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FROM IBORS TO RFRS: IMPACTS ON BANKS PROCESSES AND PROCEDURES

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AIFIRM – Associazione Italiana Financial Industry Risk Managers

AIFIRM WOULD LIKE TO THANK

Commission coordinators:
Umberto Cherubini (*Università di Bologna*)
Marco Bianchetti (*Intesa Sanpaolo*)

Members of the commission:
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— BUSETTI Maurizio (Numerix)
— CAPIZZANO Alberto
— CASTAGNA Antonio (IASON)
— CASTELLUCCIO Alessandro (ICCREA BANCA)
— CAVALLINI David (CABEL)
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— CIGOLINI Marco (BANCO BPM)
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AIFIRM Commission

The AIFIRM Commission with focus on IBOR Reform has been set up in November 2018 with the aim of sharing the recommendations issued by the ECB Working Groups on the market rates reform and identifying potential impacts on the market participants from an operative point of view.

The Working Group of the Commission is made of participants from the main Italian banks, as well as professionals and consultants concerned in focusing the topic of market rates reforms.

The opinions expressed represent only the point of view of the authors and do not reflect necessarily that of the Institute/Company to which they belong.

The coordination of the Working Group and the preparation of the position paper have been carried out by Umberto Cherubini *(Università di Bologna)*, Marco Bianchetti (*Intesa Sanpaolo*) and Iason Consulting, with the cooperation and organizational support of the PMO KPMG.

The contribution of all participants has been really appreciated.

1. INTRODUCTION: IBORs transition overview

The Inter-Bank Offered Rates (IBORs) have been referenced by a large volume and a broad range of financial products and have been widely used by the market players as benchmarks for an enormous number of market transactions in the last decades, since they have been introduced by the British Bankers' Association in the '80s. The benchmarks are calculated through estimates carried out by contributor panel banks, and they reflect the offered rates for interbank unsecured wholesale deposits by measuring the cost of funding in the banking sector[1].

The use of reference rates as benchmarks is now deeply embedded in the current market since it facilitates the standardization of floating-rates-based contracts and reduces the complexity of pricing different typologies of financial products. However, (i) the decline of liquidity in the interbank unsecured deposits, (ii) the case of attempted market manipulations, since these benchmarks are based on good faith estimates and not on actual transactions, and (iii) the growth of a non-bank centralized financial market, have pushed worldwide authorities, regulators and market players to look for Alternative Reference Rates (ARRs) in order to better reflect the evolution of new market features. In particular the Financial Stability Board (FSB) specified[2] the criteria needed to create the new benchmark rates, which should:

- be robust;
- be anchored in observable market transaction;
- minimize the opportunities of market manipulation.

The benchmark reform is also pushed by market participants' needs of using risk-free or nearly risk-free rates:

- they would make sense for many derivatives transactions due to the greater use of collateral and CCPs clearing in the derivatives market;
- many transactions do not need a reference rate which includes the bank credit risk;
- a reference rate based on the interbank offered rates does not reflect the market's offered rates any longer, as a big portion of the market is constituted by wholesale transactions involving non-bank counterparties.

Each jurisdiction has recognized the importance of the reform and responded with specific regulations.

On June, 8th 2016 the European Union responded by adopting Regulation (EU) 2016/2011 (the Benchmark Regulation or BMR) which translates in a European regulation the principles stated by IOSCO and FSB. Some of the BMR requests, such as the inclusion of fallback clauses in specific type of contracts, are in force since 1st January 2018, while other BMR requests, such as the permission of using the critical benchmarks not compliant to the BMR, will be postponed to December, 31st 2021, as proposed on February 2019: the postponement of the compliance deadline for the BMR will provide two extra years to market participants with respect to the original deadline.

Various working groups have been established to define new reference rates for the different currencies with which IBOR rates are contributed.

The Working Group on Euro Risk-Free Rates made great efforts to provide guidelines and recommendations to market participants, in order to facilitate a smooth transition while considering the different types of impacts that institutions should face (legal, accounting, risk management, etc.).

1.1. Features of the new RFRs and revised benchmarks

Authorities gave guidelines to define the new reference rates in order to meet the market participants'requests of more robust and reliable benchmarks. The new benchmarks:

- they are transaction based
- could be secured or unsecured
- they could reflect the borrowing costs from wholesale market including non-bank counterparties.

The table below reports the main features of the reference risk free rates identified by the authorities to initially side next to the IBORs and eventually substitute them:

Jurisdiction					
Rate	**Euro Short Term Rate (€STR)**	**Secured Overnight Financing Rate (SOFR)**	**Reformed SONIA**	**Reformed SARON**	**Reformed TONAR**
Working Group	Working Group on Euro RFR for the Euro area	Alternative Reference Rates Committee	Working Group on Sterling Risk-Free Reference Rates	National Working Group on Swiss Franc Ref. Rate	Study Group on Risk-Free Reference Rates
Rate administrator	European Central Bank	Federal Reserve Bank of NY	Bank of England	SIX Swiss Exchange	Bank of Japan
Live	Pre-€STR: 15/3/2017 €STR: Oct. 2019	3 April 2018	Yes	Yes	Yes
Transition plan	No	Yes	No	No	No
Tenor	Overnight	Overnight	Overnight	Overnight	Overnight
Secured	No	Yes	No	Yes	No
Publication time	T+1 (8:00 CET)	T+1 (8:30 ET)	T+1 (9:00 GMT)	T (12:00, 16:00, 18:00 CET)	T (17:15 JST)
Market	EUR borrowing cost in the wholesale sector from MMSR banks	USD loans collateralized by Treasury Securities	GBP borrowing wholesale bilateral or broker transactions	CHF interbank repo transactions	JPY uncollateralized overnight call rate market
Data	Data from MMSR, size > 1 mln€	Data from BNYM and DTCC	Data from Sterling Money Market daily collection	Data from the order book of SIX Repo Ltd electronic trading platform	Data provided by money market brokers
Formula	Volume-weighted trimmed average (25%)	Volume-weighted trimmed average	Volume-weighted trimmed average (25%)	Volume-weighted average	Volume-weighted average

The reformed RFRs enhance some current benchmarks weak features:

- they are now rooted deeper in the market than the former reference free rates (example EONIA and €STR) because of the inclusion of non-bank counterparties deals;
- volumes increased considerably by introducing non-bank counterparties deals with the aim of improving the weakness of the data set due to low bank deposits activities, thus creating more robust benchmarks;
- the spread between the RFRs and the predecessors seems to be stable although the value of the reformed RFRs is lower due to both borrowing costs from non-bank deposits - which cannot use the central bank deposit - and secured transactions included in the data-set in some cases.

Regarding EURO area, some of the key properties of pre-€STR, that led the Working Group to recommend €STR as euro risk-free rate on 13th September 2018, are:

- it displayed significant and steady volumes, markedly above EONIA volumes. On average, around 30 banks report data each day out of a pool of 52 MMSR reporting banks, which ensures that there is sufficient underlying data to calculate a reliable rate;
- its performance, compared with that of EONIA over the period mid-March 2017 to end-July 2018, showed that pre-€STR was very stable with an average daily volatility of just 0.4 basis point, it reflected actual market moves (rather than idiosyncratic factors) and was trading at a stable spread of around 9 basis points below EONIA, reflecting transactions with a broad range of financial corporations, not just banks, with their expectations and opportunity costs.

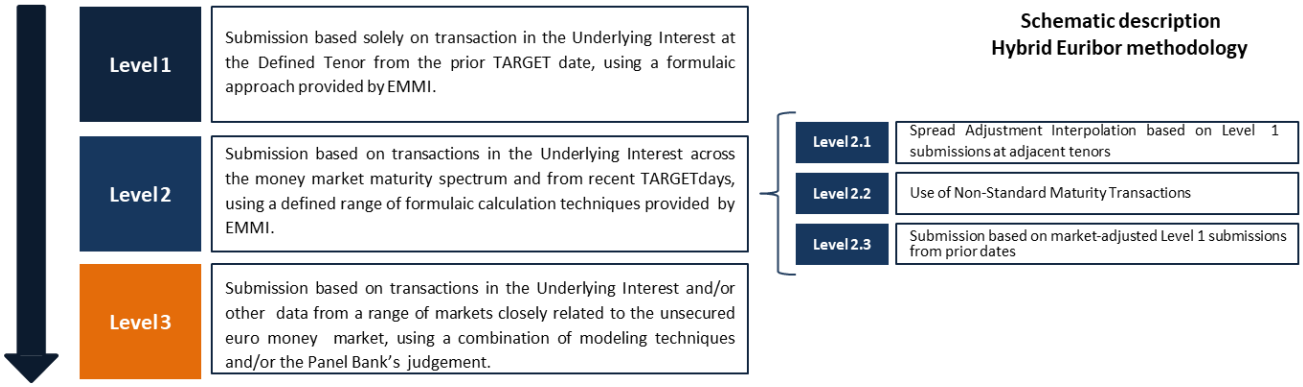
The ECB provided a one-off spread between €STR and EONIA of 8.5 bps, calculated as the arithmetic average of the daily spread between EONIA and pre-€STR (data from 17/04/2018 until 16/04/2019), after removing the 15% of observations from the top and the bottom of the sorted series.

From the 2nd October 2019, €STR has started to be published and from the 1st October 2019 EONIA rate is computed basing on a "recalibrated methodology" as follow:

Euro Short-Term Rate (€STR) + 8.5 bps

While EONIA was published at 19.00 CET on each business day (T), €STR is published at 8:00 CET on the next business day (T+1). In case of errors in the €STR calculation that affect the rate value by more than 2 bps, €STR will be revised and re-published on the same day at 09:00 CET. As a consequence of the recalibrated methodology, EONIA is published on the next business day (T+1) at 9:15 CET.

EURIBOR rate will continue to be published, but its methodology has been revised and by the end of 2019 all panel banks will contribute their data following the "hybrid" determination methodology developed by EMMI, based on a 3 levels hierarchy:



The ECB WG recommended to use the €STR term structure as a fallback to EURIBOR.

1.2. Timeline for the transition to RFR

The table below reports the main milestones of the transition from old benchmarks to new RFRs:

EUROPEAN UNION	
February 2018	• *Set-up of the working group on euro risk-free rates*
May 2018	• *ECB announces €STR*
June 2018	• *First public consultation on the assessment of candidate euro risk-free rates*
August 2018	• *Summary of responses to the first public consultation*
September 2018	• *WG on euro risk-free rates recommends ESTER as euro risk-free rate* • *High-level implementation plan*
December 2018	• *Report on the transition from EONIA to ESTER* • *Second public consultation on determining an ESTER-based term structure methodology as a fallback in EURIBOR-linked contracts*
January 2019	• *Guiding principles for fallback provisions in new contracts for euro-denominated cash products*
March 2019	• *Recommendations on the transition path from EONIA to €STR and on a €STR-based forward-looking term structure methodology* • *EMMI cessation 30/360, ACT/365 basis*
July 2019	• *Recommendations on the EONIA to €STR legal action plan*
August 2019	• *ISDA publication on pre-cessation issues for LIBOR and certain other interbank offered rates* • *Report on the impact of the transition from EONIA to the €STR on cash and derivatives products*
October 2019	• *€STR publication begins (02/10/2019)* • *EONIA recalibrated as €STR + spread*
November 2019	• *Reports on financial accounting implications and fallbacks provisions*
December 2019	• *Hybrid Euribor phase-in by conclusion*
June 2020	• *LCH and EUREX will switch to €STR for EUR collateral remuneration for cleared derivatives trades*
December 2021	• *Recalibrated EONIA will be discontinued*
USA	
April 2018	• *FED begins SOFR publication*
Q1 2019	• *Cleared SOFR OIS trading* • *ISDA derivatives protocol launches*

Q2 2019	• *Amendment of 2006 ISDA definitions* • *Publication of 2019 ISDA definitions*
July 2020	• *LCH will switch to SOFR for USD collateral remuneration for cleared derivatives trades*
October 2020	• *CME will switch to SOFR for USD collateral remuneration for cleared derivatives trades*
Q2 2021	• *CCPs no longer accept new swap contracts for clearing with EFFR as PAI and discounting*
UK	
April 2018	• *BoE reform enters into force, reformed SONIA publication begins*
2019	• *Development of operational capability for SONIA-referencing FRNs, loans and other instruments;* • *Term benchmark rate produced and made available to use (subject to outcome of consultation);* • *GBP fall-back language agreed and implementation begins*
2020-2021	• *Transition and fallback plans in place*
January 2022	• *Libor production no longer guaranteed by FCA*
SWITZERLAND	
2017	• *SARON swap Market is active* • *LCH clear SARON swaps*
December 2017	• *Discontinuation of TOIS fixing and replacement with SARON*
June 2019	• *NWG recommended to use a compounded SARON as a term rate wherever possible*
JAPAN	
December 2016	• *TONAR is selected as preferred alternative RFR for JPY*
July 2019	• *Announcement of a Task Force to be established in order to realize the calculation of robust Term Reference Rates and making them a credible benchmark*
Q2 2021	• *Calculation and publication of "production" rates*

2. Introduction of the risk scenarios: a first overview of impacts on procedures and processes

The IBORs transition has several impacts on internal procedures and processes present in each financial institution and these impacts can be clustered around four different risk scenarios:

- **Publication from T to T+1:** defined T as the Target Day in which market transactions are observed, all new RFRs publication dates are shifted to T+1 from the current T. This scenario has been already observed with EONIA reform, where the EONIA+ (the EONIA obtained summing €STR and a fixed 8.5 basis points spread) and the new RFR "€STR" are published by 9:30am at T+1 while the old benchmark EONIA was published at 7:00pm at T. The same shift was applied also to SONIA when its reform took place in 2018.

- **Yield curve management and valuation issues:** the new RFRs demand new yield curves with new economic properties. This translates into higher efforts for IT systems in creating and managing them, taking into account implementation needed in the pricing phase due to the new term rates modelling[3]. IT systems should be configured to recognize and use the more appropriate curve with economic properties that suit trade-specific features.

- **Migration from IBORs' to RFRs:** IT systems capacity may be not enough to manage a massive transition from the IBORs to RFRs in a short time. This case could be tested by banks with the €STR reform, which demands in the 2020 a massive migration of all cleared derivatives contracts from the EONIA to €STR discounting in a single day when the CCPs will decide the migration will take place (current planned date is 22nd June 2020). In 2022 we will assist to a bigger migration when current IBOR benchmarks won't be published anymore and all contracts referenced to them will have to fallback on RFRs designated to substitute them.

- **Fallback Clause:** since 1st January 2018 the Benchmark Regulation obligates the contracts to include a fallback clause specifying which reference rates should be used when IBORs won't be available anymore. This implies that procedures should recognize the fallback clause when necessary. Also, the quantitative aspects of remuneration should be explained by a clear framework that can be applied to software in order to calculate the correct remuneration of the contracts affected by the transition.

3. Risk Scenario 1: fixing from T to T+1

The benchmark reform redesigns the calculation framework for new RFRs including real transactions that happened on a specific date and the new methodology is more time-consuming since the volume of transactions to be processed will be higher. The result is a delay in the publication date of the RFRs, from the current day T to T+1 in order to have more robust and reliable value (example, USD overnight benchmark "SOFR" and the overnight euro-area benchmark "€STR"). Once the benchmark reform is completed, the procedures need to be configured to process the new rates published in delay with respect to the current ones which affects institution processes too.

3.1. Impacts on the procedures and processes

The publication at T+1 lead to impacts on daily banks' operations:

- the procedures need to recognize the differences between the value date and fixing date since this information is needed for both End of Day (EoD) and End of Month (EoM) activities; taking the wrong value may lead to wrong calculation of settlement payments.
- there could be issues in correctly handling outstanding deals calculations linked to difficulties in managing the past history of the deal linked to current market conventions.
- being the procedures in the IT architecture heavily interconnected with each other, any change affects other applications in the same layer and the ones connected downstream.
- Back and Middle office teams have shorter time to check the settlement amounts so they will have to improve the efficiency of their processes.

For this reason different bank departments are requested to have a very high level of synchronization in the procedure's configurations and elevated inter/intra-departments communication since one single strategy is necessary in the whole financial institution in order to face successfully the benchmark reform.

3.1.1. Fixing T+1: Value date vs fixing date

The EONIA reform presents similarity with the SONIA reform: in the past SONIA had the same fixing and publication date in T and when it was reformed in April 2018 started being published in T+1.

Currently IBORs are published in T and they have value date in T+2[4]. After the reform, the natural IBORs' replacement (e.g. the O/N reference benchmarks) are published in T+1 but are referred to T, requiring new configurations to correctly handle them in the procedures. There are two main impacts:

- **Misrepresentation of settlement amounts:** procedures must be able to manage the different publication time to avoid wrong settlement and the intra-day re-running of the procedures – which are very expensive and time-consuming for financial institutions.

This can be faced:

  - by modifying the procedure in order to recognize the correct fixing value, and
  - by changing the scheduling of the data flow (this solution can be applied only if the procedure is not at the beginning of the layer or on the critical path of time-constrained processes).

However some procedures are already fed with the fixing value published in T+1 (the day after the data observation) and they do not need any reconfiguration of the process to understand the correct fixing date. In any case, also these procedures must review their dataflow time by rescheduling it of few hours.

- **Losing outstanding deals information:** many procedures are not able to classify the same deal with two different fixing conventions and IT systems may be affected by errors when they try to rebuild the past cashflows when the fixing convention has been already switched to the new one. There are three main simple technical recommendations to be taken into account for this:
    - Create a linked table where the old value date and fixing date are recorded (in this way the software takes the information needed by reading this auxiliary table).
    - Enhance the software in order to be able to associate two different conventions to different parts of the life of the same deal.
    - Close all outstanding deals with the former convention and reopen them with the new one using market operation procedures (if IT systems allow this approach)

3.1.2. Fixing T+1: re-scheduling of the daily operations

Processes: Scenario T+1 causes direct impacts on the banks' processes due to the delay in the publication rate. Different bank layers are affected in different ways, and the table below shows possible impacts and the possible recommendations to be taken:

Bank Layer	Possible Impacts on Processes	Possible Recommendations / Actions to be taken
Accounting&Settlement	• Reduced time for the EoD/EoM process • Delayed data-flow and possible impacts on business daily operations	• Use proxy-rate and rerun intraday once the fixing is available • Reschedule daily operations • Use previous day fixing
Funding&Loans	• Reduced time for interest rates and payments calculation	• Changes in market conventions • Restructure data-flow process
Risk Management	• Delay in risk measurement • Reduced time for daily operations (e.g. market data validation/bootstrap of curves)	• Minimize the impacts on the risk measurement process by internal strategic decisions
Current Accounts	• Delay in the interest rates calculation • Delay in liquidation of current accounts • Delay in data flow	• Reschedule of daily operations • Different market conventions
Collateral&Clearing	• Delay in collateral interest payments • Delay in settlement of transactions	• Intraday rerun when fixing is available • Postpone interest calculation

	• Reduced time for users to validate processes outcomes	• Use old fixing and calculate delta (correction payment) for the settlement of floating rate repos (ICMA guidelines)
Staff Unit	• Differences between daily and monthly metrics due to different strategic decisions taken by the different department • Delay in data flow between different departments	• Reorganize dataflow • Reorganize daily process to meet different departments requirements • Reschedule overall processes belonging to different layers

There are also some further recommendations to be followed across the whole bank in order to have an efficient migration strategy:

- **Market conventions:** processes in the settlement must be able to inherit the new market conventions. The delay in the settlement can bring both higher litigation costs and decline in commissions which could affect the profit of the banks. For example, the floating rate repos settlement process has been affected by the delay in the publication time introduced with the EONIA reform, leading the market participants to follow the ICMA memorandum[5] in using the last available fixing in the IT system instead of the correct rate. This recommendation is used for the so-called "Repos Rolling", as they pay interest on the cash flows before the maturity of the instrument. This convention helps the market players with quick win solutions. Yet, in order to avoid litigation and legal risk, the cashflow adjustment is introduced to potentially compensate one of the counterparties involved in the transaction for the partially wrong market value calculation linked to the use of a different fixing from the correct one.

- **EoD vs EoM layers:** Some processes run on a daily basis, while others have monthly frequency, but both of them have to report consistent accounting measures to regulators and stakeholders. It is very risky if all procedures either do not communicate among them or do not use the same conventions because their figures won't match in final accounting reports, possibly leading to inconsistent risk measures and divergences between monthly/yearly accounting results and daily managerial P&L calculation. This can be translated in higher regulatory costs, regulators' fines and further expensive implementations to be done to align procedures.

- **Technological limitations:** Departments may have adopted different IT solution during the years, and the benchmark reform is showing the weakness of some of them. Some solutions realized in the past would need to undergo expensive implementations and changes in the framework that calculates amounts used to settle financial contracts. Also, some procedures would need enhancements to allow a rerun during the day. The impacts on procedures affect the bank processes, leading financial institutions to a trade-off between investing in technological enhancements and redesign their processes to enhance them to fit to the new conventions.

- **Changing the process policy:** Some departments can decide to use different benchmarks to pay back interest on selected depos and loans. This solution may be used in accounting layers where banks may use the last available fixing to close the EoM accounting process, but is very risky from a regulatory point of view because it can lead to inconsistencies.

Box A: Analysis of impacts on Fast-Closing process

Fast-Closing Process *is one accounting activity affected by the Benchmark transition due to delay of the benchmark publication. This case has been analyzed during the EONIA and €STR transition, but the risk scenario can be replicated for other IBORs transitions.*

Each month, financial institutions close their monthly accounting process by the first 7 days of the following month. The delay in the rate publication causes a reduction of the available time to complete the Fast Closing process. The process is probably the most interconnected one since it links several different departments belonging to the same bank. Several procedures are involved in order to aggregate all the bank operations: Front Office systems, settlement procedures, trading applications and many others. This network is highly synchronized, and the timeline to complete the whole calculation is very tight. Indeed, working environments are only available for a short time as many of them are used for daily batch operations too. The change in the publication time will imply a review of the process' timeline in order to acquire the last fixing of the month in the monthly data-set.

Here there is a brief description of the stages composing the Fast-Closing process and how they are impacted by the benchmark transition.

1. **Dump of the data-set:** at the end of last working day, the Front Office systems stop recording the new deals and applications backup the monthly data in specific **End-of-Month-environments** (a database used for this specific scope), where the data are processed – this solution avoids disturbing the daily batch processes. After the IBORs transition, the End-of-Month Environments **have to wait** until the next day in order to include the last fixing of the month. Different recommendations may be used to face it. The most used solutions are (i) to **exclude** the last fixing or (ii) to shorten the **fast-closing process** of twelve hours. The first solution is the less expensive but may not match the regulators demands.

   *Impacts***:** depending on the accounting policy of financial institutions.

2. **Curves Validation:** The last day of the month, the discounting/forwarding **curves are freezed,** and they are sent to the procedures using them in the fast-closing calculations. The certification is made by the risk department following its own Fair Value policy. After the benchmark transition, the fair value policy could make changes to consider the new scenario at T+1.

   *Impacts***:** depending on the fair value policy.

3. **Data-check**: After the back-up and after the data-flow transmission in the EoM environment, the data-set undergoes a data-check in order to analyze if the data quality is as good as recorded in the batch environment (it means no data has been destroyed/corrupted during the transmission). IBOR transition has no direct impact in this phase, but definitely a **rescheduling of the data-flow** is required.

   Impacts: depending on the timeline of fast closing processes.

4. **Aggregation of the data:** in EoM environment the data set is built from contributions coming from several different departments of the institution. It means all the procedures in different layers need to be **synchronized** and need to follow the same timeline. The scenario T+1 demands all the departments to coordinate to ensure that data-flow consider the last rate of the month in all procedures.

   *Impacts***:** need of highly synchronized procedures.

5. **Final check on the data:** unless former procedures caused errors that corrupt the data flow, the final check of the aggregated data should not present impacts.

   Impacts: depending on the delay in the former layers of the whole process.

4. Risk Scenario 2: Discounting Curves and Valuation

The IBORs transition affects the discounting methodology and change curves economic properties, in some cases requiring adaptations also in the pricing process. In parallel also reference rates used to calculate floating coupons could be affected by the transition and the procedures of financial institutions need to be enhanced and configured in order to correctly face the new setup.

4.1. Impacts on the process and procedures

The bank's procedures need two main pieces of information to manage the Discounting Cash Flow (DCF) process for valuation purposes: the schedule of future payments and the discounting curves.

Contractual cashflows could be based either on the outcome of the market price formation process leveraging on the liquidity of the ARRs-linked products[6] (*forward looking*), or on realized rates referring to the past (*backward looking*):

- The first option relies on the information contained in current market prices and is already available at the beginning of the coupon period, like it happens currently for IBORs
- The second one leverages on compounded overnight rates and thus it is known only at the end of the same period but can ensure lower coupons volatility, like we're seeing for first SONIA-linked FRNs
- There is a third option that is based on realized O/N rates and for which the rate is known at the beginning of the period: this happens when backward looking calculation is performed on a different period from the real coupon one; by the way this is not considered a viable option since contractual coupon value is not in line with the real economic value of the payment.

In order to evaluate financial instruments we need to discount contractual cashflows from payment dates to today and to do so we need to have proper discounting curves derived from information contained in liquid vanilla market instruments.

The IBORs reform can be challenging for yield curves management for different reasons:

- Illiquidity of the market: in such scenario the procedures cannot build the discounting curves based on the outcome of the market price formation process because a liquid derivatives market doesn't exist yet. This may create difficulties also in the pricing of Unsecured and Secured cash product, where market participants would like to know coupon payments in advance and in some specific cases demand a forward-looking methodology in order to capture the cost of funding of the bank for longer horizon-time maturities.
- In the procedures, each financial product is classified by a code used to link the term rate on the discounting curves: if the RFR-linked products are not liquid enough we cannot build the curves, the term rates cannot be filled, and the pricing process fails. But the liquidity of the market is an example of the so-called "chicken-and-eggs"[7] problem, as the cash market is difficult to develop in absence of liquidity hedging derivatives and vice-versa. For this reason market players are recommended to cooperate in order create a liquid market for both derivatives and cash instruments.
- Clean vs Dual discounting methodology: the introduction of the new ARRs[8] could lead to problems linked to the choice between clean and dual discounting methodologies during the transition time. The clean methodology means one single discounting regime for one counterparty, while the dual methodology means using different discounting curves at the same time with the same counterparty.
- Even though the dual discounting could be the cleanest way to treat legacy and new RFR-linked product to two different benchmarks, it highly affects the procedures of the bank for calculations depending on discounting curves like the creation of volatility surfaces and this can lead to different prices calculated for instruments with very similar contractual cashflows. These reasons are pushing financial institutions and banks to opt for one single discounting regime and most probably the big switch will be triggered by the change in the rate used for collateral remuneration and Price Alignment

Interest (PAI) calculation at central CCP (currently planned for LCH and EUREX on June 22nd 2020[i]). For the EONIA transaction in Euro currency, the European Working group recommend using the clean discounting methodology (see paragraph 3.1.1.).

- Economic properties of the discounting curves: IBORs reform is highly challenging for the management of the discounting curves due to the different economic properties[9] underlying the new benchmarks that are not anymore representing the riskiness of the banking sector due to the broadened scope of transactions considered during fixing calculation. Banks need to assess how the changes in the curves' properties affect their internal and compensations models in the pricing process, such as the cash compensations, the Liquidity Spread, the Credit spread, the spread between the risk free rates benchmarks (EONIA under the ISDA definition 2006 and EONIA estimated by the FROs). All these adjustments could create deep impacts in the procedures underlying the most important banks' processes.

Box B: Focus on modelling in-arrears term rates and its IT impacts

IBORs reform will lead to new reference rates to be used for floating payments calculation since the current IBORs indices will not exist anymore. The main options on the table are using a backward-looking or forward-looking rate. While the first methodology is based on a compounded-in-arrears term rate, where the simplest model is obtained by the geometrical average of the realized rates of the past, the forward-looking methodology is based on the market-based price formation process and there are trade-offs in choosing one methodology instead of the other:

- Backward-looking: this methodology allows to obtain the term rates of the curve by the daily compounding of the realized term rate of the past. Being the backward-looking based on the compounded-in-arrears models with realized rates, it cannot reflect the volatility of the current rate due to its smoothness linked to the geometric averaging. This methodology application is questioned because the rate is known only at the end of the period and a treasurer would prefer to know payment amounts in advance.
- Forward-looking: this methodology uses indices built on prices quoted on the market relying on the so called market prices formation price process. For instruments with cashflows linked to forward-looking indices the rates are known at the beginning of the coupon period and they reflect the market expectations. The forward-looking term rates based on the unsecured cash products capture the fluctuations in term of financial system funding levels and they represent the market players perceive the interest rates referred to the upcoming times. The forward-looking term rate based on the market-implied prediction of derivatives captures the volatility of the interest rate in the future, and they do not include the cost of funding.

The forward-looking term rates based on RFRs linked derivatives present structural differences with the single-curve Libor market model forward rates, as they do not include any credit risk premium due to their risk-free rates status. Forward term-rates of the O/N benchmarks can be modeled jointly with the backward-looking compounded-in-arrears rates in the same interest rate pricing model which has been "rebranded" as Forward Market Model (FMM) instead of Libor Market Model (LMM)[10]. If not going for a full implementation of new models, pricing libraries will have anyway to be updated to for a correct handling of the new standards.

The new compounded rates calculation could affect old and not recently upgraded procedures among banks and financial institutions in accounting, loan origination and administration, settlement and collateral departments. Probably Derivatives Pricing and Risk IT systems can already manage the backward-looking methodology since in these areas there are already some real cases based on this feature, but other very old departments' procedures demand by far more time-consuming and expensive interventions in order to implement it in their software. In fact, most of these procedures were developed considering only the forward-looking methodology, and they must be updated to manage the backward or to re-organize their dataflow process. Please note that these tasks may become very challenging in procedures be up to 30 years-old[11].

For example:

- the loan departments have high volumes of contracts and the backward-looking methodology request higher system computational capacity and particular attention must be given to the accrued interest calculation.
- Loan systems must reset their daily loan rate every day because on a daily basis they need to build the forward O/N term-rates to settle floating cashflows.
- Obsolete systems cannot face these tasks and the financial institutions may be out of the loan markets if they are not able to meet the market needs and follow its shift.

Market participants are recommended to change their IT platforms rather than to upgrade very old software/procedures versions, which probably will imply far more expensive interventions. Upgrading an old system may request from 6 to 24 months in order to:

- Perform a feasibility analysis to understand the impact of system updates in the bank IT infrastructures;
- Implement the needed changes
- Run Non-regression test, System Integration Test, and Users Acceptance Test;
- Go-Live and post go live support;

For this reason all market players are recommended not to wait the last phase of the reform (around 2021 year-end) but they should tackle the reform as soon as possible to engage the majority of counterparties, clients and stakeholders and have them on boarded for the changes.

4.1.1. Focus on EONIA transition – Management of the new curves in the IT systems

The European Risk-Free Rates reform, from the EONIA to €STR is the first step of the Eur-IBOR reform. Conceptually, the change of the IBOR-linked to the RFR-linked products create similar impacts on the procedures than the EONIA reform. During the EONIA reform, the benchmark transition will be smooth, and the oldest (EONIA) and newest (€STR) benchmarks will both temporary coexist, creating the problem for the banks to choose between the clean and dual discounting regime. Also, the pricing process will have to consider compensation models to be used upon migration date to avoid litigations and legal issues.

The overnight European benchmark EONIA is going to be substituted by a new more robust, more reliable and transaction-based benchmark, the so-called €STR. The transition has started on October , 2nd 2019 and the EONIA benchmark will be dismissed on December, 31st 2021. At the beginning of the transition the €STR market is expected to be cool and dry[12], creating difficulties in the curve construction and thus challenges for banks and financial institutions regarding how to price €STR-linked products in their IT systems.

The three main open points are about (i) the yield curve construction, (ii) the management of the pricing process, and (iii) the application of a Clean vs Dual Discounting methodology.

1) Yield curve construction: the initial lack of liquidity of the €STR market does not allow using the term rates coming from the outcome of the market price process of the RFR-linked products. Then, the ECB Working Group suggests the banks to follow two scenarios during the EONIA transition:

   - €STR market is illiquid: the €STR curve is built by shifting of -8.5bps the EONIA curve.
   - €STR market is liquid: the EONIA curve is built by shifting the €STR curve by 8.5bps.

The two scenarios must be managed by the procedures in the discounting process and they should allow a smooth switch between the two regimes. Also, the procedures need two main pieces of information: the

information about the reference rate linked to the product and the discounting curves associated to the product. In the EONIA transition, some applications may not have this information, and interventions/adjustments on the portfolio's records - manually made by the users - could be necessary alongside the IT developments. Once the €STR market is liquid enough, the first instruments used for building the curves could be futures, fixed-float swaps, three/six-month basis swaps and in general Floating Rate Options. When €STR market will reach a sufficient liquidity, EONIA curves will start being extrapolated by the €STR ones[13].

2) Pricing Process: The banks' procedures have to recognize the RFR-linked products in order to estimate the spread between the old EONIA-linked products and the new €STR ones. It is important to asses both model adjustments and the compensation scheme in derivatives and bilateral CSA[14]. Also, the procedures need to be enhanced to manage correctly PAI and Variation Margin (VM) calculations both for linear and for non-linear derivatives. While for the first typology of derivatives the compensation scheme will be based on cash in EUR area and cash/basis swaps for USD, it is not yet clear what will happen for non-linear instruments that are based on vanilla instruments affected by the switch. Finally, the Working Group of the ECB recommends the market participants to start reducing their reliance on EONIA prices for modelling and discounting purposes and to directly monitor €STR and EONIA OIS price during the transition and switch to the new framework as soon as market will be sufficiently developed.

3) Clean vs Dual Discounting: Once both the EONIA and €STR curves are generated, the financial Institutions and banks have to assess the discounting regime with the counterparty. For the IT system, the clean discounting (single regime of discounting with the same counterparty) is more manageable than a dual discounting (two different regimes of discounting with the same counterparty). The dual discounting regime requires high computational capacity in order to manage two different curves for similar contracts at the same time with the same counterparty and increases the burden of operational risk. Given the issues about the dual discounting, the Working Group recommend using the clean discounting and configuring IT systems and procedures in order to manage this approach.

5. Risk Scenario 3: Migration from the IBORs to the RFRs

This chapter is based on the current market perceptions that the IBORs reform takes place at the end of the 2021, once the O/N benchmark reform is completed for all the currencies areas. In this scenario, starting from January 2022 the IBORs will not be published any longer and during this transition phase the financial institutions need to migrate their own portfolios from the IBORs to the O/N RFR.

The IBORs may be published as long as the IBORs market becomes illiquid because trading activities naturally switch to the O/N rates market and there are no official constraints regarding the timing of this switch. The scenario in which IBORs market remains liquid for decades until all the long-maturity deals expire presents different problems to the market participants linked to:

- the application of different discounting methodologies
- compensation schemes
- settlements
- time-consuming calculations
- operational risk

Due to all these issues, the end of IBORs market and the one-off migration to new RFRs seem to be the most likely alternative to the “smooth” incremental migration scenario.

5.1. Impacts on procedures and processes

Once the new O/N Benchmark market will be liquid enough and will match the market standards, IBORs reform will involve a massive migration of the outstanding contracts recorded in banks and institutions databases from the old IBORs to the new Overnight reference rates. The strategy underlying the contracts migration implies making the right choice regarding two fundamental features: timing and methodology.

The behaviors linked to these two points are driven by the type of counterparty:

- The CCPs contracts: the timing and methodology of the migration of the outstanding deals are mostly decided by the Central Counterparties (Eurex, LCH, etc.), as the clearing houses manage the majority of interest rates derivatives market[15]. Nevertheless, CCPs ask the market players to suggest what could be the most efficient operational framework in order to manage the migration under market standards which can meet the needs of all the market players.
- The OTC market: bilateral negotiations and decisions drive the migration of these types of contracts. Some moral suasions to follow the CCPs’ frameworks and align to their timetable are made by regulators and in general by the market participants to avoid litigations and operational issues. In general, market participants are recommended to have their system migrations as close as possible with the CCPs migration and to follow the compensation methodology proposed by the CCPs even in the OTC market to minimize market disruption risks.

Both counterparties typologies demand operational efforts and new IT solutions and configurations depending on the timing and the compensation schemes behind the chosen migration approach.

5.1.1. Impacts given by migration horizon-time

For the timing there may be two main solutions[17]:

- Big Bang Approach: All the contracts are migrated from the old IBORs to the new O/N benchmarks in a pre-determinate date, and the CCPs lead the migration that takes place in a very short time window.

- This could be considered the most practical and pragmatic approach, as it could mitigate potential litigations by using the same compensation schemes and a single methodology shared by all the market participants once they are aligned. Also, the outstanding contracts undergo a single discounting regime for all the counterparties to assess and certify the net present value delta. On the other hand, the operational efforts behind the big bang migration is very high and market participants are asked for a high level of synchronization in order to link their system both with the CCPs and other counterparties' ones. Some instruments undergo different discounting regimes with different compensation schemes effective on different dates and the netting compensation may result difficult in a short window time. Also, the negotiations with each counterparts for OTC derivatives trades demand more time as they are bilateral by definition. Finally, the volumes of trades between the CCPs in the same currencies' areas may be very different and some may be more ready than others for a specific date, causing operational issues linked to different readiness levels between market players.

- Phased Approach: Market participants amend their contracts in different dates by bilateral agreements when they are ready for it. The uncertainty behind the dates may extend the timing and creating issues to the market participants. Also, the system may work with different benchmarks and with different economic properties, creating issues both to IT systems and to the economic meaning of the contracts. The pros of this solution are related to migration management strategies, which allows banks to organize better both their IT infrastructures and their operational efforts (internal resources) without being forced to adhere to externally set deadlines. This approach also helps the CSAs contracts and the bilateral agreements, where market participants have more time in order to migrate the contracts avoiding litigation and losses.

5.1.2. Impacts given by the compensation schemes

The migration involves remuneration schemes between the counterparties. So far, in the IBORs reform there is still a lack of a single and shared model, but CCPs such as EUREX proposed a model to compensate the counterparties in the EONIA reform[18]. In the EONIA reform, the compensation is based on the fact that the spread between the €STR and EONIA is constant (8.5 bps). While the two O/N benchmarks share the same horizon time (both are overnight benchmark) and also the same "risk free rate" definition, in the context of IBORs migration we need to highlight that O/N benchmarks have different economic properties from the deposit banks rates, starting from the differences in the credit risk and liquidity risk embed in the benchmarks[19]. Some models may be based on the sensitivity to the interest rate, the portfolio value and the interest rate spread, as it happens in the O/N benchmark reforms, but the schemes should include credit and liquidity spreads adjustments. In general, models are not easy to find, and the procedures can lead to errors if they do not have a clear and reliable framework models.

The procedures must include three different compensations schemes:

- Cash compensation: counterparties quantify the delta Net Present Value and compensate the other party using cash;

- Asset compensation: counterparties quantify the delta Net Present Value and compensate the other party by asset (for example a using basis swaps involving both the old benchmark and the new one);

- Hybrid methods: include both the compensations schemes – these schemes are still being discussed by market participants.

Any methodology creates impacts on the procedures as they need both to be integrated in the IT system and be fed by a dataflow containing the whole information needed to recognize the deal, the benchmark and the methodology of compensation. All these aspects cannot be ignored during the systems' implementation to avoid further issues in the management of the deals.

6. Risk Scenario 4: Fallback Clause

European Benchmark Regulation (BMR) asks to include a specific fallback clause in all reference rate linked contracts starting from 1st January 2018. European regulator asks the banks and financial institutions to adapt the fallback clause for legacy contract since the beginning of the 2020. The O/N risk-free rates will become IBORs fallback for the corresponding currency areas:

- USD LIBOR is substituted by the SOFR
- GBP LIBOR is substituted by the SONIA
- EURIBOR is substituted by the €STR
- YEN LIBOR is substituted by TONAR
- CFH LIBOR us substituted by the SARON

In order to complete the reform, a fallback clause has to be inserted in both legacy and new IBOR-linked contracts. The fallback clause allows the owner of IBORs-linked products to have a smooth transition and avoid litigation with trading counterparties when IBORs benchmarks will not be published anymore.

The fallback clause topic presents different problems:

- Management of the fallback clause: Financial Institutions do not usually use fallback clauses outside the derivatives market, and this can create impacts in the procedures which manage secured/unsecured cash products. The lack of a standard fallback framework in the money market must be managed by the users with ad hoc or manual interventions, in particular for compensation schemes. Also, complete agreements between trading partners are more difficult to be reached in syndicated credit operations and in general in the securitization market due to the high number of counterparties involved.
- Languages of the fallback clause: So far, the fallback clauses intend to fill gaps caused by a temporary lack of IBORs, but they never have been used for a definitive transition from IBORs to Alternative Reference Rates. Some market participants may argue about the meaning of the fallback clause since it is anyway subject to juridical interpretation.
- Compensation behind the fallback clause: The fallback clause dramatically changes the economic features and structure of the deal, and this affect both the value and the application of pricing models used to calculate it. [20]. Indeed, the remuneration of the contracts changes because the contracts has different economic features which should be reflected in the price. One of the solutions suggested to reduce this change may be to use synthetic IBORs instead of “pure” ARRs. Synthetic IBOR means to build a rate adding a fixed spread over ARRs.
- This is specular to the idea of triggering the fallback clause within the EONIA reform, where this benchmark is defined as €STR plus a fixed spread (EONIA = €STR + 8.5bps). Once the fallback clause is triggered, the O/N rates must be compounded together with the spread to obtain desired term rates. The same aspect will be seen also in the IBORs reform where for example the Bank of England already specified that GBP LIBORs will fallback on SONIA plus fixed spreads related to different tenors calculated with a precise methodology based on historical spreads between overnight and term rates.

6.1. Defining the framework for the fallback clause

As the management of the fallback clause may create litigation, a standard framework about the fallback process must be defined among market participants. Regulatory and legislative solutions are requested to allow a smooth transition away from IBORs.

The procedures have to be configured to:

- recognize the reference rate linked to the deal
- activate the fallback clause when some specific conditions are met by reading the available information at deal level
- compensate the counterparty for the market value change cause by the activation of the fallback clause.

There are general recommendations to be followed by market participants in order to define the process of the fallback clause:

- Identify specific languages to enhance existing fallback clauses.
- Build a framework to compensate the counterparty in order to avoid litigation and legal issues. The framework must be shown to the regulators and approved by them.
- Market participants must discuss and agree on newly created market conventions.
- Timely communication with clients and counterparties is crucial to avoid litigations.

All the listed steps must be taken into consideration when designing the operational framework that procedures have to follow in order to correctly manage the clauses.

6.2. Configuring and managing the fallback clause in the IT Systems

The fallback clause framework must be included in the procedures to automatically identify, elaborate and compensate the counterparties when the benchmark is either temporary unavailable or permanently dismissed. Also, the temporary unavailability of the benchmark may be tackled with different solutions than the case of a permanent dismissing of the rate. In the first case, market participants could agree to use the last available fixing in the system to fill the temporary lack of benchmark. This approach cannot be used in case of permanent dismissing otherwise the same last available fixing would be applied “theoretically” forever since there will be no further publication of the dismissed benchmark.

It is very important that procedures are able to distinguish between the two cases using information coming from the market that are recorded and available in IT systems. Please note that how procedures can recognize a permanent vs temporary unavailability of the benchmark is still an open point.

If the temporary solution may result easy to implement by using the last available fixing in the system, in the permanent dismissing the market participants have to define exactly the rules/conditions that will trigger the switch to the new rate and compensate counterparties.

There are three main phases to focus on:

- Data transmission: the information about the fallback clause must be transmitted to all IT system components in order to avoid errors in connected procedures and deal classification;
- Data elaboration: the fallback clause must be elaborated by the procedure and the rate have to be considered for future payments without overwriting past history in the deal information;
- Compensation: the procedure has to send the information of the compensation needed to the settlement procedures in order to remunerate the clients/counterparties.

7. Conclusions and next steps

The document maps some impacts related to IBORs transition on bank processes and procedures around four different clusters (named “risk scenarios”). Some of them have been already verified in similar situations that took place in the past (like SONIA reform) while some others of them are only expected since they are the outcome of internal analysis conducted by banks and financial institutions.

Even if risk scenarios are originated by different factors in the financial system (*different benchmark publication time*, *interaction between market players, legal interpretation of contracts*) they are all linked in different ways to IT implementations that will be needed to successfully overcome them.

There may be several different solutions to face impacts generated by the reform and each bank and financial institution will be able to use its own strategies relying on available budget and internal know-how to choose between external vendors and internally developed custom solutions. The overall cost can be considerable and it is estimated[21] that 60% of the budget for the whole benchmark reform will be used for IT implementations and legal contracts remediation.

At the same time an increased coordination between all market participants regarding the choice of new market conventions needs to be achieved to avoid market fragmentation, litigation and legal risks which may negatively affect the trust among market participants and create market disruptions. Again looking at IT processes and procedures, by choosing different internal solutions not aligned with market standards, banks and financial institutes can be left out from the market as counterparties and retail clients could find difficulties during trading, settlement and accounting operations.

In conclusion, market participants must be aware that they must be able to face the coexistence of multiple rates at the same time associated with the same financial products, with different fixing times and conventions. It is crucial that IT systems are able to support operations in this complex future scenario in order to offer a high-quality service to clients, increase the trust of counterparties and keep pace with times.

8. Notes

[1] "What drives interbank rates? Evidence from the Libor Panel" Michaud and Upper, 2008

[2] "Reforming Major Interest Rate Benchmarks", Financial Stability Board, 22nd July 2014

[3] "LIBOR replacement: a modelling framework for the in-arrears term rates", Andrei Lyashenko, Fabio Mercurio, July 2019

[4] GBP Libor has a different fixing convention to T. For this benchmark the fixing and publish day are the same.

[5] "Repo market best practice with respect to the transition from EONIA to €STR.", ICMA, July the 2nd, 2019

[6] The ARR linked products may not be liquid at the beginning of the reform, and this aspect can bring difficulties in the curve creation and price process.

[7] Beyond LIBOR: a primer on the new reference rates, BIS, March 2019

[8]The EONIA reform is part of the IBORs transition, and it can be defined as the first step before reforming the EURIBOR. In order to have a more robust and stronger benchmark, "based-transactions", the European Central Bank introduced the overnight benchmark so-called "€STR".

[9] "Beyond LIBOR: a primer on the new reference rates", page 34, paragragh "Basic characteristic of overnight reference rates"

[10] Andrei Lyashenko and Fabio Mercurio's Model, "LIBOR replacement, a modelling framework for in-arrears term rates".

[11] "LIBOR switch spells trouble for loan system". Natasha Rega-Jones, 6th September 2019.

[12] The IBORs reform should start once the new RFR reform is completed. This means that the market is already trading the RFR-linked products, and the discounting curves construction should not present the same difficulties that the market is currently faced with the RFR reform.

[13] "Report by the working group on euro risk-free rates", chapter 5.2, page52, 19th August 2019.

[14] "Report by the working group on euro risk-free rates", chapter 5.4, page 61, 19th August 2019.

[15] The Italian Banks have almost the 80% of their IRS and other Rate Derivatives with the CCPs as counterparty, and this data shows how the banks are subjected to the CCPs decision.

[17] The time definitions can be found on Report of the Working Group of the ECB, August 2019.

[18] "Risk-free Rates/benchmark transition, working group meeting – Eurex clearing AG", July 2019

[19]Several market participants are skeptical about the economic differences reflected in the O/N benchmark. The IBORs reflect the liquidity of the bank markets and the credit risk between financial institutions. The O/N benchmarks are based transactions and they reflect different economic features.

[20] "LIBOR Fallbacks in focus – a lesson in unintend consequences" – Davis Polk | Oliver Wyman, 2018

[21] Shankar Mukherjiee, partner at EY, "LIBOR switch spells trouble for loan system", September the 5th, 2019

[i] LCH sets date for euro swap discounting change, Risk.net, 27/09/2019