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Agenda item 5: Update by Subgroup 2 on the identification and recommendation of a term structure on RFRs

Fifth meeting of the working group on euro risk-free rates

Frankfurt am Main, 13 September 2018

Subgroup 2 – Progress status overview and next steps

➤ **SG2 progressed significantly on Term Structure methodologies assessment:**

- Forward looking methodologies (Futures based and OIS based)
- Backward looking methodologies (Fixing upfront and Fixing in arrears)

➤ **SG2a, 2b and 2c have worked together to determine the pros and cons of each**

- From an IOSCO Compliance standpoint (in particular wrt principles 6, 7, 8 and 9)
- From a practical implementation standpoint: taking into account how difficult or simple new term structures would be to construct, understand and use

➤ **Impacts of using backward looking rates (fixing in arrears) were also assessed for Loans / Mortgages, Bonds and Securitizations**

We then went on to define new deliverables:

Criterias needed for a methodologies scorecard	**Consultation on Term Structure Methodologies**

And organise coordination with SG3 and SG4

Subgroup 2 – Remaining uncertainties

EONIA Transition path:

➢ **Not chosen yet, but key to the creation of a liquid derivatives market, which in turn is key to the creation of a forward looking rate**

BMR Compliance of the Euribor Hybrid methodology:

➢ **Not decided yet, but will determine the pace of the Euribor transition**

Which legal and/or regulatory framework will support the transition

The outcome of the ongoing ISDA Consultation on Fallbacks

EONIA Transition path ?	EURIBOR Hybrid BMR Compliant ?	Legal / Regulatory framework to support the transition ?

Working Group Meeting – 13.09.2018

Subgroups 2A, B and C - update on work progress

00 Subgroup 2B Analysis of compliance with IOSCO principles of Subgroup 2A methodologies

01 Futures based methodology

02 OIS quote based methodology

03 OIS transaction based methodology

04 Backward looking methodologies

05 Methodologies compared

06 Subgroup 2C Overview of term structure selection criteria

Subgroup 2B Analysis of compliance with IOSCO principles of Subgroup 2A methodologies

Analysis based on options presented in the July 11 RFR Session

- **Forward looking**
  - An important consideration regarding Forward-looking methodologies is the **lack of information about market volumes** (IOSCO Principle 7) since these markets do not exist yet. WG2A is trying to obtain a proxy based on current OIS and Futures market depth.
  - Compared to backward looking methodologies that are calculated from an RFR, the **role of an Administrator is highly recommended** for forward looking benchmark methodologies, even if this role would be less necessary if the methodology was based on a simple closing price on the futures market
  - **Taking the above points into consideration and based on the information received by SG2B there is nothing in any the options proposed that would prevent and administrator to comply with the IOSCO princip**les


- **Backward looking**
  - These methodologies are based on simple mathematical calculations based on the overnight RFR**.**
  - **There is nothing in any the options proposed that would be against the IOSCO Principles**
  - However, in order to increase the robustness of the RFR as a replacement of current term rates, it would be very helpful if the **RFR administrator or an appointed calculation agent were to timely publish the backward looking computations** of the most common tenors (i.e. 1, 3, 6 and 12 month) to increase market transparency, reduce information asymmetries and facilitate operational issues.

  - There has been an issue raised regarding potential **legal issues** (not related to BMR or IOSCO) when backward methdologies are calculated with a compounded methodology (particularly regarding comsumer protection laws). We have asked WG3 to look into this issue.

Futures based methodology

Description (1/2)

The model uses a sequence of overlapping futures to extract the expected levels of the RFR between the ECB dates.
THIS MODEL IS BASED ON CERTAIN SIMPLIFICATIONS AND THEREFORE WILL RESULT IN A NATURAL BASIS WITH THE OIS MARKET BECAUSE OF THE ASSUMPTIONS BELOW.
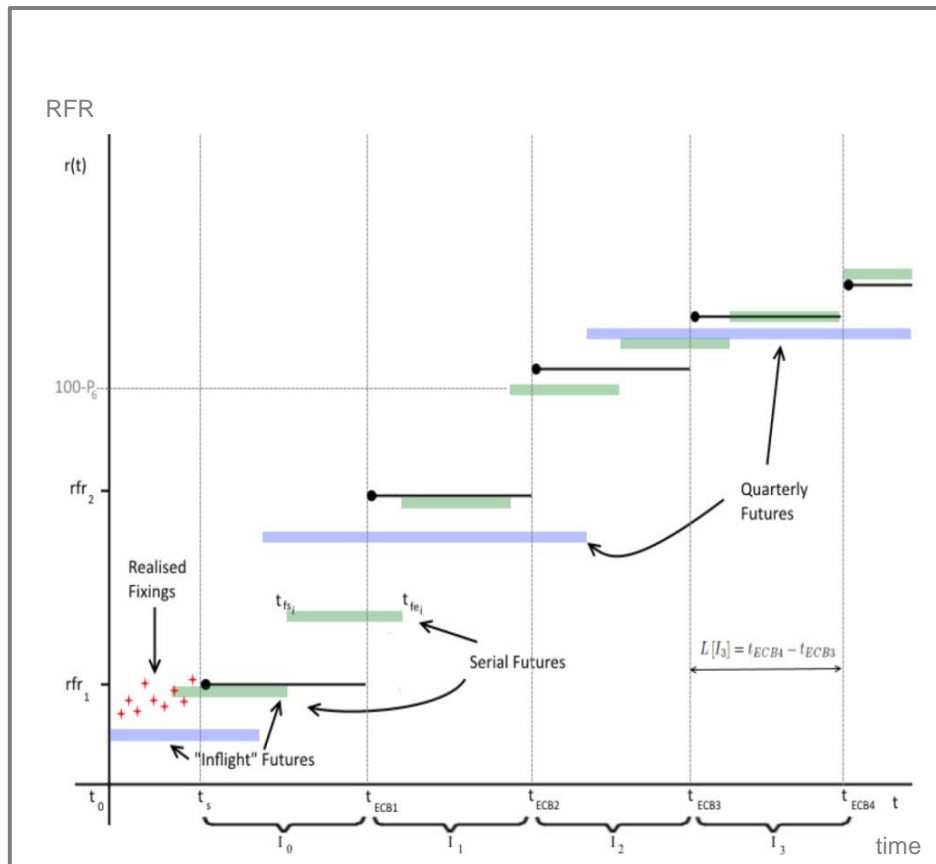
Assumptions

Liquid futures market

- There is a liquid futures market in the new RFR and this contains both monthly (serial) and quarterly futures

Risk-free rate

- The risk-free rate is assumed to be constant between ECB monetary policy decisions, which consequently implies that the dates are known in advance

No turn effects

- There are no turn effects included for end of month/quarter/year

Scale factor

- A scale factor must be applied to the model in order to make it fit economic theory

6

Futures based methodology

Description (2/2)

Taking a closer look at a specific interval the methodology becomes more apparent. The sensitivities of all the futures, which intersect with the interval between two ECB dates, are computed and used to solve for the forward compounded RFR. However, this alone will not produce an optimal solution therefore additional optimisation constraints must be introduced to the model.
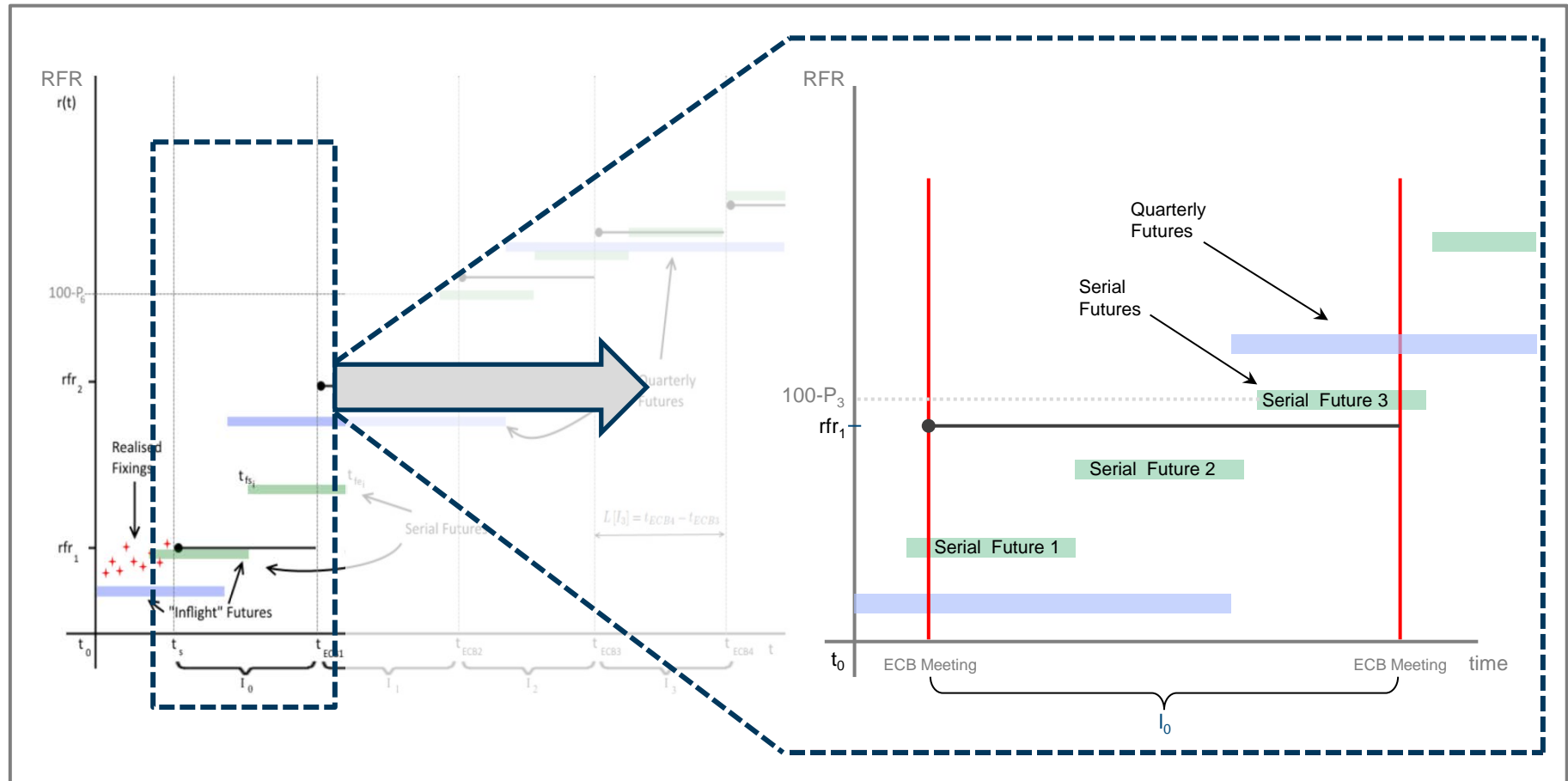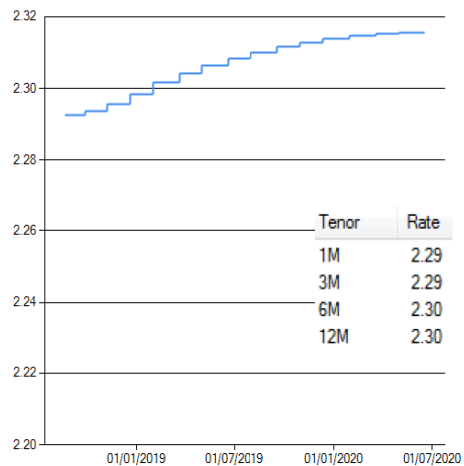
Futures based methodology

Constraining the model

For the model to be coherent with the economic theory of periodical and monotonic increases or decreases, two distinct constraints using a minimization process are applied to make the model consistent. To show the difference in approaches, extreme values have been assumed for the scale factor.[1]

"Delta / First Derivative"	"Convexity / Second Derivative"

Jump constraint

Tenor	Rate
1M	2.29
3M	2.29
6M	2.30
12M	2.30

Curvature constraint

Tenor	Rate
1M	2.03
3M	2.08
6M	2.16
12M	2.29

The jump sizes of the term rate are minimized, making the jumps in between intervals smaller. Central banks do not usually increase or decrease rates at one policy meeting by large amounts.	The curvature of the term rate is approximated to zero, making the function quasi linear. Normally, central banks hike in similar increments.

1…If a sensible value for the scale factor is chosen, there is minimal impact on the output term rate.

Futures based methodology

Pros & cons

+	**-**
• Forward looking	• Model risk related to the model calibration
• Simple to implement	• Reliant on liquid Future markets
• Transparent and robust	• Understanding for the real economy potentially challenging
• Rate directly reconstructable by market participants	• Model assumptions may not match economic reality
• Based on a heavily regulated underlying market	• An administrator may not be comfortable with the influence they have on the model
• Less open to manipulation	

OIS quote based methodology

Description

The term rate represents the mid-price for OIS based on the RFR in EUR for the maturities 1m, 3m, 6m and 12m to be calculated automatically based on an algorithm with built in integrity protection measures, e.g. using randomised snapshots during a given data collection window applying liquidity checks, outlier cleansing, quality weightings, etc.

Tradeable Quotes

Trading Venue 1

Sell	0.87	15m
Buy	0.81	10m

Trading Venue 2

Sell	0.88	5m
Buy	0.82	5m

...

Trading Venue n

Sell	0.85	10m
Buy	0.80	20m

Global Order Book

Buy	Price	Sell
	0.88	5m
	0.87	15m
	0.86	
	0.85	10m
	0.84	
	0.83	
5m	0.82	
10m	0.81	
20m	0.80	
	0.79	

VW Sell = 0.862

VW Mid = 0.835

VW Buy = 0.808

'Fill' 25m

*
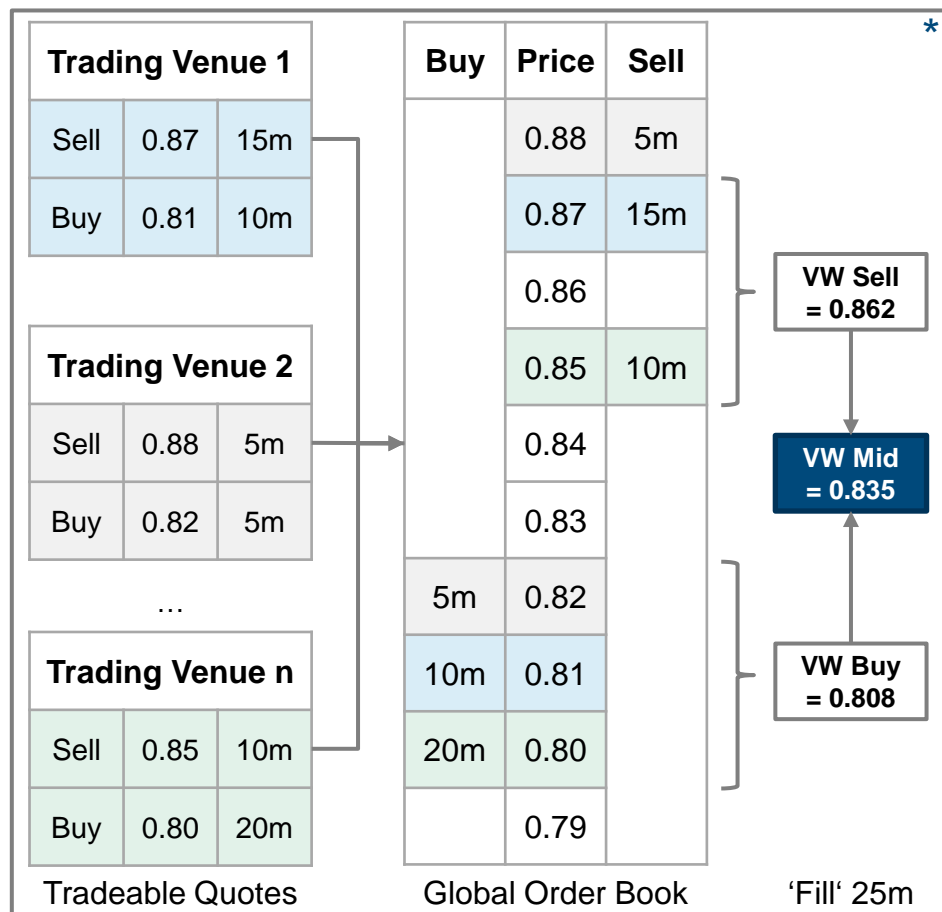
- Daily publication at 11 AM is recommended for the term rate for consistency with EURIBOR / Hybrid EURIBOR.
- The term rate on RFR is to be calculated on firm tradeable/committed quotes.
- Regulated electronic trading venues (i.e. MTFs) are considered the suitable data sources for the calculation of the term rate on RFR.
- The duration of the data collection window is to be decided:
  - A very short window (2 minutes for example) implying a point in time fixing may be more supportive for the derivative market
  - A longer time window (1 day for example) would be more consistent with the proposed EURIBOR Hybrid methodology

*…the method shown here is for the ICE Swap rate based on the IBA presentation given to SG2A on 01.08.2018

OIS quote based methodology

Pros & cons

+	-
• Forward looking • Robust even when only a limited number of actual transactions available • Basic methodology already in use for BMR/IOSCO benchmarks (for example ICE Swap rate) • Underlying data comes from heavily regulated sources	• Not based on actual transactions • Reliant on dealers providing liquidity on individual electronic trading platforms with tight bid/ask pricing

OIS transaction based methodology

Description and pros & cons

- Methodology clearly heavily dependant on volumes actually transacted in the market
- As discussed in previous meetings the source of the transaction data becomes additionally critical
- If limited actual volume in spot based transactions which is very common in the OIS market, forward starting transactions could be used but raises similar complexity to the futures based methodology already discussed
- Sub Group 2C can provide further analysis on the current data supplied by both the ECB (for MMSR data) and LCH.
- **Sub Group 2A will additionally consider a Hybrid method using both firm quotes and transactions**

+	−
- Forward looking - Provided sufficient transactions and volumes are available, least risk of manipulation - Simple to understand	- Reliant on sufficient volumes in spot transactions - Reliant on sufficient activity in the market in all monetary policy conditions - Not suitable for a point in time fixing

MMSR Data

- **Average daily turnover**, for both spot and non-spot starting dates of Vanilla OIS (fixed vs EONIA).

€ mn	Tenor					Totals	
	1M	**3M**	**6M**	**12M**	**Other**	**Volumes**	**# trades**
Spot	2,081	5,279	1,949	1,643	14,078	25,030	
Avg # trades	2	7	4	7	62		82
Non-Spot	783	6,035	427	1,057	8,538	16,840	
Avg # trades	0	4	1	3	19		27
Average						**41,870**	**109**
Minimum						**n.a.[1]**	**22**
Maximum						**185,529**	**328**

- Period under consideration: 01 July 2017 – 30 June 2018.
- Note: forward tenors are approximations as follows: 1M 28-32 days after settlement, 3M 88-92 days, 6M 170-190 days; 12M 350-370 days. Spot tenors are precise. Averaging over the number of business days in the period.
- [1] The amount cannot be displayed as it conflicts with confidentiality rules.

- Number of consecutive days with no activity: 0
- Number of MMSR reporting agents trading at least once in the timeframe: 39
- Number of MMSR reporting agents per day

Average number **of agents**	Minimum number	Maximum number
17	9	25

- Concentration of trading activity by group of banks

	Top 3 banks	Second Top 3 banks	Third Top 3 banks	Top 9 banks
Market share in volume X%	51%	19%	12%	82%
Market share in number of trades X%	46%	20%	14%	80%

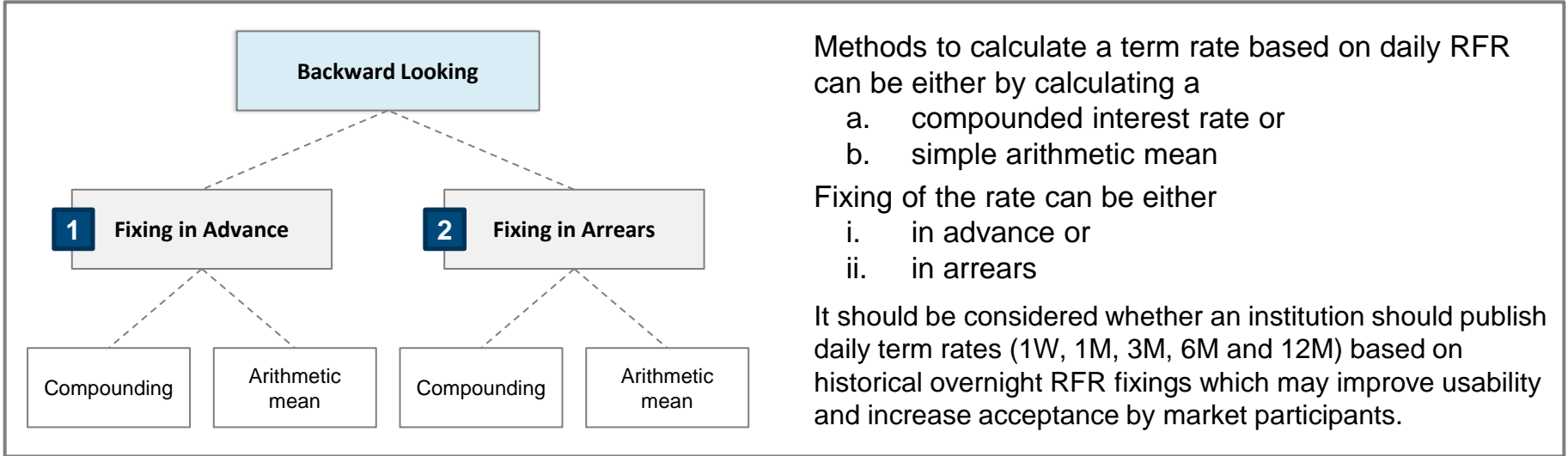# OIS transaction based methodology – Data Sources

Observations

- **We have also received data from LCH, that paints a similar picture, with the exception of significantly larger volumes in the "Non-Spot Other" category.**

- While the data largely speaks for itself, we clarified a couple of things :
    1. "Other" includes all other maturities which may include maturities >1yr.
    2. "Non-spot" is exactly as it says, so includes all forward deals grouped by tenor e.g. in the 3M bucket, you could have 1x4s, 2x5s, 3x6s etc. i.e. it may not be possible to easily aggregate these in terms of rates.
    3. We noted that the top 9 banks account for approx. 80% of the data (82% in volume and 80% in no. of trades).
    4. Breakdown by country was not available.

- Current volumes (over the observation period) may be at subdued levels due to market conditions, monetary policy and regulation. This could change in the future especially with respect to monetary policy.

- There are however, significant daily volumes, that overall, could possibly be used to create a transaction based curve.

Conclusion

- **We are of the opinion that the spot starting data in the main tenors, 1M, 3M, 6M and 12M, is currently insufficient to support a purely transaction based methodology for these tenors.**
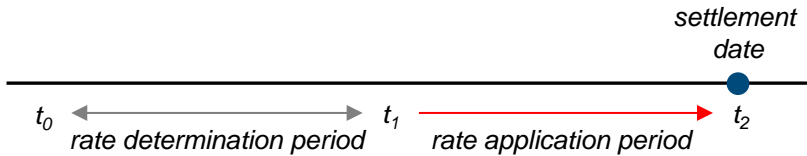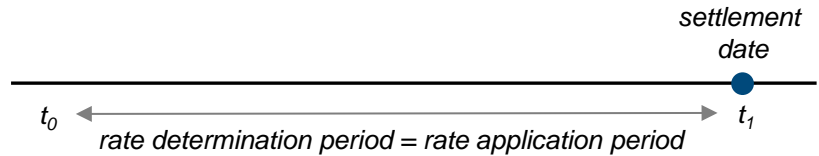
Backward looking methodologies

Description

```
              ┌─────────────────────────┐
              │    Backward Looking      │
              └─────────────────────────┘
               /                        \
        ┌──────────────────┐      ┌──────────────────┐
        │ 1 Fixing in      │      │ 2 Fixing in      │
        │   Advance        │      │   Arrears        │
        └──────────────────┘      └──────────────────┘
          /            \            /            \
   ┌───────────┐  ┌───────────┐ ┌───────────┐ ┌───────────┐
   │Compounding│  │ Arithmetic│ │Compounding│ │ Arithmetic│
   │           │  │   mean    │ │           │ │   mean    │
   └───────────┘  └───────────┘ └───────────┘ └───────────┘
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Methods to calculate a term rate based on daily RFR can be either by calculating a

a. compounded interest rate or
b. simple arithmetic mean

Fixing of the rate can be either

i. in advance or
ii. in arrears

It should be considered whether an institution should publish daily term rates (1W, 1M, 3M, 6M and 12M) based on historical overnight RFR fixings which may improve usability and increase acceptance by market participants.

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1 Fixing in Advance

Where the rate is already known before the accrual period starts based on historical rates:

t_0 ← rate determination period → t_1 → rate application period → t_2 — settlement date

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2 Fixing in Arrears

Where the observation and the accrual period is equivalent

t_0 ← rate determination period = rate application period → t_1 — settlement date

Backward looking methodologies

Pros & cons

	+	**−**
Fixing in Advance	• Very simple calculation • Most market participants are familiar with the calculation method • Likely to be more acceptable to users, specifically Corporate and Retail, as the rate to be applied to their claims would be known in advance • Could be easily published by the administrator of the RFR on a daily basis • In line with the ISDA proposal as described in the consultation paper	• Not forward looking • Unlikely to be accepted by market participants due to the time lag vs the market, meaning (stale and not a current market rate) • Potentially "arbitrage-able" • Backward looking does not reflect expected future rate developments, so fixing in advance might open a gap between underlying and hedging product
Fixing in Arrears	• Very simple calculation • No forward rate needed • Most market participants are familiar with the calculation method • Could be easily published by the administrator of the RFR on a daily basis • Calculation method similar to the pay-out for the hedging instrument OIS • In line with the ISDA proposal as described in the consultation paper	• Some products might need a longer period between fixing and payment, therefore fixing in arrears with a short payment lag will not fit • Potentially challenging for Corporates due to the uncertainty of future cash flows • May require development to change IT systems

Backward looking methodologies – Fixing in Arrears

Impact on Bonds

- Payment of coupons/interest. As the amount of the coupon will only be known one day after period end date, this would be the earliest that the coupon could be paid. This late coupon/interest payment could be an event of default. **Legal docs would need to be looked at in order to avoid this.**

- For EMTN programmes certain conditions have been amended/deleted given the uncertain status of EURIBOR and the impact of BMR. **These need to be adjusted again**. On top of this, it is observed that an interest fixed in arrears may be not be manageable within the existing provisions which rule the adoption of a successor rate on legacy contracts.

- Because of the uncertainty on the accruals (at the trade date one cannot know the accrued coupon), a lag may be applied to the calculations for operational reasons.

- SPPI implications for assets: EIB's recent issuance of a SONIA-linked bond clarified that **such issues can be classified both as FVOCI or as FVHTC** (at amortized cost). We are liaising with IASB for an official position on this.

- Due to the success of the EIB bond and the proposed Fannie Mae SOFR-linked bond, we understand that many users (both issuers and investors) will be able to tackle these issues and a common ground can be found.

- **Accounting and Tax impacts for bonds are still to be assessed; we may take stock of other groups' works for an opinion.**

Backward looking methodologies – Fixing in Arrears

Impact on Securitizations

- Here we may apply the same observations that we made for Bonds, but there is an additional complexity because often the **underlying assets** (mortgages, auto loans, receivables) **are often linked to EURIBOR** tenors. A switch to an O/N index could add a basis risk vs the fall back rate in the underlying transactions, unless also underlying assets would switch to the same ON index <u>in the same timeframe</u>.

Backward looking methodologies

Impact on Loans/Mortgages

- Under a backward-looking RFR, interest payments on term transactions would not be known in advance, and users would need to make two changes: a change from a forward-looking rate to a backward-looking rate as well as a change from an interbank offered rate to a risk-free rate. **For some market participants**, making the change to a backward-looking rate **would be extremely challenging or even impracticable** under several points of view, e.g., front office systems, legal contracts and structures; this is particularly true for SMEs.

- The market could also be offered a choice between forward-looking and backward-looking rates, though this might split liquidity between them. Some participants **may also be reluctant to invest time and money** preparing for backward-looking rates first in the expectation that they may be able to use forward-looking term RFRs, if and when they become sufficiently robust, at a later stage.

Backward looking methodologies

Impact on other instruments

- It is understood that **money market instruments** are typically fixed rate; those floating rate instruments that are linked to Euribor are - by definition – short term, and may be switched to ON-based index, with the same caveats of bonds in term of lag in index observations.

- **Total-Return based products**, or performance based products (e.g. benchmarks for investment funds), typically used in the asset management industry or in pension funds, are by definition backward-looking, therefore there should not be any change vis à vis the present situation.

- **Leasing and Factoring products** may be challenged from switching to an ON based methodology. Some more in depth analysis is requested on this side.

Methodologies compared

Pros & cons

	+	**−**
01 Futures based	• Forward looking • Simple from a modelling perspective • Transparent and robust • Rate directly reconstructable by market participants • Based on a heavily regulated underlying market • Less open to manipulation	• Model risk related to the model calibration • Reliant on liquid Future markets • Understanding for the real economy potentially challenging • Model assumptions may not match economic reality • An administrator may not be comfortable with the influence they have on the model
02 OIS quote based	• Forward looking • Robust even when only a limited number of actual transactions available • Basic methodology already in use for BMR/IOSCO benchmarks (for example ICE Swap rate) • Underlying data comes from heavily regulated sources	• Not based on actual transactions • Reliant on dealers providing liquidity on individual electronic trading platforms with tight bid/ask pricing
03 OIS transaction based	• Forward looking • Provided sufficient transactions and volumes are available, least risk of manipulation • Simple to understand	• Reliant on sufficient volumes in spot transactions • Reliant on sufficient activity in the market in all monetary policy conditions • Not suitable for a point in time fixing
04 Backward looking	• Very simple calculation • Most market participants are familiar with the calculation method • Could be easily published by the administrator of the RFR on a daily basis • Calculation method similar to the pay-out for the hedging instrument OIS • In line with the ISDA proposal as described in the consultation paper	• Some products might need a longer period between fixing and payment, therefore fixing in arrears with a short payment lag will not fit • Backward looking does not reflect expected future rate developments, so fixing in advance might open a gap between underlying and hedging product

Subgroup 2C Overview of term structure selection criteria

01   Term Structure Qualities

02   Term Structure Characteristics

03   Methodological Qualities

04   Governance and Accountability

05   Other Requirements

- Underpinned by a broad base of transactions
- Transactions represent sufficient volume/depth
- Existence of active related markets
- Representative of near risk free bank borrowing costs (at any time), (minimal counterparty risk)
- Reasonably aligned with policy rates
- Underlying interest that the benchmark seeks to measure must be easy to understand
- Eligible transactions clearly defined / accessible data sources
- Calculation methodology easy to understand on a rudimentary basis
- Appropriate euro area representation
- Minimal opportunities for market manipulation