PIMCO

Transition from LIBOR to SOFR

Lima
September 2019

For instititional investor use only

LIBOR

Definition: An average interest rate that a bank would be charged by other banks for unsecured funding over a specified term

Current USD LIBOR Submitting Panel: 16 Banks submit daily (trim the 4 highest/lowest submissions)

- 4 U.K. Banks
- 4 European Banks
- 3 Japanese Banks
- 3 U.S. Banks
- 1 Swiss Bank
- 1 Canadian Bank

		Volume (Trillions USD)	% Maturing by end of 2021
Over-the-Counter Derivatives	Interest rate swaps	81	66%
	Forward rate agreements	34	100%
	Interest rate options	12	65%
	Cross currency swaps	18	88%
Exchange Traded Derivatives	Interest rate options	34	99%
	Interest rate future	11	99%
Business Loans	Syndicated loans	1.5	83%
	Nonsyndicated business loans	0.8	86%
	Nonsyndicated CRE/Commerical mortgages	1.1	83%
Consumer Loans	Retail mortgages	1.2	57%
	Other Consumer loans	0.1	-
Bonds	Floating/Variable rate notes	1.8	84%
Securitizations	Mortgage-backed securities (incl. CMOs)	1	57%
	Collateralized loan obligations	0.4	26%
	Asset-backed securities	0.2	55%
	Collateralized debt obligations	0.2	48%
Total USD LIBOR Exposure		**199**	**82%**

Source: The Alternative Reference Rate Committee, Second Report, March 2018.

Transition away from LIBOR

2008

Apr: U.S. Fed learns of problems with LIBOR

May: U.K. Regulators made aware of problems

Dec: Trade group responsible for LIBOR changes setting process

2012

2012 - Present: Bank settle/ fined multiple billion for LIBOR manipulation

Individuals arrested convicted for LIBOR manipulation

2014

Dec: Fed Reserve convened AARC (Alternative Reference Rate Committee), tasked to find new rate

2017

July: FCA chief Andrew Baily, announces FCA will not force banks to make LIBOR submissions beyond 2021

June: ARRC selects SOFR as LIBOR replacement

2018

Apr: Fed bgins publishing SOFR

May: CME launched SOFR Futures

July: FNMA issues first SOFR FRN

2019

Apr: AARC endorese waterfall and fallback language on cash products

2020

2nd half: LCH to move PAI discounting to SOFR

2021

End 2021: Create/publish term SOFR

END 2021:

Potential end to SOFR: FCA No longer compels Banks to Submit

What is SOFR

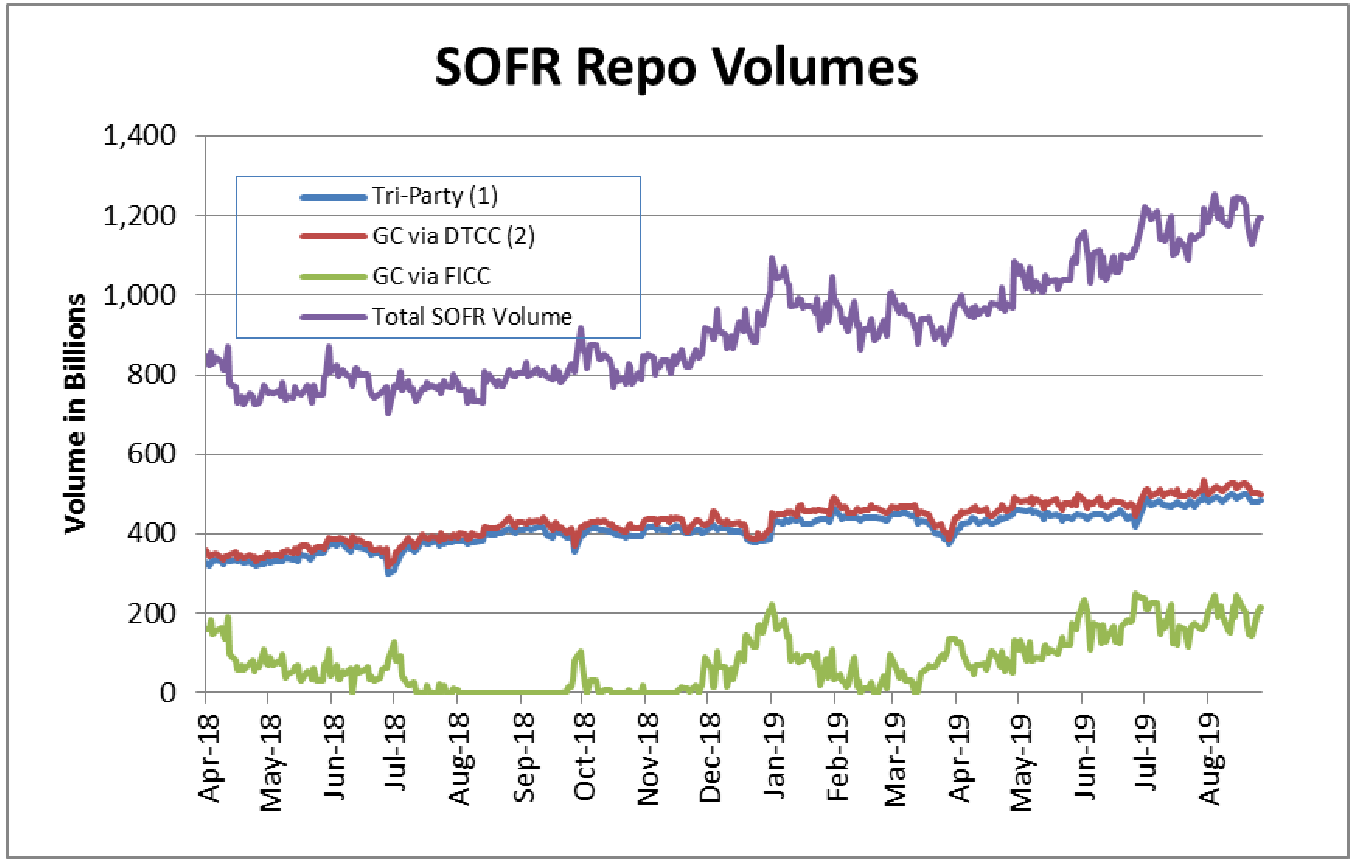
SOFR: Secured Overnight Financing Rate

What is it: Broad measure of the cost of borrowing cash overnight collateralized by Treasury securities

What is included:

- Tri-party Repo collected from BNYM
- General Collateral Repo transactions obtained from DTCC (excluding specials)
- General Collateral Repo transactions cleared through FICC (excluding specials)

How is it calculated: Volume-weighted median
Published: 8:00am EST by New York Fed



Source: Bloomberg, New York Federal Reserve

Comparison of LIBOR to SOFR

SOFR	LIBOR
Risk free rate	Bank lending rate (credit risk)
O/N Rate (backward-looking)	Lending rage (forward-looking)
Secured (collateralized by Treasuries)	Unsecured
Calculated by NY Federal Reserve	Calculated by ICE Benchmark Administration
Transaction Based	Waterfall for calculation (often expert judgement)
~$1 Trillion in daily transactions	~$1 Billion in daily transactions
No term structure	Term Structure

Current SOFR Market: Cash Market

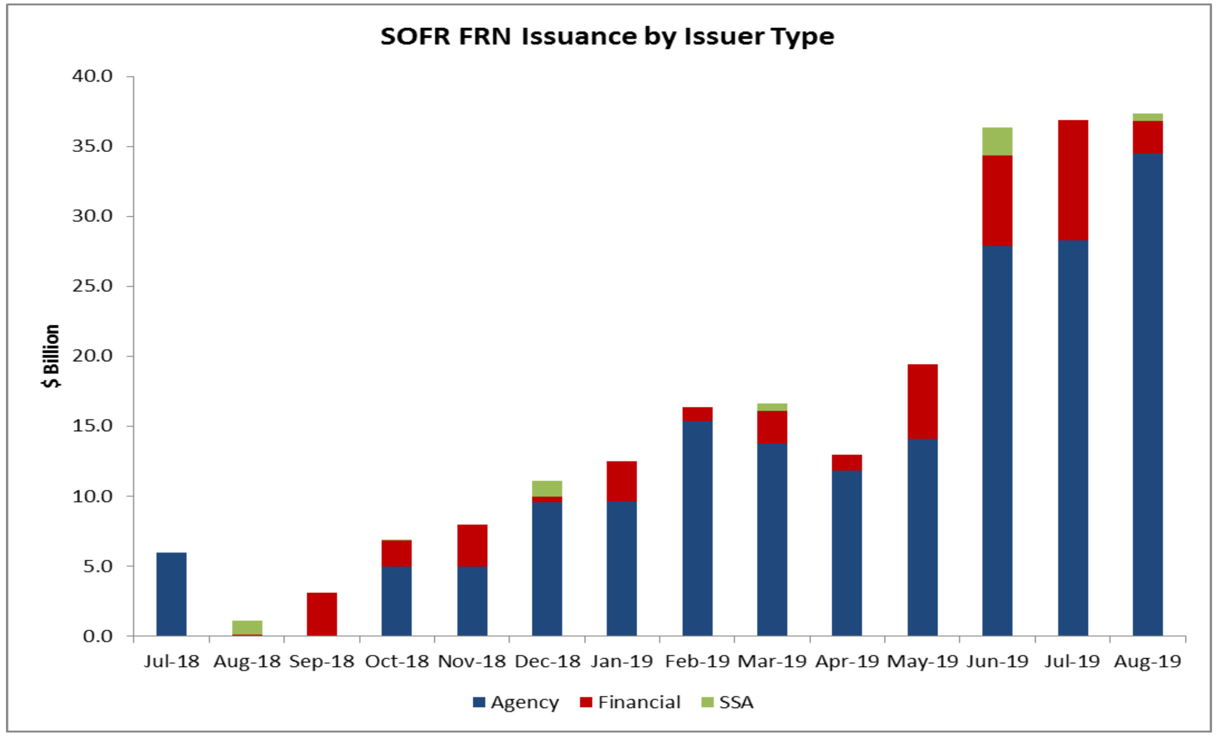
Total issuance through August has been ~$225bn

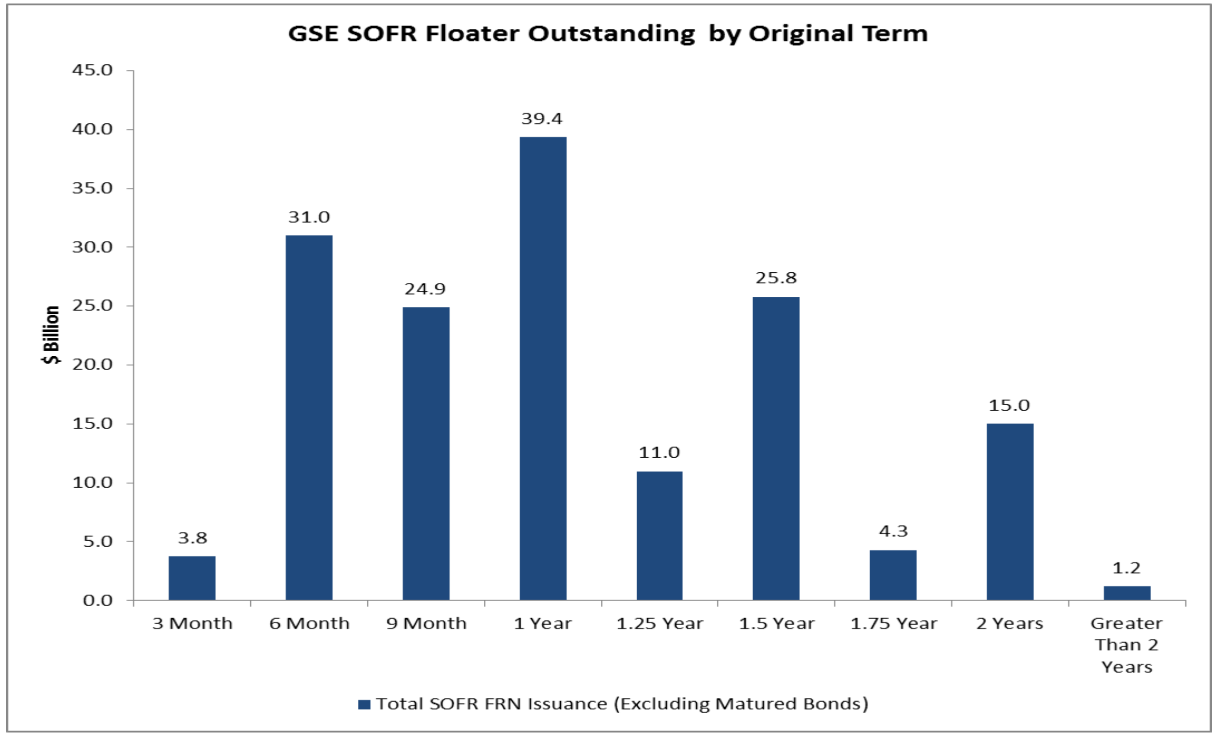
- US agencies have been ~80%

The majority of issuance is 2-year and less

- Demand has primarily been from U.S. money market funds

What the market needs: Increased issuance from non-financial corporates





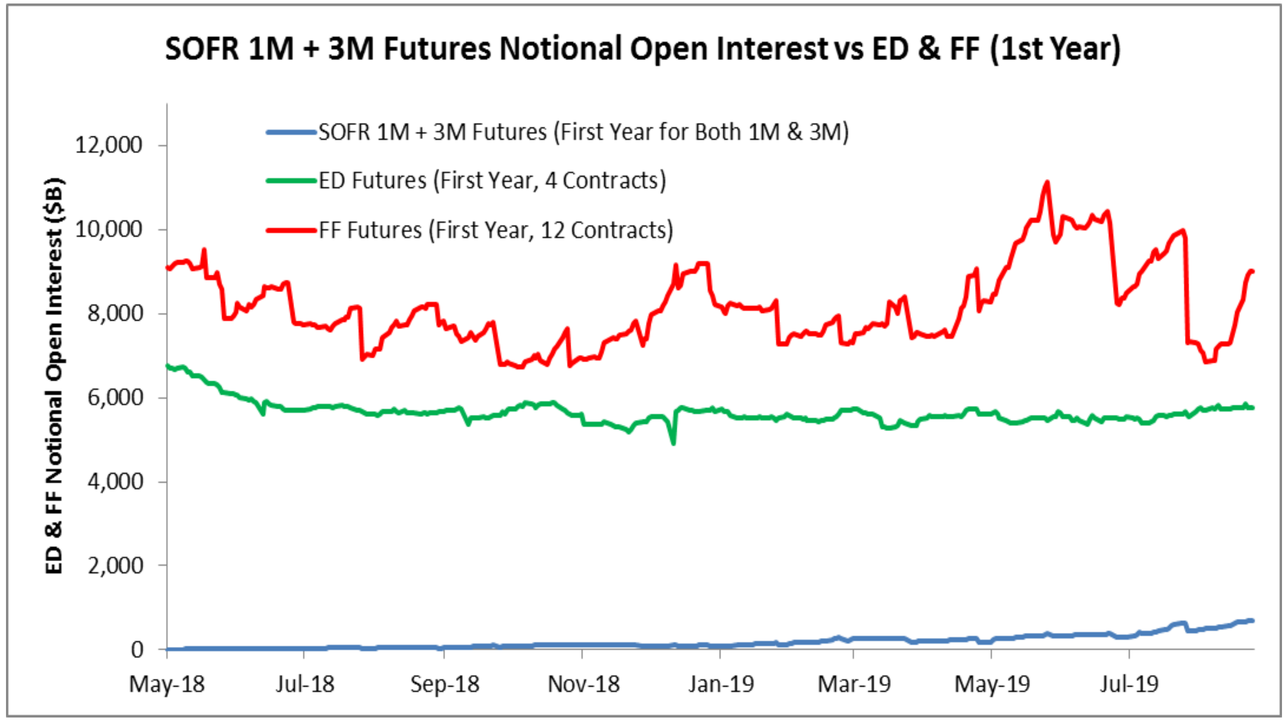
Source: Bloomberg

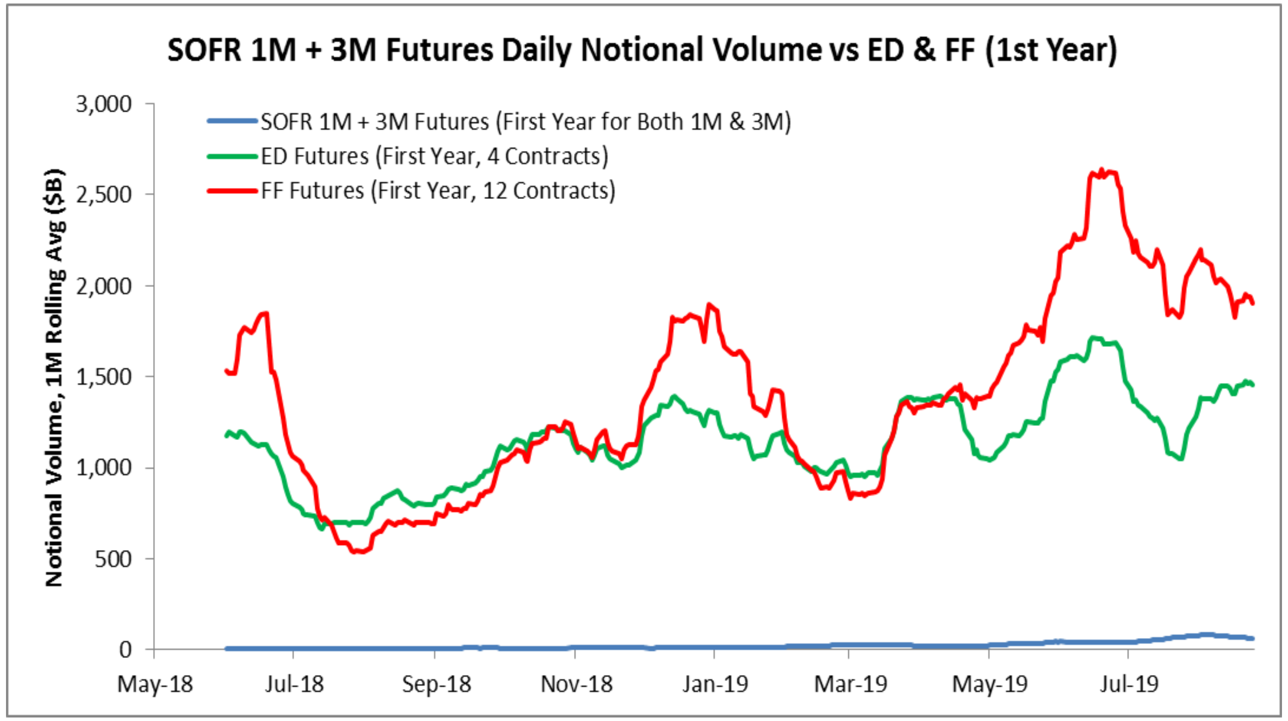
Current SOFR Market: Derivatives

SOFR Futures Open Interest (OI) and Volumes have increased

- They still significantly lag both Eurodollar and Fed Fund Futures
  - 12% -> First year SOFR futures OI vs. ED
  - 7.7% -> First year SOFR futures OI vs. Fed Funds

  - 6.3% -> First year SOFR futures daily volume vs. ED
  - 3.8% -> First year SOFR futures daily volume vs. Fed Funds





Source: Bloomberg

Problems with SOFR Market: No consistence across issuers

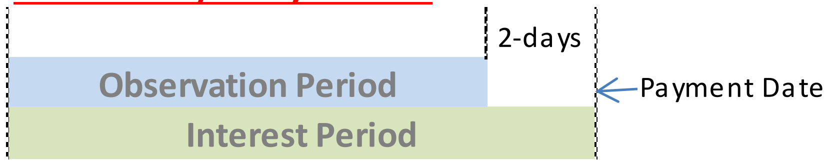
SOFR is a backward-looking overnight rate compared to LIBOR which is a forward-looking term-rate

- This has led to no consistence amongst issuers

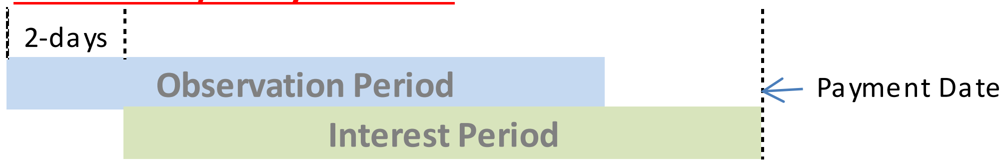
Lockout: A specified period of time before the coupon payment to which interest rates are held constant to determine interest payment

Lookback (reset): Coupon payment is determined by the observed values beginning and ending "X" days prior to interest accrual period

SOFR FRN w/ 2-day Lockout



SOFR FRN w/ 2-day Lookback



Issuer	Federal Home Loan Bank	Bank of America	Credit Suisse	European Investment Bank
Issue	FHLB 8/21/20 (3130AGXB6)	BAC 6/21/21 (06050TMM1)	CS 7/20/20 (22549LTM7)	EIB 6/10/22 (29878TDE1)
Coupon Calculation	Simple Average	Daily Compounding	Simple Average	Daily Compounding
Payment Date	On Interest period end date	2 business days following the interest period end date	On Interest Period End Date	On Interest Period End Date
Lookback	1	none	1	5
Lockout	2	none	0	0

Problem with SOFR Market: Calculation methods matter, especially in a low interest rate world

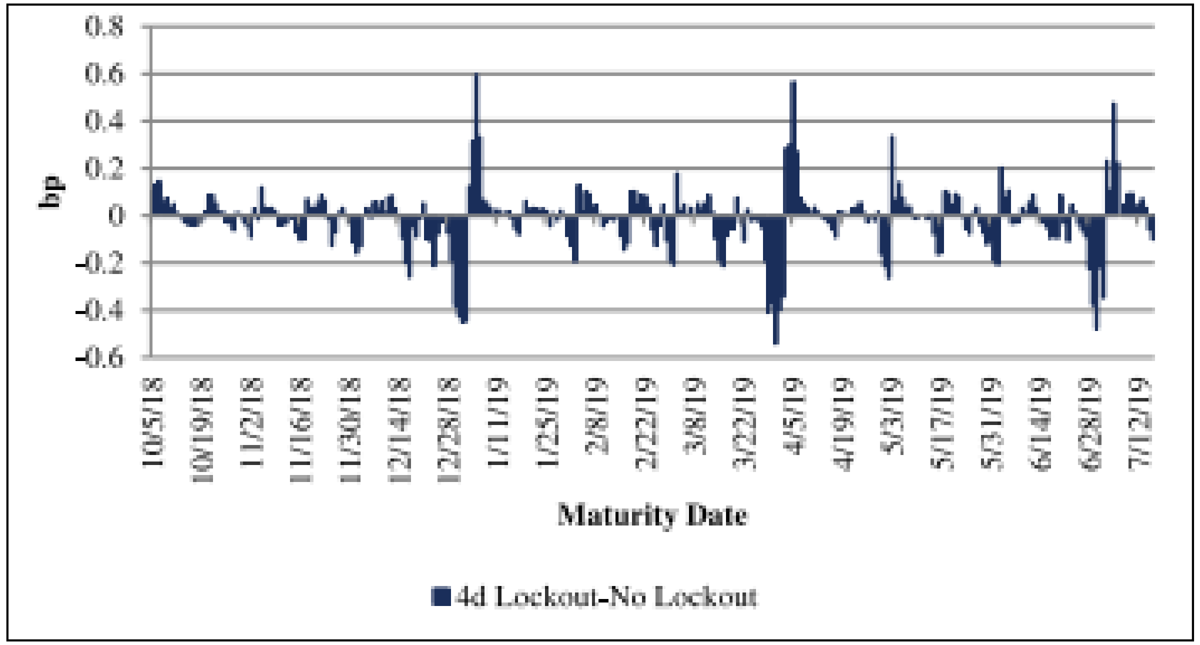
Lockout: Returns are different depending on timing of lockout period

- Best case for investor: Lockout period begins on last day of month
  - Takes advantage of elevated SOFR for ME / QE / YE spikes
- Worse case for investor: Lockout period is over last day of month
  - Do not receive elevated SOFR for ME / QE / YE spikes

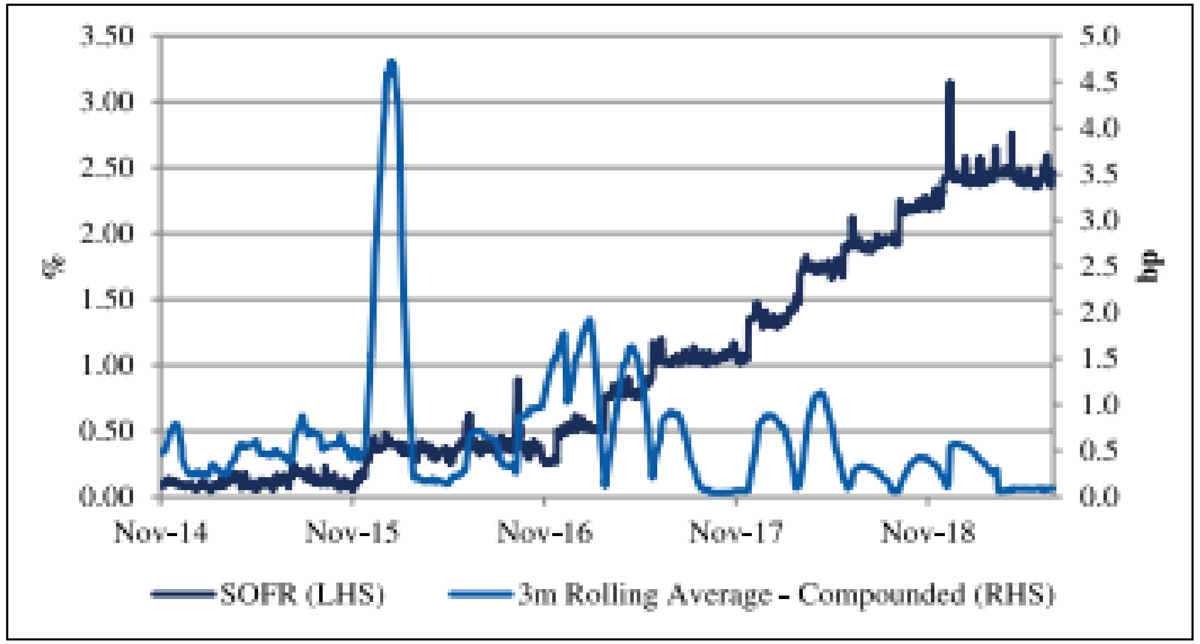
Compound vs Simple Average: Can have meaningful differences because compound method discounts outlier rates

- Rising rate environment: simple average is typically better for investors
- Decreasing rate environment: simple average is typically worse for investors

Difference in Return b/w 4-day and no lockout for 1yr Maturity



Rolling 3-month of Average SOFR less Compounded SOFR

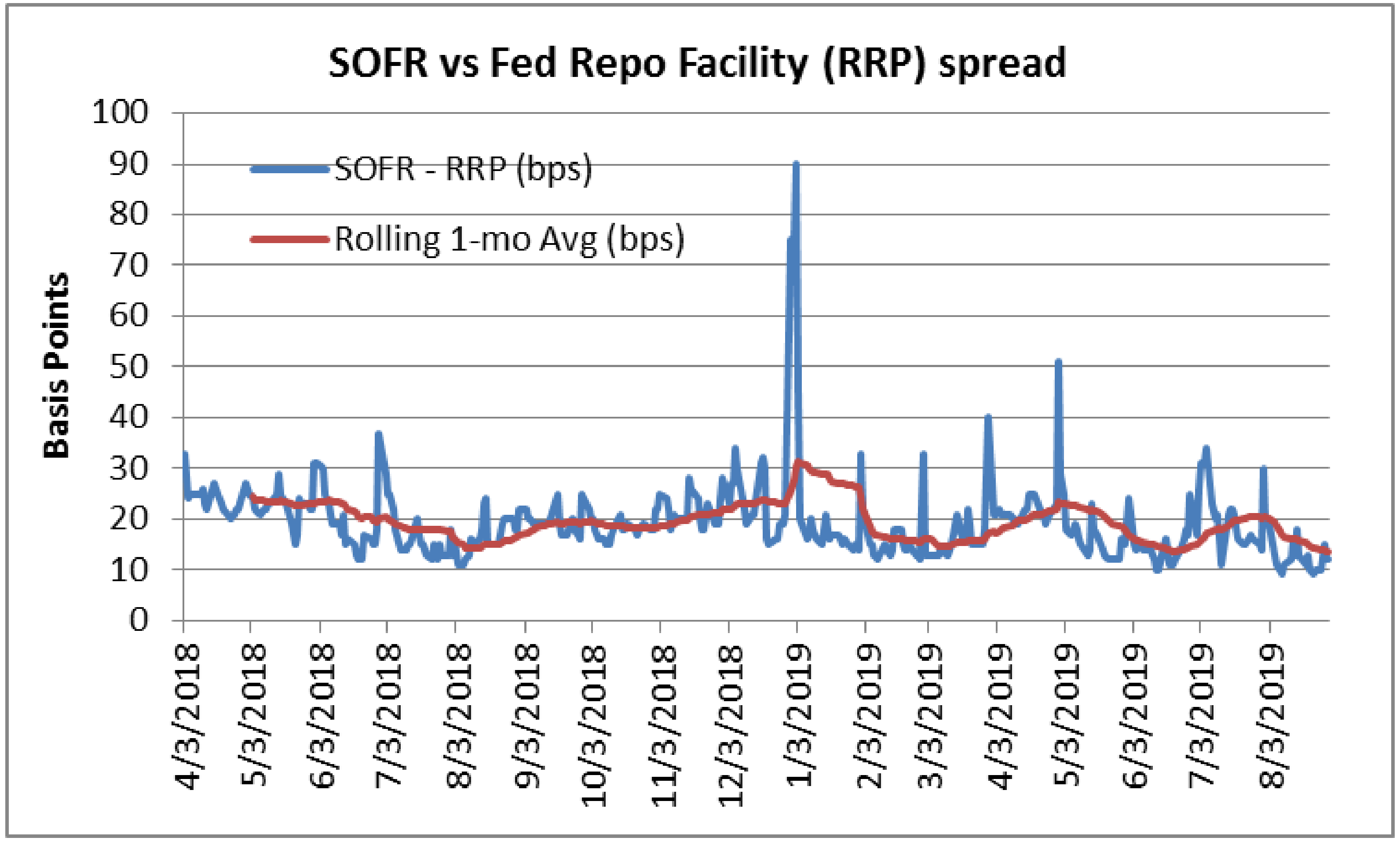


Source: BMO

Problem with SOFR Market: Volatility around month-ends

SOFR is volatile around month-end dates due to constrained dealer balance sheets

Possible Solution: Standing Fed Repo Facility -> this was mentioned in Fed Minutes from June's meeting



Source: Bloomberg

New SOFR issuance on horizon: Treasury

Treasury has tasked TBAC at the last two refunding announcements to explore floating rate issuance with SOFR as the benchmark

Based on this, Treasury is likely to issue a 1-year SOFR Floating Rate Note

- Interest: Daily Compounding
- Lockout: 2-days
- Lookback: 1-days

Consideration for Treasury:

- Demand: Does it cannibalize existing issuance?
- Cost: Is it more expensive to issue vis-à-vis current T-bill benchmarked Floating Rate Notes?

4/25/19 (On Prior Presentation):

US T-Bills	
3m	2.359
3m3m	2.384
6m3m	2.252
9m3m	2.338
12mo Px:	2.333

SOFR Futures	
SFRH9	2.455
SFRM9	2.395
SFRU9	2.315
SFRZ9	2.238
12mo Px:	2.351

7/22/19:

US T-Bills	
3m	2.071
3m3m	2.043
6m3m	1.781
9m3m	1.885
12mo Px:	1.945

SOFR Futures	
SFRM9	2.305
SFRU9	1.945
SFRZ9	1.755
SFRH0	1.570
12mo Px:	1.894

From TBAC presentation, July 31, 2019

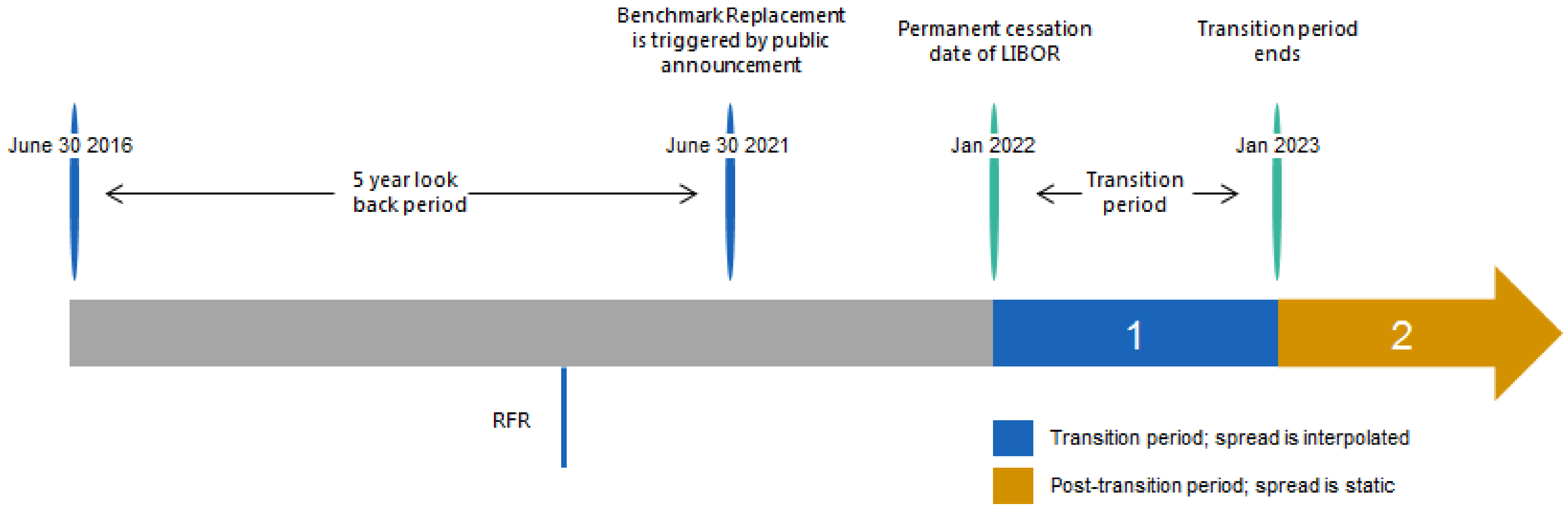
Source: Bloomberg

LIBOR: What happens to existing and new debt maturing after 2021 (Derivatives)

ISDA announced on July 30th its expected fallback language with some unknowns

Create a static spread using mean/median difference between LIBOR and compounded SOFR over "X" lookback period

Transition Period of "X" time where the SOFR plus spread is equal to a linear interpolation between (1) spread observed in SOFR/LIBOR basis market and (2) static spread calculated from lookback period.



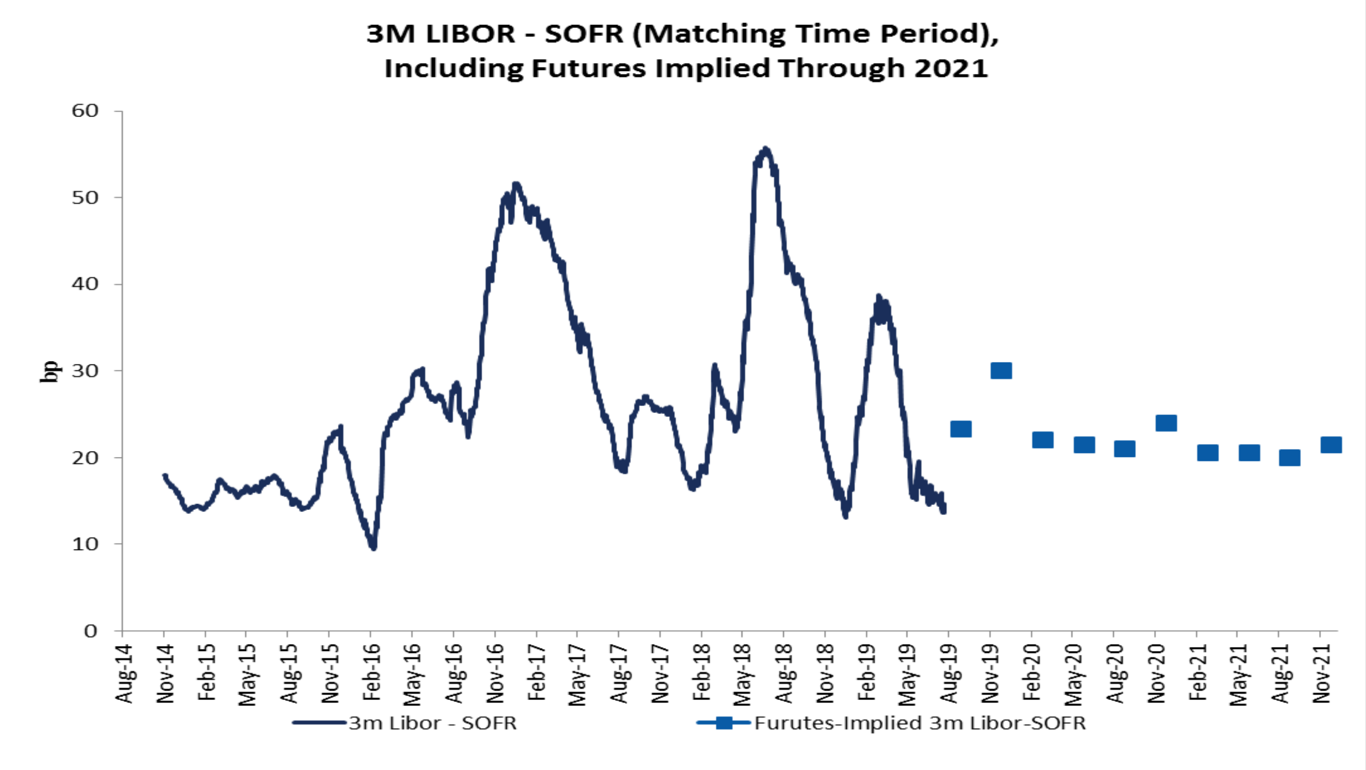
Source: MBO, ISDA

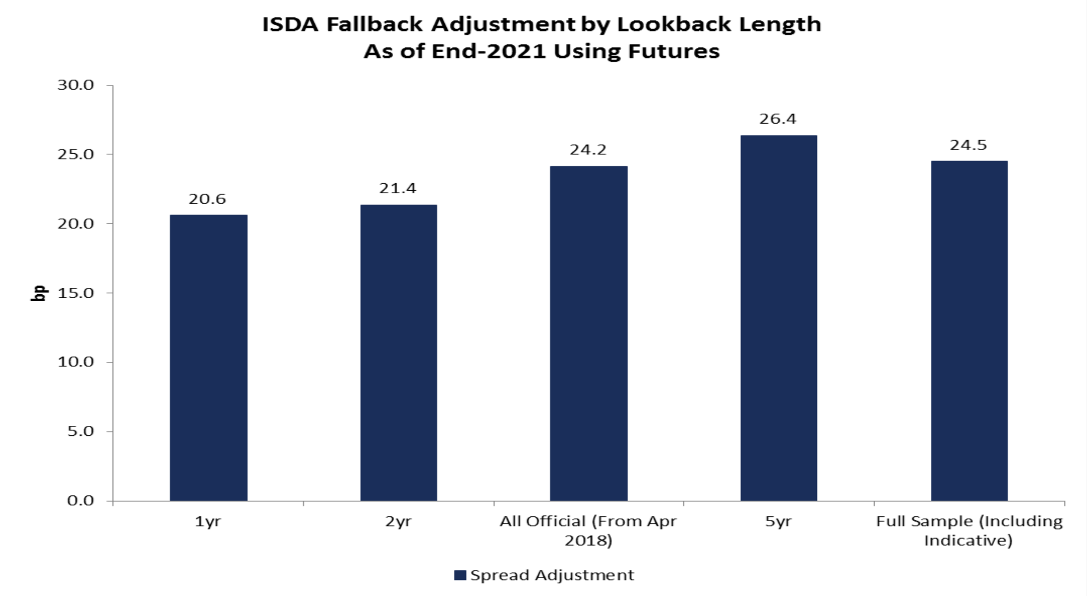
LIBOR: What happens to existing and new debt maturing after 2021 (Derivatives) VALUATION

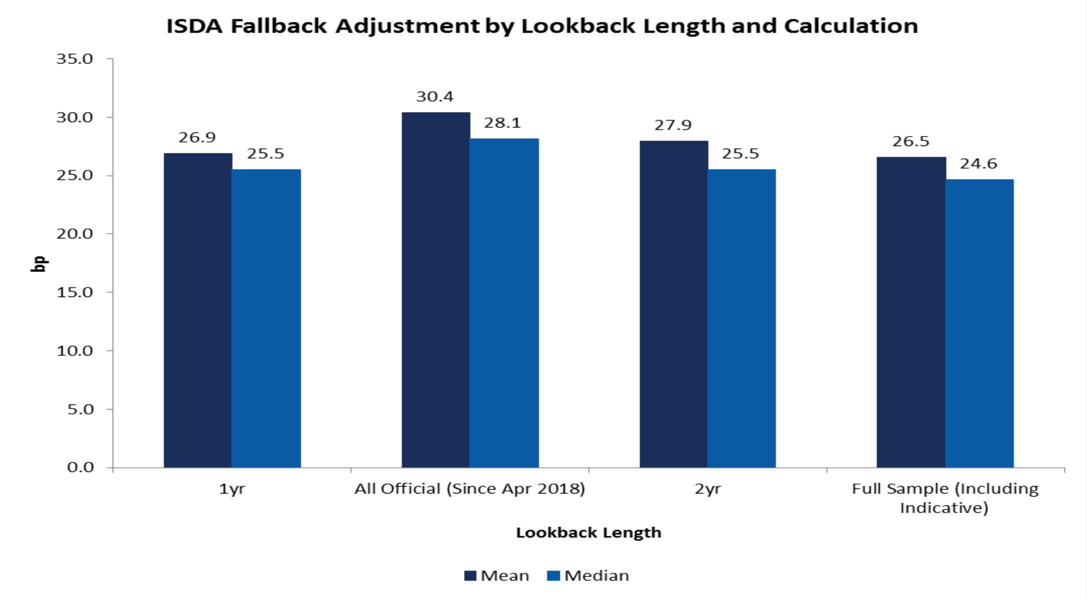
There will be winners and losers no matter what the final approach is

Using Mean vs. Median is worth 1-3bps
- Mean includes outliers and the distribution is asymmetric

Lookback period is worth 1-5bps







Source: Bloomberg

LIBOR: What happens to existing and new debt maturing after 2021 (Cash Securities)

Existing Debt

Review fallback language on all securities

- For many Floaters if LIBOR ceases to exist, the bond converts to a fixed rate security (last LIBOR setting is used for the coupon of the bond for the rest of the term)
- For other Floaters that convert to a new benchmark, perform sensitivity analysis to understand the cost/value of this conversion

New Debt

ARRC has provided both Fallback Triggers and Waterfall replacement benchmarks for different floating rate instruments

- Ensure that all new issuance that is bought follows this methodology

Fallback Triggers

- Public statement by administrator that it has ceased to provide LIBOR
- Public statement by regulatory supervisor that administrator will cease to provide LIBOR
- Public statement by regulatory supervisor that the benchmark is no longer representative

Waterfall of fallback rates for LIBOR FRNs (non-securitized, non-syndicated loans)

- Term SOFR recommended by relevant government body + Spread
- Compound SOFR + Spread
- Replacement rate recommended by relevant government body + Spread (address if SOFR has been discontinued)
- Replacement rate in ISDA definition + Spread (address if SOFR has been discontinued and government body has not selected rate)
- Replacement rate determined by issuer or its designee

Appendix

Chart
Performance results for certain charts and graphs may be limited by date ranges specified on those charts and graphs; different time periods may produce different results. Charts are Provided for illustrative purposes and are not indicative of the past or future performance of any PIMCO product.

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