

May 26, 2020

Department of the Treasury
Development and Potential Issuance of Treasury Floating Rate Notes Indexed to the Secured Overnight Financing Rate
[Docket No. TREAS-DO-2020-0007]
govsecreg@fiscal.treasury.gov

Re: Docket Number **TREAS-DO-2020-0007**

To Whom it May Concern:

The comments below are submitted in response to the invitation to comment posted at 85 Fed. Reg. No. 100 (pages 31282-31284, May 22, 2020). The issue presented below implicates matters referred to therein under the heading "Security Structure".¹

There is a problem inherent in the mathematical formula relating to compound interest set forth in the Appendix to the ARRC's *A User's Guide to SOFR*² (the "Guide"), and referred to there as "ISDA's definition for Compounded SOFR". Although in use for some two decades in the overnight index swap market, that formula contains an analytically unsupportable departure from traditional compounding that entails the possibility (demonstrated by example below) that two 7-day transactions (the period used in the examples given in the Guide's Appendix) having identical sequences of prevailing interest rates for each of their consecutively numbered days (i.e., same rate on the first day, second day, etc.) may nevertheless not have the same overall interest accruals.

That is not a result that should be comfortably tolerated in a rational financial system. As pointed out in the invitation to comment at 85 Fed. Reg. 100 p. 31283, "Treasury is cognizant that its issuance decisions can have broader effects on other issuers and market practices."

Traditional compounding for a period of seven consecutive days would have an interest accrual factor for each day that can take the form $(1 + \text{that day's interest rate})$, with the product of the seven such factors resulting in an overall accrual factor that when multiplied by the original principal gives the total of principal plus interest at the end of the seven-day period. The use of Friday's rate for Saturday and Sunday in such a regime, reflecting the absence of a market determination of the rate for those days, does not affect the algebraic structure. The Guide formula for a week instead has four factors of the form $(1 + \text{that day's interest rate})$, one for each

¹ The issues pointed out in this comment were presented in comments to the Federal Reserve Bank of New York, which appear at <https://www.newyorkfed.org/markets/medialibrary/media/markets/SOFR-avg-index-comments-Feb2020> (pages 5-6), and were earlier discussed in an October 2, 2019 article available at <https://www.law360.com/articles/1203860/post-libor-rate-comes-with-interest-accrual-concerns>.

² https://www.newyorkfed.org/medialibrary/Microsites/arrc/files/2019/Users_Guide_to_SOFR.pdf

of Monday, Tuesday, Wednesday, and Thursday, and for the period Friday-Saturday-Sunday a single factor of the form $(1 + 3 * (\text{Friday's rate}))$. Thus the Guide formula attributes the Friday rate to Saturday and Sunday, but the algebraic treatment of that period reflects simple interest accrual rather than compound interest accrual.

The following example illustrates a start-day anomaly inherent in the Guide formula for compounded SOFR (references to interest rates are to effective daily rates):

Assume that the only non-business days in the period 5/3/2021 through and including 5/19/2021 are weekend days:

Let Transaction A begin with rate **R** on Monday 5/3/2021, then continue with rate **r** on 5/4, rate **r** on 5/5, rate **r** on 5/6, and rate **R** on Friday 5/7. Under the Guide formula, rate **R** will be attributed to each of Saturday 5/8 and Sunday 5/9. The sequence of rates on days 1 through 7 of Transaction A is thus **RrrrRRR** for the seven consecutive days.

Let Transaction B begin with rate **R** on Thursday 5/13/2021, then have rate **r** on Friday 5/14. Under the Guide formula rate **r** will be attributed to each of Saturday 5/15 and Sunday 5/16. Let the transaction continue with rate **R** on Monday 5/17, rate **R** on 5/18, and rate **R** on 5/19. The sequence for the seven consecutive days of Transaction B is also **RrrrRRR**.

In accordance with the Guide formula's treatment of non-business days, the two transactions have the same interest rates applicable on the same consecutively numbered days.

Under the Guide formula, the overall accrual factor for Transaction A is $(1+R)*((1+r)^3)*(1+(3*R))$.

Under the Guide formula, the overall accrual factor for Transaction B is $((1+R)^4)*(1+(3*r))$, which clearly differs algebraically from the result in Transaction A.

The potential for the occurrence of such a start-day anomaly is embedded in the treatment of non-business days in the Guide formula for compounded SOFR.³

It might be argued that in demonstrating that start-day anomaly the sequence of identical rates should not include the rates attributed by the formula on non-business days but should rather focus only on the rates determined by the market on the five business days. However, if viewed from that perspective the potential for the anomaly to occur will still exist (and seemingly will be more likely to occur). Consider a sequence of five consecutive business days with the following interest rates for the respective business days: **A, A, A, B, C**. In other words on the first, second, and third business day of such sequence the rate is **A**, on the fourth business day the rate is **B**, and on the fifth business day the rate is **C**. If the first day of such a sequence is a Monday, then Friday will occur on the fifth business day and the overall accrual factor under the Guide formula for the full 7-day period will be $((1+A)^3)*(1+B)*(1+(3*C))$. But if that sequence of five consecutive business days begins on a Tuesday, then Friday will occur on the

³ In the case of a week having an additional non-business day, the effects of the Guide formula's departure from traditional compounding can be further exaggerated. For discussion of this effect, please see the article referred to in note 1.

fourth business day, and the overall accrual under the Guide formula for the full 7-day period will be the algebraically different $((1+A)^3)(1+(3*B))(1+C)$.

In comparing traditional simple interest to traditional compound interest, the Guide states, "From an economic perspective, compound interest is the more correct convention."⁴ If the Friday interest rate is denoted as k , traditional compounding would treat the accrual factor for the three-day Friday-Saturday-Sunday period as the product $(1+k)(1+k)(1+k) = (1+k)^3$. The Guide formula treats the accrual factor for that period as $(1+(3*k))$. The difference between $(1+k)^3$ and $(1+(3*k))$ is the sum of the two components of the binomial expansion of $(1+k)^3$ not contained in $(1+(3*k))$, i.e., $(3*k)$ and $(3*(k^2))$. Thus the Guide formula will give an overall accrual factor somewhere between simple interest and traditional compounding.

It is not here suggested that the start day anomaly illustrated above is likely to occur frequently, or that the difference in overall results at low interest rates will necessarily survive rounding conventions. But the anomaly would not exist if traditional compounding were in effect for the entire seven day period (during which the Friday rate would be applicable for Saturday and Sunday).

Is there a good reason to continue the use of a formula containing the potential for a result that offends rational finance when the correction is so easy?

Very truly yours,
Thomas Volet

⁴ *A User's Guide to SOFR*, p.5.