

Secured Overnight Financing Rate (SOFR) Futures

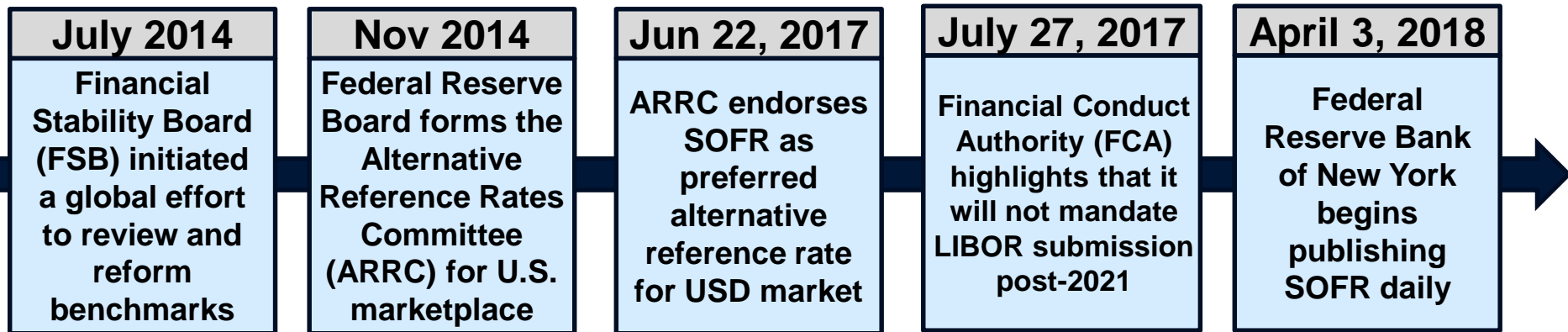
Launched May 7, 2018

www.cmegroup.com/sofr

Introduction to SOFR and the ARRC

In 2014, the Federal Reserve commissioned the Alternative Reference Rates Committee (ARRC), tasked with identifying an alternative USD interest rate benchmark based firmly in market transaction data. After extensive research, in June 2017 the ARRC selected the **Secured Overnight Financing Rate (SOFR)**, a broad treasury financing rate, as the preferred alternative reference rate for the USD Marketplace

Recent events have intensified focus on the path forward for short-term interest rate (STIR) products



CME Group has been deeply involved in this initiative for several years

Member of LIBOR Oversight Committee since April 2013

Member of ARRC since September 2015

Participant in ISDA Working Group on Benchmark Fallbacks

Published White Paper: What's Next for LIBOR and Eurodollar Futures?

Hosted market-wide webinar on ARRC and SOFR, attended by 900 market participants

Collected feedback from 100+ participants on SOFR Futures design

Launched SOFR Futures on May 7, with 60 participants in the first week

What is the Secured Overnight Financing Rate (SOFR)?

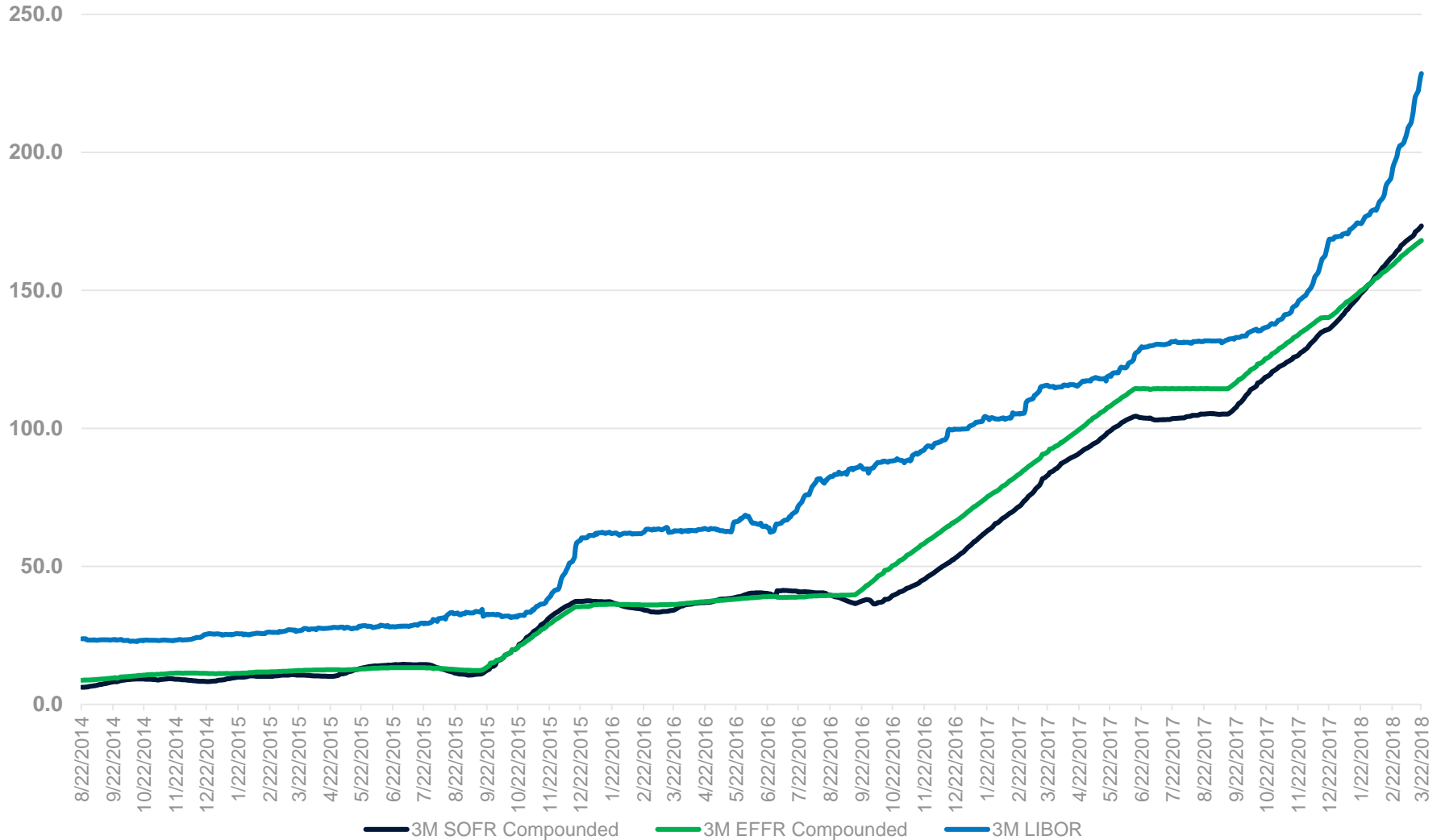
- SOFR is endorsed by the Fed-sponsored Alternative Reference Rate Committee (ARRC) as a robust alternative reference rate for the USD Marketplace
- ARRC's criteria included liquidity of the underlying market, usefulness to all market participants, feasibility of calculating the rate, and consistency with IOSCO principles for benchmarks (such as Benchmark Quality and Governance)*
- Underpinned by the U.S. Treasury overnight repurchase (repo) market, for which the pool of eligible transactions exceeds \$700 billion per day, and is growing**
 - Data to be sourced from tri-party repo data from Bank of New York Mellon (BNYM), and cleared bilateral and GCF Repo data from the Depository Trust & Clearing Corporation (DTCC)
 - Calculated as a transaction-volume-weighted median rate
 - Various filters and trims are applied to cleared bilateral and GCF transactions from DTCC to clean idiosyncrasies such as inter-company transactions and repo specials. Also, the Fed's RRP transactions are excluded to help determine the representative cost of overnight secured funding.
- SOFR is financially distinct but highly correlated with benchmark Eurodollar and Fed Fund rates. Therefore, we believe that the Eurodollar, Fed Fund, and SOFR futures may co-exist for a long time providing valuable choice in investing, risk management, and hedging tools.

*ARRC Second Report, page 4

**ARRC Second Report, page 7

<https://www.newyorkfed.org/medialibrary/Microsites/arrc/files/2018/ARRC-Second-report>

3-Month Compounded SOFR, 3-Month Compounded EFFR, and 3-Month LIBOR®



Based on extensive customer input, CME Group launched 3-Month and 1-Month SOFR Futures contracts

SOFR Futures Product Development Timeline



- The 3-Month SOFR futures strip consists of 20 quarterly contracts which settle to the compounded SOFR in a given reference period between two IMM dates
- The 1-Month SOFR futures strip consists of 7 monthly contracts which settle to the arithmetic average of SOFR in a given calendar month

Complementarity between SR3 and SR1: The 1-Month SOFR futures strip will prove useful to market participants who seek finer granularity in framing market expectations of future SOFR values over the nearby 1-month to 7-month interval during which the front 3-Month contract becomes more set each day from daily SOFR fixings.

After the nearby contract enters its Reference Quarter, the contract rate becomes a mix of (i) known SOFR values, ie, published values for all days from start of the Reference Quarter to the present, and (ii) market expectations of SOFR values for all remaining days in the Reference Quarter that lie ahead.

SOFR Futures Contract Design: Launching May 7, 2018

Based on extensive customer input, CME Group launched 3-Month and 1-Month SOFR futures contracts. The 1-Month SOFR futures strip will prove useful to market participants who seek finer granularity in framing market expectations of future SOFR values over the nearby 1-month to 7-month interval during which the front 3-Month contract becomes more set each day from daily SOFR fixings.

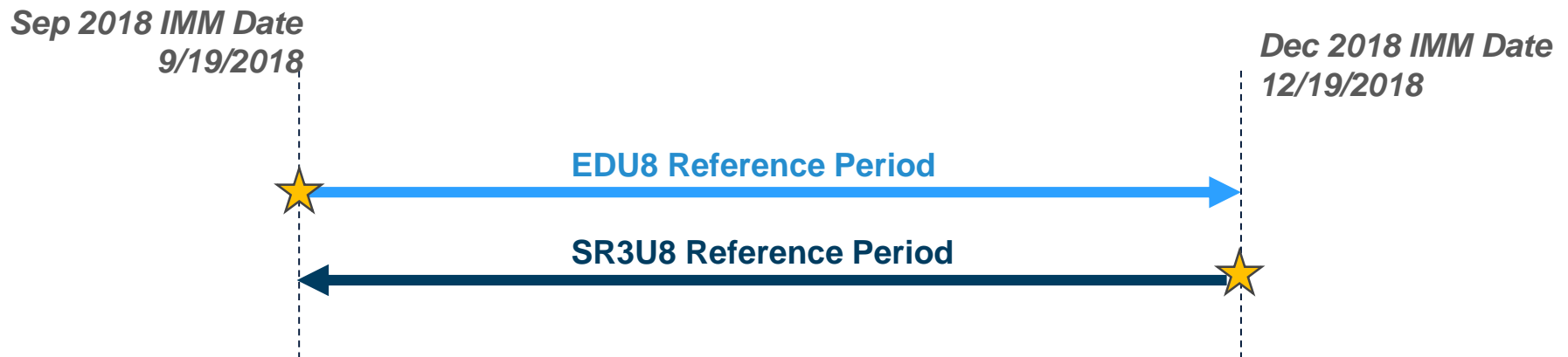
	3-Month SOFR Futures	1-Month SOFR Futures
Contract Unit	Compounded daily Secured Overnight Financing Rate (“SOFR”) interest during contract Reference Quarter, such that each basis point per annum of interest = \$25 per contract.	Average daily Secured Overnight Financing Rate (“SOFR”) interest during futures contract delivery month, such that each basis point per annum of interest is worth \$41.67 per futures contract.
Price Basis	Contract-grade IMM Index: 100 minus R	Contract-grade IMM Index: 100 minus R
Contract Size	\$25 per basis point per annum	\$41.67 per basis point per annum
Minimum Price Fluctuation	Nearby Delivery Month: 0.0025 IMM Index points (¼ basis point per annum) equal to \$6.25 per contract All Other Delivery Months: 0.005 IMM Index points (½ basis point per annum) equal to \$12.50 per contract	Nearby Delivery Month: 0.0025 IMM Index points (¼ basis point per annum) equal to \$10.4175 per contract All Other Delivery Months: 0.005 IMM Index points (½ basis point per annum) equal to \$20.835 per contract
Delivery Months	Nearest 20 March Quarterly months (Mar, Jun, Sep, Dec)	Nearest 7 calendar months
Globex Product Code	SR3	SR1

For more specific SOFR contract specifications, please refer to Appendix slides 12 and 13

3-Month SOFR vs. Eurodollar Futures: Contract Months and Reference Periods

- Due to the nature of their underlying rates, Eurodollar Futures are forward looking (using 3-month rates) while SOFR Futures are backward looking (using an overnight rate)
- SOFR Futures are named so that each contract month's 3-month reference period begins at the same time of as the most relevant Eurodollar future
- While the reference period is the same for both products, the final settlement date and last trade date differs

★ *Indicates final settlement day*



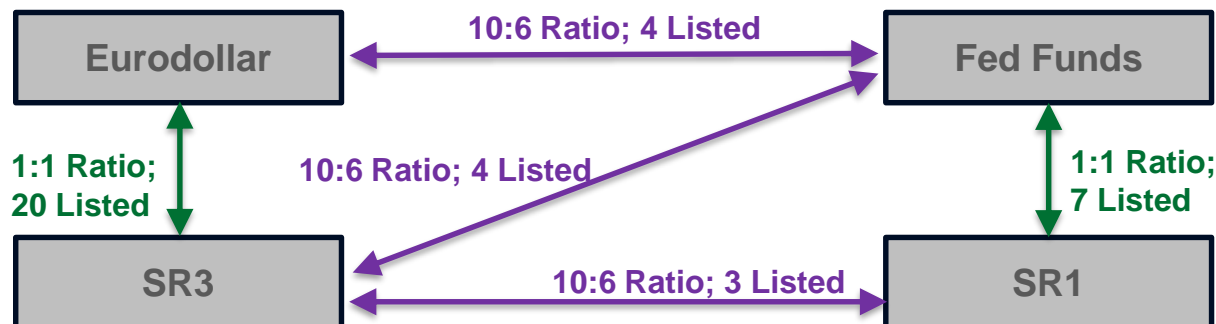
Inter-Commodity Spreads facilitate liquidity formation in SOFR Futures

- CME Globex offers spread instruments that reduce leg risk and improve liquidity formation by matching orders from related markets
- We offer inter-commodity spreads between short term interest rate futures
 - Eurodollars vs. Fed Fund Futures launched March 12
 - 1-Month SOFR vs. Fed Fund Futures available May 7 (with implied)
 - 3-Month SOFR Futures vs. Eurodollar Futures available May 7 (with implied)
 - 3-Month SOFR Futures vs. 1-Month SOFR Futures available May 7
 - 3-Month SOFR Futures vs. Fed Fund Futures available May 7
- Implied functionality creates orders using related spread markets.
 - For example, if there are market makers providing liquidity in 1-Month SOFR vs. Fed Fund Futures, the CME Globex match engine will use this in combination with the Fed Fund markets to create orders in the SOFR outright

CME Clearing provides margin offsets of up to 85% between related STIR Futures

Inter-commodity spreads for Short Term Interest Rates

Spreading against established liquidity pools of FF and ED futures assist in developing liquidity in SOFR futures



Spread Weightings

- Fed Funds and 1-Month SOFR Futures are \$41.67 DV01 contracts
- Eurodollars and 3-Month SOFR Futures are \$25 DV01 contracts
- To keep positions balanced, spreads between instruments with different DV01s will be weighted to have 10:6 leg ratios to balance the risk, derived from the DV01s which are \$41.67 for 1-Month contracts (Fed Funds and SR1) and \$25.00 for 3-Month contracts (Eurodollars and SR3)
- For weighted spreads, Legs are arranged to match exposures between IMM dates: 1 quarterly Eurodollar or 3-Month SOFR Future spread against the next 2 Fed Fund or 1-Month SOFR Futures contract months (e.g. 3 April FF + 3 May FF vs. 10 March ED)

Globex Symbol Example	Spread Code	Implied Y/N	Front Leg	Back Leg	Leg Ratio	Launch Date
ZQJ8K8-GEH8	EF	No	Fed Funds	Eurodollars	(3+3) : 10	March 12
SR3H8-GEH8	IS	Yes	SOFR 3-Month	Eurodollars	1:1	May 7
SR1H8-ZQH8	IS	Yes	SOFR 1-Month	Fed Funds	1:1	May 7
SR1J8K8-SR3H8	EF	No	SOFR 1-Month	SOFR 3-Month	(3+3) : 10	May 7
ZQJ8K8-SR3H8	EF	No	Fed Funds	SOFR 3-Month	(3+3) : 10	May 7

Secured Overnight Financing Rate (SOFR) Swaps

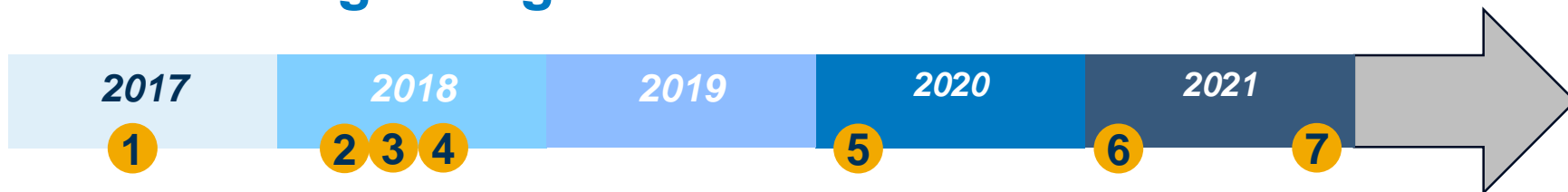
CME is targeting Q3-2018 for clearing OTC SOFR-based swaps.

- Clearing OTC SOFR Swaps further extends CME Group's leadership as the only clearing house to offer clearing for Interest Rate Swaps, Swaptions and Interest Rate futures within a single netting pool.
- The deep liquidity and potential offsets found in our Interest Rate franchise makes CME the natural home for SOFR clearing.

Field	Description
Swap Types	<p><u>OIS:</u></p> <p>Fixed versus SOFR</p> <p><u>Basis:</u></p> <p>1M USD-LIBOR versus SOFR</p> <p>3M USD-LIBOR versus SOFR</p> <p>6M USD-LIBOR versus SOFR</p> <p>Fed Funds versus SOFR</p>
Floating Rate Index	<p>USD-SOFR-OIS-Compound</p> <p>USD-SOFR</p>
Maximum Maturity	5 Years
Settlement Convention	T+1
Forecasting Curve	SOFR Futures + Convexity Bias Adjustment
Discounting Curve	Existing USD Fed Funds Curve
Price Alignment Rate	USD daily effective federal funds rate
Holiday Calendars & Business Day Conventions	Flexible support for business days, calendars and adjustments

*Pending regulatory review

CME Offerings in light of ARRC's Paced Transition Plan

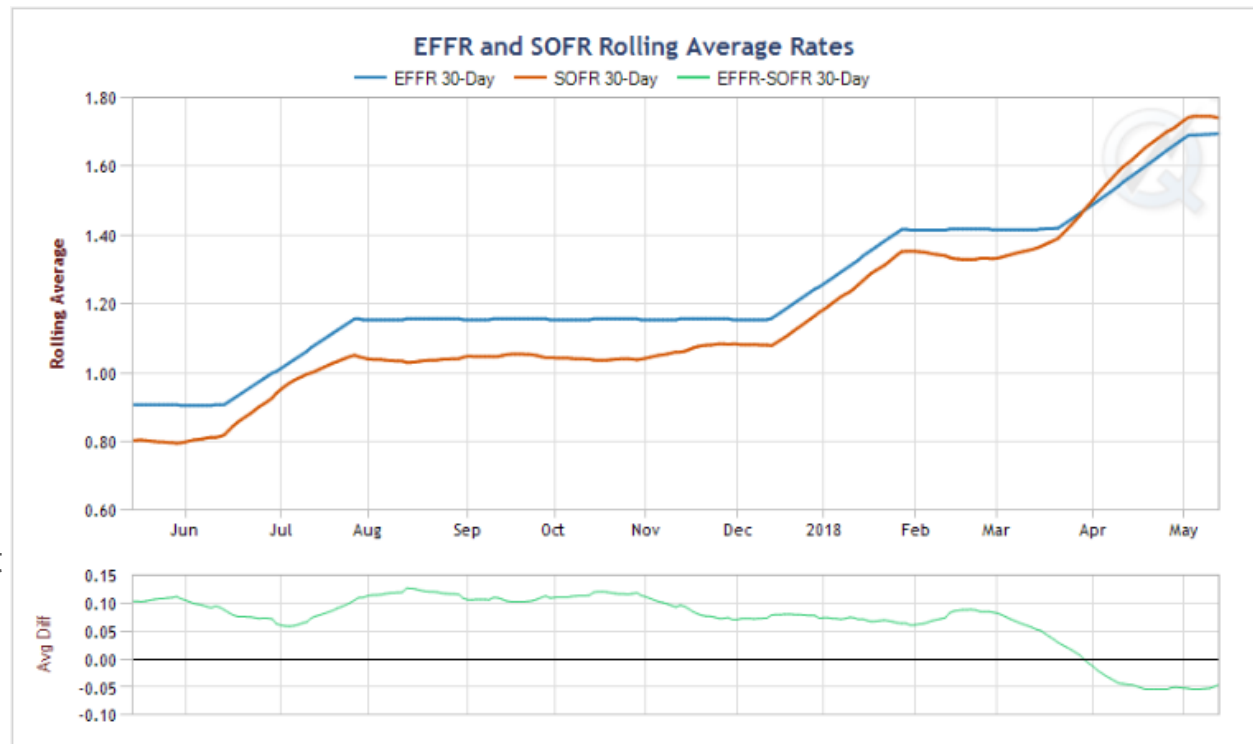


	Step	Timing
1	ARRC Nominates SOFR as preferred rate for U.S. Dollar marketplace	June 22, 2017 (Complete)
2	SOFR daily publication begins	April 3, 2018 (Complete)
3	CME futures contracts launch	May 7, 2018 (Complete)
4	CME provides OTC Clearing for SOFR OIS (Fed Funds used for discounting and price alignment)	Q3-2018
5	CCPs begin accepting swaps that use SOFR for discounting and price alignment	Q1-2020
6	CCPs no longer accept new swap contracts for clearing with EFR as PAI and discounting, except for the purpose of reducing risk in legacy contracts	Q1-2021
7	Creation of term reference rate, potentially based on SOFR-derivatives markets once liquidity has developed sufficiently to produce a robust rate	Before end of 2021

Source: ARRC Roundtable November 2nd
<https://www.newyorkfed.org/arrc/meetings>

Why Trade SOFR Futures?

- Futures are a reliable indicator of market expectations of SOFR along the curve
- Easy spread trading against Eurodollar and Fed Fund futures via CME Globex inter-commodity spreads, provides a transparent basis market
- Margin efficiencies against Eurodollar and Fed Fund Futures, up to 85%, and will become eligible for efficient portfolio margining against CME-cleared swaps
- SOFR futures since launch are supported by over ten market makers
- Clients have indicated that SOFR futures will have immediate investing, risk management, and hedging applications for repo and relative value traders.
- Differences in SOFR and EFR are affected by supply and demand dynamics in each market, and create relative value trading opportunity for futures market participants

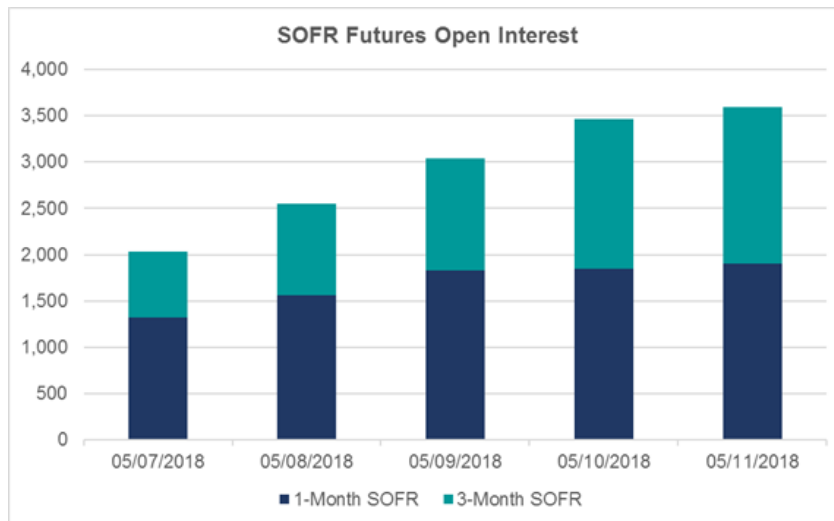


See the latest version of this chart (and more) at www.cmegroup.com/stiranalytics

SOFR Activity

- Day 1 volume 3,200 contracts, with participants using both 1-Month SOFR Futures (SR1) and 3-Month SOFR Futures (SR3)
- Open Interest reached 11,000 at the end of the first month (6/1/2018)
- 60 Global Firms participated in the first week of activity, including a mix of banks, hedge funds, asset managers, and proprietary trading firms
- There are a dozen participants in the market making program providing 2-sided quotes

Markets often trading at 0.5 basis points wide (min. tick) across the front five expiries in both SR1 and SR3



X	CC	Product	Descri...	Qty	Bid	Ofr	Qty
- 1-Month SOFR Future							
x	SR1	1-Month SOFR Future	May18	206	98.2725	98.2750	154
x	SR1	1-Month SOFR Future	Jun18	225	98.125	98.130	174
x	SR1	1-Month SOFR Future	Jul18	205	98.025	98.035	205
x	SR1	1-Month SOFR Future	Aug18	250	98.005	98.015	200
x	SR1	1-Month SOFR Future	Sep18	177	97.980	97.990	128
x	SR1	1-Month SOFR Future	Oct18	100	97.825	97.855	100
- 3-Month SOFR Future (Outright)							
x	SR3	3-Month SOFR Future	Jun18	428	98.015	98.020	100
x	SR3	3-Month SOFR Future	Sep18	175	97.840	97.845	25
x	SR3	3-Month SOFR Future	Dec18	77	97.680	97.685	145
x	SR3	3-Month SOFR Future	Jun19	100	97.445	97.450	200
x	SR3	3-Month SOFR Future	Sep19	100	97.360	97.410	250

For more information...

Visit our website at www.cmegroup.com/sofr to find contract specifications, educational materials, analytical tools, and more.

Or contact the interest rate product team at InterestRates@cmegroup.com

Appendix

SOFR Futures – Vendor Codes for Outrights and Spreads

SOFR Futures Vendor Codes

**These vendors are not yet supporting SOFR spreads, please contact their help desk to request support*

Product Type	3-Month SOFR	1-Month SOFR	3-Month SOFR vs. Eurodollars	1-Month SOFR vs. 30-Day Fed Funds	1-Month SOFR vs. 3-Month SOFR	30-Day Fed Funds vs. 3-Month SOFR
	Outright	Outright	1:1 Spread	1:1 Spread	10:6 Spread	10:6 Spread
CME Globex	SR3	SR1	SR3	SR1	SR1	ZQ
Thomson Reuters Globex Chain RICs	0#1SRA:	0#1S1R:	0#1SRA-ED:	0#1S1R-FF:	0#1S1R-S1R-SRA:	0#1FF-FF-SRA:
Thomson Reuters Composite Chain RICs	0#SRA:	0#S1R:	0#SRA-ED:	0#S1R-FF:	0#S1R-S1R-SRA:	0#FF-FF-SRA:
TT	SR3	SR1	SR3	SR1	SR1	ZQ
CQG	SR3	SR1	SGIO	SZIO	SRWI1	ZSWI1
FIS/SunGard	SR3	SR1	SR3	SR1	SR1	ZQ
Fidessa	SR3	SR1	SR3	SR1	SR1	ZQ
Bloomberg	SFR Comdty	SER Comdty	Not yet supporting*	Not yet supporting*	Not yet supporting*	Not yet supporting*
ION (Pats & FFastFill)	SR3	SR1	Not yet supporting*	Not yet supporting*	Not yet supporting*	Not yet supporting*
Broadway Technology	SR3	SR1	Not yet supporting*	Not yet supporting*	Not yet supporting*	Not yet supporting*

Contract Specifications: Three-Month SOFR futures

	Three-Month SOFR futures
Trading Unit	Compounded daily Secured Overnight Financing Rate (“SOFR”) interest during contract Reference Quarter, such that each basis point per annum of interest = \$25 per contract. Reference Quarter: For a given contract, interval from (and including) 3rd Wed of 3rd month preceding Delivery Month, to (and not including) 3rd Wed of Delivery Month.
Price Basis	Contract-grade IMM Index: 100 minus R. R = compounded daily SOFR interest during contract Reference Quarter.
Contract Size	\$25 per basis point per annum
Minimum Price Increment	Contracts with Four Months or Less Until Termination of Trading: 0.0025 IMM Index points (¼ basis point per annum) equal to \$6.25 per contract All Other Contracts: 0.005 IMM Index points (½ basis point per annum) equal to \$12.50 per contract
Last Trading Day	Exchange Business Day first preceding 3rd Wed of Delivery Month. Termination of Trading: Close of CME Globex trading on Last Day of Trading.
Delivery	Cash settlement, by reference to Final Settlement Price, on first US government securities market business day following Last Day of Trading. Final Settlement Price: Contract-grade IMM Index evaluated on the basis of realized SOFR values during contract Reference Quarter $R = [\prod_i \{1+(d_i/360)*(r_i/100)\} - 1] \times (360/D) \times 100$ n = Number of US government securities market business days in the Reference Quarter i ~ Running variable indexing US government securities market business days during Reference Quarter \prod_i denotes the product of values indexed by the running variable, i = 1,2,...,n. r _i = SOFR value for i th US government securities market business day d _i = Number of calendar days to which r _i applies D = $\sum d_i$ (ie, number of calendar days in Reference Quarter)
Contract Months	Nearest 20 March Quarterly months (Mar, Jun, Sep, Dec). For each contract, Contract Month is the month in which Reference Quarter begins. Example: For a “Sep” contract, Reference Quarter starts on IMM Wed of Sep and ends with Termination of Trading on the first US government securities market business day before IMM Wed of Dec, the contract Delivery Month.
CME Globex Algorithm	Allocation (A Algorithm, with Top Order Allocation = 100% and Pro Rata Allocation = 100%)
Block Minimum	4pm–12am CT, Mon-Fri on regular business days and at all weekend times: 1,000 contracts 12am– 7am CT, Mon-Fri on regular business days: 2,000 7am–4pm CT, Mon-Fri on regular business days: 4,000
Product Code	SR3
Bloomberg Code	SFRA Comdty <GO>

Contract Specifications: One-Month SOFR futures

	One-Month SOFR futures
Trading Unit	Average daily Secured Overnight Financing Rate (“SOFR”) interest during futures contract Delivery Month, such that each basis point per annum of interest is worth \$41.67 per futures contract.
Price Basis	Contract-grade IMM Index: 100 minus R. R = average daily SOFR interest during contract Delivery Month.
Contract Size	\$41.67 per basis point per annum
Minimum Price Increment	0.005 IMM Index points (½ basis point per annum) equal to \$20.835 per contract, provided that: <ul style="list-style-type: none"> • If first day of contract Delivery Month is Sat, Sun, or Mon, then MPI is 0.0025 Index points, equal to \$10.4175 per contract, as of first trading day of contract Delivery Month. • If first day of contract Delivery Month is Tue, Wed, Thurs, or Fri, then MPI is 0.0025 Index points, equal to \$10.4175 per contract, as of last Sunday of month preceding contract Delivery Month.
Last Trading Day	Last Exchange Business Day of contract Delivery Month.
Delivery	Cash settlement, by reference to Final Settlement Price, on first US government securities market business day following Last Day of Trading. Final Settlement Price: Contract-grade IMM Index evaluated at R = arithmetic average of daily SOFR during Delivery Month.
Contract Months	Nearest 7 calendar months
CME Globex Algorithm	Split FIFO and Pro-Rata (K Algorithm, with Top Order Allocation = 100% and Pro Rata Allocation = 100%)
Block Minimum	4pm–12am CT, Mon-Fri on regular business days and at all weekend times: 500 contracts 12am– 7am CT, Mon-Fri on regular business days: 1,000 7am–4pm CT, Mon-Fri on regular business days: 2,000
Product Code	SR1
Bloomberg Code	SERA Comdty <GO>

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CME (“the Exchange”) has entered into an agreement with ICE Benchmark Administration Limited which permits the Exchange to use ICE LIBOR as the basis for settling Three–Month Eurodollar futures contracts and to refer to ICE LIBOR in connection with creating, marketing, trading, clearing, settling and promoting Three–Month Eurodollar futures contracts.

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