

SOFR & €STR Discounting Transition Process For Cleared Swaps

June 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

Transition Process: Following the standard EOD cycle using EFFR discounting/PA on Friday, CME will generate a discounting transition report that provides the NPV of all trades under SOFR discounting and corresponding cash adjustment amounts needed to account for the change in discounting rate.

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

€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

Transition Process: Following the standard EOD cycle using EONIA discounting/PA on Friday, CME will generate a discounting transition report that provides the NPV of all trades under ESTR discounting and corresponding cash adjustment amounts needed to account for the change in discounting rate.

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

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

Variation Margin & Cash Adjustment

SOFRA and €STR Discounting Transition

Variation Margin and Cash Adjustment

Discounting Transition Cash Flow Example

| | Date | Current NPV | Prior NPV | VM | Adjustment | Total Cash |
|----------------------------|---------------------|-----------------|------------------------|------|------------|------------|
| 1 | T - 1 (Thursday) | \$100 (EFFR) | | | | |
| 2 | T (Friday) | \$125 (EFFR) | \$100 (EFFR) | \$25 | | \$25 |
| Processing Options: | | | | | | |
| A | T + 1 (Monday) | \$140 (SOFR) | \$125 (EFFR Friday) | \$15 | -\$1 | \$14 |
| B | T + 1 (Monday) | \$140 (SOFR) | \$126 (SOFR) | \$14 | | \$14 |

The purpose of generating the IRS Discounting Transition Report is to:

- Isolate the impacts of the discounting transition for each USD IRS trade cleared at CME
- Provide participants operational flexibility in processing this transition on Monday via either:
 - **Option A**, referencing the cash adjustment amount and prior-day EFFR NPV
 - **Option B**, referencing the prior-day SOFR NPV, consistent with Monday's trade register

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

| Column Header | Description | Sample Value | Type |
|----------------------------|---|---------------|--------------|
| Value Date | Business Date | 10/16/2020 | Date |
| Position Account ID | Position Account | 3TTNN7 | VARCHAR(8) |
| Cleared Trade ID | CME Trade ID | 6355844 | Integer |
| Platform ID | SEF/Platform ID | 7897868G9H | VARCHAR(255) |
| Client ID | Client ID | 1423523IS | VARCHAR(255) |
| REG_TRADE_ID | USI | CCCIRS6355844 | VARCHAR(255) |
| Firm ID | 3 digit clearing firm ID | 998 | VARCHAR(3) |
| ORIGIN | HOUS or CUST | CUST | VARCHAR(4) |
| PRODUCT_TYPE | type of swap | OIS | VARCHAR(5) |
| Currency | 3 digit currency code | USD | VARCHAR(3) |
| NPV_NEW_DISC | NPV under SOFR discounting | 2,266.34 | Float |
| NPV_PRIOR_DISC | NPV under EFFR discounting | 2,244.28 | Float |
| NPV_ADJ_NEW_DISC | ADJ NPV under SOFR discounting | 2,266.34 | Float |
| NPV_ADJ_PRIOR_DISC | ADJ NPV under EFFR discounting | 2,244.28 | Float |
| NPV_ADJ_DIFF | New ADJ NPV minus Prior ADJ NPV | 22.06 | Float |
| FX_RATE | FX Rate use to convert non-deliverable currencies' NPV differences to the adjustment amount. Equal to 1 for USD | 1.000000 | Float |
| OFFSET_ADJ_AMT | Cash adjustment amount Prior ADJ NPV minus new ADJ NPV | -22.06 | Float |

Variation Margin and Cash Adjustment

Curve Construction

The below demonstrates the SOFR curves construction used for computing the cash compensation:

- The short end of the SOFR curve is constructed using monthly and quarterly listed SOFR futures contracts. These products are the most liquid futures in the marketplace
- Convexity adjustments are applied to SOFR futures to better reflect the differential of interest rate risk between OTC and exchange traded instruments
- Fed Funds-SOFR Basis swaps are used for the remainder of the curve as they are the most liquid OTC products
- Quotes taken at 3:00 p.m. ET.

Forward rates will be held constant for the transition process

| | Tenor | Instruments |
|---|---|--------------------------------|
| Forecasting and Discounting Curve Inputs | 1M | CME Monthly SOFR Futures (SR1) |
| | 3M-2Y | CME Monthly SOFR Futures (SR3) |
| | 3Y,4Y,5Y,7Y,10Y,12Y,15Y,20Y,25Y,30Y, 40Y, 50Y | Fed Funds-SOFR Basis Swap |

Draft proposal intended for soliciting further participant feedback

Re-Hedging Process

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

| (\$MM DV01) | Pre-Transition | Transitioning w/o Re-hedging | Basis Swaps | Transitioning w/ Re-hedging |
|-------------------------|----------------|------------------------------|-------------|-----------------------------|
| Outright ICE LIBOR Risk | \$20MM | \$20MM | - | \$20MM |
| EFFR Discounting Risk | \$1MM | \$0 | \$1MM | \$1MM |
| SOFR Discounting Risk | \$0 | \$1MM | (\$1MM) | \$0 |

*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: 2Y, 5Y, 10Y, 15Y, 20Y, 30Y
- Participants can choose to have these swaps booked as either CME cleared:
 - Float-versus-float basis swaps, or
 - Pairs of fixed-versus-float swaps
- Basis Swaps will be processed after the close on October 16th with a cleared date of October 19th
 - Swaps booked at a \$0 NPV
 - No variation or initial margin will be calculated for these swaps on transition date
 - Float-versus-float basis swaps: Breakeven spread is included on the SOFR leg
 - Pairs of fixed-versus-float swaps: Difference in par rates will reflect the breakeven spread

Client Election Process

| Election: | 1. Choose how re-hedging swaps are booked | 2. Whether to liquidate swaps in the auction |
|--------------|---|--|
| Default: | Float v. Float Basis Swap | Not to participate in the auction |
| Alternative: | Pairs of Fixed v. Float Synthetic Basis Swaps | Participate in the auction |
| Process | <i>FCMs facilitate clients' selection</i> | <i>FCMs facilitate clients' selection & Clients sign CME agreement</i> |

Discounting Re-Hedging Process – SOFR Only

Basis Swap Details

The steps below describe the mechanism used by CME to calculate the basis swaps' notional amounts

- Imply SOFR-based par quotes for instruments used in the bootstrapping process
- Compute the delta sensitivity to the instruments used for generating the SOFR curve by sequentially bumping the implied quotes up and down for each instrument under SOFR discounting. This delta ladder vector will be computed for the production portfolio and the instruments identified in the re-hedging exercise
- Bucket the delta ladder vector using linear interpolation to each of the instruments identified in the re-hedging exercise
- Calculate the notional amount and direction of the corresponding basis swaps to the nearest \$1 by using matrix inversion to neutralize the SOFR risk

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; EFR - 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 Friday transition process
- CSV report delivered to firm and client sFTP folders
 - All parties receiving Trade Registers will receive this report

Sample report:

| Value Date | Trade ID | Curve Name | 2 Year | 5 Year | 10 Year | 15 Year |
|------------|----------|-------------|-------------|------------|--------------|------------|
| 10/16/2020 | 1446246 | USD_SOFR_1D | -157.0307 | 442.3291 | 2.7073 | -5.9383 |
| 10/16/2020 | 1447678 | USD_SOFR_1D | -357.9837 | -188.2520 | 99.8234 | 806.2125 |
| 10/16/2020 | 1442453 | USD_SOFR_1D | 59.7710 | 64.9625 | 225.4575 | 165.3493 |
| 10/16/2020 | 1444939 | USD_SOFR_1D | -259.9575 | 19.7858 | 8.5534 | 19377.8389 |
| 10/16/2020 | 1441641 | USD_SOFR_1D | 1.0911 | 3.1523 | 5.8781 | 9.1668 |
| 10/16/2020 | 1445732 | USD_SOFR_1D | -28596.9878 | 11165.1008 | -102124.1556 | 13373.9478 |

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Auction Mechanism

SOFR Only

SOFR Discounting Transition – Client Elections

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

| Election: | 1. Choose how re-hedging swaps are booked | 2. Whether to liquidate swaps in the auction |
|--------------|---|--|
| Default: | Float v. Float Basis Swap | Not to participate in the auction |
| Alternative: | Pairs of Fixed v. Float Synthetic Basis Swaps | Participate in the auction |
| Process | <i>FCMs facilitate clients' selection</i> | <i>FCMs facilitate clients' selection & Clients sign CME agreement</i> |

Legal Agreement Details - CME SOFR Auction Customer Agreement

- Client consents that results of the auction are binding
- All re-hedging swaps received for the position account are submitted to the auction (no partials)
- Maximum loss limit based on a percentage of gross discounting exposure in DV01

Maximum Loss Limit

CME Auction Process

- Defined as the maximum dollar amount that each client could incur as a result of the auction
- The limit will be set based on prevailing liquidity prior to the auction legal agreement being made available, and universally applied to all clients
- If the cost of auctioning the net risk, when allocated back to participants' portfolios, exceeds the loss limit, the auction will not be executed

Basis Swap Auction Process

Approach Overview

Timing: Monday, October 19th, CME will open the auction window between 9-10am ET

- Auction will be held over a short period of time (approximately 30 minutes)

Eligible Bidders: Auction participants will be invited by CME

- May include CME IRS members and active participants in the SOFR/Fed Funds market
- All participants will be subject to NDA

Design: Single voluntary auction, inclusive of all 6 tenor points

- Allows dealers to consider offsetting risk when providing prices
- CME will be asking for a 2-way price to protect participating clients if the auction is not executed

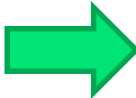
Auction Type: Determined by CME based on the size of the portfolio being auctioned

- Winner-takes-all: The best price wins the portfolio (smaller portfolio)
- Dutch-style: Execution price is determined based on the bid filling the last clearing size of the portfolio (larger portfolio)

Basis Swap Auction Process

Potential Auction Benefits

1. Positions netting across all participating clients is expected to result in lower cost of execution, as demonstrated below:

Gross DV01: \$5M
Market Bid/Ask: 1.0bp  **Net DV01: \$2M**
Realized Bid/Ask: 0.4bp
Realized Savings: 60%

| Customer | DV01 | Cost Based on Individual Liquidation | Cost Using The Auction | \$ Saving |
|--------------|--------------------|--------------------------------------|------------------------|--------------------|
| Customer A | (\$500,000) | (\$500,000) | (\$200,000) | \$300,000 |
| Customer B | (\$1,000,000) | (\$1,000,000) | (\$400,000) | \$600,000 |
| Customer C | \$1,500,000 | (\$1,500,000) | (\$600,000) | \$900,000 |
| Customer D | \$2,000,000 | (\$2,000,000) | (\$800,000) | \$1,200,000 |
| Total | \$2,000,000 | (\$5,000,000) | (\$2,000,000) | \$3,000,000 |

2. A sizeable pool of large and active SOFR/Fed Funds basis dealers combined with an optimal auction setup

Basis Swap Auction Process

Dutch Auction Example

Process:

1. Portfolio divided into equally proportioned “vertical slices” across all six tenor points, these “slices” represent the minimum portfolio bidding size
2. Each bidder submits bid (stated in terms of \$ bid/ask) at either the minimum bidding size, or its multiples
3. The auction price is determined based on the last clearing size of the portfolio, all winning bidders get filled at that price

Example: Auction portfolio with net \$2M DV01, shown on slide 18, divided into four equal slices (25% of portfolio):

| Bidder | Submission | Allocation | Premium Received |
|--------|------------|---------------------|------------------|
| 1 | \$375,000 | \$500k DV01 “Slice” | \$500,000 |
| 2 | \$450,000 | \$500k DV01 “Slice” | \$500,000 |
| 3 | \$475,000 | \$500k DV01 “Slice” | \$500,000 |
| 4 | \$500,000 | \$500k DV01 “Slice” | \$500,000 |
| 5 | \$550,000 | N/A | - |
| 6 | \$625,000 | N/A | - |

Final auction cost will be:
 $\$500,000 \times 4 \text{ Slices} = \$2,000,000$

| | | |
|--------------|--------------|------------------------|
| Included Bid | Excluded Bid | Auction Clearing Price |
|--------------|--------------|------------------------|

Basis Swap Auction Process

Auction Results and Communication

Immediately after the auction bidding window closes, CME will determine if the auction will be executed based on whether the auction cost, allocated to customers' portfolios, breaches the maximum loss limit

- Auction participants will be notified within minutes whether the auction is executed
- Participating clients will be notified shortly thereafter

If auction is executed, CME will allocate the auction cost to individual clients and book offsetting trades.

Cost Participation % Share is calculated as a ratio of a client's gross DV01 to the entire auction portfolio gross DV01.

| Customer | Gross DV01 | Cost Participation % Share |
|--------------|--------------------|----------------------------|
| Customer A | (\$500,000) | 10% |
| Customer B | (\$1,000,000) | 20% |
| Customer C | \$1,500,000 | 30% |
| Customer D | \$2,000,000 | 40% |
| Total | \$5,000,000 | 100% |

Net DV01: \$2M
Bid/Ask: 1.0bp
Cost: (\$2,000,000)

| \$ Cost |
|----------------------|
| (\$200,000) |
| (\$400,000) |
| (\$600,000) |
| (\$800,000) |
| (\$2,000,000) |

If auction is not executed, clients may seek an alternate means of risk mitigation

Basis Swap Auction Process

Auction Risks and Considerations

- If there is no, or limited, position netting, i.e. all participating clients are in the same direction, this may materially diminish the auction benefits and increase the cost of the auction due to the large concentrated risk being auctioned off at the same time vs bilateral trading which may be spread over longer period of time
- A large move in the SOFR/Fed funds basis price from Friday night, October 16th to Monday morning, October 19th may jeopardize CME's ability to execute an auction as the resultant mark-to-market may exceed the previously communicated maximum loss threshold
- By participating in the auction, you agree to sell your SOFR/Fed Funds basis swaps according to following:
 - **If the auctioned portfolio generates a loss (expected case):** The cost would be no greater than the maximum loss limit, as communicated by CME
 - **If the auctioned portfolio generates a gain:** The gain would be allocated consistent with the earlier participation share methodology
- Clients with very small exposures may get a better price transacting on a bilateral basis

Analysis, Testing, & Readiness

SOFR and €STR Discounting Transition

Available Analysis – SOFR Discounting Transition

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 trade level **(SOFR Only)**
3. Resulting Basis Swaps from Re-hedging Process **(SOFR Only)**
4. Historical descriptive statistics of the EFRR/SOFR basis **(SOFR Only)**

CME periodically refreshes data used to conduct such analysis

To receive this information, please send an email with the CME position account ID to:

CMEOTCAnalysis@cmegroup.com

SOFR Testing and Readiness Timelines



Test Phase 1: August 26th – September 18th

- Simulates the transition-date processing (Oct 16)
- CME produces the 'IRS Discounting Transition Report' daily in NR
- IRS Trade Register (VM, PAA, and NPVs) are based on EFR discounting
- IM requirements are calculated using EFR-based NPVs/risk

Re-Hedging Process Test: *September 18th*

- CME simulates the Re-Hedging Process at end-of-day in NR
- Creating basis swaps for all accounts w/ USD Swaps
- Sending corresponding clearing confirmed messaging.
- The IRSTR will show the basis swaps with a cleared date of Sept 21

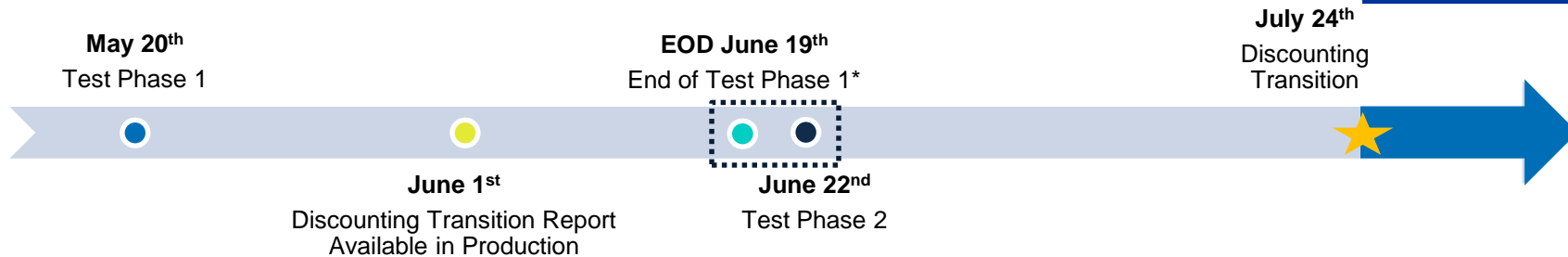
Test Phase 2: September 21st – October 16th

- Simulates the post-transition environment (Oct 19th onward)
- CME begins publishing the IRSTR reflecting SOFR discounting
 - IRS Trade Register (VM, PAA, and NPVs) are based on SOFR
- IM requirements are calculated using SOFR-based NPVs/risk
- IRS Discounting Transition Report no longer published in NR

Discounting Transition Report in Production: *September 28th*

- Shows NPV change leading up to Transition Date
- All reports contain the date as part of file name and a Value Date within the report: IRSDIS_[FIRM ID]_YYYYMMDD_EOD.csv

€STR Testing and Readiness Timelines



Test Phase 1: May 20th – June 19th

- Simulates the transition-date processing (July 24th)
- CME produces the 'IRS Discounting Transition Report' daily in NR
- IRS Trade Register (VM, PAA, and NPVs) are based on EONIA discounting
- IM requirements are calculated using EONIA-based NPVs/risk

*End-to-End Test: *Weekend of June 19th*

CME's NR Phases switches over the weekend allows for a test of the full transition weekend within the New Release environment

Test Phase 2: June 22nd – July 24th

- Simulates the post-transition environment (Jul 26th onward)
- CME begins publishing the IRSTR reflecting €STR discounting
 - IRS Trade Register (VM, PAA, and NPVs) are based on €STR
- IM requirements are calculated using €STR-based NPVs/risk
- IRS Discounting Transition Report no longer published in NR

Discounting Transition Report in Production: *June 1st*

- Shows NPV change leading up to Transition Date
- All reports contain the date as part of file name and a Value Date within the report: IRSDIS_[FIRM ID]_YYYYMMDD_EOD.csv

Client Readiness Checklist

Operational process to account for the change in discounting rate

- Determine whether to update prior NPVs or recognize a cash adjustment
- Determine how to independently reconcile the cash adjustment

Develop a strategy for handling basis swaps for the SOFR discounting transition

- 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
- Elections:** basis swaps vs fixed/float swap pairs, auction participation

Preparing for the discounting transition

- Develop understanding of the magnitude of the cash adjustment
- Gain familiarity with discounting risk sensitivities and corresponding basis swap notional amounts for SOFR Transition
- Setup to trade and clear SOFR/€STR discounted instruments as well as SOFR-indexed instruments
- Engage with FCMs ahead of the discounting transition to ensure all elections and operational setups are in place

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This presentation contains references to draft proposals that have been provided for the purposes of soliciting participant feedback. Such proposals may be subject to change at CME's discretion.

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