# How to Use SOFR

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#### Averaging

The financial contracts using overnight RFRs have referenced an average (1-month or 3-month) of the overnight RFR for floating rate payments, not one-day's value. Those averages tend to be very smooth and appropriate for use in financial contracts (a 3-month average of SOFR is less volatile than 3-month LIBOR, even over year ends).



Source: Bloomberg

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#### Compound versus Simple Averaging

Compounding interest reflects the time value of money – for example, a money market account pays compound interest – and is used in OIS swaps and some futures. However, other contracts use simple averaging, largely because of historical precedent. There is some basis between the two types of averaging, but it is generally small and any difference can be adjusted for so that borrowers do not pay more or less under either convention.

Loan Rate:	1 percent	5 percent	10 percent
Loan Maturity:			
1-month	0.0	0.9	3.8
3-month	0.1	3.0	12.2
6-month	0.2	6.2	25.0

 Table 2: Basis between Compound and Simple Interest (bp)



Models for Using RFRs

The FSB and National Working Groups are looking at several models for using overnight risk-free rates in cash products

#### • In Arrears

- *Plain*: Used averaged rate over current interest period, paid on last day of the period (day *T*)
- Payment Delay: Use averaged rate over current interest period, paid k days after day T (Note: ISDA's conventions for SOFR swaps use a 1-day payment delay)
- Lookback: Use averaged rate over current interest period lagged k days (a 3-5 day lookback has been used in SONIA FRNs)
- *Lockout*: Use averaged rate over current period with last *k* rates set at the rate for day *T-k* (a 3-5 day lockout has been used in most SOFR FRNs).

#### • In Advance

- Last Reset: Use averaged RFR from the last interest reset period as rate for current reset period
- *Last Recent*: Use averaged RFR from a shorter recent period as rate for current reset period

#### • Hybrid Models

- Principal Accrual: Payments set *In Advance*, principal and interest accrue *In Arrears*
- Interest Rollover: Payments set *In Advance*, any missed interest relative to *In Arrears* is rolled over into the next payment period.



### Pros and Cons

Payment Delays or Lookbacks are consistent with ISDA compounding definitions and more easily hedged and do not skip any interest days. A lockout does skip some days and has some basis to the In Arrears model used in OIS swaps (below), On the other hand, for most of the interest period, the daily interest rate will correspond to the most recent published value of the RFR, which may be important to certain investors who do not have hedging needs.

Basis between Quarterly Compounded 3-day Lockout vs Pure Arrears (bp)



#### In Advance versus In Arrears

The tension between In Arrears and In Advance is that borrowers will reasonably prefer to know their payments ahead of time – well ahead of time for a consumer product – and so prefer In Advance, while investors will reasonably prefer returns based on rates over the interest period (In Arrears) and view rates set In Advance as "out of date".

But this isn't an entirely new problem: One-Year LIBOR (which is used in most adjustable rate mortgages currently) can often quickly become out of date, by about the same magnitude that a compound overnight rate (here EFFR) has become out of date, so while these issues will rightly be an area of focus, this is already an issue in the current market although it does not receive much focus.



Source: Federal Reserve Bank of New York, staff estimates

## In Arrears/In Advance (continued)

The amount of basis between In Advance and In Arrears also depends on the frequency of interest periods. With a one-month reset, the basis is comparable to the amount of basis between simple and compound averaging. Even at 3- or 6-month resets the basis is limited and averages out to zero over longer periods of time. The below graph shows what would have been the historical basis on a hypothetical 5-year loan based on EFFR in Advance relative to a loan based on EFFR in arrears for 1-month, 3-month, and 6-month interest periods.



### Models of In Advance

Using "Last Reset" with a shorter reset period and/or Using "Last Recent" can substantially cut the basis to relative to In Arrears. Below we show what the historical basis would have been on a hypothetical 5/1 ARM based on EFFR in Advance relative to EFFR in Arrears using different reset periods and different variations of "Last Recent"/"Last Reset"



## Sizing the Amount of Basis Risk

By way of a comparison, the amount of basis risk in a Last Reset 6-month SOFR In Advance Mortgage would historically have been clearly smaller than the amount of risk involved in a mortgage being prepaid one year earlier or later than expected. And the basis risk involved should be easier to hedge and is only ever relevant for hybrid ARMs that move in to the variable rate – more than half close out before a variable rate applies.



Comparing Basis Risks

# Hybrid Models

Hybrid models would be new but eliminate almost all basis relative to in Arrears and in a loan or mortgage while allowing the borrower to know their payments in Advance. If used in a consumer ARM, they would not materially alter the cumulated mortgage payments that a consumer would make or the principal they would pay down, for example, relative to a basic Last Reset 6 Month In Advance Mortgage. However, they would be a new form of product and would need to be explained in a way that consumers felt comfortable with, and servicers would need to be able to support these models.

