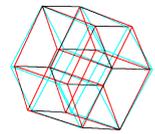


SOFR: The Advantages vs. LIBOR and Hedging Fallback Risk with Eris SOFR Futures

In this note we examine the pros and cons of the SOFR and LIBOR interest rate fixings. We argue that SOFR is superior in many ways, and that hedging out LIBOR exposure ahead of forced fallback, may be worth considering now.

- LIBOR will go into end-of-life at the end of 2021^[1].
- LIBOR swaps will see the LIBOR fixing convert to a “fallback rate” plus a spread. This new rate will be SOFR.
- SOFR is an overnight rate evidenced by more than \$1 trillion of daily transactions, while LIBOR is a 3 month survey rate, now largely based on expert judgement.
- SOFR’s daily granularity eliminates reset risk even for hedges that do not have perfect maturity matching, and resulting stubs are easily hedgeable.
- Despite the challenges associated with change, SOFR is more resilient to exogenous shocks and has other advantages over LIBOR.
- The fallback spread over SOFR is still being finalized, representing a source of future risk.
- Users of USD LIBOR products may wish to start hedging with SOFR today, getting ahead of the changes and eliminating the future fallback spread uncertainty.
- The shift from LIBOR to SOFR introduces an opportunity for market participants to explore the simplicity and price transparency of low cost futures markets by adding Eris LIBOR and Eris SOFR Swap Futures to their trading toolbox.



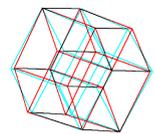
- SOFR swaps are ideally suited to standardization; daily resetting and compounding SOFR removes the discrete fixing risk of term-LIBOR which requires customization.
- Eris SOFR Swap Futures alleviate the quantitative and administrative burden of managing the daily compounding calculations necessary to keep track of SOFR; this is automatically incorporated in the Eris price and reported in daily settlement files.

For over 30 years, LIBOR has been the unbeaten champion of interest rate market benchmarks, underpinning hundreds of trillions of interest rate contracts, from swaps, to options, to FX forward basis, to eurodollar contracts. It arguably forms the foundation of the entire interest rate derivatives market, and has been emulated in dozens of currencies. Yet in recent years, and especially since the 2008 financial crisis, shortcomings have become apparent:

- LIBOR was originally a funding rate between banks, and became a useful benchmark for hedging these rates, but banks now predominantly fund themselves with deposits and secured funding.
- Today LIBOR is largely set by expert judgement, and is not a market-traded rate. A number of high-profile fines have shown that it has been subjected to manipulation.
- It is far from being a risk free rate, as it incorporates liquidity and default risks for term lending, between banks whose credit quality may vary widely.
- The most popular 3-month term, but also the other terms, do not always provide enough granularity to accurately determine stub period rates.
- Three-monthly fixings have enough duration that it is often crucial to exactly match maturities between exposures and hedges in order to avoid reset risk, precluding the use of cheap standardized IMM products, and exposing users to interpolation risk.

For these, and other reasons, market authorities around the world are pressing for a move to an interest rate benchmark based on market transactions, to serve the same purpose namely, to provide an unbiased, as close to risk-free as possible, index, which can supplant LIBOR in most of its traditional use cases. That rate, for US dollars, is known as SOFR (“Secured Overnight Funding Rate”), and has the following characteristics:

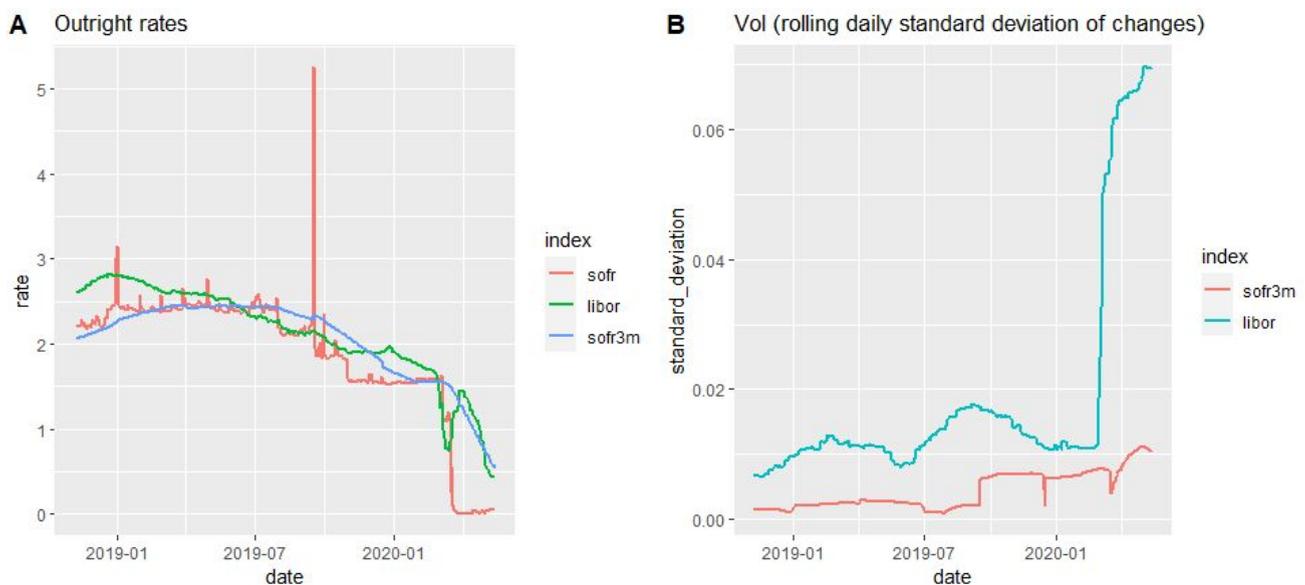
- It is an overnight rate, thereby reducing to the minimum term risk, and hugely increasing granularity for the pricing of small periods.
- Hedges between SOFR-based exposures are intrinsically more accurate since they share the vast majority of their fixings, even when their maturities do not match exactly.



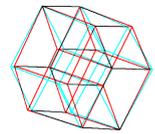
- The daily granularity means new ease to pricing “stub risk” - any period may be priced by compounding the (expected or realized) SOFR. By contrast LIBOR locks the user to term, opening up the possibility of disadvantageous resets (for example at month or quarter beginnings and ends) to which the user will be subjected for an entire LIBOR period.
- SOFR is collateralized, representing the weighted average overnight rate at which market participants borrow against US Treasury collateral. In other words, it is as close to a risk free rate as it is possible to create.
- It is not determined by expert-judgment, but rather SOFR is compiled from actual repo transactions, by the Federal Reserve Bank of New York.

Risk comparisons - SOFR vs LIBOR

The most used LIBOR benchmark being a 3-month rate, and SOFR an overnight one, we must adjust the latter to compare it to the former. Market convention for SOFR swaps will be for the floating SOFR leg to be a daily compounded historical rate. However for the purposes of comparing some statistics on each benchmark, we have chosen to compare a 3m SOFR average, to 3m LIBOR.



In chart A above, it is clear that the “SOFR” rate is quite volatile on a daily basis (red line), representing as it does the ebbs and flows of the overnight market, where technical considerations and liquidity peaks and troughs are common. Yet when we take a 3m rolling average (blue line), it is obvious that the volatility is much lower. This is borne out in chart B, where we see that on average, the daily standard deviation for the SOFR3m average (red line) has been around 0.5% in 2019 and early 2020, while that for LIBOR has been closer to 1.3% (excluding the most recent period). In other words, we already see that, under normal conditions, a rolling average SOFR rate has low volatility, indeed significantly lower than LIBOR. However it is when we look at the most recent 3 months that the advantages of



SOFR become abundantly clear (rhs of chart B). Early in the recent COVID-19 episode LIBOR became very volatile, representing credit and liquidity risks in the interbank lending markets. Indeed rolling 1-day LIBOR 3m volatility reached 7%, whereas SOFR3m barely moved above 1%. This is to be expected given LIBOR's uncollateralized nature and the term risk a lender faced in a 3m instrument, but the fact that the rate was largely set by expert judgement rather than by transactions during the crisis brings it's questionable nature as a benchmark into full-light.

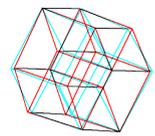
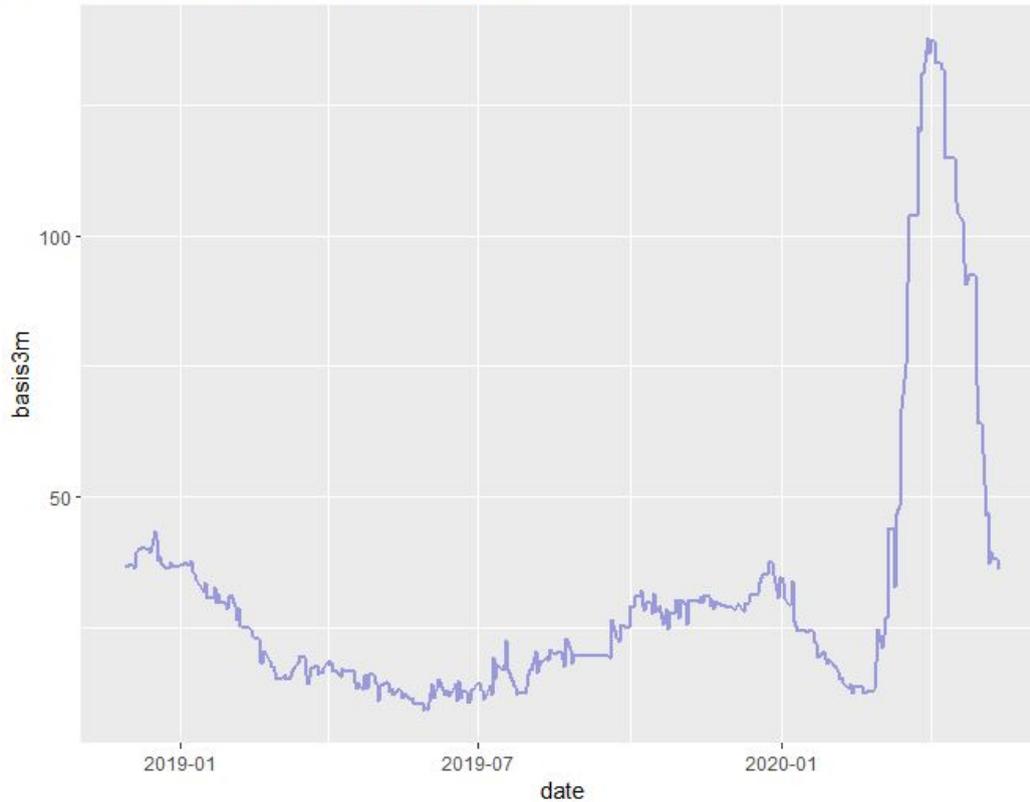
A lending rate, not a borrowing rate

Moreover, when it comes to corporate lending facilities, LIBOR is typically a rate at which banks lend, while they borrow through customer deposits, secured funding and repurchase agreements, each more closely aligned to SOFR. Given the asymmetry around the rates used for borrowing and lending, LIBOR is subject to a user bias, and this is exacerbated during times of market stress.

Another related point worth nothing is that a three month rolling SOFR average is much less volatile than LIBOR, since the underlying instrument, SOFR itself, is a) collateralized with treasuries, thereby eliminating credit risk, and b) an overnight rate with low term risk. We can conclude that exposure to SOFR has a lower volatility, and therefore a lower risk. *A lower volatility rate evidenced by real, market transactions, and one without a user bias, is a lower risk rate for its users.*

Future pricing

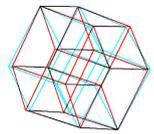
Chart C below plots the basis between 3m LIBOR and SOFR, expected by the basis swap market (in this case, "USSRVLC Curncy" on the Bloomberg Terminal). Rather than looking at how the historical relationship between the benchmark indices has compared, this is implied future pricing, at any given time, given as the number of basis points to be added to the equivalent SOFR average, to get to the LIBOR benchmark. As can be seen, the implied future pricing hovered between 10bps and 45bps in 2019 that is, LIBOR 3m was expected to trade between 10 and 45 bps higher than SOFR throughout the year. Yet in Q2 of this year, that expected basis traded all the way up to 137bps.

**C** 3-month LIBOR vs SOFR forward basis

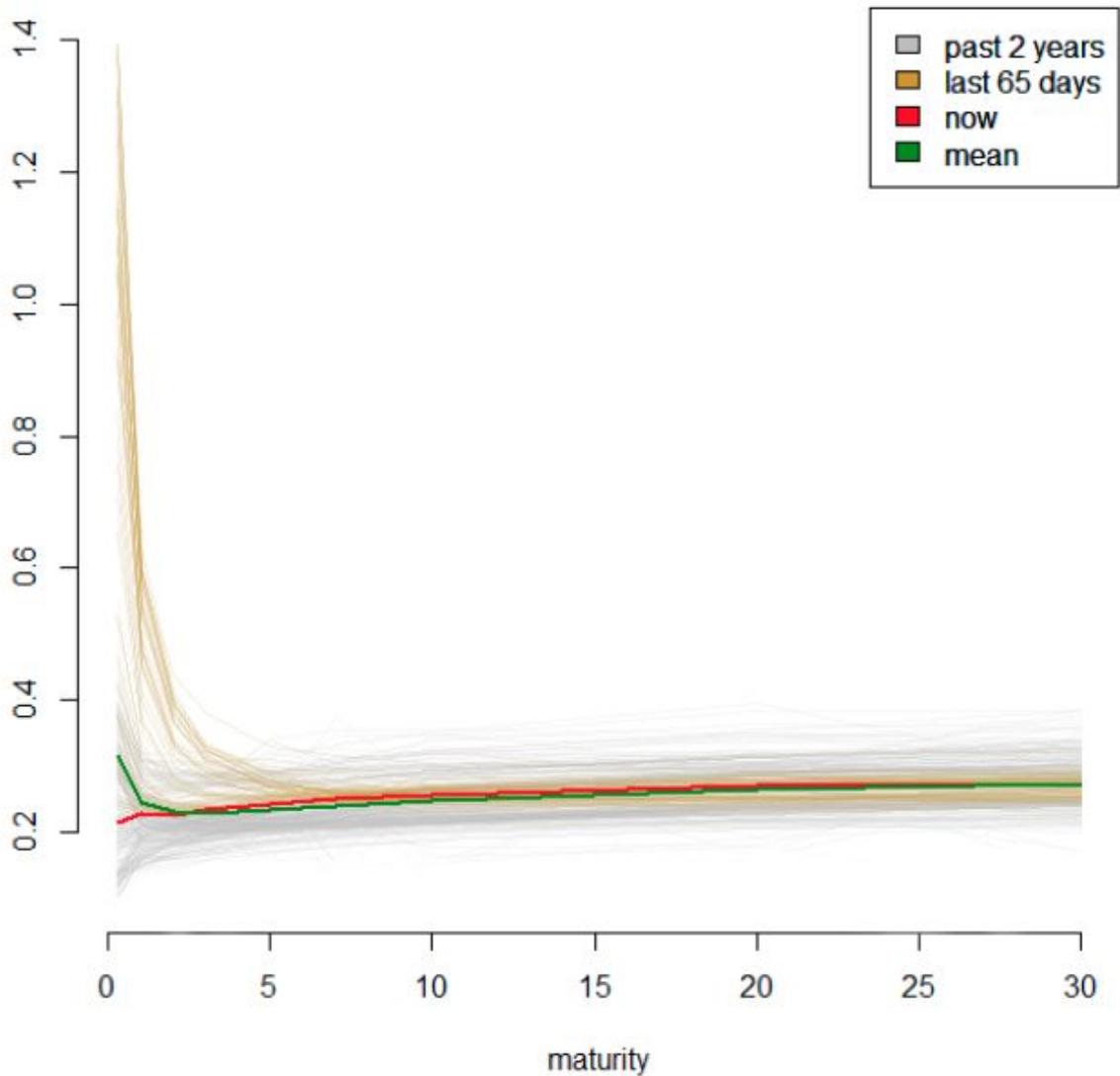
This “misbehaviour” of LIBOR has significant implications for current users of any financial product based on it. Receivers of floating LIBOR on interest rate swaps who were fortunate enough to experience a fixing around that time, would have benefitted from a much larger than expected floating leg payment. However the opposite is true for fixed receivers who had to *pay* an inordinately big floating coupon. Either way one can see that *LIBOR introduces significant volatility* which most risk systems will penalise, and which in most cases is worth looking to reduce.

Future corporate borrowing

The general objective for derivative users should be to use a benchmark interest rate which is as close as possible to the central bank’s risk free floating rate. This results in an interest rate swap that is a pure hedge of benchmark interest rates; the outcome of the shift to SOFR. This omits LIBOR’s liquidity and credit risk components, which may be better calculated and hedged separately by the counterparties. Indeed, LIBOR today and particularly during a crisis, seems to better reflect a reluctance to lend, rather than an actual cost of funds. There is little reason for a non-bank end user to have to take implicit exposure to banking sector credit risk in addition to, or mixed into, their own. SOFR removes this risk and provides a “neutral”, unbiased, low volatility, and granularly extendable rate upon which to build an interest rate strategy.

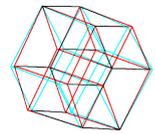


History of SOFR vs LIBOR curve



How to hedge LIBOR into SOFR

The chart above indicates an 2 year history of the term structure of the basis between SOFR vs LIBOR, expressed as the difference between the term rates of each. It is notable that we are currently near the mean of the past year, and far from the stressed levels of Q2 seen here and in chart C earlier. Therefore, this may well be an opportune time to lock in the SOFR vs LIBOR basis, at an attractive rate and before the uncertainty associated with forced fallback rates, and the potential spotlight of regulators.



Investors should examine the documentation on their current LIBOR contracts to ascertain exactly what will happen when LIBOR is no longer set. Assuming LIBOR exposure will enter standard ISDA fallback, one hedging methodology to consider will be trading listed Eris SOFR Futures contracts (which CME Group will be listing in October 2020) versus Eris LIBOR Swap Futures contracts (currently listed and trading today). If the exposure is paying LIBOR, then selling Eris LIBOR contracts vs buying Eris SOFR contracts, in the correct maturities, will effectively eliminate the risks discussed above.

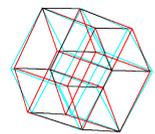
SOFR suitable for standardization relative to LIBOR

SOFR is a daily compounding rate and this has significant advantages over LIBOR term rates. Its daily compounding nature eliminates the reset risk associated with periodic LIBOR term resets. This means standardized quarterly SOFR instruments, like Eris SOFR Futures are suitable for hedging any SOFR indexed exposure, regardless of its start or end date. This is in contrast to LIBOR, where swaps are typically customized such that LIBOR resets of both the swap hedge and exposure coincide.

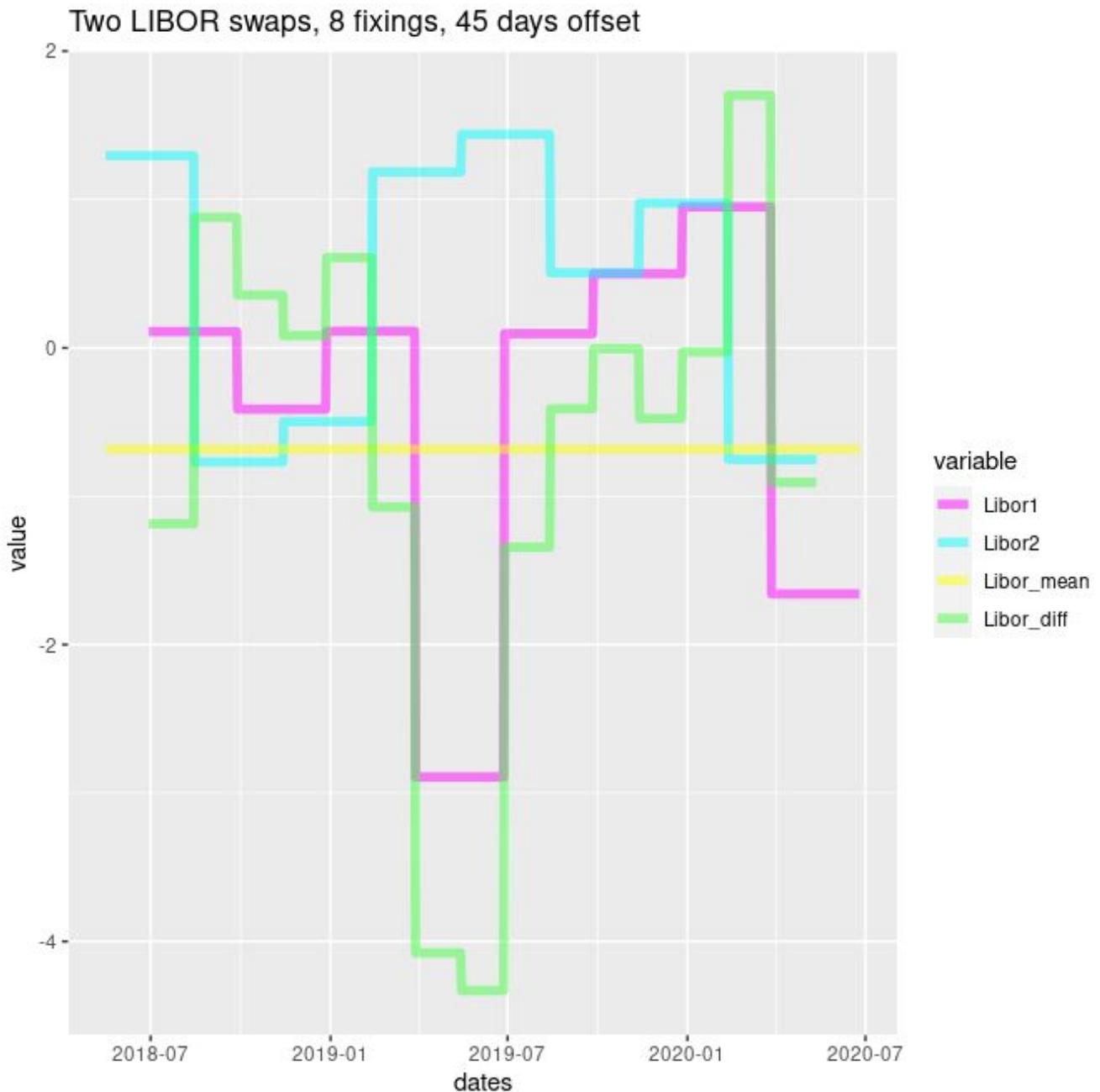
The reasons for this advantage is the outlier risk on small sample sizes, which can be explained as follows: a 2y LIBOR exposure, with quarterly resets in February, May, August and November, that is hedged with a swap starting on the March IMM date, such as the March Eris LIBOR Futures contract, exposes the user to eight 3-month duration mismatch risks, namely the risk of adverse LIBOR fixings between the exposure and the Eris hedge. Although the law of large numbers may reduce this risk for a long tenor exposure and an offsetting, but mismatched swap, which provides enough resets to permit a reversion to mean, LIBOR exposures typically require LIBOR swaps with matching resets to remove this risk entirely.

SOFR, by contrast, is a daily resetting rate and all SOFR resets within an exposure period will offset corresponding resets within the SOFR swap hedge. Therefore, there is significantly less reason to match the start and end dates of hedges with those of exposures. And given that SOFR is evidenced and set by commercial transactions, the stub risk, the period outside which the SOFR fixings of the exposure and the swap hedge do not coincide, may be precisely evaluated and hedged efficiently.

We illustrate these differences in the following two charts. In both cases we are assuming fixing volatility of identical magnitude, and are only considering the “noise” component around a theoretically “true” rate. It is this random error (“reset risk”) which LIBOR forces the investor to carry for potentially long periods, compared with SOFR .



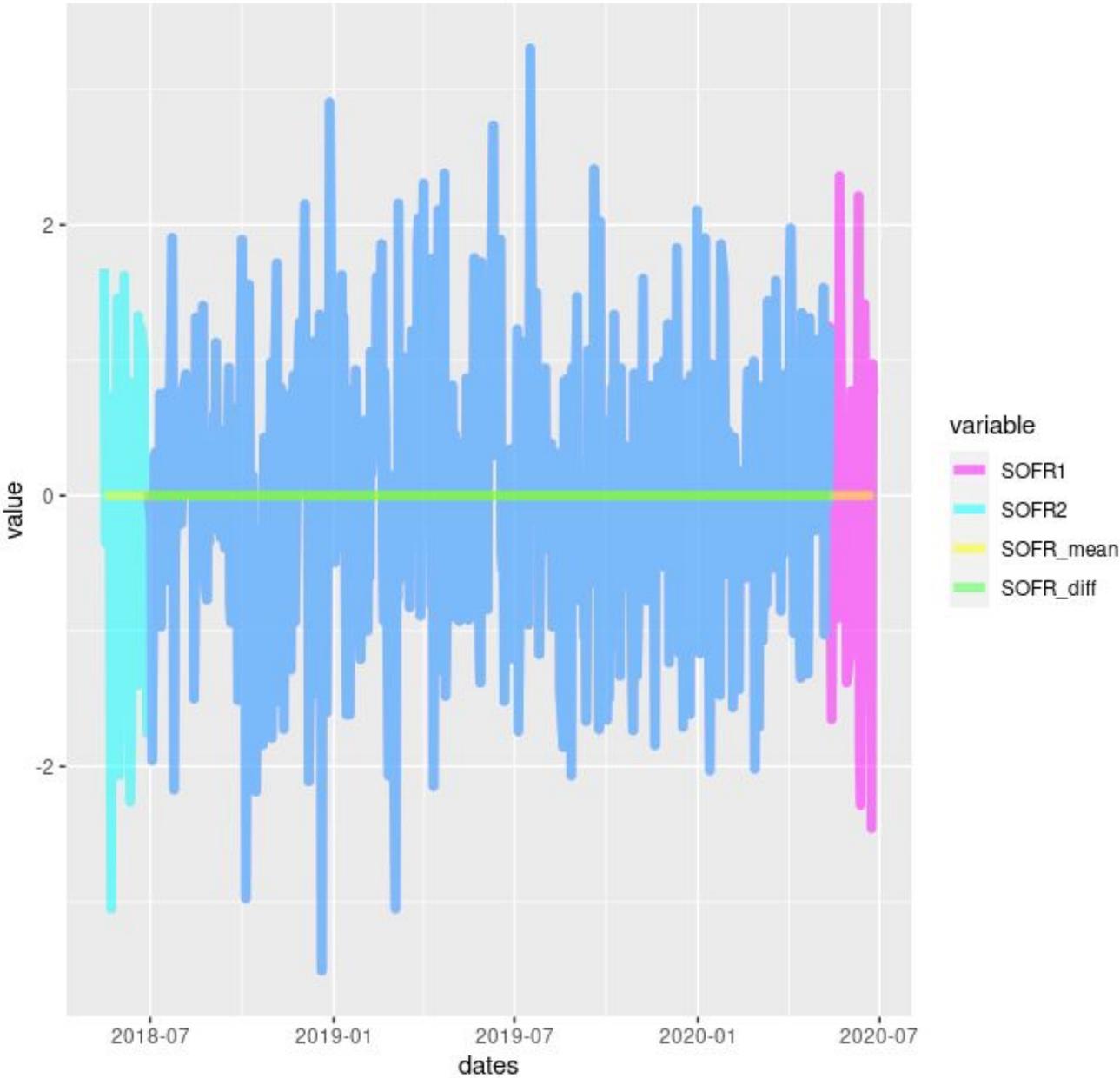
The first chart shows eight 3-month LIBOR fixings, each for two 2y swaps, offset by 45 days. The reset risk is clear, especially in period 4 (mid 2019) where there is significant divergence between the two. This divergence is experienced by the investor for the full three months of the fixing, and can lead to a significant profit or loss, resulting purely from fixing risk. Indeed the mean of around 0.7bps for the entire swap (yellow) is non-trivial (though this is just one example and the number could be smaller or larger).

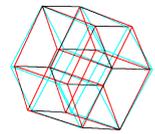


The second chart shows the same thing, but for two SOFR-based swaps, again 45 days offset. Whichever number of *actual* fixings there might be, these would comprise accumulated compounded daily SOFR fixings, so essentially, each 2y SOFR swap contains

520 fixings. As is clear, the intra-overlap fixings exactly offset each other (blue), unlike for LIBOR. Moreover, even for such a small number of instruments, the extra-overlap fixings (cyan, magenta) are numerous enough to essentially average zero. These stubs are exactly hedgeable since they are composed from tradable daily SOFR rates, unlike LIBOR which can only be traded in large fixed periods thereby exposing stubs to offset risk as well.

Two SOFR swaps, 520 fixings, 45 days offset





Eris SOFR Futures

In October 2020, CME Group will list Eris SOFR Swap Futures based on the patented and proven Eris Methodology, alongside the existing series of Eris LIBOR Swap Futures. With expected tenors of 1, 2, 3, 4, 5, 7, 10, 12, 15, 20 and 30-years, the Eris SOFR series will provide market participants with a visible yield curve of SOFR pricing in an easily accessible and simple to trade SOFR swap futures contract.

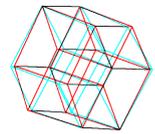
With LIBOR exposure subject to the ISDA fallback provisions, future resets of LIBOR will become SOFR plus a spread once fallbacks are initiated. Therefore, market participants may view standardized Eris SOFR Swap Futures as suitable offsets to existing LIBOR exposure.

Summary Contract Specifications

Contract Notional	\$100,000
Fixed Leg	Fixed rate, set to within 0.25% of the forward rate at time of listing, matching the Sifma SOFR MAC rates
Floating Leg	USD-SOFR-COMPOUND: rate determined at the end of each accrual period, calculated as the daily compounded SOFR fixings during the accrual period. Accrual periods follow the Modified Following business day convention
Payment Frequency/ Payment Dates	Annual fixed and floating legs, both paid 2 business days following the end of each accrual period, on an Actual/360 day count basis, on a NY holiday calendar
Contract Price	Contracts cash settle for life to the Eris Price, which captures all the cash flows of the swap $\text{Eris Price} = 100 + A_t + B_t - C_t$ At = NPV of future cash flows on date t, discounted on SOFR curve Bt = Accumulated historical payments of fixed and floating amounts Ct = Eris PAI™ on date t, equivalent to accumulated daily SOFR interest on previous business day's NPV less today's cash flows

Contracts will be standardized: swap effective dates will be IMM dates (third Wednesday of March, June, September and December) and annual accrual end dates will be market standard, aligning with their swap effective date, adjusting in accordance with the Modified Following business day convention.

Conclusion



SOFR has numerous advantages over LIBOR. By being collateralized, it eliminates interbank credit risk which should not be borne by end users. Being an overnight rate, it is easy to compound to any period desired without adverse interpolation risk. Its daily frequency all but eliminates reset risk, and even oddly sized periods such as stubs can easily be hedged. This dramatically simplifies risk management since exact maturity matching is much less important. And being a weighted average of real trades, bias, sample, and polling risks are removed, and it is much harder to game the system. The charts have shown that LIBOR's theoretical disadvantages very much manifest themselves as real adverse market moves during times of stress.

For all of these reasons, regulators have recently re-affirmed that they are committed to moving away from LIBOR by the end of 2021, replacing it with SOFR. Investors may wish to take advantage of currently normalized spreads between SOFR and LIBOR to eliminate their LIBOR risks, ahead of what could continue to be a volatile period, and ahead of the considerable uncertainty around forced "fallback". The Fed's recent affirmation of zero rates through 2022, which were followed by a 7% equity market drawdown, testify to the increased uncertainty in upcoming years. We note sizable issuance by corporations in recent months as risky to credit markets in general, and therefore to LIBOR.

Eris SOFR Futures

One efficient way to transition to SOFR now would be to trade CME Group's streaming and easily accessible Eris SOFR Swap Futures. These can be traded outright, for users who wish to use SOFR now, or can be traded against existing Eris LIBOR swap futures, in order to transition from LIBOR to SOFR ahead of being forced to do so. For further information on Eris LIBOR products please see earlier notes in this series at:

Signaliser Eris Trade Note 1: [Adding Alpha with Eris Swap Futures](#)

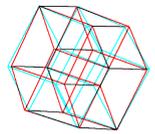
Signaliser Eris Trade Note 2: [The Equivalence of Eris Futures and IRS](#)

For more information on Eris SOFR futures visit www.erisfutures.com/sofr or contact info@erisfutures.com.

[1] <https://www.fca.org.uk/markets/libor>

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