

SOFR, So Good

March 2019

Priya Misra
Global Head, Rates Strategy
1 212 827 7156
priya.misra@tdsecurities.com

Presented By



A Brave New World

- The problem with Libor
- Understanding SOFR
- The Legacy Problem
- The Future

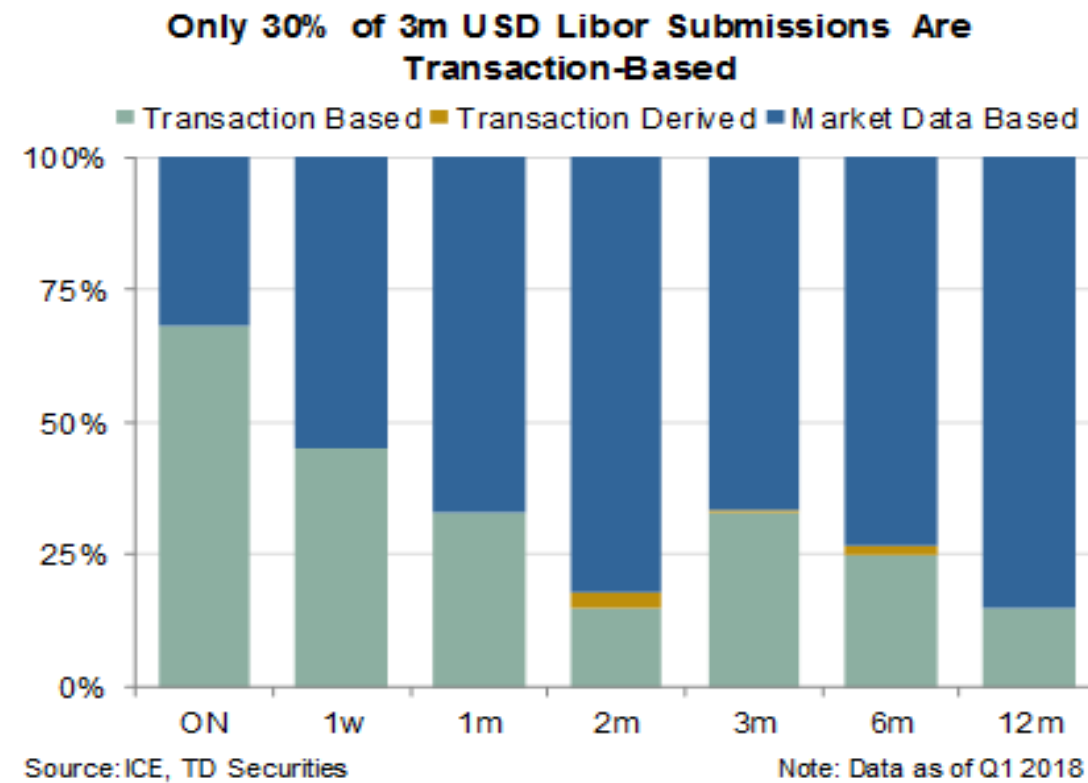


The Problem with Libor

- Lack of unsecured bank transactions
- Significant exposure across cash and derivatives

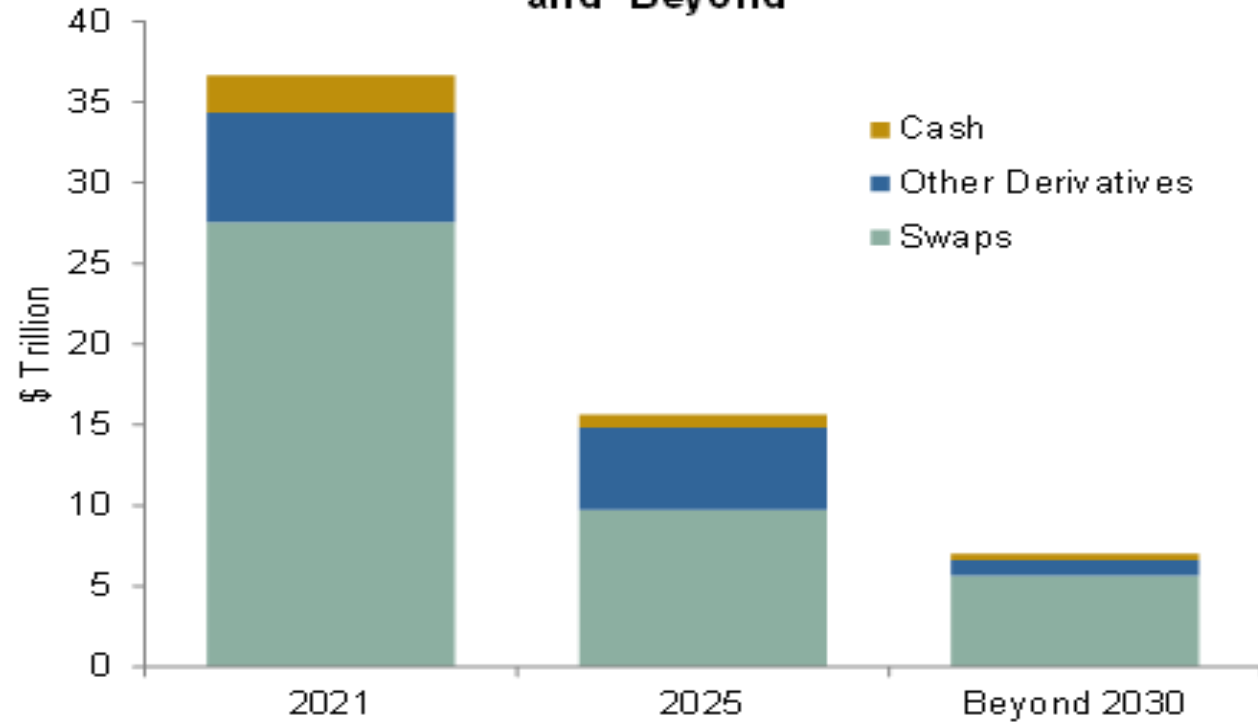
What's the problem with Libor?

- In June 2017, the ARRC voted on a broad Treasury repo rate (SOFR) as a new benchmark to replace Libor
 - SOFR rate began to get published in Q2 2018.
- In July 2017 FCA's Bailey suggested that Libor may cease to exist after 2021
- We expect a long transition period before the cash and derivatives market transitions to the new rate
 - An estimated \$200tn of financial products are linked to USD Libor



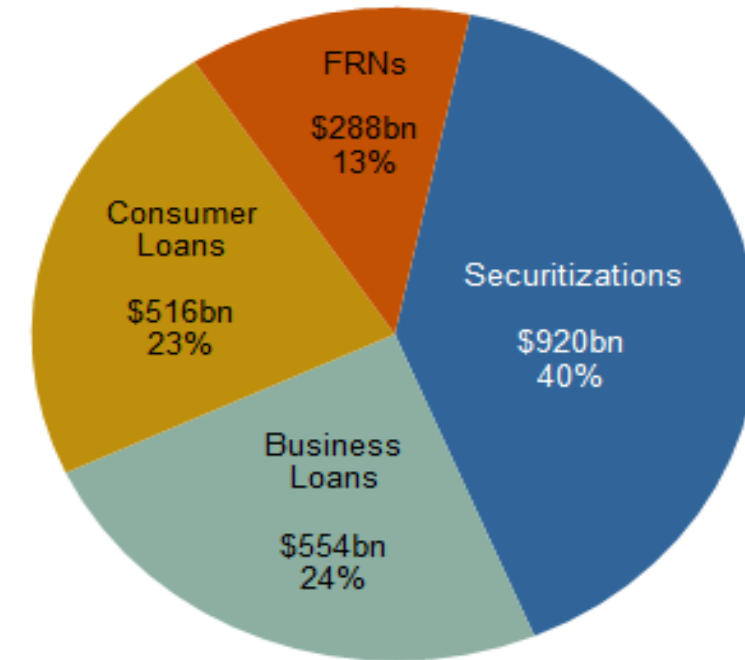
The USD Libor Exposure Problem

USD Libor-Related Notional Outstanding in 2021 and Beyond



Source: ARRC (2018), TD Securities

Breakdown of USD Libor Notional Outstanding Not Maturing by 2022 (ex Derivatives)



Source: ARRC, TD Securities

Libor Alternatives Taking Shape Globally

	Current	US	UK	Euro Area
Benchmark Rate	LIBOR	SOFR (Secured Overnight Financing Rate)	SONIA (Sterling Overnight Index Average)	ESTER (Euro Short-Term Rate)
Administrator	ICE Benchmark Administration (IBA)	Federal Reserve Bank of New York (FBNY)	Bank of England (BoE)	European Central Bank (ECB)
Definition	Unsecured wholesale interbank lending rate based on daily annualized interest rate <i>submissions</i> from 16 panel banks	Secured overnight repo rate based on transaction data of daily volume from 3 repo markets: Tri-party (BNYM); inter-dealer GCF (DTCC); FICC-cleared bi-lateral (DTCC)	Overnight unsecured transactions negotiated bilaterally as well as those arranged via brokers	Wholesale euro unsecured overnight borrowing costs of euro area banks
Term	Overnight / Spot and 6 term rates (1wk, 1m, 2m, 3m, 6m, 12m)	Overnight	Overnight	Overnight
Launch	1984	April 2018	1997 Reformed, since April 2018	October 2019
Secured/Unsecured	Unsecured	Secured	Unsecured	Unsecured
Calculation Method	Arithmetic mean of trimmed panel bank submissions (upper and lower quartiles excluded to remove outliers)	Volume-weighted median	Volume-weighted mean rounded to 4 decimal points	Volume-weighted mean rate rounded to 3 decimal points
Publication	Fixing conducted each day at 11:00 am and published at 11:55 am London time	8:00 am New York time +1 day	9:00 am GMT +1 day	9:00 am CET
Rate based on	Lack of actual transactions has led to reliance on expert judgement and indicative pricing	Transactions	Transactions	Transactions
Level relative to central bank rate		SOFR averaged 3.9 bp lower than EFRR since 2014	SONIA runs 5bp lower than BOE rate	ESTER is 5bp lower than Depo rate
Volumes underlying the rate	Less than \$1bn of daily Interbank trading	Approximately \$700 bn+ per day	£30-50 bn per day	
Floating Rate Note	Spot rate Forward looking Paid quarterly 2 day observation lag	Average rate Backward looking Paid quarterly 1 day observation lag 4 day lock out	Compound rate Backward looking Paid quarterly 5 day observation lag	
Derivatives	Developed market	Developing market – SOFR swaps vs Fed Funds and vs LIBOR have taken place, but inter-bank only Compounded SOFR rate	Developed market – SONIA trades vs LIBOR (compounded, quarterly paid) and vs Fixed (Compounded, paid annually)	

ARRC Paced Transition Plan

ARRC Paced Transition Plan for Libor — Running Ahead of Schedule		
Anticipated	Step	Actual Progress
H2 2018	Infrastructure for futures and OIS trading in SOFR is put in place.	ARRC members already trading futures and OIS.
End 2018	Trading begins in futures and/or bilateral uncleared OIS that reference SOFR.	CME launched SOFR futures on May 7, 2018.
	Build SOFR-linked cash and derivative liquidity.	SOFR floaters issued in 2018.
Q1 2019	Trading begins in cleared OIS that reference SOFR in the current (EFFR) PAI and discounting environment.	LCH began clearing SOFR swaps on Jul 18 and CME began clearing SOFR swaps on Oct 1 2019.
Q1 2020	CCPs begin allowing market participants a choice between clearing new or modified swap contracts in current PAI/discounting environment or SOFR for PAI and discounting.	CME began clearing SOFR Swaps using SOFR PAI/discounting on Oct 1 2019.
Q2 2021	CCPs no longer accept new swap contracts for clearing with EFFR as PAI and discounting except for the purpose of closing out or reducing outstanding risk.	
End 2021	Creation of a term reference rate based on SOFR-derivatives markets once liquidity has developed sufficiently to produce a robust rate.	

Source: ARRC, TD Securities





SOFR

- An overnight repo transacted rate
- Impacted by repo (Fed funds rate, bill supply, balance sheet)

What is SOFR?

What is SOFR?

- SOFR, or Secured Overnight Financing Rate, was chosen by the Alternative Reference Rates Committee (ARRC) to replace LIBOR
- The rate is a broad measure of the cost of borrowing cash overnight collateralized by Treasury securities
- The rate is a volume-weighted median of transaction-level data

Who publishes it? When and Where?

- The New York Fed publishes the rate on its website at approximately 8am each business day for prior day's transactions
- The rate includes nearly \$800bn in transactions

What moves SOFR?

- Fed Funds Effective: SOFR should track overnight effective Fed funds → SOFR should trade below Fed funds since it is secured while Fed funds transactions are unsecured
- Bill supply: Repo rates rise when bill supply increases as cheaper bills become a more attractive alternative to repo
- Reporting dates: Repo rates spike on reporting dates as the balance sheet becomes expensive

Characteristics of SOFR

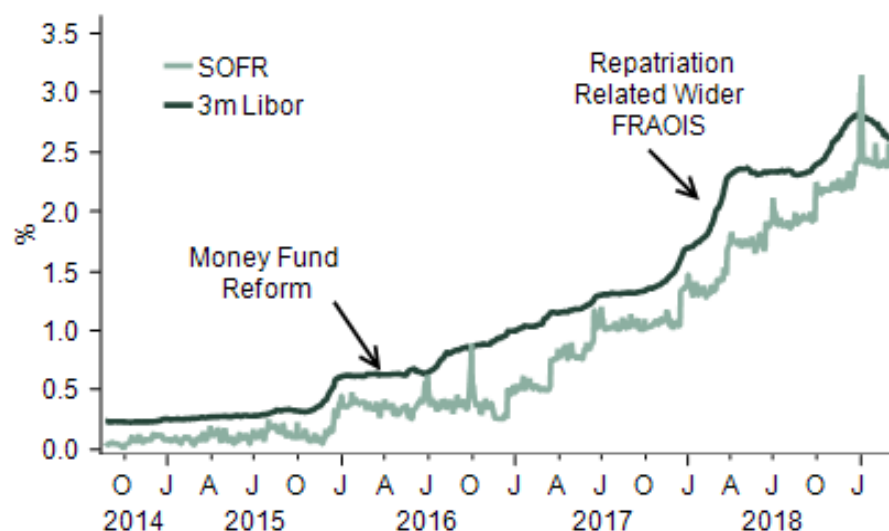
- Overnight: Unlike LIBOR which is a term rate, SOFR is an overnight rate
- Volatile: SOFR is more volatile than LIBOR or effective fed funds
- Less credit component: SOFR should spike less in a credit event
- Backward-looking : Term SOFR could be based on historical data

Looking Ahead

- SOFR futures began trading in May
- SOFR swaps have just begun to trade
- Trading volumes and open interest in SOFR futures continues to grow
- FASB recently officially adopted SOFR as a benchmark rate for hedging purposes on October 25th, (ASC -815)
- Derivatives that reference SOFR are a key component in the transition due to the widespread use of contracts for hedging
 - A key requirement for building liquidity in derivatives is for loans and mortgages to reference SOFR
- There are significant efforts underway to introduce SOFR-linked fallback language for existing LIBOR linked contracts
 - The ARRC recently published a consultation on LIBOR fallback contract language
 - The organization is actively seeking feedback before publishing final recommendations in December 2018

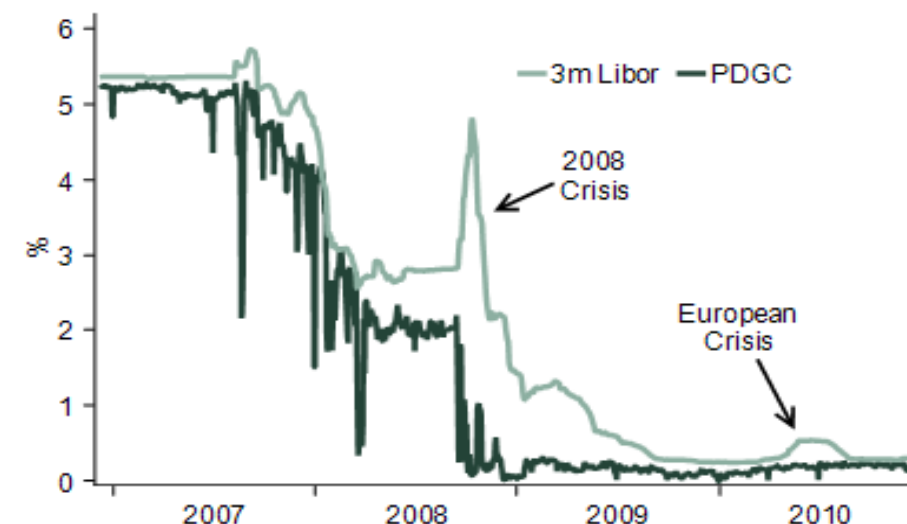
How Has SOFR Performed vs Libor Historically?

Libor Widened vs SOFR During Money Fund Reform and Current Period



Source: NY Fed, TD Securities

Libor Spiked During 2008 and European Crisis, While PDGC Remained Low



Source: NY Fed, Bloomberg, TD Securities
Note: PDGC represents Primary Dealer GC rate - a useful proxy for historical SOFR.

Key SOFR Statistics

Rate	Average Daily Volume (\$bn)	Average SOFR-EFFR (bp)	Average SOFR-EFFR, Ex-Quarter End (bp)	Range of Spread to EFFR (bp)	Range of Spread to EFFR Ex-Qtr Ends (bp)
SOFR (August 2014 to Today)	689	-3.7	-4.0	-20 to 60	-20 to 30
SOFR Proxy (1998-Feb 2018, ex-crisis)	n/a	-4.8	-4.6	-222 to 94	-168 to 94
SOFR Proxy (2007-2008 Crisis)	n/a	-22	-21	-273 to 47	-273 to 47

Source: New York Fed, SIFMA, TD Securities

Note: SOFR Proxy refers to Primary Dealer GC data released by the Fed, which we believe is a useful proxy for historical SOFR.



The Legacy Problem

- Derivatives: ISDA fallback
- Cash: renegotiate fallback
- The zombie Libor problem

Identify Exposure, Study Fallback, Resolve

- Derivatives: ISDA to formalize fall-back by 2Q
 - Using term rate compounded in arrears
 - Historical mean/median spread
- Cash: renegotiate fall-backs if possible
- Don't grow existing Libor exposure
- Legal liability



The Future

- SOFR-linked issuance
- SOFR derivatives
- Proper fallback language

SOFR Floaters: Closely Resembling Fed Funds Floater Framework

Key Characteristics of SOFR FRNs			
Characteristic	SOFR Floater	Fed Funds Floater	Treasury Floater
Index	SOFR	Fed funds effective rate	High rate from 13wk Treasury bill auction
Coupon Frequency	Quarterly	Quarterly	Quarterly
Reset Frequency	Daily	Daily	Daily
Reset Determination	1 business day prior	1 business day prior	1 business day prior
Coupon Lockout	2-4 business days prior to interest date	4 business day prior to interest date	2 business days prior to an FRN issue date or FRN interest date
Coupon Calculation	Simple average	Simple average	Index Rate computed from the most recent auction of 13-week Treasury bills that took place on a day before the accrual day, plus the Spread, divided by 360, subject to a minimum of zero.
Day Count Basis	Actual/360	Actual/360	Actual/360
Minimum rate	Minimum interest rate of 0.000%	Minimum interest rate of 0.000%	0.000% minimum daily interest accrual

Source: Fannie Mae, FFCB, TD Securities



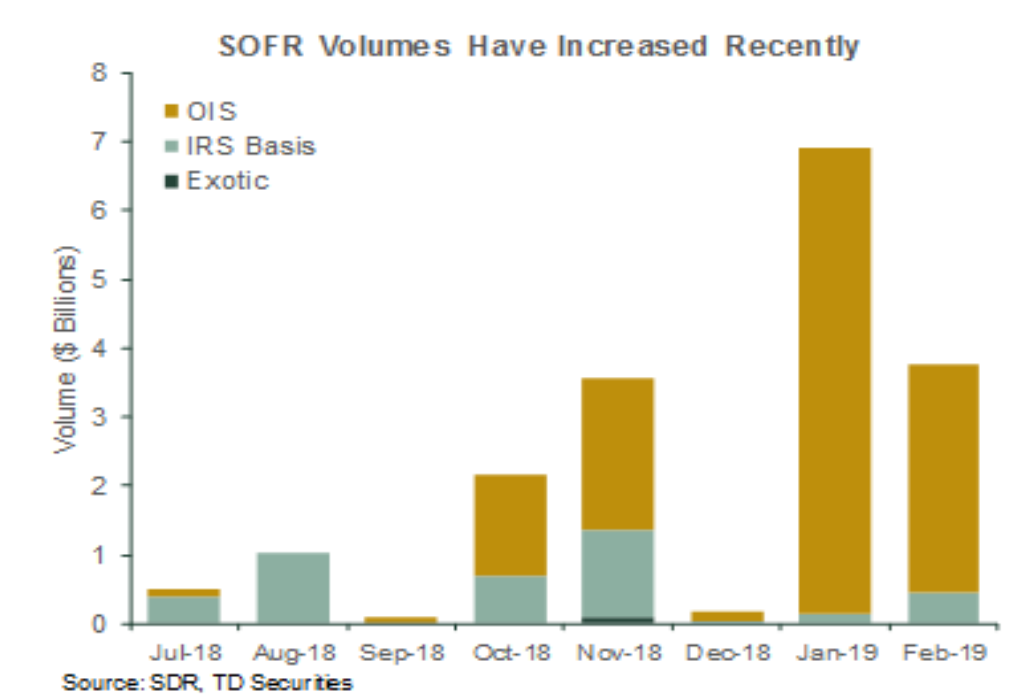
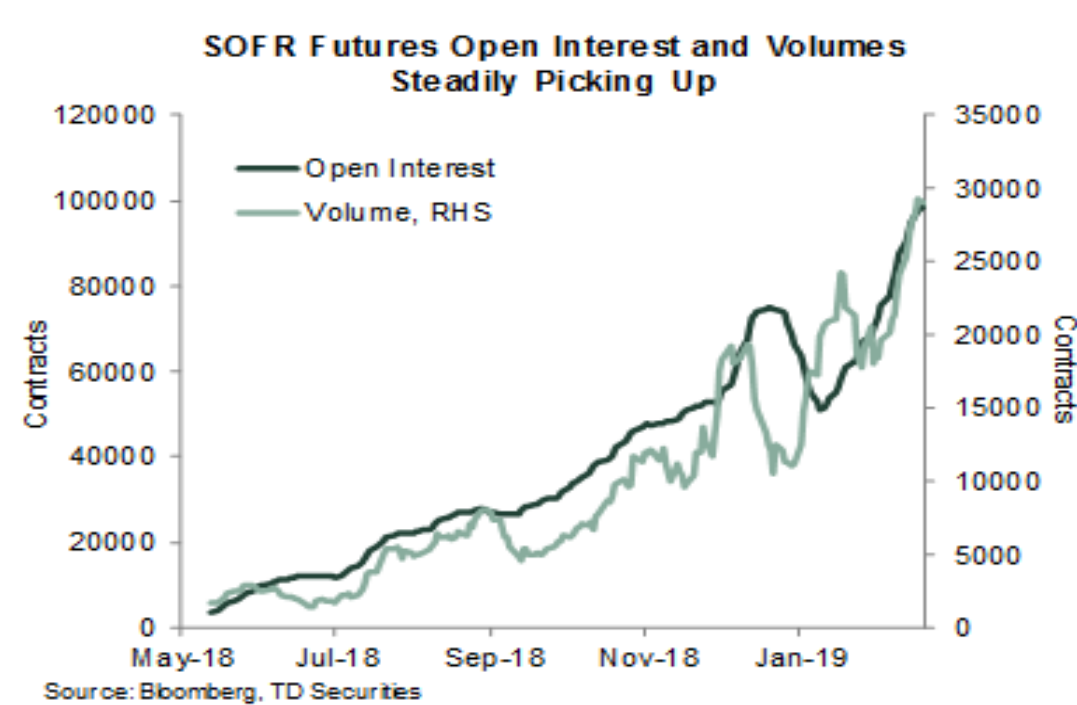
SOFR Floater: GSEs/SSAs Have Made up 80% of Issuance

- 2018 SOFR Issuance: \$36.4bn
- 2019 SOFR Issuance: \$39bn
- From July 2018 until today, GSE/SSA made up 80% of issuance

Issuer Name	Ticker	Number of Issues	Total SOFR Market Share	Amount Issued (\$ million)
Federal Home Loan Banks	FHLB	14	43.0%	32,400
Federal National Mortgage Association	FNMA	7	17.2%	13,000
Federal Home Loan Mortgage Corp	FHLMC	14	14.7%	11,119
International Bank for Reconstruction & Development	IBRD	1	1.3%	1,000
European Investment Bank	EIB	1	1.3%	1,000
Federal Farm Credit Banks	FFCB	2	1.3%	1,000
Landeskreditbank Baden-Wuerttemberg Foerderbank	LBANK	2	0.7%	517
African Development Bank	AFDB	1	0.2%	150
Federal Agricultural Mortgage Corporation	FAMCA	1	0.1%	80
			Total GSE/SSA SOFR Issuance	60.266

SOFR Derivatives: SOFR Futures Liquidity Improving

- Been trading on the Chicago Mercantile Exchange since May 2019
- Provide the first input for observable rates from which rates for valuing the SOFR pay-leg of a swap
- Open interest in SOFR futures has grown to \$100k contracts (\$155bn notional)



SOFR Derivatives: SOFR Swaps

- In 2H 2020, LCH will use SOFR as the discount rate for all derivatives PAI
- Chicken and egg problem regarding term rate
 - Derivatives need cash market
 - Cash market needs term rate
 - Term rate needs derivatives
- Regulatory incentive to transition away from Libor
 - Risk of higher margins for Libor based trades
 - Risk of higher bank capital for Libor exposure in the Fed stress tests

SOFR Swaps		
Features	LCH	CME
Start Date for Cleared SOFR OIS	18-Jul-18	1-Oct-18
Ahead of ARRC Paced Transition Plan?	✓	✓
Discounting Method	USD OIS	SOFR
Compounding of SOFR Leg?	✓	✓
Payment Lag	2 days	2 days
Theoretical Impact of Discounting Method on Initial Margin	Higher rate, smaller PV, lower margin	Lower rate, higher PV, greater margin

Source: LCH, CME, TD Securities

Disclaimer

This material is for general informational purposes only and is not investment advice nor does it constitute an offer, recommendation or solicitation to buy or sell a particular financial instrument. It does not have regard to the specific investment objectives, financial situation, risk profile or the particular needs of any specific person who may receive this material. No representation is made that the information contained herein is accurate in all material respects, complete or up to date, or that it has been independently verified by TD Securities. Recipients of this analysis or report are to contact the representative in their local jurisdiction with regards to any matters or questions arising from, or in connection with, the analysis or report.

Historic information regarding performance is not indicative of future results and investors should understand that statements regarding future prospects may not be realized. All investments entail risk, including potential loss of principal invested. Performance analysis is based on certain assumptions, the results of which may vary significantly depending on the modeling inputs assumed. This material, including all opinions, estimates and other information, constitute TD Securities' judgment as of the date hereof and is subject to change without notice. The price, value of and income from any of the securities mentioned in this material can fall as well as rise. Any market valuations contained herein are indicative values as of the time and date indicated. Such market valuations are believed to be reliable, but TD Securities does not warrant their completeness or accuracy. Different prices and/or valuations may be available elsewhere and TD Securities suggests that valuations from other sources be obtained for comparison purposes. Any price or valuation constitutes TD Securities' judgment and is subject to change without notice. Actual quotations could differ subject to market conditions and other factors.

TD Securities disclaims any and all liability relating to the information herein, including without limitation any express or implied representations or warranties for, statements contained in, and omissions from, the information. TD Securities is not liable for any errors or omissions in such information or for any loss or damage suffered, directly or indirectly, from the use of this information. TD Securities may have effected or may effect transactions for its own account in the securities described herein. No proposed customer or counterparty relationship is intended or implied between TD Securities and a recipient of this document.

TD Securities makes no representation as to any tax, accounting, legal or regulatory issues. Investors should seek their own legal, financial and tax advice regarding the appropriateness of investing in any securities or pursuing any strategies discussed herein. Investors should also carefully consider any risks involved. Any transaction entered into is in reliance only upon the investor's judgment as to financial, suitability and risk criteria. TD Securities does not hold itself out to be an advisor in these circumstances, nor do any of its representatives have the authority to do so.

The information contained herein is not intended for distribution to, or use by, any person in any jurisdiction where such distribution or use would be contrary to applicable law or regulation or which would subject TD Securities to additional licensing or registration requirements. It may not be copied, reproduced, posted, transmitted or redistributed in any without the prior written consent of TD Securities.

Australia: If you receive this document and you are domiciled in Australia, please note that this report is intended to be issued for general information purposes only and distributed through the Toronto Dominion Australia Limited ("TDAL"). TDAL does not hold itself out to be providing financial advice in these circumstances. TD Securities is a trademark and represents certain investment dealing and advisory activities of Toronto-Dominion Bank and its subsidiaries, including TDAL. The Toronto-Dominion Bank is not an authorized deposit-taking or financial services institution in Australia. TDAL is a holder of an Australian Financial Services License (404698) and is regulated by the Australian Securities and Investments Commission.

New Zealand: The Toronto-Dominion Bank is not a "registered bank" in New Zealand under the Reserve Bank Act 1989.

Canada: Canadian clients wishing to effect transactions in any security discussed herein should do so through a qualified salesperson of TD Securities or TD Securities Inc. TD Securities Inc. is a member of the Canadian Investor Protection Fund.

China, India and South Korea: Insofar as the document is received by any persons in the People's Republic of China ("PRC") (which, for such purposes, does not include Hong Kong, Macau or Taiwan), India and South Korea, it is intended only to be issued to persons who have the relevant qualifications to engage in the investment activity mentioned in this document. The recipient is responsible for obtaining all relevant government regulatory approvals/licenses themselves, and represents and warrants to TD Bank that the recipient's investments in those securities do not violate any law or regulation, including, but not limited to, any relevant foreign exchange regulations and/or overseas investment regulations. The Toronto-Dominion Bank has a representative office in Shanghai, Mumbai and Seoul which should be contacted for any general enquiry related to The Toronto-Dominion Bank or its business. However, neither any of the Toronto-Dominion Bank offshore branches/subsidiaries nor its representative offices are permitted to conduct business within the borders of the PRC, India and South Korea. In locations in Asia where the Bank does not hold licenses to conduct business in financial services, it is not our intention to, and the information contained in this document should not be construed as, conducting any regulated financial activity, including dealing in, or the provision of advice in relation to, any regulated instrument or product. This publication is for general information only, without addressing any particular needs of any individual or entity, and should not be relied upon without obtaining specific advice in the context of specific circumstances.

Hong Kong: This document, which is intended to be issued in Hong Kong only to Professional Investors within the meaning of the Securities and Futures Ordinance (the "SFO") and the Securities and Futures (Professional Investor) Rules made under the SFO, has been distributed through The Toronto-Dominion Bank, Hong Kong Branch. The Toronto-Dominion Bank, Hong Kong Branch is regulated by the Hong Kong Monetary Authority.

Japan: For Japanese residents, please note that TD Securities is not licensed in Japan and this is being provided to qualified financial institutions ("QFI") only under a relevant exemption to the Financial Instruments and Exchange Law.

If you have received this document from TD Securities (Japan) Co., Ltd., it is being provided only to institutional investors. TD Securities (Japan) Co., Ltd. is regulated by the Financial Services Agency of Japan and is distributing this document in Japan as a Type 1 Financial Instruments Business Operator registered with the Kanto Local Finance Bureau under registration number, Kinsho 2992, and a member of Japan Securities Dealers Association.

Singapore: This report is distributed in Singapore by The Toronto-Dominion Bank, Singapore Branch, and recipients in Singapore of this report are to contact The Toronto-Dominion Bank, Singapore Branch in respect of any matters arising from, or in connection with, this report. The Toronto-Dominion Bank, Singapore Branch is regulated by the Monetary Authority of Singapore. Where this report is issued or promulgated in Singapore, it is only intended for distribution to a person who is an accredited investor, expert investor or institutional investor (as defined in the applicable Singapore laws and regulations).

United Kingdom and Europe: This document is prepared, issued or approved for issuance in the UK and Europe by TD Securities Limited in respect of investment business as agent and introducer for TD Bank. The Toronto-Dominion Bank is authorised by the Prudential Regulation Authority and subject to regulation by the Financial Conduct Authority and limited regulation by the Prudential Regulation Authority. TD Securities Limited is authorised and regulated by the Financial Conduct Authority. Insofar as the document is issued in or to the United Kingdom or Europe, it is intended only to be issued to persons who (i) are persons falling within Article 19(5) ("Investment professional") of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005 (as amended, the "Financial Promotion Order"), (ii) are persons falling within Article 49(2)(a) to (d) ("High net worth companies, unincorporated associations, etc.") of the Financial Promotion Order, or (iii) are persons to whom an invitation or inducement to engage in investment activity (within the meaning of section 21 of the Financial Services and Markets Act 2000) in connection with the issue or sale of any securities may otherwise lawfully be communicated or caused to be communicated. European clients wishing to effect transactions in any security discussed herein should do so through a qualified salesperson of TD Securities Limited. Insofar as the information in this report is issued in the U.K. and Europe, it has been issued with the prior approval of TD Securities Limited.

United States: U.S. clients wishing to effect transactions in any security discussed herein must do so through a registered representative of TD Securities (USA) LLC. (a) the U.S. firm accepts responsibility for its contents, (b) persons receiving the report should effect transactions in securities discussed in the report through the U.S. firm, and (c) transactions in such securities by recipients of the report are actually effected only through the U.S. firm.

If you would like to unsubscribe from our email distribution lists at any time, please contact your TD Securities Sales Contact or email us at privacy.EAP@tdsecurities.com. You can access our Privacy Policy here (https://www.tdsecurities.com/tds/content/AU_PrivacyPage?language=en_CA&language=en_CA).

TD Securities is a trademark of the Toronto Dominion Bank and represents TD Securities Inc., TD Securities (USA) LLC and TD Securities Limited and certain investment and corporate banking activities of TD Bank and its subsidiaries.

© Copyright 2019 The Toronto-Dominion Bank. All rights reserved.

