to the close of business July 24, 2020. The transition was previously scheduled to occur on June 19, 2020

Publication of €STR by the ECB began on October 2, 2019. Under the reformed methodology, EONIA is calculated as the €STR plus a spread of 8.5 basis points. Given the working group on euro risk-free rates has recommended that publication of EONIA will be discontinued on January 3, 2022, we believe that it is important to efficiently transition discounting and price alignment to help build liquidity in €STR derivatives.

**Scope:** Cleared EUR interest rate swap products (IRS, OIS, FRAs, Basis, ZCS)

**Transition Date:** Close of Business July 24, 2020

**Process:** CME will conduct a standard end-of-day valuation cycle with EONIA discounting and upon completion of this initial cycle, CME will then conduct a special cycle in which positions will be valued with €STR discounting

**Cash Adjustment:** To neutralize the value transfer from the discounting change CME will process a cash adjustment that is equal and opposite to the NPV change on each trade in all accounts

**€STR Curve:** To facilitate this transition, CME will create a new €STR curve ahead of the transition

*Note: EONIA being calculated as €STR plus a fixed spread of 8.5 basis points makes it unnecessary to perform a Re-hedging Process*

*This decision was announced on April 20, 2020 and can be found here:* [CHADV 20-168]
€STR Testing and Readiness Timelines

**Indicative Impact Analysis: *Currently Available***

CME can provide indicative impacts from the discounting transition for existing cleared portfolios based on data for a pre-selected date.

CME plans to periodically refresh data used to conduct such analysis going forward.

To receive this information, please send an email with the CME position account ID to CMEOTCAnalysis@cmegroup.com.

**Test Phase 1: May 20th – June 19th**

- CME simulates the discounting transition on a nightly basis to test the Transition Date using data from test environment.
- IRS Trade Register: VM, PAA, and NPVs are based on EONIA.
- €STR pricing curves are available.
- IM is calculated using EONIA.

**Test Phase 2: June 22nd – July 24th**

- Testing period for post-Transition Date processing.
- IRS Trade Register: VM, PAA, and NPVs are based on €STR.
- IM is calculated using €STR.
- Indicative €STR-based IM Analysis available via CME CORE in the weeks leading up to the transition.
- Beginning June 1st, CME plans to provide the Discounting Transition Report in a production environment for testing.
- Firms may test the transition over the weekend of June 20th and 21st within their systems.
Variation Margin & Cash Adjustment

SOFR and €STR Discounting Transition
Variation Margin and Cash Adjustment

Transition Cash Flow Example

<table>
<thead>
<tr>
<th>Date</th>
<th>Current NPV</th>
<th>Prior NPV</th>
<th>VM</th>
<th>Adj Amt</th>
<th>Total Cash</th>
</tr>
</thead>
<tbody>
<tr>
<td>T – 1</td>
<td>$100 (EFFR)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>$125 (EFFR)</td>
<td>$100 (EFFR)</td>
<td>$25</td>
<td></td>
<td>$25</td>
</tr>
<tr>
<td>T</td>
<td>$126 (SOFR)</td>
<td>$125 (EFFR)</td>
<td>$1</td>
<td>($1)</td>
<td>$0</td>
</tr>
<tr>
<td>T + 1</td>
<td>$140 (SOFR)</td>
<td>$126 (SOFR)</td>
<td>$14</td>
<td></td>
<td>$14</td>
</tr>
</tbody>
</table>

The Transition Date is shown on rows 2 and 3
• Row 2 represents the standard close of business on the Transition Date.
  VM = Current NPV – Prior NPV

• Row 3 shows the value under SOFR Discounting. The $1 NPV movement is offset with a -$1 adjustment amount.

On T+1, the day after the transition, the VM calculation will reference the SOFR-based NPV on T. $140-$126 = $14

The purpose of conducting the ‘Special cycle’ and producing the corresponding IRS Discounting Transition Report is to:
  o Isolate the impacts of the discounting transition for each USD IRS trade cleared at CME
  o Provide participants operational flexibility in processing this transition

Clients not wanting to process the output from the special cycle can achieve the same results by calculating the variation margin for Monday using the below formula:

\[ VM \text{ on Monday} = NPV_{SOFR \ Monday} - NPV_{EFFR \ Friday} + Cash \ Adj. \]
Variation Margin and Cash Adjustment

IRS Discounting Transition Report

- Shows revised NPVs under the new discounting methodology and the cash adjustment at the trade level for each position account
- Produced as part of the Special EOD Cycle
  - Publication targeted for 8 pm ET on the Transition Date
- CSV report delivered to firm and client sFTP folders
  - All parties receiving Trade Registers today will receive this report
- FCMs and Customers can find sample reports on CME’s Intra-Links site

<table>
<thead>
<tr>
<th>Column Header</th>
<th>Description</th>
<th>Sample Value</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value Date</td>
<td>Business Date</td>
<td>10/16/2020</td>
<td>Date</td>
</tr>
<tr>
<td>Position Account ID</td>
<td>Position Account</td>
<td>3TTNN7</td>
<td>VARCHAR(8)</td>
</tr>
<tr>
<td>Cleared Trade ID</td>
<td>CME Trade ID</td>
<td>6355844</td>
<td>Integer</td>
</tr>
<tr>
<td>Platform ID</td>
<td>SEF/Platform ID</td>
<td>7897868G9H</td>
<td>VARCHAR(255)</td>
</tr>
<tr>
<td>Client ID</td>
<td>Client ID</td>
<td>1423523IS</td>
<td>VARCHAR(255)</td>
</tr>
<tr>
<td>REG_TRADE_ID</td>
<td>USI</td>
<td>CCCIRS6355844</td>
<td>VARCHAR(255)</td>
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<tr>
<td>Firm ID</td>
<td>3 digit clearing firm ID</td>
<td>998</td>
<td>VARCHAR(3)</td>
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<td>ORIGIN</td>
<td>HOUS or CUST</td>
<td>CUST</td>
<td>VARCHAR(4)</td>
</tr>
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<td>PRODUCT_TYPE</td>
<td>type of swap</td>
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<tr>
<td>Currency</td>
<td>3 digit currency code</td>
<td>EUR</td>
<td>VARCHAR(3)</td>
</tr>
<tr>
<td>NPV_NEW_DISC</td>
<td>NPV under SOFR discounting</td>
<td>2,266.34</td>
<td>Float</td>
</tr>
<tr>
<td>NPV_PRIOR_DISC</td>
<td>NPV under EFFR discounting</td>
<td>2,244.28</td>
<td>Float</td>
</tr>
<tr>
<td>NPV_ADJ_NEW_DISC</td>
<td>ADJ NPV under SOFR discounting</td>
<td>2,266.34</td>
<td>Float</td>
</tr>
<tr>
<td>NPV_ADJ_PRIOR_DISC</td>
<td>ADJ NPV under EFFR discounting</td>
<td>2,244.28</td>
<td>Float</td>
</tr>
<tr>
<td>NPV_ADJ_DIFF</td>
<td>New ADJ NPV minus Prior ADJ NPV</td>
<td>22.06</td>
<td>Float</td>
</tr>
<tr>
<td>FX_RATE</td>
<td>FX Rate use to convert non-deliverable currencies’ NPV differences to the adjustment amount. Equal to 1 for EUR, USD, MXN</td>
<td>1.000000</td>
<td>Float</td>
</tr>
<tr>
<td>OFFSET_ADJ_AMT</td>
<td>Cash adjustment amount Prior ADJ NPV minus new ADJ NPV</td>
<td>-22.06</td>
<td>Float</td>
</tr>
</tbody>
</table>

EUR discounting transition would follow same process on July 24, 2020
Variation Margin and Cash Adjustment

Curve Construction

The below shows the curves used for computing the cash compensation which is computed as:

\[
\text{Adjusted } NPV_{\text{EFFR Discounting}} = \text{Adjusted } NPV_{\text{SOFR Discounting}}
\]

*Under this approach, forward rates are held constant*

- **EFFR Discounting**
  - Pricer = \(\text{Adjusted } NPV_{\text{FedFund Discounting}}\)
  - Forecast curves: USD LIBOR BBA 1M, 3M, 6M; USD EFFR
  - Discount curves: USD EFFR

- **SOFR Discounting**
  - Pricer = \(\text{Adjusted } NPV_{\text{SOFR Discounting}}\)
  - Forecast curves: USD LIBOR BBA 1M, 3M, 6M; USD EFFR
  - Discount curves: USD SOFR

Instruments used for Bootstrapping

- USD FedFund
- USD LIBOR BBA 1M
- USD LIBOR BBA 3M
- USD LIBOR BBA 6M
- USD SOFR

Draft proposal intended for soliciting further participant feedback

EUR discounting transition would follow a similar process on July 24, 2020 with forward rates being held constant
Re-Hedging Process & Auction Mechanism

SOFR Only
Discounting Re-Hedging Process – SOFR only
Maintaining Original Discounting Risk Exposures with Mandatory Basis Swaps

The Goal of the ARRC’s Discounting Transition is to Gradually Expose Participants to SOFR

<table>
<thead>
<tr>
<th>($MM DV01)</th>
<th>Pre-Transition</th>
<th>Transitioning w/o Re-hedging</th>
<th>Basis Swaps</th>
<th>Transitioning w/ Re-hedging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outright ICE LIBOR Risk</td>
<td>$20MM</td>
<td>$20MM</td>
<td>-</td>
<td>$20MM</td>
</tr>
<tr>
<td>EFFR Discounting Risk</td>
<td>$1MM</td>
<td>$0</td>
<td>$1MM</td>
<td>$1MM</td>
</tr>
<tr>
<td>SOFR Discounting Risk</td>
<td>$0</td>
<td>$1MM</td>
<td>($1MM)</td>
<td>$0</td>
</tr>
</tbody>
</table>

For illustration purposes only
Delta ladder computed based on zero-rate bump

Transitioning to SOFR discounting will effectively move the discounting risk of all CME-cleared participant portfolios from EFFR to SOFR at closing curve levels on October 16, 2020

To mitigate both the re-hedging costs associated with this transition and the sensitivity of valuations to closing curve marks on that day, CME will book a series of EFFR/SOFR basis swaps to participants’ accounts

Through these basis swaps, CME’s Re-hedging mechanism restores participants back to their approximate EFFR discounting exposures

• If the basis swaps are held, participants gain incremental exposure to SOFR as new risk is cleared and as the dynamics of the legacy portfolio change after the transition

• Alternatively, by unwinding the resulting basis swaps via auction or directly sourcing liquidity, participants immediately transition their discounting risk from EFFR to SOFR
Discounting Re-Hedging Process – SOFR only

Basis Swap Details

• Swap Tenors (based on market consultation): 2Y, 5Y, 10Y, 15Y, 20Y, 30Y
  o CME is analyzing the effectiveness of above tenors and may add/remove accordingly

• Participants can choose to have these swaps booked as either CME cleared:
  o Float-versus-float basis swaps, or
  o Pairs of fixed-versus-float swaps

• Basis Swaps will be processed after the close on October 16th with a cleared date of October 19th
  o Swaps booked at a $0 NPV
  o No variation or initial margin will be calculated for these swaps on transition date
  o Float-versus-float basis swaps: Breakeven spread is included on the SOFR leg
  o Pairs of fixed-versus-float swaps: Difference in par rates will reflect the breakeven spread
Discounting Re-Hedging Process – SOFR only

Basis Swaps

The steps below highlights the mechanism used by CME to compute swaps for re-hedging purposes:

• Imply the SOFR based par quotes for the instruments as used for bootstrapping

• Compute the Delta sensitivity to the instruments used for SOFR curve generation based on SOFR discounting by bumping the implied quotes (from above) sequentially up and down for each instrument. Delta ladder vector is computed for the production portfolio as well as for the instruments identified for re-hedging purposes

• Bucketing the delta ladder vector from above to each of the instruments identified for re-hedging purposes. Linear interpolation will be used for bucketing

• Compute the notional of the identified risk compensation package by using matrix inversion to help neutralize the SOFR risk

• Adjust the direction so that the basis swap re-hedges the portfolio to approximately restore participants back to their original discounting risk profile

• Round the notional to $1 and ensure there is a balance book after rounding
Discounting Re-hedging Process – SOFR only

Basis Swap Characteristics

- **Index:** USD-SOFR-COMPOUND vs USD-Federal Funds-H.15-OIS-COMPOUND
- **Start Date:** 10/21/2020  
  **Maturity Date:** + {2yr, 5yr, 10yr, 15yr, 20yr, 30yr}
- **Roll convention:** 21 (both legs)
- **Cal period Adj Frequency:** 3M (both legs)
- **Cal period Adj Calendar:** USNY (both legs)
- **Payment Frequency:** 3M (both legs)
- **Payment Offset:** 2D (both legs)
- **Payment Related to:** End period (both legs)
- **Payment Calendar:** USNY (both legs)
- **Spread:** On SOFR leg
- **Comp Method:** Spread Exclusive (both legs)
- **Day Count:** ACT/360 (both legs)
- **Fixing Date Cal:** SOFR – USGS; EFFR - USNY
- **Floating Index Tenor:** 1D
- **Fixing Date Offset:** 0D
- **Fixing Date type:** Business
- **Fixing Date Business date convention:** Preceding (both legs)
Discounting Re-hedging Process – SOFR only

Trade-Level Report for Discounting Risk

- Available on SOFR Transition Date
- Attributes SOFR discounting risk impacts back to individual trades, helping participants allocate risk between entities sharing the same position account
- Produced as part of the Special EOD Cycle
- CSV report delivered to firm and client sFTP folders
  - All parties receiving Trade Registers will receive this report

Sample report*:

<table>
<thead>
<tr>
<th>Value Date</th>
<th>Trade ID</th>
<th>Curve Name</th>
<th>2 Year</th>
<th>5 Year</th>
<th>10 Year</th>
<th>15 Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/16/2020</td>
<td>1446246</td>
<td>USD_SOFR_1D</td>
<td>-157.0307</td>
<td>442.3291</td>
<td>2.7073</td>
<td>-5.9383</td>
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<tr>
<td>10/16/2020</td>
<td>1447678</td>
<td>USD_SOFR_1D</td>
<td>-357.9837</td>
<td>-188.2520</td>
<td>99.8234</td>
<td>806.2125</td>
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<tr>
<td>10/16/2020</td>
<td>1442453</td>
<td>USD_SOFR_1D</td>
<td>59.7710</td>
<td>64.9625</td>
<td>225.4575</td>
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<tr>
<td>10/16/2020</td>
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<td>USD_SOFR_1D</td>
<td>-259.9575</td>
<td>19.7858</td>
<td>8.5534</td>
<td>19377.8389</td>
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<tr>
<td>10/16/2020</td>
<td>1441641</td>
<td>USD_SOFR_1D</td>
<td>1.0911</td>
<td>3.1523</td>
<td>5.8781</td>
<td>9.1668</td>
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<tr>
<td>10/16/2020</td>
<td>1445732</td>
<td>USD_SOFR_1D</td>
<td>-28596.9878</td>
<td>11165.1008</td>
<td>-102124.1556</td>
<td>13373.9478</td>
</tr>
</tbody>
</table>

* Proposed columns for review

Draft proposal intended for soliciting further participant feedback
Proposed Basis Swap Auction Mechanism – SOFR Only

- Ahead of the auction, CME Group will:
  - Obtain legal agreements in September from clients electing to participate in the auction
  - Net exposures across all participating firms’ portfolios at each tenor point
- Single auction inclusive of all 6 tenor points run on the morning of Monday, October 19th
  - Allows dealers to consider offsetting risk when providing prices
- CME will open the auction window between 9-10am ET on Monday and provide dealers with the total size of the net risk
  - CME will be asking for a 2-way price to protect participants if the auction fails
  - Dealers will have the ability to provide prices for either the entire portfolio, or a vertical slice
  - In the event of a successful auction, dealers will be filled at the same level (Dutch auction)
- CME will be responsible for:
  - Defining a universal loss limit (X% of an individual client gross DV01) that would be the maximum loss incurred at the individual client level
  - Determining whether or not the auction is successful and corresponding communication
  - Allocation of net auction cost to individual clients (based on absolute value of DV01 at each individual tenor point) and booking of offsetting trades
- Items still to be determined:
  - Level of the universal loss limit
  - Additional client considerations
Client Readiness Checklist

• Operational booking of the cash adjustments
  ❑ Decide whether to recognize cash adjustment at individual trade level or book level
  ❑ Determine how to independently reconcile the cash adjustment

• Develop a strategy for handling basis swaps for SOFR Transition
  ❑ Election: Basis Swaps vs Synthetic basis swaps (pairs of fixed vs float OIS)
  ❑ Ability to process SOFR & EFFR OIS, SOFR vs EFFR basis swaps and SOFR discounting
  ❑ Identify whether there is a need to allocate basis swap risk between entities utilizing the same position account
  ❑ Ensure internal systems can capture trades created by the CCP

• Decide whether to hold or liquidate resulting basis swaps for SOFR Transition
  ❑ Election: Whether or not to participate in the auction
  ❑ Determine internal accounting treatment & compliance for either holding or liquidating basis swaps

• Testing Recommendations
  ❑ Understanding of the magnitude of the cash adjustment
  ❑ Gaining familiarity with discounting risk sensitivities and corresponding basis swap notional amounts for SOFR Transition
  ❑ Ability to trade SOFR/€STR-indexed and discounted instruments
Operational Reporting

SOFR and €STR Discounting Transition
Operational Processing

Transition Date Reporting

Existing IRS Trade Register

- Adjusted NPV, NPV, VM and PAA calculated using current discounting method – no change

**USD Example**

<table>
<thead>
<tr>
<th>Date</th>
<th>NPV (EFFR disc)</th>
<th>NPV (SOFR disc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-Oct-20 (T-1)</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>16-Oct-20 (T)</td>
<td>✓</td>
<td>-</td>
</tr>
</tbody>
</table>

**PAA Report**

- No change on transition date

**Curve and Discounting Factor files**

- No change to SOFR curve (currently published in Production)
- New €STR discounting curve inputs will be made available in existing EUR Curve report
- New IRSDF file will be published for €STR discounting curve

**IRS Discounting Transition Report** (as described on slide 10)

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**EUR discounting transition would follow same process on July 24, 2020**
Operational Processing

Transition Date + 1 Reporting

Existing IRS Trade Register

- Adjusted NPV, NPV, VM and PAA calculated using **new** discounting method

**USD Example**

<table>
<thead>
<tr>
<th></th>
<th>NPV (EFFR disc)</th>
<th>NPV (SOFR disc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-Oct-20</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>16-Oct-20 (T)</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>19-Oct-20</td>
<td>-</td>
<td>✓</td>
</tr>
</tbody>
</table>

**PAA Report**

- Alternative reference rate (€STR, SOFR) will replace current O/N rate (EONIA, EFFR)
  - No operational changes may be required; existing columns on PAA report will be used

**Curve and Discounting Factor files**

- No change

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**EUR discounting transition would follow same process on July 24, 2020**
Disclaimer

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