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CORPORATE TREASURY TECHNOLOGY PREPAREDNESS FOR LIBOR TRANSITION

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CONTENTS

OVERVIEW

LIBOR is in the process of being retired and replaced with new alternative rates like SOFR (Secured Overnight Financing Rate). The transition away from Libor has several impacts for the corporate treasurer.

1. Renegotiation of existing financial contracts – including debt, swaps, and investments - but primary exposure for most corporations is revolving credit facilities.
2. Replacement of LIBOR in critical tax and accounting calculations for intercompany loans and cash pooling
3. Need to ensure financial technology solutions accommodate tracking accounting and valuation of SOFR and other LIBOR/IBOR replacement indexed instruments.

While most treasury and finance groups are actively categorizing, documenting and negotiating the replacement of their LIBOR based financial instruments, an underappreciated risk resides in **systems risk** for the financial tracking and administration of new alternate rates like SOFR.

Risks of not having systems ready to track, value and account for these new rates will result in:

- Excessive manual effort to create required financial reports
- Properly account interest accruals for these external and internal (i.e., intercompany loans) transactions and
- Disputes on interest payment settlements with counterparties.

Many organizations are looking to address this treasury technology gap risk after the contracts are renegotiated. The potentially extended time frame, costs and staff impact requirements of correcting the technology gap, make addressing it immediately more critical.

> *Research indicates that 2,500 US based non-financial corporates are at risk of not being able to accommodate the alternate rates like SOFR by December 31, 2021 due to limitations in treasury management systems and ERPs to track, account for and value their SOFR (and other replacement global risk-free rates) based borrowings, investments and derivatives.*[1]

USD LIBOR Retirement Dates Set

Though a majority of non-financial corporate Treasurers are actively addressing the replacement of LIBOR, many are unaware of the pending deadline, or hoping that it will be extended. Here are the key dates to be aware of as of the publication of this white paper.

Date	Action
March 2021	The process for the replacement of USD LIBOR became formalized and the credit spread between LIBOR and SOFR was set.
December 31, 2021	In SR-20-27, the **Federal Reserve, FDIC and OC** have recommended. "The agencies encourage to cease entering into new contracts that use USD LIBOR as reference as soon as practicable and in any event by ***December 31, 2021.***"

While June 30, 2023 is the official end to rate-setting for remaining LIBOR rates (1-week and 2-month USD LIBOR cease quoting December 31, 2021), this is intended as a wind-down period for remaining outstanding derivatives and loans. It is generally accepted, given the Fed and FCA guidance, that its use as an index will be effectively over for funding and derivative investments by December 31, 2021.

[1] PMC estimate developed in consultation with vendors of installed and hosted TMS systems and of ERP Treasury modules that are not able to upgrade by December 31, 2021

[2] Collateralized Loan Obligation (CLO)

COMPLICATIONS OF AN OVERNIGHT RISK-FREE RATE

Some Treasurers have underestimated the complications of the transition to SOFR. In our recent study several Treasurers stated, "I will just get the new rate from my rate provider." While SOFR is a well-defined and supported index, it is an overnight rate and lacks a forward term structure, posing interest calculation challenges.

SOFR, and other international risk-free overnight rates like SOFR, are the predominant indices that banks and the market in general are looking to replace LIBOR with. While these are generally accepted as superior benchmarks due to deep market and international acceptance, they come with complications. They are a risk-free overnight rate while LIBOR had both embedded credit-risk adjustment and more importantly a term structure. The challenge of SOFR is that it requires averaging or compounding a series of daily SOFR rates over a period, whereas LIBOR offered a single term rate for the same period.

While a term structure for SOFR will develop (July 2021 Term SOFR announcement by ARRC and see SOFR in Advance in Appendix), most practitioners and banks are adopting the arrears interest convention. To support the more complex SOFR in arrears interest calculation (see Interest Calculations in Appendix), financial technology vendors (e.g., treasury management systems (TMS) and ERP/GL systems) are still updating/preparing their systems to accommodate the incorporation of alternative rates like SOFR.

The requirement for calculation includes a calculation of daily reset rates for the period in question using one of 3 potential averaging or compounding methods and a time series of daily SOFR rates on which to calculate. Variations on this calculation approach is required for both the advanced and arrears interest calculations. See the calculation details in the appendix.

> *Global IBOR risk-free-rate replacements are generally overnight rates that lack a term structure which represents more complex interest and valuation challenges*

TECHNOLOGY PREPAREDNESS

Once you have successfully transitioned from your LIBOR based financial transactions to a new alternate rate (i.e. SOFR), you will require your systems (or provider) to perform 2 fundamental calculations.

1. Calculate **interest** for payments/settlements and associated interest **accruals** for accounting
2. Calculate **mark-to-market** or valuation of instruments.

A number of items must be in place for both of these calculations to work, and your financial systems or 3rd party vendors must be able to support these two basic functions

WHAT SHOULD YOU BE DOING TO ASSESS THIS RISK?

1	2	3	4	5
IDENTIFY Identify which systems or 3rd party vendors you are using to track, account and potentially revalue your LIBOR based financial transactions.	**ASSESS** Utilize the questions detailed in the appendix (Vendor Questions) to assess the preparedness of these systems (both internal or vendor provided financial technology systems) support for alternative rates.	**ENGAGE VENDORS** Engage relevant vendors (or consultants) on any additional costs or resource availability in supporting your system reconfiguration.	**PLAN TO UPGRADE** Develop a plan to upgrade your existing system, or a bridge strategy until your system can be upgraded, or a transition plan to a new system/service that can support the new financial instruments. Resource and	**BUDGET** Resource and budget for the effort and potential cost of configuring the new alternate rate transactions in your system, or upgrade and configuration if upgrade is required or deployment of a new system and technology.

VENDOR AND FINANCIAL TECHNOLOGY RISKS

Treasury departments and or finance and accounting will need to adapt their systems to accommodate these new non-LIBOR indexed instruments. Typically, this is a Treasury management system (TMS) and, in some cases, a financial instruments module of their ERP system (e.g. SAP or Oracle EBS). Many of these vendors have been developing upgraded capabilities or new functionality to accommodate SOFR and SOFR like transactions. While the SAAS (re. cloud) based solutions functionality will be upgraded automatically it is the private hosting or installed/on-premise deployments that represent the largest risk for Treasuries that use these technologies as upgrades will be required in most cases.

The challenge of upgrades is time, cost and resource availability. Typically, an upgrade of a TMS and ERP require significant planning, coordination and testing before deploying. This represents both resource and cost impacts. In the case of an ERP upgrade it impacts the entire organization as our study indicates the whole ERP system will need to be upgraded to a certain level before the financial transactions module changes can be applied.

Even if the vendor system is ready, there is a resource and scheduling bottleneck to be considered. Vendor upgrade support teams are fully booked and, as noted, corporate Treasury users have resource, budget and timing constraints on when they can perform the upgrade.

In the US, our study estimates approximately 2,500 TMS and ERP users of non-SAAS TMS or ERP systems are exposed. A significant number of these organizations are not going to be upgraded or prepared to model these SOFR instruments by year end 2021 at which times these calculations will be required.

SAAS TMS users also need to be aware that there will be resourcing effort required to configure the re-negotiated LIBOR replacement instruments into their systems. In addition, vendors may be charging additional module fees and support charges to assist with reconfiguration. Finally, vendor resources for assistance may be unavailable due to high demand.

Treasurers have said they will resort to calculating on Excel and like temporary solutions, but these come with audit risk and the potential for error.

APPENDIX

APPENDIX A

Interest Calculations

The calculations are provided below for review. More detailed explanations, conventions and examples can be found in the ARRC User's Guide to SOFR

As discussed in the User's Guide, ISDA's Compound SOFR formula is based on the following annualized rate calculation:

$$Compound\ Annualized\ Interest = \left[\prod_{b=1}^{T}\left(1+\frac{r_b \times n_b}{N}\right)-1\right]\frac{N}{d_c}$$

Where:

T = the number of business days in the interest period

dc = the number of calendar days in the interest period (dc=∑nb)

rb = the interest rate applicable on business day b

nb = the number of calendar days for which rate rb applies (on most days, nb will be 1, but on a Friday it will generally be 3, and it will also be larger than 1 on the business day before a holiday). This can also be stated as the number of calendar days from and including business day b to but excluding the following business day.

N = the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365).

And b represents a series of ordinal numbers representing each business day in the period

Loan, Debt, Securitizations, and Derivatives Markets have developed several different conventions for using SOFR in Arrears. These include payment delay (used in derivatives), Lookback without shift (used in loans and some debt issuances), and lookback with shift (used in some debt issuances). These are discussed in more detail in the User's Guide, but the basic formulas for each can be found below, both for simple and compound interest.

APPENDIX A

Interest Calculations

SOFR IN ARREARS

Simple Interest $\left[\sum_{b=1}^{T}\left(\frac{r_b \times n_b}{N}\right)\right]\frac{N}{d_c}$

With Payment Delay $\left[\sum_{b=1}^{T}\left(\frac{r_b \times n_b}{N}\right)\right]\frac{N}{d_c}$ *paid on* $T+k$

With Lookback without Shift $\left[\sum_{b=1}^{T}\left(\frac{r_{b-k} \times n_b}{N}\right)\right]\frac{N}{d_c}$ *paid on* $T+1$

With Lookback with Shift $\left[\sum_{b=1}^{T}\left(\frac{r_{b-k} \times n_{b-k}}{N}\right)\right]\frac{N}{d_o}$ *paid on* $T+1$ (*where* $d_o = \sum n_{b-k}$)

Compound Interest $\left[\prod_{b=1}^{T}\left(1+\frac{r_b \times n_b}{N}\right)-1\right]\frac{N}{d_c}$ *paid on* $T+1$

Payment Delay $\left[\prod_{b=1}^{T}\left(1+\frac{r_b \times n_b}{N}\right)-1\right]\frac{N}{d_c}$ *paid on* $T+k$

Lookback without Shift $\left[\prod_{b=1}^{T}\left(1+\frac{r_{b-k} \times n_b}{N}\right)-1\right]\frac{N}{d_c}$ *paid on* $T+1$

Lookback with Shift $\left[\prod_{b=1}^{T}\left(1+\frac{r_{b-k} \times n_{b-k}}{N}\right)-1\right]\frac{N}{d_o}$ *paid on* $T+1$ (*where* $d_o = \sum n_{b-k}$)

SOFR IN ADVANCE

Average: In addition to producing SOFR, the Federal Reserve Bank of New York also publishes 30-day, 90-day, and 180-day averages of SOFR and a SOFR Index daily on its website. These rates can be used directly, as is done with LIBOR.

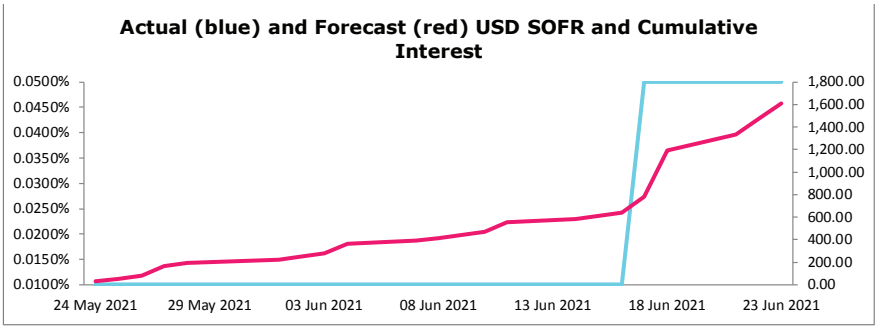
Term: CME currently produces SOFR term rates and other vendors may do so as well. The ARRC has not yet recommended a SOFR term rate, but has published a set of market indicators that would give it confidence that SOFR derivatives market liquidity had sufficient depth for it to recommend a term rate with confidence. These rates could also be used directly as is done with LIBOR.

Example Calculations

The following is an example of a 1-month borrowing utilizing the annualized compound in arrears calculation.

This calculator including actual rate updates is available free at https://www.pmctreasury.com/pmc-analytics/

Compounding Calculation	
Calculation Date	14 Jul 2021
Interest Period Start Date	01 Jun 2021
Interest Period End Date	01 Jul 2021
Lookback Days	5
Observation Shift	FALSE
Day Count	360
USD Notional	100,000,000.00
Actual Rate	0.0193%
Interest Accrued	1,608.33
Interest Forecast	0.00
Interest Total	1,608.33



Observation Date	Period Start Date	Period End Date	USD SOFR	Observation Days	Period Days	Unannualized / Effective RFR $\frac{r_i \times n_i}{N}$	Compounding Factor $\prod_{i=1}^{d_0}\left(1+\frac{r_i \times n_i}{N}\right)$	Annualized Cumulative Compound RFR $\left[\prod_{i=1}^{d_0}\left(1+\frac{r_i \times n_i}{N}\right)-1\right]\times\frac{N}{\sum n_i}$	Cumulative Period Interest
24 May 2021	01 Jun 2021	02 Jun 2021	0.0100%	1	1	0.000000277778	1.000000277778	0.0100%	27.78
25 May 2021	02 Jun 2021	03 Jun 2021	0.0100%	1	1	0.000000277778	1.000000555556	0.0100%	55.56
26 May 2021	03 Jun 2021	04 Jun 2021	0.0100%	1	1	0.000000277778	1.000000833334	0.0100%	83.33
27 May 2021	04 Jun 2021	07 Jun 2021	0.0100%	1	3	0.000000833333	1.000001666668	0.0100%	166.67
28 May 2021	07 Jun 2021	08 Jun 2021	0.0100%	4	1	0.000000277778	1.000001944446	0.0100%	194.44
01 Jun 2021	08 Jun 2021	09 Jun 2021	0.0100%	1	1	0.000000277778	1.000002222224	0.0100%	222.22
02 Jun 2021	09 Jun 2021	10 Jun 2021	0.0100%	1	1	0.000000277778	1.000002500003	0.0100%	250.00
03 Jun 2021	10 Jun 2021	11 Jun 2021	0.0100%	1	1	0.000000277778	1.000002777781	0.0100%	277.78
04 Jun 2021	11 Jun 2021	14 Jun 2021	0.0100%	3	3	0.000000833333	1.000003611117	0.0100%	361.11
07 Jun 2021	14 Jun 2021	15 Jun 2021	0.0100%	1	1	0.000000277778	1.000003888895	0.0100%	388.89
08 Jun 2021	15 Jun 2021	16 Jun 2021	0.0100%	1	1	0.000000277778	1.000004166674	0.0100%	416.67
09 Jun 2021	16 Jun 2021	17 Jun 2021	0.0100%	1	1	0.000000277778	1.000004444453	0.0100%	444.44
10 Jun 2021	17 Jun 2021	18 Jun 2021	0.0100%	1	1	0.000000277778	1.000004722232	0.0100%	472.22
11 Jun 2021	18 Jun 2021	21 Jun 2021	0.0100%	3	3	0.000000833333	1.000005555570	0.0100%	555.56
14 Jun 2021	21 Jun 2021	22 Jun 2021	0.0100%	1	1	0.000000277778	1.000005833349	0.0100%	583.33
15 Jun 2021	22 Jun 2021	23 Jun 2021	0.0100%	1	1	0.000000277778	1.000006111128	0.0100%	611.11
16 Jun 2021	23 Jun 2021	24 Jun 2021	0.0100%	1	1	0.000000277778	1.000006388908	0.0100%	638.89
17 Jun 2021	24 Jun 2021	25 Jun 2021	0.0500%	1	1	0.000001388889	1.000007777805	0.0117%	780.00
18 Jun 2021	25 Jun 2021	28 Jun 2021	0.0500%	3	3	0.000004166667	1.000011944505	0.0159%	1,192.50
21 Jun 2021	28 Jun 2021	29 Jun 2021	0.0500%	1	1	0.000001388889	1.000013333410	0.0171%	1,330.00
22 Jun 2021	29 Jun 2021	30 Jun 2021	0.0500%	1	1	0.000001388889	1.000014722317	0.0183%	1,474.17
23 Jun 2021	30 Jun 2021	01 Jul 2021	0.0500%	1	1	0.000001388889	1.000016111227	0.0193%	1,608.33

APPENDIX B

Questions for Vendors

These questions have been prepared by the non-financial Treasury working group of the ARRC for Treasury and Finance groups to utilize in assessing the preparedness of their vendors.

A version in excel is available for download and distribution here.

Questions for non-financial corporate treasuries to ask of their financial software vendors

NOTE: SOFR+ refers to US and international overnight risk free rate indices as published for the replacment of an IBOR (see tab listing International Risk-Free Rates)

These questions include high level capabilities required for the IBOR transition and is intended to capture whether these capabilities are planned enhancements for the application

	QUESTIONS	
ID	Application Type / Asset Class	High Level Requirement
1.1	Infrastructure Information/Analytics	Publication of simple and compound average SOFR+ over standard interest periods, including a SOFR+ index / calculator
1.2	Infrastructure Information/Analytics	Analytics on SOFR+ products
1.3	Infrastructure Information/Analytics	Publication of SOFR+ product data (e.g., historical data, trends and comparisons)
1.4	Infrastructure Information/Analytics	Flexibility to customize SOFR+ analytics / views without vendor assistance or platform changes (i.e., existing applications can be modified without a new vendor release)
2.1	Term Loans and Credit Facility Loans	Ability for Treasury system(s) to value/mark-to-market SOFR+ Loans (e.g., risk analytics) - Average SOFR+ In Advance
2.2	Term Loans and Credit Facility Loans	Ability for Treasury system(s) to value/mark-to-market SOFR+ Loans (e.g., risk analytics) - Simple Average SOFR+ In Arrears
2.3	Term Loans and Credit Facility Loans	Ability for Treasury system(s) to value/mark-to-market SOFR+ Loans (e.g., risk analytics) - Compound Average SOFR+ In Arrears
2.4	Term Loans and Credit Facility Loans	Ability for Treasury system(s) to calculate accruals, interest, amortized carry value, gain/loss, settlement - Average SOFR+ In Advance
2.5	Term Loans and Credit Facility Loans	Ability for Treasury system(s) to calculate accruals, interest, amortized carry value, gain/loss, settlement - Simple Average SOFR+ In Arrears
2.6	Term Loans and Credit Facility Loans	Ability for Treasury system(s) to calculate accruals, interest, amortized carry value, gain/loss, settlement - Compound Average SOFR+ In Arrears
2.7	Term Loans and Credit Facility Loans	Ability for calculations based on simple SOFR+ conventions such as lookbacks (including observation period shift), lockouts, payment delays and floors
2.8	Term Loans and Credit Facility Loans	Ability for calculations based on compounded SOFR+ conventions such as lookbacks (including observation period shift), lockouts, payment delays and floors
2.9	Term Loans and Credit Facility Loans	Ability to set various payment frequencies in accordance with various product type conventions
3.1	Treasury / ALM	Ability to base intercompany and external funding on SOFR+
3.2	Treasury / ALM	Ability to manage hedge accounting under IAS39, IFRS9
3.3	Treasury / ALM	Ability for systems to forecast cash flows for SOFR+ based floating rate exposures
3.4	Treasury / ALM	Ability update accounting systems for SOFR+ products, which may include simple and compound average SOFR+ calculations`
4.1	Risk Management / Valuation	Ability to enhance pricing and risk models for SOFR+ (e.g., curve construction, discount curves, pricing implications)
4.2	Risk Management / Valuation	Ability for systems to incorporate accurate SOFR+ historical data sets for risk models
4.3	Risk Management / Valuation	Ability for systems to account for changes to risk calculations impacting regulatory capital
4.4	Risk Management / Valuation	Ability for solution to accommodate need for higher computational power and flexible infrastructure to support new ARR data and scenario impact on risk
5.1	Document Management & Fallbacks	Ability to identify contracts impacted by the IBOR transition
5.2	Document Management & Fallbacks	Ability to convert contract terms (e.g., fallback language) into structured data sets for system consumption
5.3	Document Management & Fallbacks	Ability to systematically flag contracts / positions for which a trigger applies
5.4	Document Management & Fallbacks	Ability to enact fallback rates following a triggering event
5.5	Document Management & Fallbacks	Ability to track contract amendments and ISDA protocol adherence
5.6	Document Management & Fallbacks	Ability to optimize workflow based on contract analytics / contract term data (e.g., ability to establish a lineage between contracts and systems of record; ability to operationalize fallback rates)
6	In House Bank	Ability to track, account, acrue and calculate in-house-bank interest and balances on SOFR+ (and other international risk free overnight rates) using margins and spread adjustments
7.1	Derivatives	Ability of Treasury system(s) to execute and transact in SOFR+ OTC derivatives - Compound Average SOFR+ In Arrears
7.2	Derivatives	Ability for Treasury system(s) to account, report, settle and manage SOFR+ derivatives, including customization of accrual/settlement dates - Compound Average SOFR+ In Arrears
7.3	Derivatives	Ability to perform multilateral bulk index change from IBOR to SOFR+
7.4	Derivatives	Ability to perform index repapering for existing contracts
8.1	FRNs	Ability for Treasury system(s) to value/mark-to-market SOFR+ FRNs (e.g., risk analytics) - Average SOFR+ In Advance
8.2	FRNs	Ability for Treasury system(s) to value/mark-to-market SOFR+ FRNs (e.g., risk analytics) - Simple Average SOFR+ In Arrears
8.3	FRNs	Ability for Treasury system(s) to value/mark-to-market SOFR+ FRNs (e.g., risk analytics) - Compound Average SOFR+ In Arrears
8.4	FRNs	Ability for Treasury system(s) to calculate accruals, interest, amortized carry value, gain/loss, settlement - Average SOFR+ In Advance
8.5	FRNs	Ability for Treasury system(s) to calculate accruals, interest, amortized carry value, gain/loss, settlement - Simple Average SOFR+ In Arrears
8.6	FRNs	Ability for Treasury system(s) to calculate accruals, interest, amortized carry value, gain/loss, settlement - Compound Average SOFR+ In Arrears
8.7	FRNs	Ability for calculations based on compounded SOFR+ conventions such as lookbacks (including observation period shift), lockouts, payment delays and floors
8.8	FRNs	Ability for calculations based on simple SOFR+ conventions such as lookbacks (including observation period shift), lockouts, payment delays and floors
8.9	FRNs	Ability to set various payment frequencies in accordance with various product type conventions
9.1	Other	Ability for systems to manage the regulatory impacts related to SOFR+ on regulatory reporting
9.2	Other	Ability for system to accommodate new curve (ARR) component instruments for curve construction
9.3	Other	Ability for system to accommodate spread curves and spread adjustments that reference a base curve