European Bank
for Reconstruction and Development

Using Risk Free Rates

February 2020

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Agenda

- Increasing global use of RFRs
- EBRD use of RFRs
- How to use RFRs in cash products
- Compounding
- Pricing implication
- Product Design

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Increasing global use of RFRs

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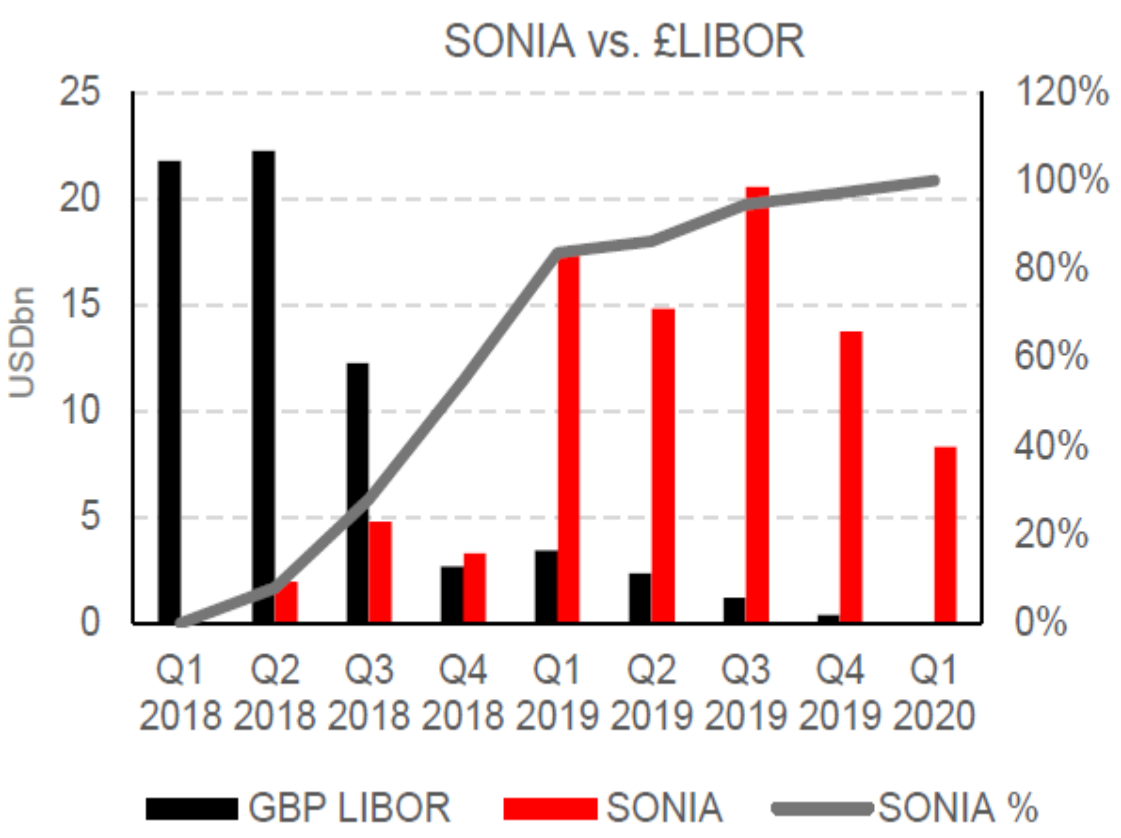
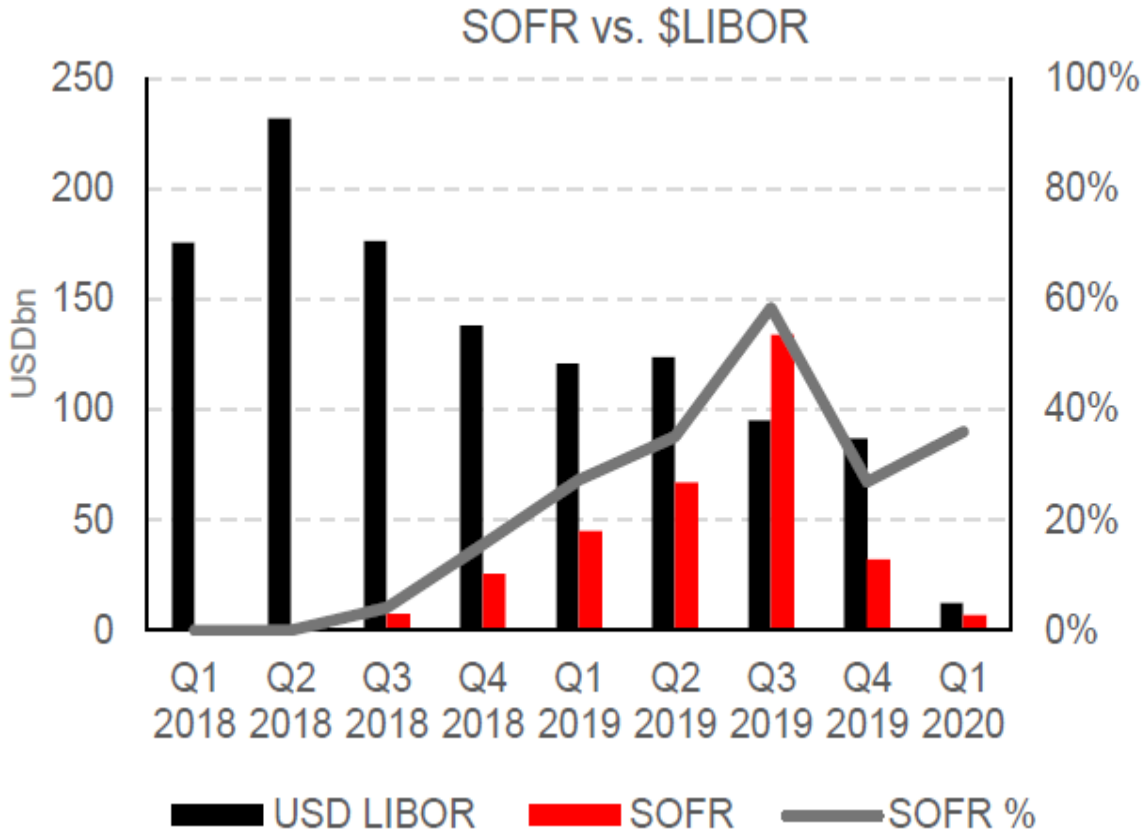
SONIA and SOFR issuance vs. IBOR (2018-2020YTD)





Source: Bloomberg and Dealogic as of 15th January 2020, HSBC analysis

Increasing global use of RFRs

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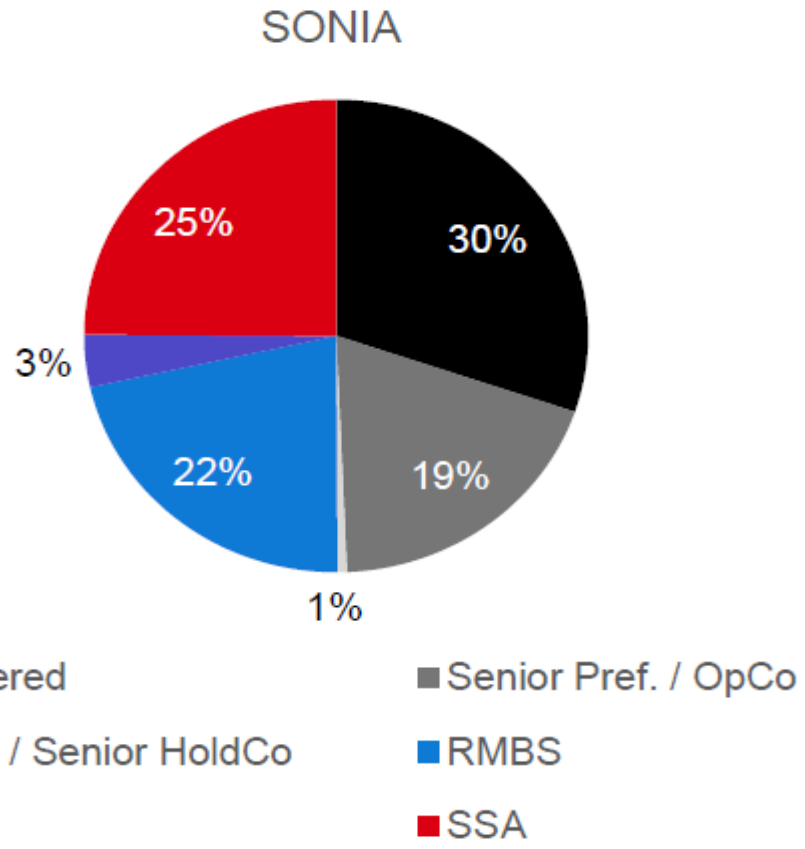
SONIA and SOFR issuance by type (2018-2020YTD)



Source: Bloomberg as of 15th January 2020, HSBC analysis

EBRD use of RFRs

- SONIA, SOFR and TIBR linked issuances
- RFRs linked OIS and cross currency basis swaps
- RFR linked loans in TRY, EGP and GEL

+ working on LIBOR transition for cash and derivatives

How to use RFRs in cash products

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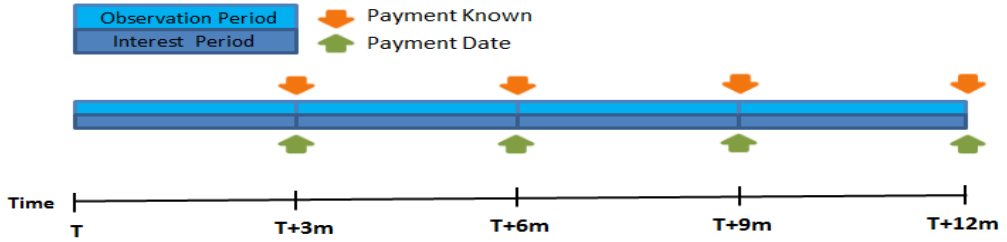
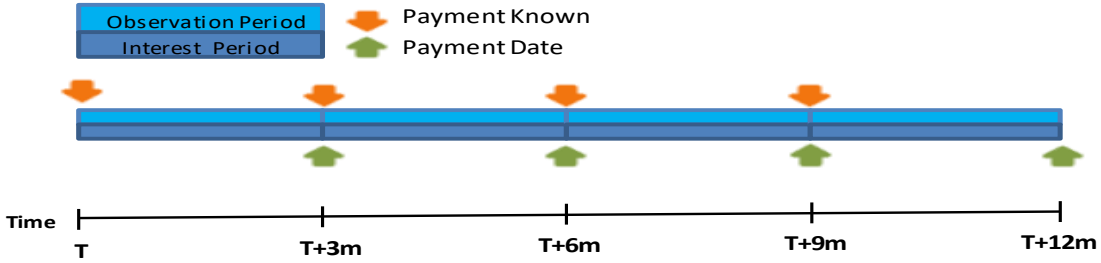
- Compounded Risk-Free Rate Setting in Arrears



- Forward Looking Term Rate



How to use RFRs in cash products

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Why start with compounding in arrears?

Compared to compounding in advance:

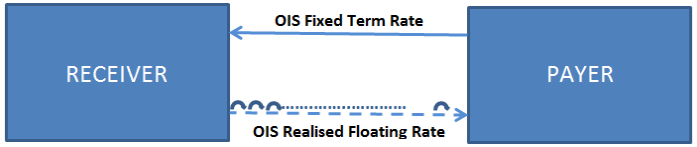
- Banks can manage interest rate risk from day one
- In line with other products conventions and therefore allows for efficient cross product risk management (e.g. can be hedged with OIS, as the market develops)
- Even though less predictable for end users, easily tracked under Inflation Targeting regime + payment lag can be introduced

➢ More efficient pricing to clients

Compared to forward looking term rate

⇒ Need to develop an Overnight Index Swap (OIS)

market first (+ a transparent and credible benchmark)



How to use RFRs in cash products

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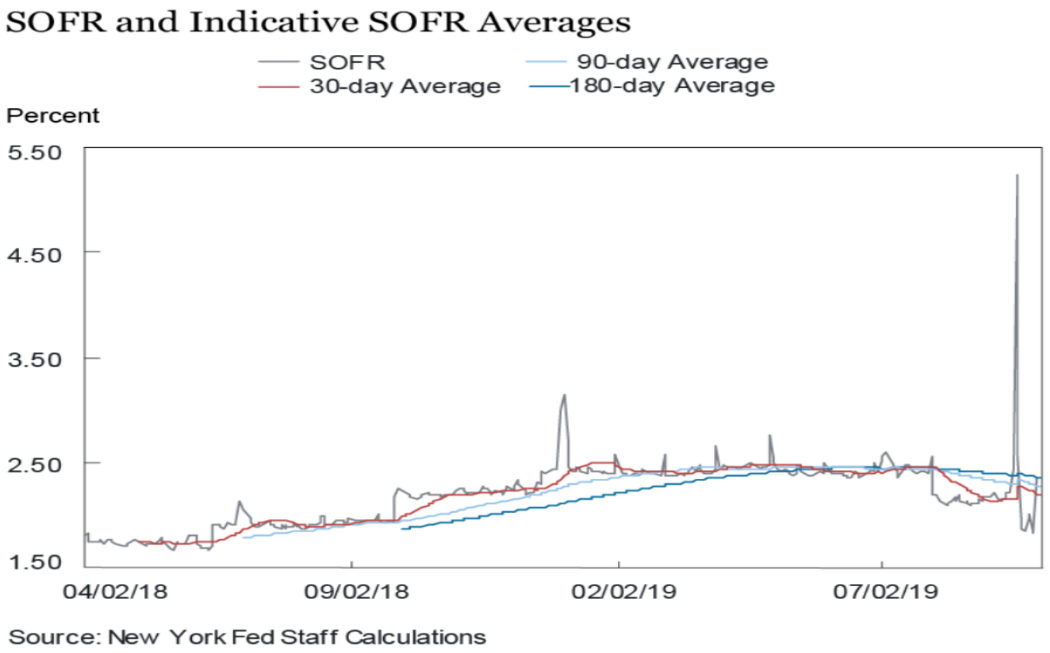
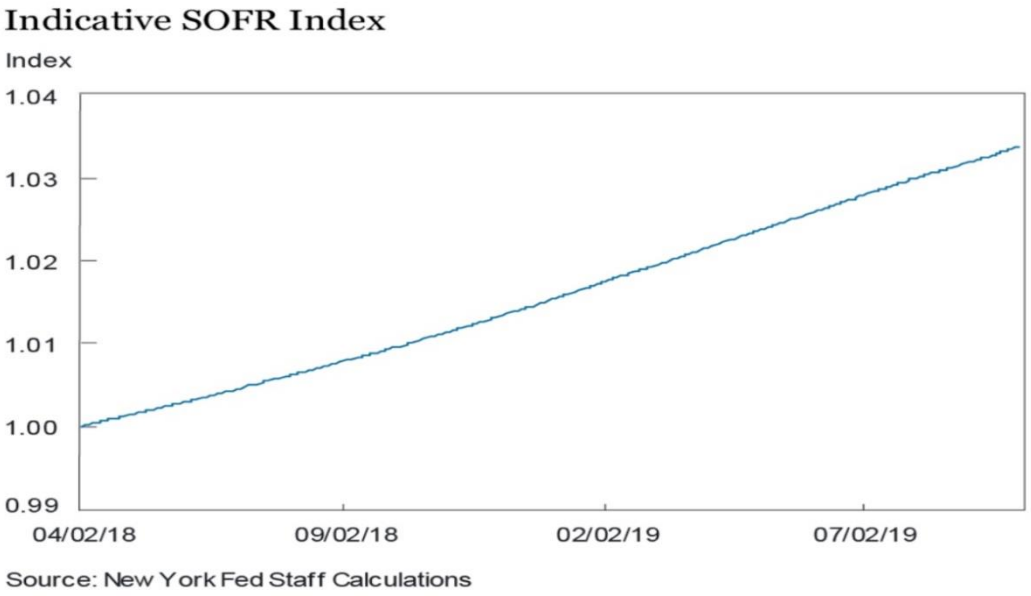
Main considerations with compounding in arrears

- Compounded rate calculation
- Product design
- Importance of conventions
- Pricing implication

The Compounded (Average) rate and Index

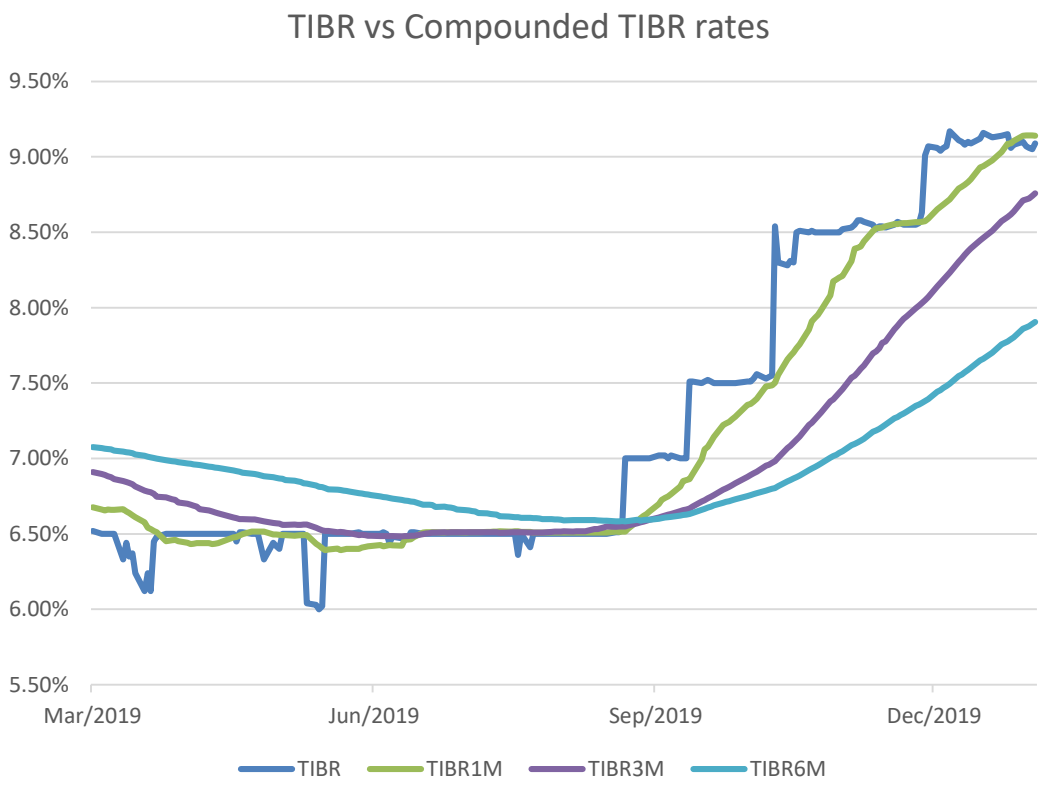




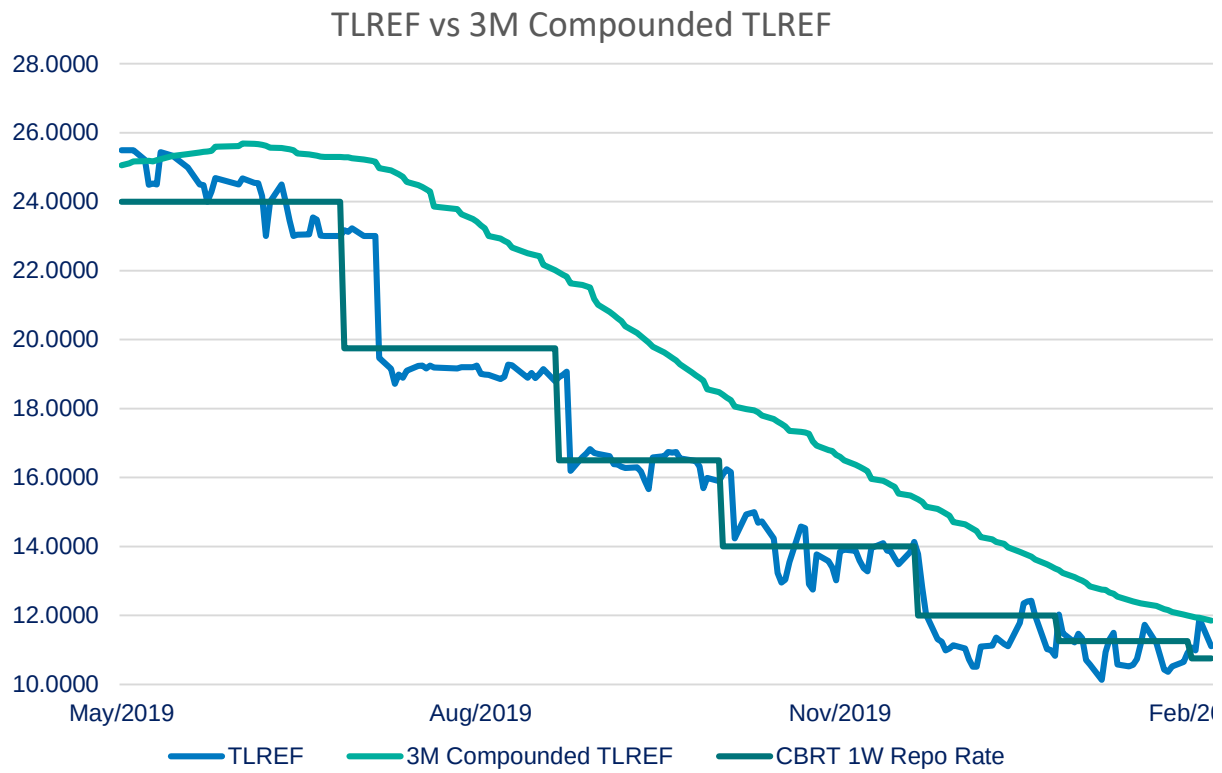
- The Compounded (Average) rates allow users to track the historical compounded rates
- The Index allows to calculate the compounded rate for the exact number of days for each Interest Period

Compounded rate

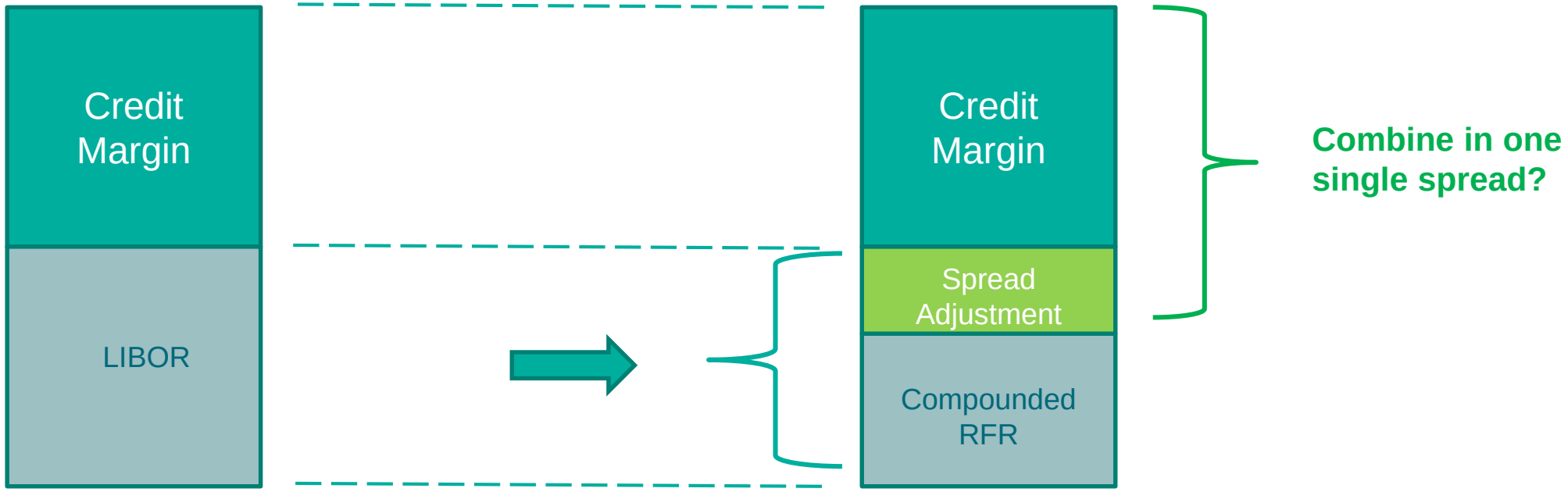
In a rate rising environment (Georgia)



In a rate cutting environment (Turkey)



Pricing of cash products



Product design
Alternative Conventions for Compounding in Arrears

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There are basically three different classes of compounding conventions:

- **Base Case**: No lag between the clarification of the amount and the payment.

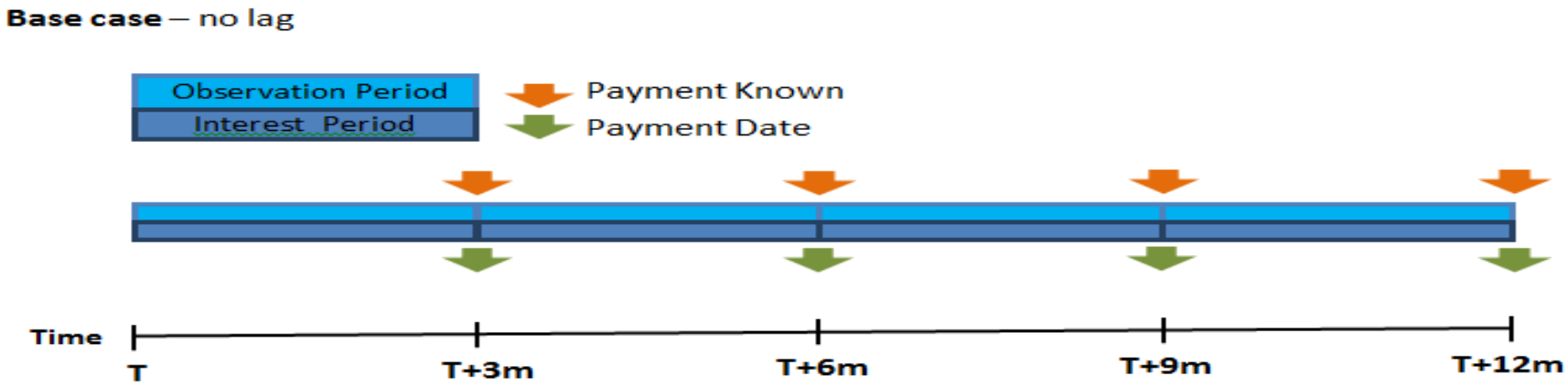
- **Options with minimum notice period**:

  - Delayed Payment
  - Lockout Period
  - In Arrears w/ Backward Shift

- **Hybrid methods**: Part of the next payment is known at the beginning of the interest period.

Product design
Compounding in Arrears: Base Case

The exact payment amount becomes clear on the payment date :

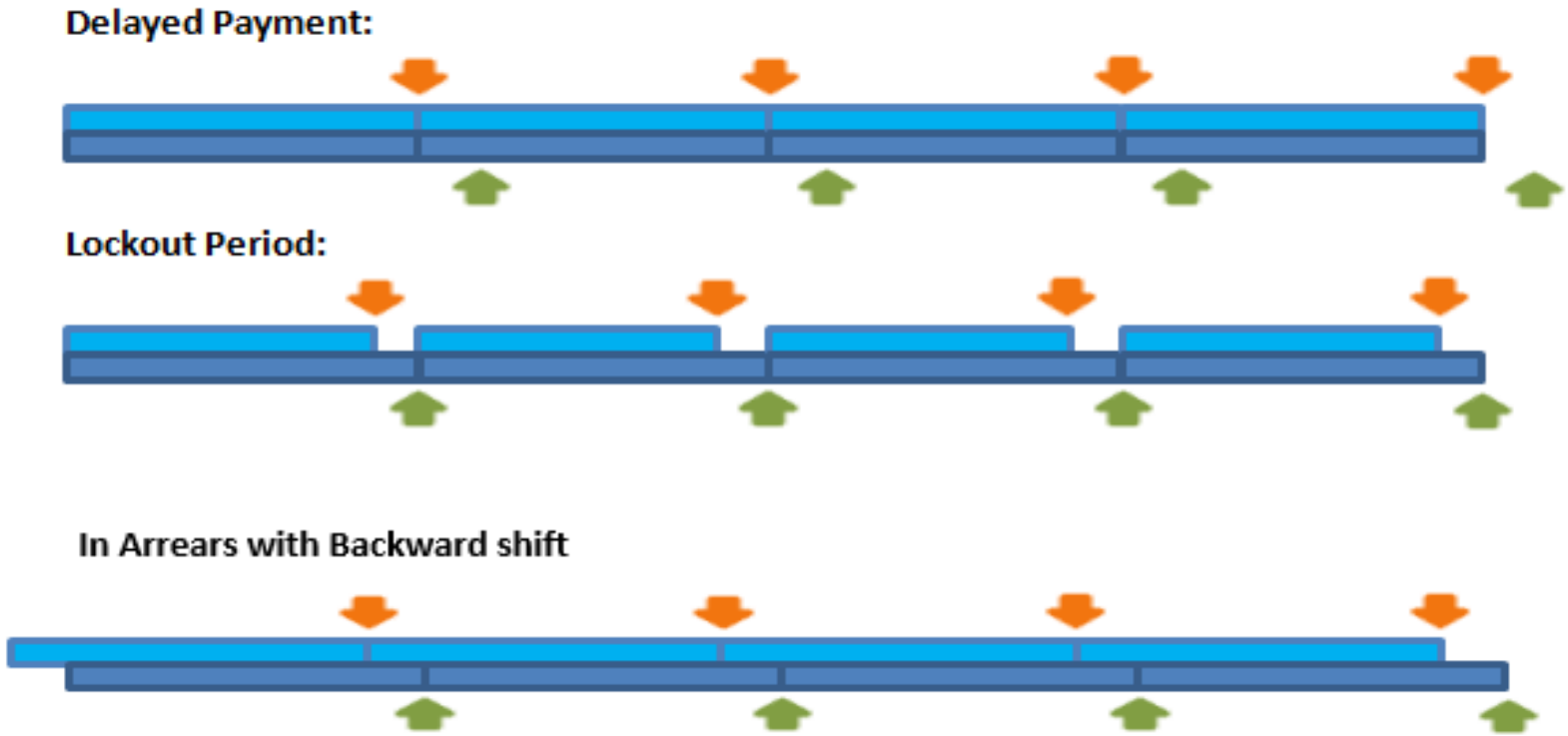


=> Operational issue: Fixing on the due date, not enough time

Product design

Compounding in Arrears: Options with a minimum notice period

A number of alternative options offering a minimum notice period could be offered to borrowers to give them more time to make payments.



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Hybrid Methods

- ***Principal Adjustment***

- **Interest payments are set in advance**, at the beginning of each interest period,
- but **principal on the loan changes over time based on the difference between the in advance and in arrears calculations for each period**

e.g. if rates moved up over the interest period, then more of the payment would go to cover interest expenses and remaining principal would be higher, while if interest rates moved down then remaining principal would be lower

- ***Interest rollover***

- **Interest payments are set in advance**, at the beginning of each interest period
- any difference between the amount of interest paid and the interest accrued in arrears is simply **rolled over into the payment for the next interest period**.

Product design
Importance of standardisation of Conventions …

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… to avoid market fragmentation and enhance liquidity and effective risk management.

Some key considerations:

- Delayed vs lock out vs shift
- Number of days for the lag/shift
- Compounding: manual calculation or index, rounding impact
- Margin treatment
- Fall backs
- Alignment with other products and markets

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Working Group on Sterling RFR – August 2019 Statement from the WG and Summary of Responses to Discussion Paper on Conventions for referencing SONIA in new contracts

Working Group considers it sensible to align with existing OIS market conventions where possible:

Convention	OIS	Bonds	Loans
Day count	Interest accrual is ACT/365 (fixed)	Interest accrual is ACT/365 (fixed)	Usually ACT/365 (fixed)
Business day convention for payments	Modified Following	Modified Following	Usually 'Modified Following'
Rounding of SONIA rate	4 decimal places at the end of the compounding period[2]	New SONIA-linked bonds may be rounded to 4 decimal places at the end of the compounding period	4 decimal places at the end of the compounding period may be used
Lag	No lag in payment	5 day period seen as sensible for most	Variable lag approach, coalescing to 5 day period where achievable
Margin treatment	N/A	Margin should be added after rate compounding	Margin should be added after rate compounding

Product design
Importance of standardisation of Conventions

There are both advantages and disadvantages to having a longer or shorter period for the shift/lag and lock out mechanisms.

The following considerations are likely to be important in this regard:

- Increasing the number of days gives a greater degree of cash flow certainty for end-users. This may be required in certain instances, for example when tax obligations need to be calculated, for less sophisticated borrowers (eg SMEs) or specific instruments (trade and working capital, export finance, Islamic finance…?

- Decreasing the number of days gives greater alignment with the general level of interest rates. This will vary for different interest periods.

- For shorter interest periods, such as 1 month, lag/lock out periods of 5 days or longer could be seen as more problematic given the shift/lag/lock out would represent a greater proportion of the interest period.

- Excessively long shift/lag/lock out periods could impact on hedge effectiveness if the end-user were to use a standard OIS for hedging purposes (i.e. no lag or lock out).

Importance of rounding conventions - example

Notional	10,000,000.00

	RFR	Compounded rate	Method 1 No rounding (Lock-in) US convention for cash products		Method 2 Rounding at the end £ convention for cash products	
d1	1.0325	1.0325	286.80555556	10,000,286.80555560		
d2	1.0325	1.033980634	286.81378130	10,000,573.61933690		
d3	1.0325	1.035464098	286.82200728	10,000,860.44134410		
d4	1.0325	1.0369504	286.83023349	10,001,147.27157760		
d5	1.0325	1.038439545	286.83845994	10,001,434.11003760	1.0384	10,001,442.22

Coupon difference	8.11

Product Design
TLREF indexed Loan example – In arrears with Backward Shift

Loan Notional	TRY 100 million
Interest Payment Dates	24/2, 24/5, 24/8, 24/11
Interest Periods	Quarterly
Interest Observation Period	Shifted backwards by 10 Business Days
Disbursement Date	24/2/20
Repayment Date	24/2/21
Base Interest Rate	TLREF compounded
Margin	Not compounded
Day count fraction	Act/365

In this example,

The first Interest Period would be from 24/02/20 to 25/05/20 (using modified following convention, with 24/05/20 being a Sunday), **with the Observation Period from 10/02/20 to 11/05/20.**

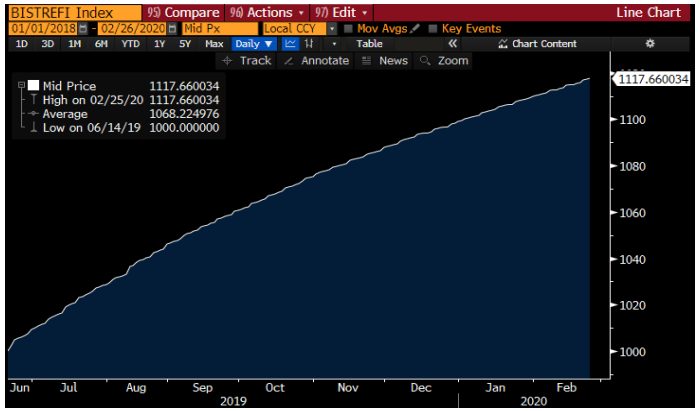
During the Observation period, TLREF would compound daily from and including 10/02/20 to but excluding 11/05/20.

The Compounded TLREF rate for the period would be known on 08/05/20 and can be calculated using the Index.

The Interest Payment on 25/05/20 would be calculated using the sum of the [Compounded TLREF over the Observation Period+ the accrued loan margin] over the Interest Period.

Product Design

TLREF indexed Loan example – In arrears with Backward Shift



$$TLREF_{compounded} = \left(\frac{TLREF\ Index_{\ End\ Period\ -1}}{TLREF\ Index_{\ Start\ Period\ -1}} - 1\right) \times \frac{365}{T}$$

With T = number of calendar days in the Observation Period

Example:

$TLREF\ Index_{End\ Period}$ *08/05/20* = 1,147.991

$TLREF\ Index_{\ Start\ Period}$ *07/02/20* = 1,112.299

T = 90

$$TLREF_{compounded} = \left(\frac{1{,}147.991}{1{,}112.299} - 1\right) \times \frac{365}{90} = 0.130137 = 13.0137\%$$

Product Design
TLRef OIS conventions

Fixed Leg		Float Leg	
Day Count	ACT/365.Fixed	Day Count	ACT/365.Fixed
Pay Freq	Quarterly	Pay Freq	Quarterly
Bus Adj	ModifiedFollowing	Index	BISTTREF Index
Adjust	Accrl and Pay Dates	Reset Freq	Daily
Roll Conv	Backward (EOM)	Bus Adj	ModifiedFollowing
Calc Cal	TU	Adjust	Accrl and Pay Dates
Pay Delay	0 Business Days	Roll Conv	Backward (EOM)
		Calc Cal	TU
		Fix Cal	TU
		Accretion Mode	Excl Sprd
		Fixing Lag	1 Business Days
		Pay Delay	0 Business Days
		Rate Cutoff	1 Business Days
		Reset Position	In Arrears

Q&A

The SOFR Index

The SOFR Index is expected to be calculated as follows for each day of publication:

$$SOFR\ Index = \begin{cases} 1, & i = 4/2/18 \\ \prod_{April\ 2,\ 2018}^{i} \left(1 + \frac{SOFR_i * n_i}{360}\right), & i > 4/2/18 \end{cases}$$

Where

$SOFR_i$ = SOFR applicable on business day i

n_i = number of calendar days for which $SOFR_i$ applies

i represents a series of ordinal numbers representing each business day in the calculation period

The Index

The Term (compounded) Rate for any interest period can then be calculated by looking up the index level from the start date and the end date of the period. Interim rates do not need to be known.

Using SOFR in this example, the calculation would be as follows:

$$SOFR\ Average\ between\ x\ and\ y = \left(\frac{SOFR\ Index_y}{SOFR\ Index_x} - 1\right) \times \left(\frac{360}{d_c}\right)$$

Where:

x = start date of calculation period

y = end date of calculation period

d_c = the number of calendar days in the calculation period

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