Item 3:
Update by subgroup 2
on term rates methodologies

Sub Group 2A: Status update

EURRFR Working Group Meeting

29.08.2019

Frankfurt am Main

Sub Group 2A

Status update

	Deliverable	Status
1.	**Credit spread methodologies:** Analysis of the various methodologies to calculate a **fixed spread**, representing the difference between EURIBOR and the €STR-based term structure methodologies	**final alignment**
2a.	**Backward-looking methodologies:** Review of the various **backward-looking methodologies** that would be possible providing a summary of pros and cons to be used by SG5 in their assessment by asset class	**final alignment**
2b.	A short technical analysis of the potential co-existence with the proposed forward-looking methodology - i.e. describing the **interaction between forward- and backward-looking methodologies**	**to start once other tasks completed**

Sub Group 2A

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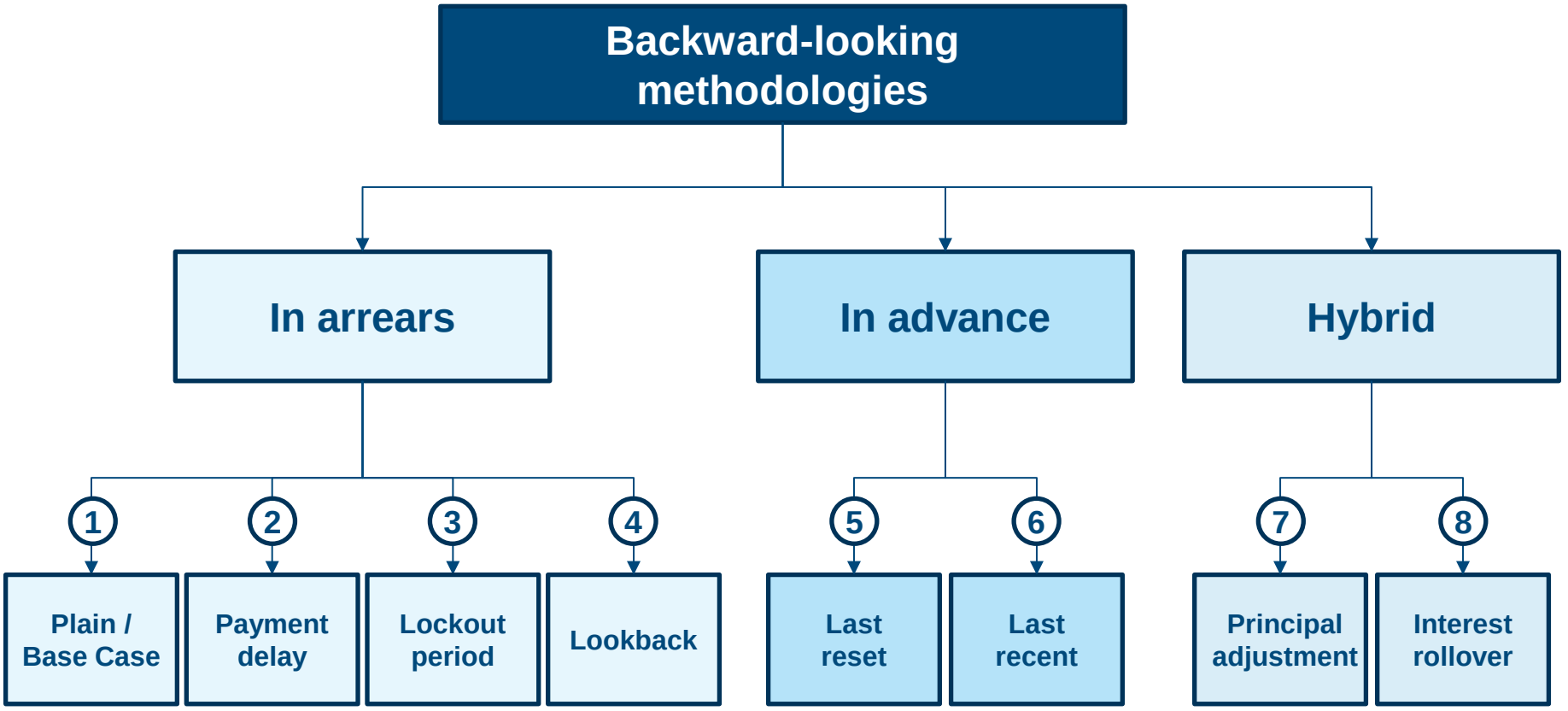
Backward-looking methodologies

Overview

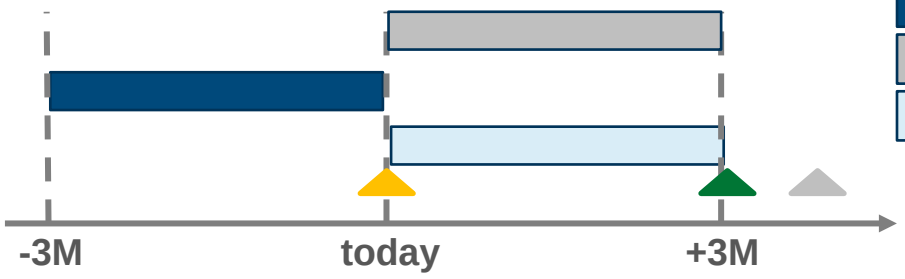


- Clear agreement among Working Group members, that the user guide to overnight risk-free rates(*) published by the Financial Stability Board (FSB) on 4th June 2019, provides a definitive list of backward-looking methodologies.
- Each of these methodologies have been assessed by Sub Group 2A.

(*) Source: https://www.fsb.org/2019/06/overnight-risk-free-rates-a-users-guide/

Backward-looking methodologies

Legend(*):



Observation period	Period used to calculate the averaged RFR
2nd Observation period	Period used to calculate the adjustment payment
Interest period	Period for which an interest instalment is paid
…Payment known	
…Payment date	
…Adjusted payment date	

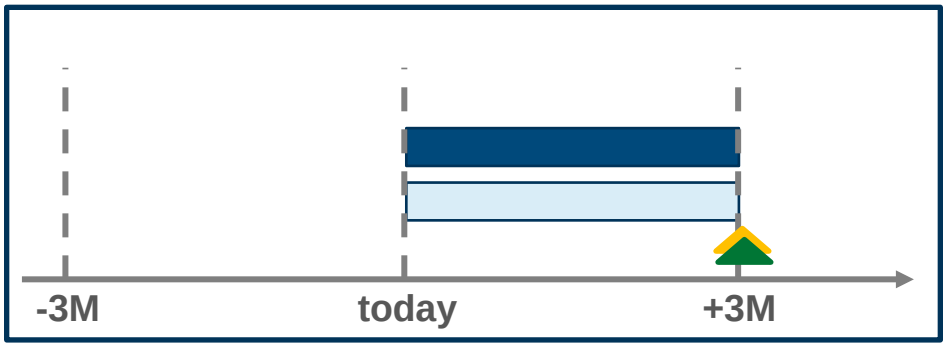
(*) The graphical descriptions of the backward-looking methodologies refer to the user guide to overnight risk-free rates published by the Financial Stability Board (FSB) on 4th June 2019, p. 8.

Evaluation Parameters

1. Operational ease/cash flow management
2. Computational ease/mechanics
3. Hedging ease
4. Client acceptance
5. Period congruency

Backward-looking methodologies: in arrears

1. Plain / Base Case - Description



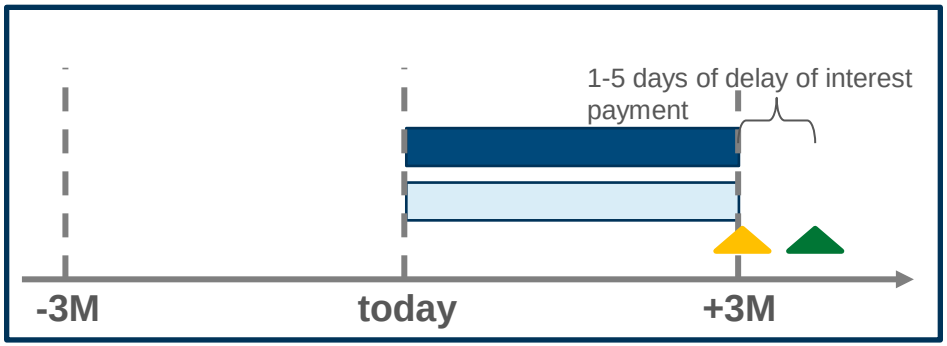
- Observation period is identical to the interest period.
- The notional is paid at the start of the period and repaid on the last day of the contract period together with the last interest payment.
- A plain in arrears structure reflects the movement in interest rates over the full interest period and payment is made on the day that it would naturally be due.

Assessment

Parameter	Description
Operational ease/cash flow management	Operational complexity due to same day payment
Computational ease/mechanics	Simple and transparent calculation, rate can be published
Hedging ease	Consistent with OIS market, so limited hedging issues
Client acceptance	Low due to operational complexity
Period congruency	Consistent
Examples of usage	Observed in some derivative markets
Conclusion	Challenging with a T+1 RFR publication time

Backward-looking methodologies: in arrears

2. Payment delay - Description



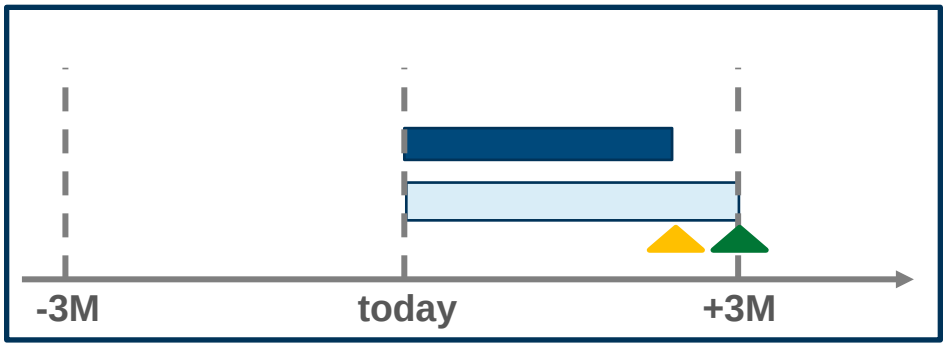
- Observation period is identical to the interest period.
- Only difference to the plain/base case is the small number of days delay in payment.

Assessment

Parameter	Description
Operational ease/cash flow management	Operational complexity due to small interest payment delay
Computational ease/mechanics	Simple and transparent calculation, rate can be published
Hedging ease	Consistent with OIS market, so limited hedging issues
Client acceptance	High for specific asset classes/users
Period congruency	Consistent
Examples of usage	OIS derivative market
Conclusion	Market standard for many derivatives products, challenging for other users

Backward-looking methodologies: in arrears

3. Lockout period - Description



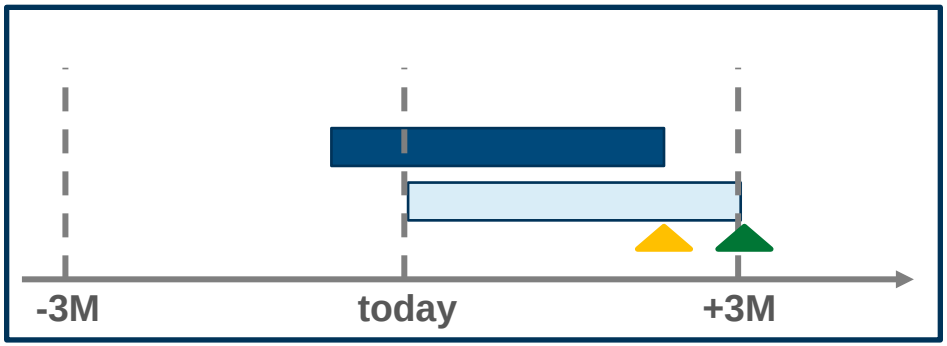
- RFR is no longer updated (i.e. frozen) for a certain number of days prior to the end of the interest period (lockout period).
- The RFR of the prior day to the lockout period is then applied for the lockout period.

Assessment

Parameter	Description
Operational ease/cash flow management	Sufficient time lag between cash flow fixing and payment date for more sophisticated users
Computational ease/mechanics	Slightly higher complexity and lower transparency due to lockout period
Hedging ease	Difficult to hedge the lockout period
Client acceptance	Potentially limited due to lower transparency – publishing rate difficult
Period congruency	Small mismatch
Examples of usage	SOFR FRN market
Conclusion	Lack of published rate and hedging challenges make it a less viable option

Backward-looking methodologies: in arrears

4. Lookback - Description



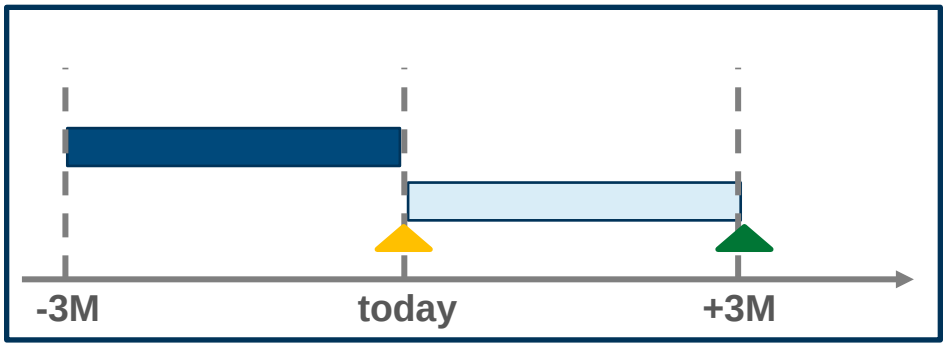
- Start of observation period a few days prior to the start of interest period.
- Both observation and interest period are of the same length.

Assessment

Parameter	Description
Operational ease/cash flow management	Sufficient time lag between fixing and payment for many users
Computational ease/mechanics	Simple and transparent calculation, rate can be published
Hedging ease	Easier to hedge than Lockout, but minor risk remain due to small mismatch
Client acceptance	High for specific asset classes/users
Period congruency	Small mismatch
Examples of usage	SONIA FRN market
Conclusion	Slightly superior to Lockout approach due to greater hedging and transparency

Backward-looking methodologies: in advance

5. Last Reset - Description



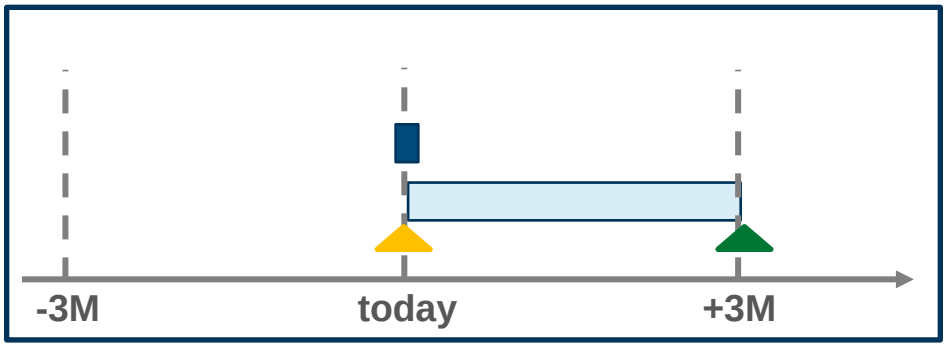
- Classic fundamentally backward-looking methodology
- Observation period references the previous 3 months to the interest period.

Assessment

Parameter	Description
Operational ease/cash flow management	Payment rate known in advance, so operationally straightforward
Computational ease/mechanics	Simple and transparent calculation, rate can be published
Hedging ease	Perfect hedge not available but basis risk
Client acceptance	Potentially only workable solution for retail and smaller corporate users
Period congruency	Inconsistent
Examples of usage	Proposed solution by other working groups for Retail Mortgages
Conclusion	Potentially viable option, if rate must be known at the start of the period Potentially very challenging for longer fixing periods, e.g. 12 months

Backward-looking methodologies: in advance

6. Last Recent - Description



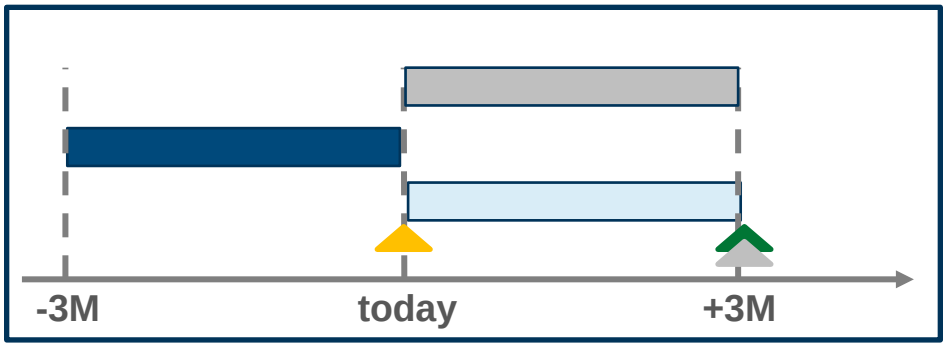
- Observation period simply references 1 day RFR fixing (or a limited number of days) and this rate is then applied for the whole period.

Assessment

Parameter	Description
Operational ease/cash flow management	Payment rate known in advance, so operationally straightforward
Computational ease/mechanics	Simple and transparent calculation
Hedging ease	No hedging possibility
Client acceptance	Difficult due to inconsistency with interest period
Period congruency	Inconsistent
Examples of usage	Not observed
Conclusion	Not an appropriate solution, as it doesn't correctly reflect the economics or allow for hedging

Backward-looking methodologies: hybrid

7. Principal adjustment - Description



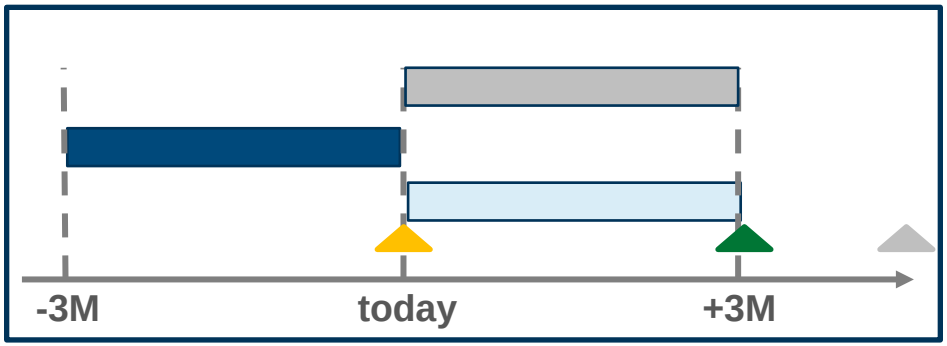
- Incorporates two different observation periods
  - i. Period 1 similar to the in advance approaches so that rate is known in advance
  - ii. Second observation period used to calculate adjustment rate – only known at the end of the period
- Adjustment factor used to adjust the payment to equate to average RFR for the current period.

Assessment

Parameter	Description
Operational ease/cash flow management	Operational complexity due to payment adjustment
Computational ease/mechanics	More complex and less transparent calculation
Hedging ease	Cash flow mismatch to hedging instrument
Client acceptance	Potentially low due to the higher complexity and lower transparency
Period congruency	Becomes consistent with the incorporation of the adjustment rate
Examples of usage	Not observed
Conclusion	Too high operational complexity vs. benefits

Backward-looking methodologies: hybrid

8. Interest rollover - Description



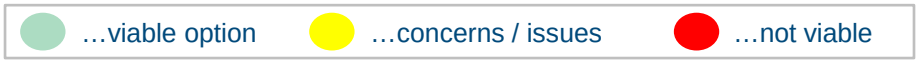
- Same methodology as the principle adjustment with the only difference that the adjustment payment occurs at some later point beyond current payment date.

Assessment

Parameter	Description
Operational ease/cash flow management	Operational complexity due to payment adjustment
Computational ease/mechanics	More complex and less transparent calculation
Hedging ease	Cash flow mismatch to hedging instrument
Client acceptance	Potentially low due to the higher complexity and lower transparency
Period congruency	Becomes consistent with the incorporation of the adjustment rate
Examples of usage	Not observed
Conclusion	Too high operational complexity vs. benefits

Backward-looking methodologies: evaluation overview

Methodo-logies	Operational ease / cash flow mgmt.	Computational ease / mechanics	Hedging ease	Client acceptance	Period congruency	Examples of usage	Conclusion
1. Plain / Base case	Operational complexity due to same day payment	Simple and transparent calculation, rate can be published	Consistent with OIS market so limited hedging issues	Low due to operational complexity	Consistent	Observed in some derivative markets	
2. Payment delay	Operational complexity due to small interest payment delay	Simple and transparent calculation, rate can be published	Consistent with OIS market, so limited hedging issues	High for specific asset classes/users	Consistent	OIS derivative market	
3. Lockout period	Sufficient time lag between cash flow fixing and payment date for more sophisticated users	Slightly higher complexity and lower transparency due to lockout period	Difficult to hedge the lockout period	Potentially limited due to lower transparency – publishing rate difficult	Small mismatch	SOFR FRN market	
4. Lookback	Sufficient time lag between fixing and payment for many users	Simple and transparent calculation, rate can be published	Easier to hedge than Lockout, but minor risk remain due to small mismatch	High for specific asset classes/users	Small mismatch	SONIA FRN market	
5. Last reset	Payment rate known in advance, so operationally straightforward	Simple and transparent calculation, rate can be published	Perfect hedge not available but basis risk	Potentially only workable solution for retail and smaller corporate users	Inconsistent	Proposed solution by other working groups for Retail Mortgages	
6. Last recent	Payment rate known in advance, so operationally straightforward	Simple and transparent calculation	No hedging possibility	Difficult due to inconsistency with interest period	Inconsistent	Not observed	
7. Principal adjustment	Operational complexity due to payment adjustment	More complex and less transparent calculation	Cash flow mismatch to hedging instrument	Potentially low due to the higher complexity and lower transparency	Becomes consistent with the incorporation of the adjustment rate	Not observed	
8. Interest rollover	Operational complexity due to payment adjustment	More complex and less transparent calculation	Cash flow mismatch to hedging instrument	Potentially low due to the higher complexity and lower transparency	Becomes consistent with the incorporation of the adjustment rate	Not observed	



Sub Group 2A

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Credit spread methodologies

Overview

	Historic Credit spread methodology	Forward Credit spread methodology	Dynamic Credit spread methodology
High level description	Historical difference between EURIBOR and €STR/EONIA	Simplification of €STR/EURIBOR forward derivative curve	Replication of the credit/liquidity risk in another index
Fixed or variable	Fixed at point of benchmark cessation	Fixed at point of benchmark cessation	Remains variable over life of the contract
Key issues	What historic period to reference?	Reference data at point of cessation	Data collection dependent

Credit spread methodologies

1. Historic Mean/Median Approach – Overview

The Historical Mean/Median approach calculates the difference between the realised compounded RFR for a given tenor and the respective EURIBOR fixing for that given tenor/period. Similar to the approach proposed by ISDA.

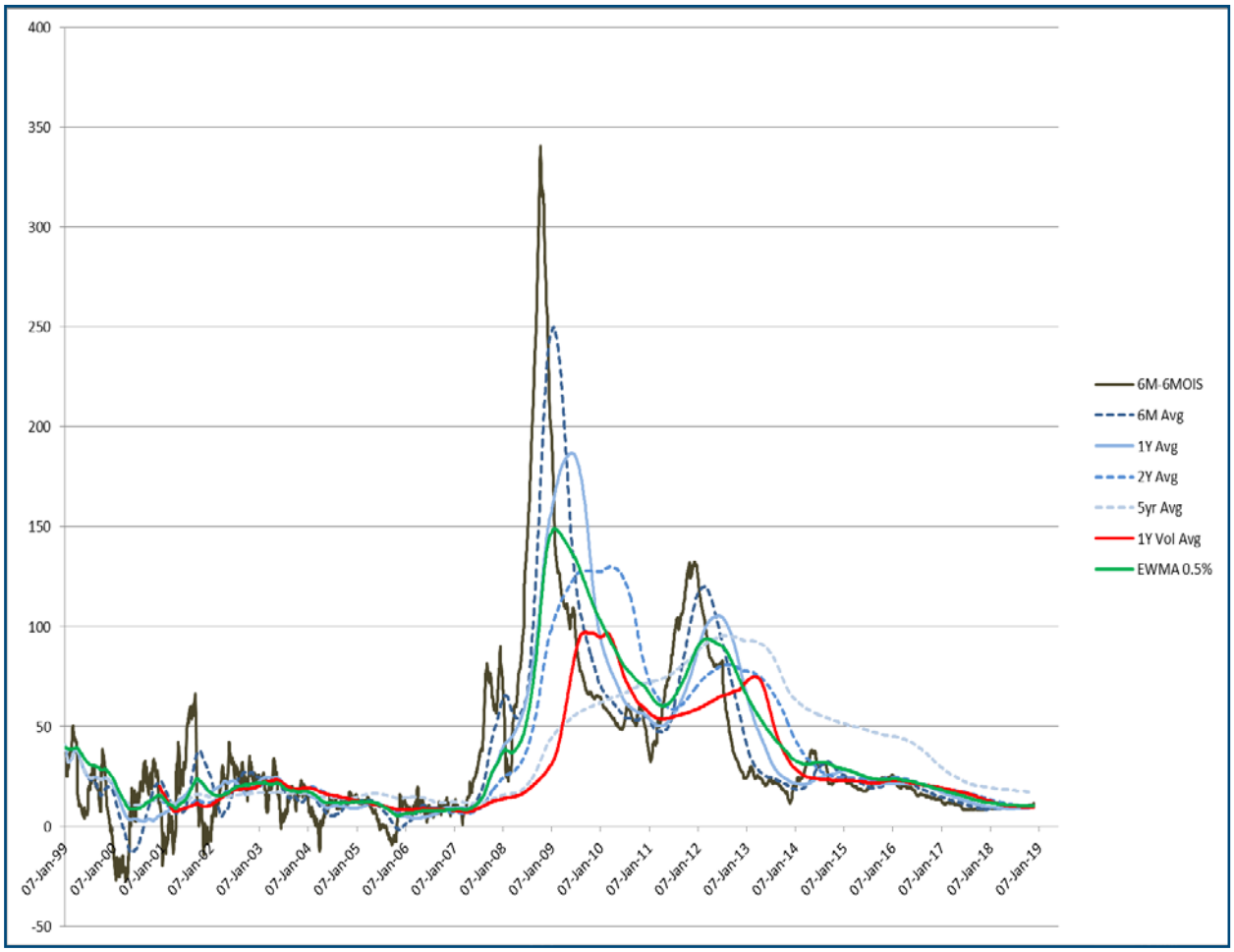
Key considerations in the methodological assessment

1. Sensitivity to periods of volatility of the spread
2. How does the spread behave in a hiking/cutting cycle?
3. Simplicity of the method
4. Consistency of term structure, i.e. likelihood of the 12M spread > 6M spread
5. Specificities of the EUR market

Credit spread methodologies

1. Historic Mean/Median Approach – Data Analysis (1/2)

EUR 6M spread averages for various tenors

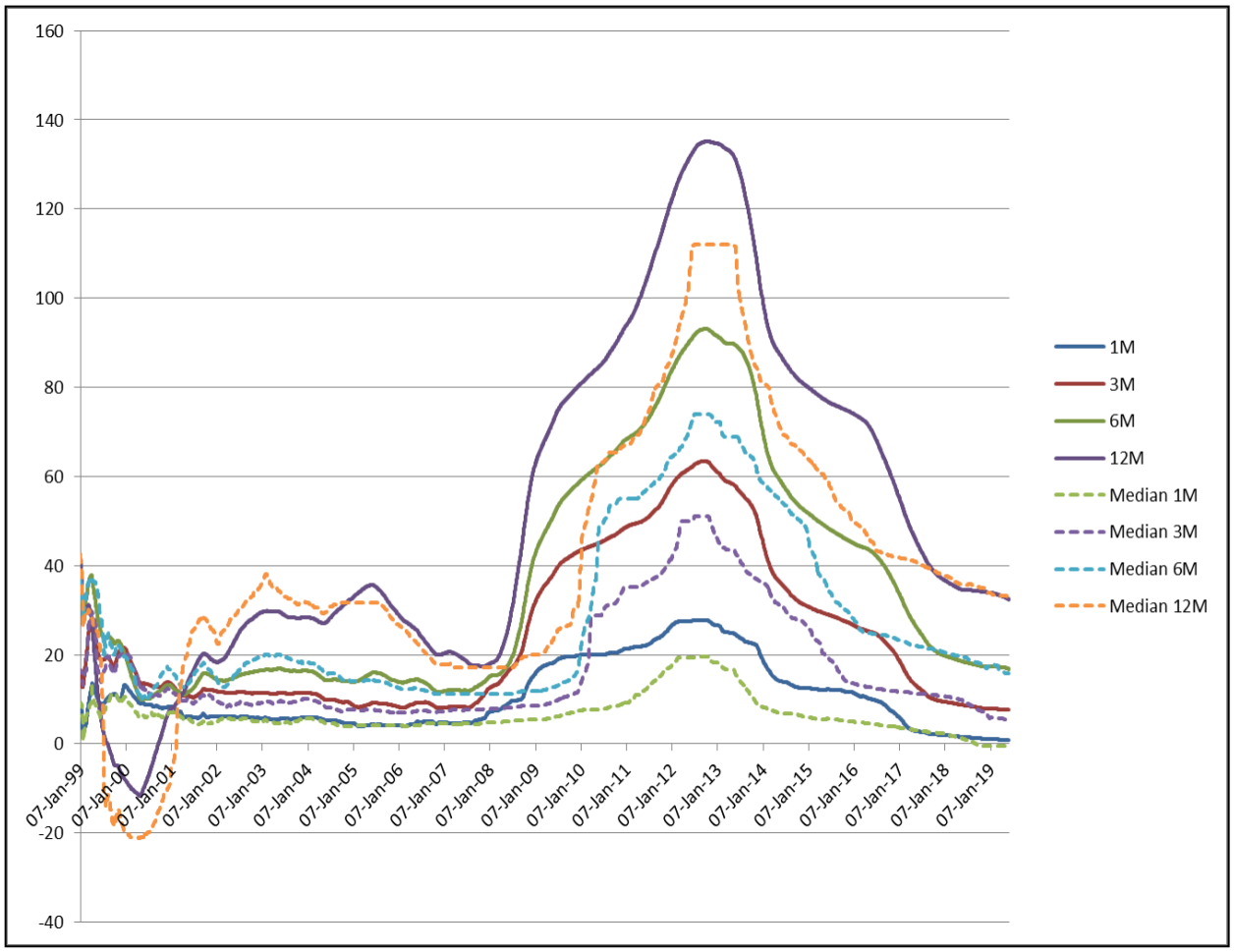


- Probability of extreme values clearly higher if averages over a shorter period considered
- Additional high probability of inconsistency of term structure if shorter period considered
- To be noted, that the actual trigger event date far more uncertain than for LIBOR

Credit spread methodologies

1. Historic Mean/Median Approach – Data Analysis (2/2)

EUR Mean/Median 5yr average for various tenors



- Clear benefit to the median approach can be seen as a simple way to reduce outliners
- Beyond this, no fundamental concerns with either the mean or median calculation

Credit spread methodologies

1. Historic Mean/Median Approach – Conclusions

PROS

- ✓ Simple and transparent if the basic methodology used
- ✓ Data requirement limited to historical fixings
- ✓ Preferred method for ISDA for other currencies
- ✓ Very low probability of manipulation of calculation
- ✓ Potentially more stable market pricing at point of trigger

CONS

- × Can be very sensitive to the historic period chosen, this becomes a critical input to the calculation
- × May not reflect current market conditions, spot value could therefore be significantly different to calculated spread
- × Potential significant value transfer/mark to market impact at point of fallback trigger

Credit spread methodologies

2. Forward Step Approach – Overview

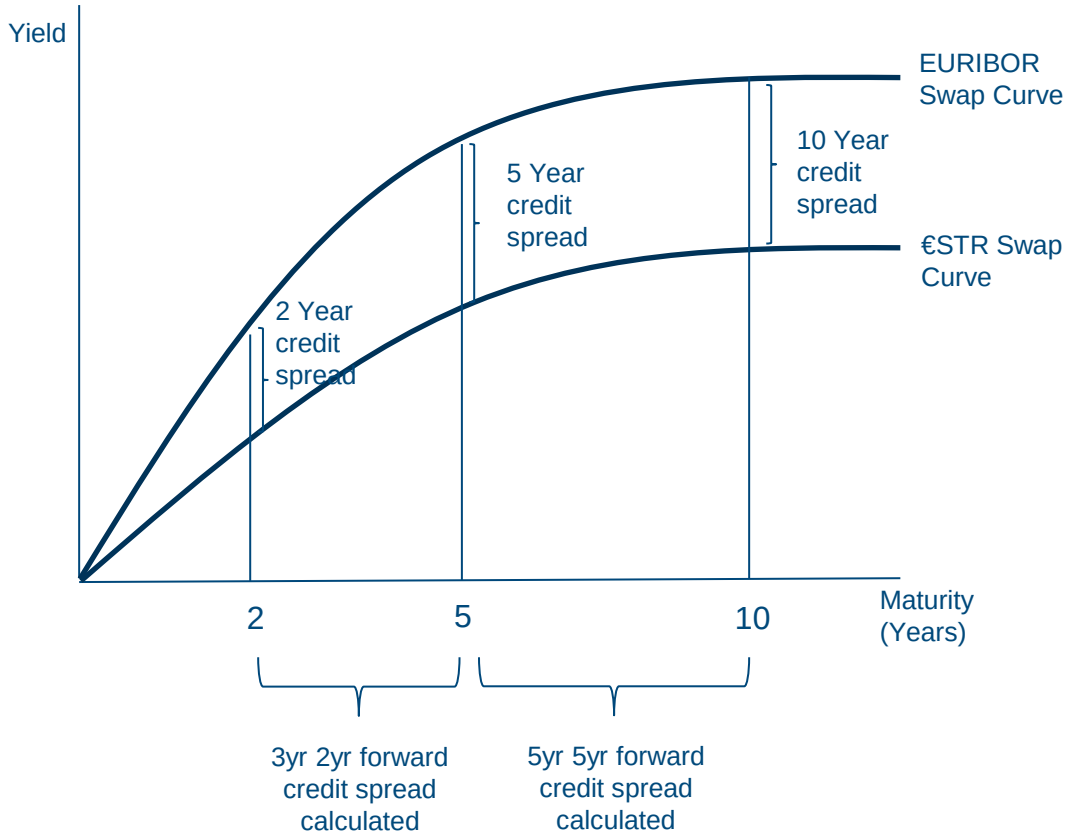
Similar to the ISDA forward approach for the credit spread calculation, the spread adjustment under this approach would be based on observed market levels for the forward EURIBOR/€STR spread in the relevant EURIBOR tenor. However, unlike the original ISDA forward approach proposal which aimed to specify a *different* spread for every day into the future, this methodology restricts the number of spread values to a limited number of points (in this example 5 tenors).

Key reasoning

- Simplification
- Reliance only on most liquid data points

Credit spread methodologies

2. Forward Step Approach – Overview



t_0 = The first calibration date which is the date from which observations of the forward curves commences. It is defined as the date 1Y prior to the discontinuation date.

t_1 = The discontinuation date. The first day on which EURIBOR will not be published.

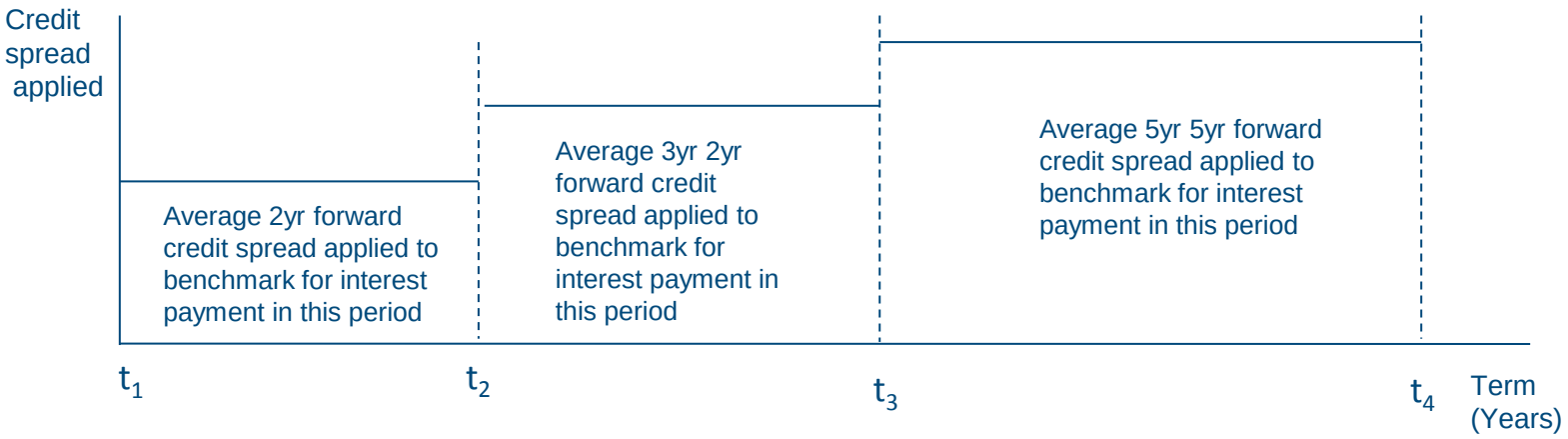
Next, there are the dates which define which credit spread should be applied after cessation. We define the following:

$t_2 = t_1 + 2$ years
$t_3 = t_1 + 5$ years
$t_4 = t_1 + 10$ years
$t_5 = t_1 + 20$ years
t_6 = Potential Final Replacement EURIBOR publication date (t_1 + 60Y?)

Credit spread methodologies

2. Forward Step Approach – Application

Application upon benchmark discontinuation



The replacement EURIBOR rate for any given day after cessation will then be obtained by taking the relevant term €STR rate and adding the credit spread according to the following map:

For $t_1 \leq t < t_2$ Use 2Y average credit spread
For $t_2 \leq t < t_3$ Use 2Y3Y average credit spread
For $t_3 \leq t < t_4$ Use 5Y5Y average credit spread
For $t_4 \leq t < t_5$ Use 10Y10Y average credit spread
For $t_5 \leq t < t_6$ Use 20Y10Y average credit spread

Credit spread methodologies

2. Forward Step Approach – Conclusions

PROS

- ✓ More accurate assessment of market value than Historic Mean/Median approach
- ✓ Value transfer impact should be minimized compared to Historic Mean/Median approach
- ✓ Only use of liquid market data points enhances transparency and reliability

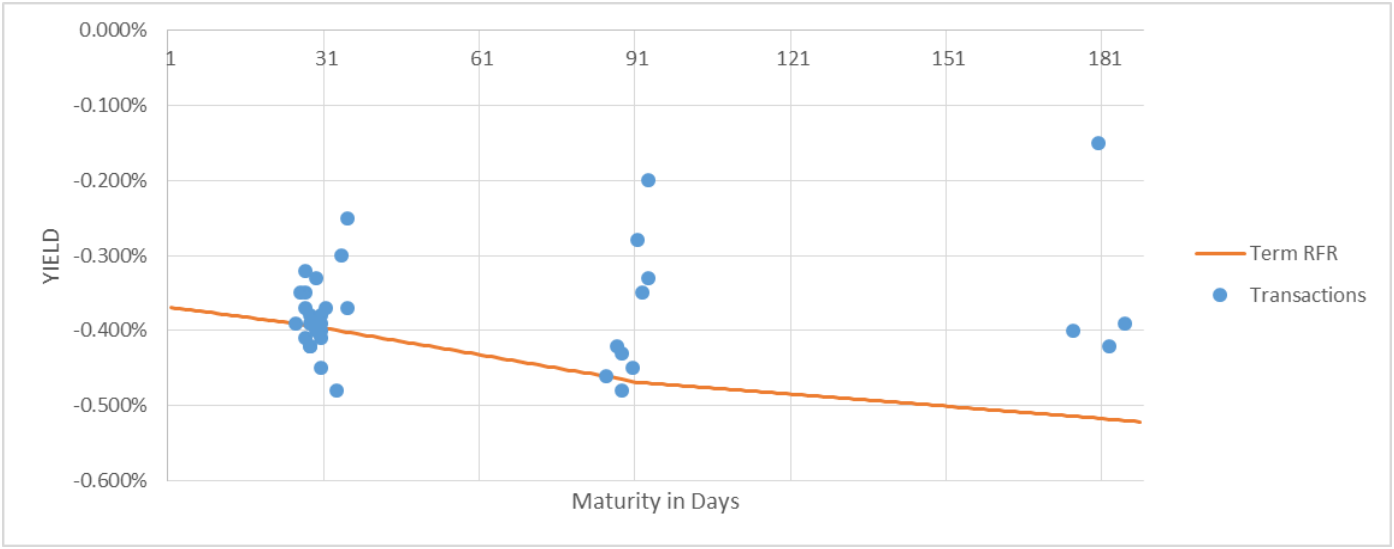
CONS

- × Much higher level of complexity than the Historic Mean/Median approach
- × Reliant on transparent and stable market for data inputs
- × Less accurate than the proposed ISDA methodology
- × Whilst significantly reduced, still potentially vulnerable to be influenced by undue transactions/quotes

Credit spread methodologies

3. Dynamic Credit spread methodology – Overview & Data Analysis

- Transaction data of unsecured short-term bank yield products are collected from the primary (term deposits, CP/CD new issues, etc.) and secondary market (CP/CD traded, bonds, etc.).
- Outliers can be cleansed (criteria for the cleansing still need to be defined).
- The credit/liquidity spread component can be computed by deducting the term RFR yield from the yield of the transaction for each available maturity.
- Finally a credit/liquidity spread can be calculated for each fixing tenor by interpolating and averaging the single data points.
- ICE Benchmarks Administrators have proposed a similar concept for the U.S. Dollar market (U.S. Dollar ICE Bank Yield Index).



Credit spread methodologies

3. Dynamic Credit spread methodology – Conclusions

PROS

- ✓ Key benefit for banks hedging the credit/liquidity risk
- ✓ In case of a fallback scenario, changes in credit/liquidity spreads of the banking industry over time could be implemented
- ✓ As the credit/liquidity spread is changing neither quickly nor frequently, transaction data of more than just one day could be used, for example 5-day rolling, 10-day rolling or even longer periods
- ✓ By aggregating daily transaction data into a rolling period, the volume and diversity of credit data could be improved compared to a daily calculation

CONS

- × Still faces similar challenge with the underlying transaction data as EURIBOR
- × Especially if EURIBOR is discontinued due to lack of available transaction data
- × Based on current observations secondary market data might not add that much additional value
- × Difficult to source transaction data
- × Not considered by trade associations or other working groups