LIBOR Transition

Make it Safe, Efficient and Simple

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Asset Management & Lending *Teams*

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1. Executive Summary

Global regulators have clearly reported that all companies should switch from the Interbank Offered Rates (IBORs) to Alternative overnight risk-free rates (RFR).

IBOR is the basis of the contracts of banks, asset management companies, insurance companies with a value estimated to be worth US$350 trillion globally on a gross notional basis.
This figure emphasizes that the market participants rely too much on IBORs and showed that a sudden discontinuation of the rate could cause systemic risks.

The rate is so embedded in the day-to-day activities of the asset managers, the financial market analysts and also the providers and the users of financial services, both unregulated and regulated which will make a successful transition a highly complex task.

Against this background, many market participants have already embarked on transition programmes, but, as some regulators have pointed out, the pace of transition is not yet fast enough. This in part is because of the absence of any formal regulatory or legal mandate. It is vital that Boards take action now to avoid reputational, legal and commercial risk later.

In another view, the fintech solutions of the asset management companies, banks, lending companies, etc., are facing too many challenges due to the IBOR transition. It is mandatory that these markets players, give a serious attention to the recommendations of their fintech company and start upgrades / implementations programs to avoid any operational risk that could cause huge losses.

The aim of this paper

This paper is intended primarily for all types of financial services firms but specially for asset management companies and lending companies. However, many of the points set out are also relevant to corporates and other end-users of LIBOR products. This paper is designed to help readers understand the transition, its impacts and more importantly the fintech perspective of this big transformation program.

So, what is the IBORs? What are the reasons of this transition?

What are the RFRs, the IBORs alternatives? What are the differences between them and the IBORs?

What are the general Impacts of this transition?

What are the impacts on the fintech solutions? And what is the readiness of your Asset management solution (Fusion Invest)? Your lending solution (LoanIQ)?

The answers to all these questions and much more, waiting to be read in this paper.

2. Problem Context

Financial industry is approaching a critical milestone – the end of the IBOR era due in 2021. Market exposures of IBOR-linked contacts are hovering at trillions of dollars, implying that innovation in terms of effective approaches to manage the upcoming change become a crucial matter for all players on the worldwide economic arena. Even financial obstacles amid the spread of COVID-19 have not caused any shift in IBOR cessation deadlines.

'Whilst the pandemic had impacted transition plans, firms still need to be ready for the deadline'

Celeste Skinner, Finance Magnates, 2020

Purpose of the paper

Although this paper targets all companies involved in the financial industry, it puts an emphasis on the fintech sector. The study tries to outline the importance of the forthcoming IBOR cessation and bring to the fore the key elements decision-makers have to keep in mind while developing approaches on how to address the issue. We start with global overview of the reasons behind the change and possible consequences and finish with more detailed view on the impacts in the financial software industry.

What is IBOR and why should we care?

The Interbank Offered Rate or IBOR is a globally accepted benchmark average interest rate used by the major global banks to lend or to borrow money from each other in an interbank market for short-term loans and other financial products.

The most common and widely used rate is the LIBOR, the London Interbank Offered Rate. It is based on five currencies (US dollar, Euro, British pound, Japanese yen, and Swiss franc) and can have different maturities: overnight, one week, and 1, 2, 3, 6 and 12 months. In total, there are 35 different LIBOR rates each business day. The rate is calculated and published each day by the InterContinental Exchange (ICE).

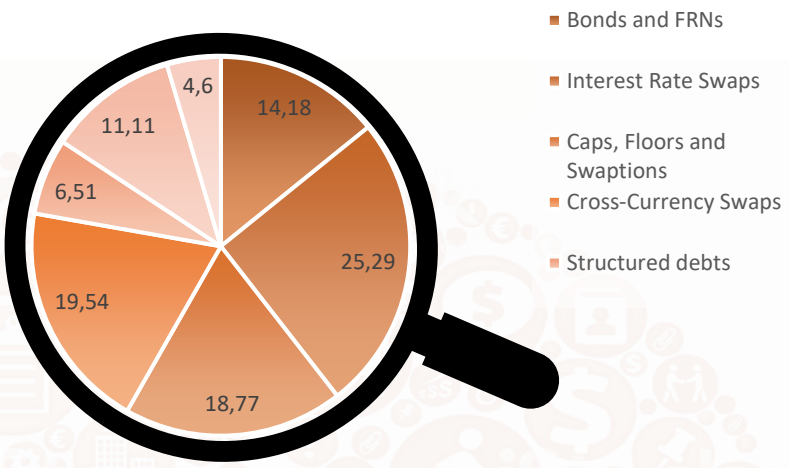
'Transitioning from LIBOR will change the financial institutions market risk profiles, requiring changes to risk models, banking product design and hedging strategies. Given the volume of banking products and processes that will have to change, we recommend that banks accelerate their plans to modernize the systems underpinning their banking products in order to meet the regulatory deadlines. Banking software vendors ... offer banks the capabilities required to ease this transition.'

Daniel Mayo, Chief Analyst, Financial Services Technology, Omdia, 2020

For many years, the IBORs are deeply embedded in the global financial market. The benchmark is used for a large range of financial products such as derivatives, bonds, corporate and syndicated loans, structured products and mortgages, to determine interest rates and payment obligations. It is heavily rooted in firm's contracts, processes and data.

Referring to the USD case, C. Nozema (CFA Financial Economist in the Institute of International Finance, 2019) confirmed that 80% of the contracts referencing USD LIBOR will mature by end of 2021, the most of them are derivatives, and that a lot of linked debt securities will mature after the phase out deadline of 2021, their value is approximated to 1,1 trillion USD; that is still a very high exposure.

Instruments to be impacted by the transition from EONIA to ESTR



The statistics are based on FINCAD survey 'End of Libor', 2019

Amid large exposure to IBOR rates among banks, assets managers, insurance companies, pension funds and corporates, we should make clear the areas impacted by cessation of IBOR rates. As recent research shows, those areas are risk, quantitative and accounting areas whereas the main challenge to face lies in the lack of flexibility of the technical solutions used and difficulty to agree on the uniform transition way with counterparties especially in OTC markets (FINCAD, 2019).

The 'uniformity' of transition approach is hindered not only at industry level but also at international levels. C. Nozema (CFA Financial Economist in the Institute of International Finance) points out that the segmentation is another issue to be addressed. Although efforts have been coordinated across jurisdictions, each new reference rate also reflects local market characteristics and preferences. Reconciling cross-country differences is particularly important for international transaction involving emerging country governments and companies.

By industry level, we mean the complexity to reach agreement with counterparties that usually arise due to 'interest rate migration arbitrage' – the transition from one rate to another will have different market value than it would have been without the switch so potentially there will be more winners and losers

Reasons for change

The previous chapters stated clearly that financial sector highly depended on the IBOR rates. Hence one may wonder: 'Why should anyone force to go away from IBOR if this transition can be highly disruptive for financial sector and consequently for the whole global economy?' Let us try to answer this reasonable question.

Let us give a basic math behind IBOR. The IBOR calculation is a biased average of several interest rates used by different credit institutions on the interbank market. The reference banks provide the rates to the benchmark administrator organization daily at a specific time.

BANK	3-MO. RATE
HBOS	2.76000%
Credit Suisse	2.75000%
Bank of America	2.75000%
Norinchukin Bank	2.74000%
J. P. Morgan Chase	2.74000%
Bank of Tokyo-Mitsubishi	2.74000%
Barclays	2.74000%
Westdeutsche Landesbank	2.73000%
UBS AG	2.73000%
Lloyds	2.73000%
HSBC	2.73000%
Deutsche Bank	2.73000%
Royal Bank of Scotland	2.72500%
Royal Bank of Canada	2.72500%
Rabobank	2.72000%
Citigroup	2.72000%

Calculating Libor

A look at how Wednesday's London interbank offered rate was calculated:

Between 11:00 and 11:10 a.m. London time, the 16 banks at left report the rates they charge other banks to borrow money.

Wednesday's three-month U.S dollar Libor:

2.73375%

The two center quartiles are averaged, and the day's Libor rate is published at about 11:30 a.m.

Source: British Bankers Association; Reuters via WSJ Market Data Group

As a result, IBOR rates, being set upon judgment of the panel of banks, have high exposure to high risk of manipulation evidenced by scandals spreading over the industry in the last years. The interbank lending at IBOR is a fiction and banks are not ready to lend to each other at this rate because of its manipulative nature; it is even inefficient to hedge the general interest risk exposures since LIBOR contains a credit risk component.

'In our view it is not only potentially unsustainable, but also undesirable, for market participants to rely indefinitely on reference rates that do not have active underlying markets to support them. As well as an inherently greater vulnerability to manipulation when rates are based on judgements rather than the real price of term funding, there are a host of questions about whether and how such reference rates can respond to stressed market conditions.'

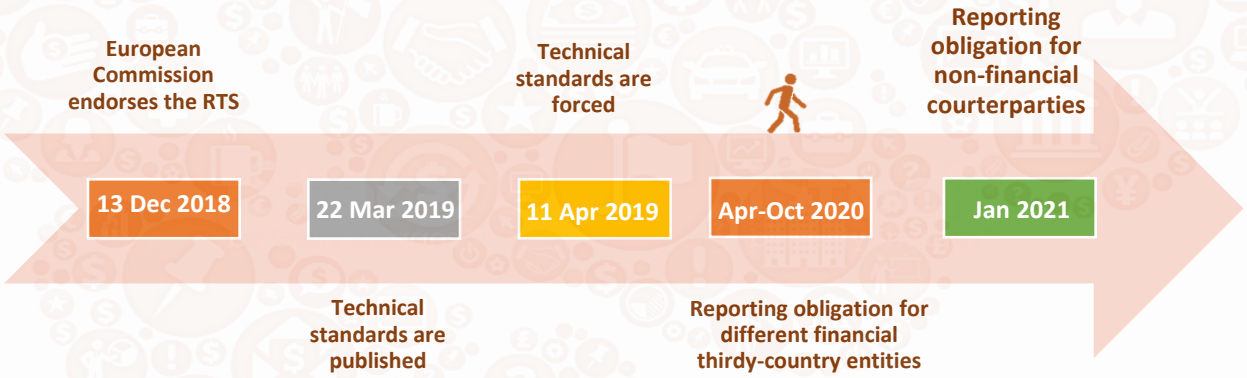
Andrew Bailey - Chief Executive of the UK's FCA (2017)

Milestones

The benchmark regulatory authorities, more notably the Financial Conduct Authority (FCA), announced a phase-out of IBOR in 2012, justifying the move by 'lack of regulation, transparency and consistency'. The FCA has made clear that at the end of 2021, it will no longer seek to support banks to submit to IBOR. By this date, many banks are planning to move to a new benchmark.

For example, European banks will no longer be able to use neither EONIA nor Euribor for any new contracts after January 2020 whereas after January 2021 the panel banks will no longer be obliged to submit the IBOR quotes – the IBOR rates will no longer be assured.

In a timeline, the Securities Financing Transactions Regulation:



As stated earlier, IBOR is embedded in firms' operating models and transitioning to alternative rates will affect how contracts are priced and how the risk is managed.

The logical question here is *'If there is no IBOR after 2021, what should we do? Are there any substitutes?'*. The answer is that indeed there are alternative rates commonly known as risk free rates (thereafter, RFR).

3. IBOR Alternatives

Let us start with the UK case. Since the FCA's announcement in 2017, the UK authorities – the FCA, the Prudential Regulation Authority (PRA) and the Bank of England – have encouraged a transition from LIBOR to alternative interest rates before the end of 2021, calling this transition 'critical'.

'The best way to make the most of the timetable set for LIBOR to end is for markets to focus on transitioning away from it, to new risk free rates", and he encouraged firms "*to educate their customers*'.

Dave Ramsden, the Deputy Governor for Markets and Banking at the Bank of England, June 2019

In the UK, the Working Group on Sterling Risk-Free Reference Rates (the RFR Working Group) has been established to develop alternative rates to replace GBP LIBOR and oversee transition. In April 2017, the RFR Working Group recommended SONIA – the Sterling Overnight Index Average – as its preferred alternative reference interest rate for sterling transactions. Since then, the RFR Working Group has been focused on how to implement transition across sterling markets.

In the US, the Alternative Reference Rates Committee (thereafter, ARRC) has identified the Secured Overnight Financing Rate (SOFR) as the rate that represents best practice for use in certain new USD derivatives and other financial contracts. To support the transition to SOFR, the ARRC developed the Paced Transition Plan, with specific steps and timelines designed to encourage adoption of SOFR. To develop enough liquidity, the ARRC is focused on supporting the launch and usage of SOFR-based financial products in the market and creating a forward-looking term rate based on SOFR.

Similar initiatives are underway globally, including in the Euro Area, Switzerland and Japan where alternative interest rate benchmarks have also been nominated:

Currency	Current Reference rate	Proposed alternative rate	Features	Publication Timing	Forum
USD	USD LIBOR*	SOFR (Secured Overnight Financing Rate) *we can use as a proxy rate EFFR (Effective Federal Funds Rate)*	Secured, overnight rate that covers multiple overnight repo market segments	8am – Next Business Day	The Alternative Reference Rates Committee
GBP	GBP LIBOR	SONIA (Sterling Overnight Index Average)	Unsecured Overnight rate that covers overnight wholesale deposit transactions	9am – Next Business Day	Bank of England
EUR	EUR LIBOR Eonia	€STR (Euro Short-Term Rate) covers overnight wholesale deposit transactions	Unsecured, overnight rate that covers overnight wholesale deposit transactions	9am – Next Business Day	Working group on euro risk-free rates
CHF	CHF LIBOR	SARON (Swiss Average Rate Overnight)	Secured, overnight rate that reflects interest paid on interbank overnight repo	6pm – Same Business Day	The National Working Group on Swiss Franc Reference Rates
JPY	JPY LIBOR TIBOR	TONAR (Tokyo Overnight Average Rate)	Unsecured, overnight rate that captures overnight call rate market	10am – Next Business Day	Study Group on Risk-Free Reference Rates
MAD	the former repo market reference rate.	MONIA (Moroccan Overnight Index Average)	Secured, overnight rate that reflects interest paid on interbank overnight repo	10am – Next Business Day	Bank Al-Maghrib

Source: collected by the writer.

There are the key differences between IBOR rates and selected alternative reference rates. These differences are presented in the table below:

	IBOR	Alternative Reference Rate
Transparency	Lack of transparency: Based on "expert judgment"	Transparent : Based on market transactions
Liquidity	High liquidity	Low liquidity
Term structure	Forward-looking with well-defined term structure	Backward-looking with no term structure
Spread Adjusment		
Credit Risk	Unsecured	CHF and USD are secured (but most alternative reference rates are unsecured)

Source: World Bank expert commentary, 2019

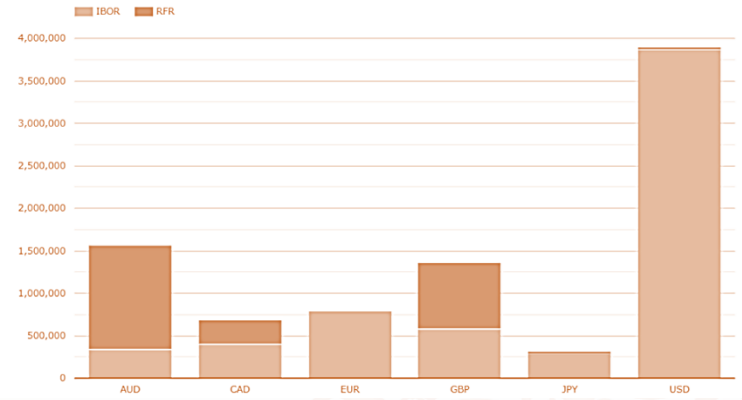
Liquidity

IBORs are the most popular rates worldwide and have abundant liquidity whereas instruments linked to alternative rates started to gain the market share relatively recently thus have limited liquidity. Measures are undertaken across different markets to push upwards the volumes of RFR-linked instruments; however, the actual data still indicates that there is a long way to go for RFR to reach at least the same volumes as IBORs.

Transparency

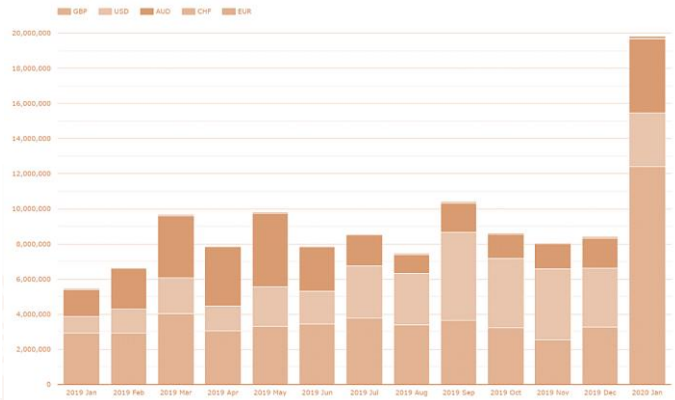
The transparency difference is the key elements why regulators pushed for the change and is linked to the way the rate data is obtain as discussed before. At the same time, other points may require a bit more explanation.

Major Currencies RFR vs IBOR



Source: based on data from Clarus Financial Technology, 2020

RFR Trading Reached a Record in January 2020



Source: based on data from Clarus Financial Technology, 2020

Despite a large surge in RFR trading, it remains negligent compared to the IBOR rates. According to an article in the Bloomberg news, the Federal Home Loan Banks sold roughly $13 billion of SOFR-linked notes since the start of November 2019 until the beginning of February 2020.

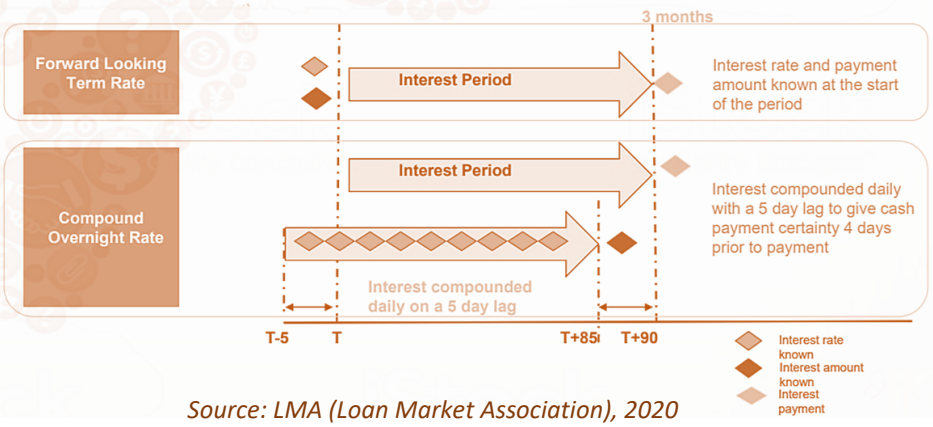
"The home loan banks will remain a key part of the Libor transition, They're the biggest part of the transition to date and if they don't continue to keep the market focused on this and get investors comfortable with transitioning to SOFR, then 2020 is going to be a critical year."

Mark Cabana, head of U.S. interest-rate strategy at Bank of America Corp.

Term-structure

Dwelling on the structural differences between interest rates, it is worth emphasizing the term-structure. In the light of the above-stated, the major quants challenge is to address the move to the in-arrears rates. The difference in term structure is one the key challenges in the transition, especially for financial software companies and as an immediate solution, the compounded overnight rates seems to be efficient for loans:

Compounded overnight rates offer a solution[2]



Source: LMA (Loan Market Association), 2020

[2] Whilst more complex and backward-looking, Compounded in Arrears appears most likely Immediate solution to LIBOR replacement for loans

What do we know up to now?

- The exposure of the financial industry to IBORs is huge
- IBORs are determined by the panel of banks and are subject to manipulation
- To increase transparency in financial system, the benchmark regulatory authorities disqualify IBOR as a benchmark rate starting from the end of 2021
- Cessation of IBORs may have detrimental effects considering that financial sector relies a lot on this rate (see point 1 from above)
- The key difference and pain point lie in term structure IBORs are forward-looking and RFR are backward-looking rates
- To remove the obscurity about what will be after IBOR, the regulators worldwide recommended alternative rates to be used that have some differences and of course they do otherwise what is the point to change

Pricing perspective[3]

The shift from forward-looking rates (Libor-like) to backward-looking rates (RFR) will have a significant re-valuation consequence for long-term outstanding contracts linked to IBOR. The pricing will have backward / forward issues, so that after transition to RFRs, it is necessary to develop new pricing models, according to S. Romagnoli (QF Program Director Department of Statistics, University of Bologna, 2020).

A.Lyanshenko and F. Mercurio (2019) worked out possibilities to cope with the change in the design of the interest rates. The scientists argue that there is a way to merge the current forward-looking approach with proposed backward-looking environment into popular market-based valuation methodologies like the LMM.

The researchers propose to model the dynamics of term rates directly, which leads to a possibility to simulate both forward-looking and backward-looking rates in one stochastic process.

In fact, the idea of converting one term structure into another found a wide application. The disruptive effects of the transition and efforts to smoothen them led to the idea of allowing the banks to keep legacy rates till expiration of outstanding contracts. This means that financial players can keep the IBOR-linked trades as they are even those who have well-defined fallback language like ISDA-regulated contracts. The only thing is to have a reliable conversion protocol that would determine that IBORs will be based on past data.

"The backward-looking rate is alive and continuously giving us information about what happens to the rate environment. The backward- and forward-looking rates only diverge when you enter the application period – before that they are the same"

Andrei Lyashenko, Quantitative Risk Management, 2019

[3] Please see the Appendix for more information about the valuation aspects.

Credit and Spread

Let us consider the 'standardized' case of ISDA regulated contracts. The fallback framework developed by the ISDA widely adopted by national working groups has three component elements:

- The fallback description, including pre-cessation and cessation triggers
- Term rate
- Spread adjustments

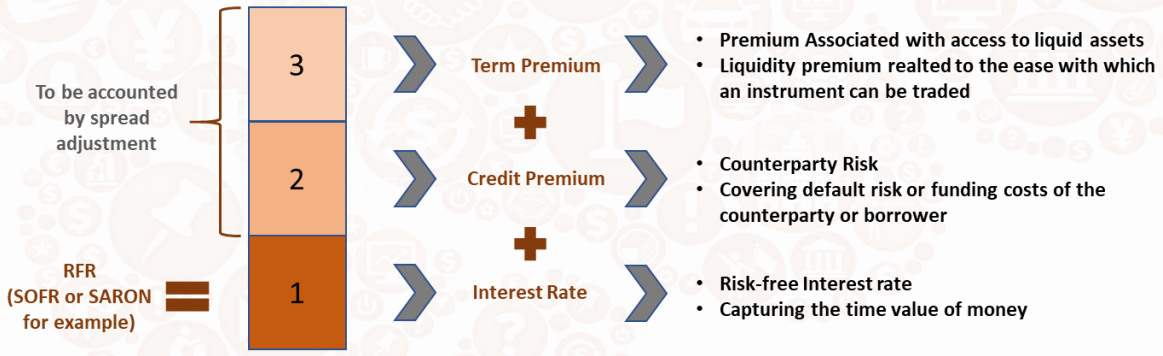
The term rate and spread adjustments are the consequence of structural differences between IBORs and RFRs.

The best approach to describe the phenomenon is its practical application. So, we would like to show the spread adjustment based on the case study for CHF LIBOR and SARON.

Case Study: Differences between CHF LIBOR and SARON requiring spread adjustments

The alternative risk-free rate is a collateralized rate derived from overnight transactions in the secured money market (the case for SOFR and SARON) or the unsecured money market (the case for the €STR and the TONAR); and therefore those in the secured market differ substantially from LIBOR, which is an unsecured interbank lending rate. LIBOR incorporates not only a credit risk premium, but also an additional term premium reflecting liquidity and fluctuations in demand and supply.

Structural differences between LIBOR and RFR leading to Spread Adjustment



Source: Based on the Swiss National Bank Analysis

As illustrated in Figure above, spread adjustments need to be introduced to account for the differences between RFR and LIBOR, ensure contract continuity and minimize value transfer on transition. While developing the fallback framework, the following three guiding principals have been followed by ISDA and other working groups:

Minimizing value transfer when the fallback is applied.	Eliminating any potential for manipulation.	Mitigating market disruptions when fallback is triggered.

The following three spread adjustment approaches have been the subject of extensive ISDA consultations:

Forward approach: Calculation based on observed market prices for the forward spread between LIBOR and RFR at the time of the trigger.	Historical mean or median approach: Based on the mean or median difference in spot between LIBOR and RFR, calculated over a fixed lookback period.	Spot-spread approach: Based on the spread between the LIBOR and RFR spot rates on the day preceding the announcement or the event triggering the fallback.

Characteristics of spread adjustment methodologies and market consensus

All three spread adjustment approaches outlined above have advantages and disadvantages, as shown below:

	Forward approach	Historical mean / median approach	Spot-spread approach
⊕	• Minimizes value transfers, as spread adjustment match the expected market pricing at the time of trigger • Enhanced transparency and reliability based on liquid market data points	• High robustness and simplicity • Reduced potential for manipulation • Extended resistance to market distortions	• Simplicity and understandability • Ability to capture market conditions at trigger event
⊖	• Enhanced susceptibility to manipulation • Potential lack of market liquidity to support the approach • Operational challenges related to data and process requirements	• Potential value transfer and market disruptions if the fallbacks are triggered • Potential issues with hedging • Lack of data availability for long lookback periods	• High sensitivity to volatility and irregular market conditions

Source: Authors

As all three methods fulfil the selection criteria to different degrees, there is no single option tailored to all needs that guarantees zero value transfer (i.e. there will always be a transfer of economic value between the parties involved in the financial contract). Nevertheless, the choice of approach to specific spread adjustment must ensure a smooth transition and consistent methodology. Following ISDA consultations in which the majority (almost 70 per cent) of market participants indicated their preference for it, the historical mean/median approach was selected based on its simplicity, robustness, and resistance to distortion and manipulation.

Further refinement and detailing of the historical mean/median are expected to be finalized, when the type of average (mean, trimmed mean or median) and the length of the lookback period need to be specified.

The ECB was the first 'adopter' of the spread approach proposing:

'Despite the creation of the €STR, EONIA will continue to exist under a new methodology that makes a direct reference to the €STR, so that EONIA can be used in existing contracts for ***a limited period*** *to allow for a smooth transition from EONIA to the €STR… EONIA be calculated by applying a fixed spread to the €STR instead of continuing to rely on a panel of banks' contributions. According to this recommendation, EONIA will, like €STR, then refer to transactions that occurred on the previous business day'*

ECB Press Release, 2019

The notion of limited period is not precise yet. The best-case scenario here may be to keep the spread based EONIA rate up to the point when outstanding contracts linked to this rate expire.

4. Transition Impacts

General Transition Impacts

IBOR transition will be like no other transformation program that firms have undertaken. The risks are significant, and the Boards should take an action to mitigate them as soon as possible. The LIBOR cessation has certainly many risk implications.

These impacts can be resumed as follow:

The table below gives more details on these risks:

Risk Type	Description
ALM Risk	Global exposure to derivative instruments and other financial contracts, like loans and bonds that are indexed to LIBOR, is immense, especially in developed and liquid markets. In response to the regulatory pressure, financial industry will increasingly move to new indexes, which entails proliferation of contracts linked RFR that may not be fully identical to the old ones based on LIBOR.
Operational Risk	The need to adapt current operating models to the new rates poses a high operational risk given limited awareness of and readiness for the upcoming change among market participants. Furthermore, firms should be aware of other areas where there are LIBOR dependencies to ensure that their systems are ready to manage RFRs and people are trained to use them.
Credit & Market Risk	The discussions about: • averaging method, • data sets, • look-back period that will be used to calibrate the historic spreads are still ongoing and future approach to manage the above-stated areas is not clear. Derived and implied term-structure for RFRs will affect interest payments creating valuation differences for existing financial instruments.
Systemic Risk	Lack of clarity around the durability and robustness of the alternative IBOR rates due to liquidity raises the concerns over the basis risk. So, a strategy should be established to reduce LIBOR exposures; the strategy should take into the need to boost demand for RFR-linked products and putting in place the capability to monitor and manage LIBOR exposures that still continue to exist after the cessation.
Tax Issues	Before amendments are made to the existing contracts, the operators should consider whether this could give rise to a disposal of the existing contract for tax purposes. If changes are considered material, this may lead to closure of the existing contract and entering to a new contract for corporate tax purposes in certain jurisdictions. Firms should also consider whether there are implications for other

	areas of the regional taxation systems; for example, hybrid rules, corporate interest restriction rules, transfer pricing and thin capitalization rules.
Litigation Risks	Counterparties may assert that the published LIBOR rate has become "non-representative," and, on that basis, assert that the agreement is reached, notwithstanding the fact that the rate continues to be published. Challenges related to compliance with EU's Benchmarks Regulation (BMR): - For instance, the IOSCO principles for Financial Benchmarks require that a benchmark reference a certain number of underlying transactions; if that is not possible for certain tenors of LIBOR, the benchmark could be viewed as non-compliant, and therefore "subject to manipulation". - RFRs plus a spread, are not really LIBOR. The difference creates a risk of winners/losers which entails a high chance in litigations amid inability to come to an agreement between counterparties.
Liquidity Risks	Market adoption of RFRs seems to be difficult without derivatives liquidity, as there is a recoverability concerns of the cash instruments. Some firms have identified concerns that a lack of liquidity and observable transactions in either the new RFRs or legacy interbank offered rate benchmarks during the initial transition phase may cause some risk factors to become "non-modellable". If these concerns materialize, the net effect could be a significant increase in capital requirements for the firms concerned. Insufficient liquidity as well, may mean that firms are unable to build forecast curves and value their portfolios effectively. This could give rise to client and counterparty complaints in the future and, in addition, to issues for the firm itself in relation to appropriate hedging.

The risks are high and substantial effort is needed as fast as possible from the financial industry side to ensure smooth transition.

Transition recommendations

The transition from IBORs to RFRs raises many issues and challenges for companies across industries and jurisdictions. The key impacts to consider are:

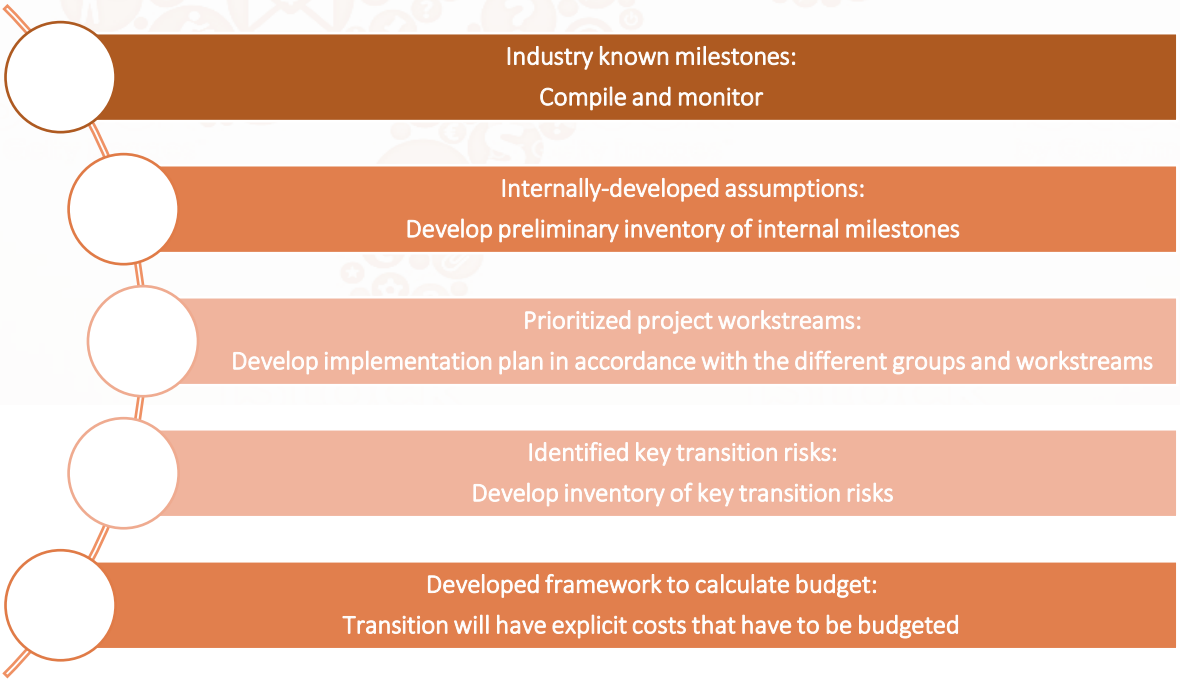
The Impact of LIBOR Transition	Description
Financial products exposure forecast	Quantity of LIBOR-linked financial product exposure (Key trade characteristics including gross notional balances, maturity profile, currency benchmark, commitments, projected exposure 2021)
Contracts	Assess the strength of fallback language in LIBOR-linked legal contracts
Systems	Create and assess an inventory of the impacted internal technology systems (including anticipated functional changes/level of impact)
Models	Create and assess an inventory of impacted model (including ranking for direct and indirect change)

D.L. Sinclair (Head of asset Liability Management, Capital Markets Department, World Bank Treasury, 2019) clearly states that

'Organizational adoption of alternative reference rates requires a well thought out process:

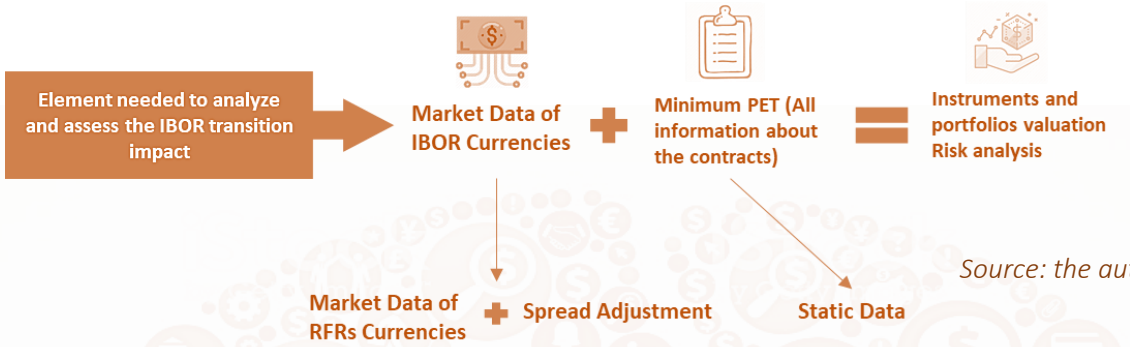
- ✓ The Impact Assessment (financial products, contracts, systems and models): is meant to capture the interconnected impacts of LIBOR transition
- ✓ Implementation of a smooth roadmap
- ✓ Governance and communication plan between internal and external stakeholders.'

So, to have a smooth transition, every stakeholder needs a plan requiring the following steps:



General Fintech Perspective

The shift from IBORs to RFR is very significant for financial software industry, especially amid lack of uniform approach for transition to RFR and absence of well-defined conventions that are still under discussion in many jurisdictions. The fintech industry that strives to propose proactive solutions capable to mitigate risks linked to IBOR cessation.



Source: the authors

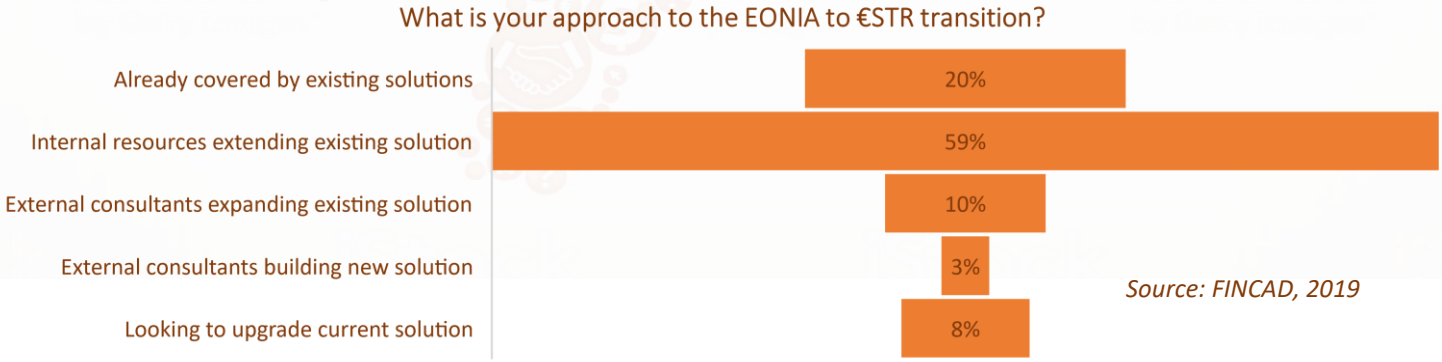
To ensure a safe and successful IBOR Transition to RFRs, the focus on the static Data and Market Data part is necessary and crucial, we must ask ourselves these questions:

- Do we have the Primary Economic Terms (PET) of every contract we have in our portfolios? –
- Will we have the data[3]?

If the answer to these questions is yes, the financial contracts will not need to be rebooked or translated onto new trading templates, if not, and there is no possibility to find the two information, a closure of contracts will be required.

In general (and not only for the contracts which have maturities beyond 2021), the existing market data of IBOR currencies will be the base of the implementation of the new Market Data of the RFRs currencies, and the existing Static data templates of the LIBORs will lay a foundation for RFRs.

One of the main challenge in the framework of the forthcoming IBOR cessation for most financial players is lack of agility of the technical system, around 35% of Europe-based financial institutions see this as the main problem to be addressed, according to the research of FINCAD (2019).



Source: FINCAD, 2019

[3] the market data should be up to date and it is better to indicate in future if the market players have the data closer to the transition point; without info on the market data and the static data, we cannot assess or analyze the transition elements (Risks, valuations, …).

Loan and Global Asset Management Software Perspective

As stated earlier, one of the key drivers pushing for the change in rates were Benchmark Regulatory Authorities followed by the working groups around the world that took advisory role on how to manage the change. Their (working groups') responsibility is to lead these discussions, to develop alternatives for the IBORs as well as to create markets for the new instruments. A variety of actors are part of the Working Groups including Finastra, our business partner and editor of multiple software solutions like LoanIQ, FusionInvest and others.

Finastra has been engaged with working groups and experts globally to find out the best options for clients and users of its state-of-the-art solutions. In this process, some challenges were raised for the various markets and asset classes, the most notably loan markets and its products.

Challenges	Description
Business Impacts	The RFRs interest calculation is complex, and its implementation will not be coordinated. The banks must be prepared to deal with this complexity. During 2020, while some deals remain linked with IBORs, others shifted to RFRs. A variety of factors are tied up to this scenario such as jurisdiction of the instrument, the currencies involved and the loan portfolio diversity of the financial institution.
Operational Costs	The RFRs will create financial operational challenges for borrowers, lenders, and agents. It will be difficult to manage operationally the overnight rates with spread adjustment, which can impact many processes such as accruals, rate set notices, internal treasury funding, billing, delayed compensation, etc.
Multi-currency Complexity	Especially for in the multicurrency context, for example, syndicated loans that commonly use multiple currencies, the impact of the transition will be felt. The RFRs require flexible multi-currency interest pricing while enforcing new terminology across asset classes linked to IBORs.

Other markets are progressing on the transition increasing the liquidity of the RFRs. The loan market needs to accelerate the transition as well. The lack of progress and readiness is clearly reflected by reluctance of issuing loans in SOFR or SONIA, for instance.

Summary of RFR liquidity across products

ASSET	ESTIMATE OF SOFR	LIQUIDITY SONIA	COMMENTS
SWAPS	**12.5%**	**50%**	SONIA linked swaps have higher liquidity at shorter tenors (only) compared to SOFR swaps due to pre-existing OIS markets.
Futures & forwards	**25%**	**25%**	Significant progress on SOFR futures in past few months, now ~ 1 percent of USDollar rates futures cleared by CME. But SONIA futures also growing, they constitute 4 percent of listed British Pound interest rate figures.
Bonds	**50%**	**75%**	SOFR bonds volume is increasing (>80 deals in Q1 2019 accounting for 24 percent of all USD FRN proceeds) but still 90 percent agency-driven. SONIA volume still robust with more participation by the private sector
Loans	**0%**	**0%**	No banks re regularly offering SOFR and SONIA loans to corporate clients

Source: Oliver Wyman 'Time to switch Rates' June 2019

Solutions

The Compound in Arrears backward-looking rate in one the main alternatives to accelerate the transition and support the loan market to not lack behind.

The solution approaches for banks and other financial institutions are, the standardization of the product by a Vendor, the development of internal solutions, a combination of both or not to take action till the forward-looking Term Rates become available. Each of these approaches has pros and cons. RME recommends to all clients the use of standardized products. This is the less risky one and it allows financial institutions to dedicate time and effort ensuring their loan agreements contain the appropriate legal terms and other impacts of the IBORs transitions, besides focus on engaging borrowers and lenders

In a proactive reaction to the upcoming challenge, our partner, Finastra, has released new versions across its solution palette that support the vital features needed to manage new rates.

For example:

Loan IQ newest version provides access to multiple rates and capabilities allowing the customer to efficiently service their different loan portfolios. This facilitates the loan operation and transition to an RFR, by using compounded rates. It is transparent system - all the calculations can be reassessing and include in the notices that provide clear information to the users. So, we can say that Loan IQ V7.5 fully support all RFR's and most mainly the 5 principal currencies (USD, EUR, GBP, JPY and CHF).

Fusion Invest newest version also provides the possibility to configure and highlight the RFRs allowing the user to efficiently manage, analyze and assess all RFR linked asset management elements.

Expert commentaries

During the past months, RME has investigated together with clients, partners, and experts, the impacts and solutions for the IBORs transition. The 2020 is an important year when adaptation is necessary, and collaboration is crucial. Below you can find some of the knowledge shared by experts that support us to assist our clients and partners efficiently.

R. Downs (Senior Product Manager Lending of Finastra, 2020) shared in one of his presentations for clients and partners that the lack of regulation creates uncertainties not just relate with the reference rates but also with the following:

- Notices to customers: the need to show or not the rate calculation in the notices is not regulated. That is why Finastra gives the option to the Loan IQ users the possibility to breakdown the rate and show the calculation. It is a decision up to the customer.
- Validation of the rates: the need to verify the rates is crucial. If the daily rate is incorrect, the compound rate will be wrong as well
- Roles and responsibilities: the need to determine the responsible to publish the new RFRs and when it will be published. Some of RFRs have started to be published recently but there are uncertainties about the differences jurisdictions advances on the RFRs and how each of them is dealing with that.
- Other challenges: to tackle upfront fee calculations or prediction of cashflows.
- Acceptance: in general, how the market will accept the RFRs? And 2021 would be a reasonable timing for adaptation?

> "2020 will be a key year for transition" FCA Statement, March 2020

Bankers also shared with RME that the IBORs transition is a challenge for all disciplines within a bank. The transition impacts many departments like legal contracts, treasury management, loan prices, negotiation, communication, sales, etc. Besides, the way decisions are taken can be a concern. If decisions centralized, it could improve consistency but can be inefficient due to a lack of expertise in certain fields (sales, legal, marketing, project management). If decentralized, it can be much more efficient but less consistent. Finding the balance between efficiency and effectiveness will become a notable challenge.

Other specialists advert the need for financial institutions to act strategically to minimize the business impacts. The following implications on the corporate lending books were referred:

- Participation in syndicated deals based on RFRs: banks must be capable to act as agents of syndicate loans based on RFRs as well as prepared to participate in syndicate loans based on these rates.
- Servicing of loans with a term beyond 2021: banks might strategically choose the rate options they plan to support and how to cope with the increasing complexity of it. Internal systems should be ready to manage the compound rate methods of calculations (the preferred one in the market by now). Besides, the institutions need to ensure accuracy of interest accruals and settlement amounts in the event of prepayment and properly communicate the calculations in the notices for borrowers and lenders.
- Operational, regulatory and reputational risk: banks need to cope with the increased operational risk, especially in the case of compounding in arrears, and to maintain regulatory compliance and contain any reputational risks linked to IBORs replacement.

The concerns regard to IBORs transition are many. The adaptation is complex and demands effort. However, bankers, experts, regulators, partners are closely engaged to find the best-fit solutions.

RME together with Finastra, is prepared to tackle this challenge and support a smooth transition process in Lending and Asset Management Software and will be pleased to help our clients avoid financial and operational disruption while staying competitive and compliant with the forthcoming change.

To know more about how we can collaborate to mitigate IBOR cessation risks or other financial challenges, contact RME **(Raven Meets Efficiency),**

for that, please see the Contacts section.

5. Points to take away

To increase transparency in financial system, the benchmark regulatory authorities disqualify IBOR as a benchmark rate starting from the end of 2021. Basically, after this deadline the IBOR rates as we know them will cease to exist.

The deadline of the transition still the same, even the Covid-19 pandemic had impacted transition plans.

IBOR transition will be like no other previous transformation. Global IBOR exposures near trillion dollars – the cessation will have a significant impacts and risks which will propagate through markets, industries and whole economies around the globe.

The regulators worldwide recommended alternative rates (RFRs) to be used that have some fundamental differences. Now the banks and the other market participants should put significant efforts to manage the transition and its aftermath.

The key difference and pain point lie in term structure IBORs are forward-looking and RFR are backward-looking rates

Yield curves, valuation models, rate templates and other areas should be reviewed to take into to ensure smooth transition.

Technological solutions should be adapted to the transition and support the new rates implementation.

RME teams with their consulting experience and expertise in Finastra products are available to support their clients to manage new rates in lending and asset management software and succeed the transition.

Appendix

This appendix will explain the new extension of the LMM and give an example of a new valuation of a LIBOR fixed-floating swap.

In what follows, we assume a term structure 0=$T_0, T_1, \dots\dots\dots\dots, T_M$, and denote by τ_j the year fraction for the interval [T_{j-1}, T_j [.

For each t, we define n(t) = min{j : $T_j \geq t$} which is the index of the element of the time structure that is the closest to time t being equal or greater than t.

$P_j(t)$: represents the extended zero-coupon bond price P (t, T_j) where

P(t,T) = E[exp(-$\int_t^T r(u)\,du$)/F_t] when t≤T and P(t,T)= exp($\int_T^t r(u)\,du$)=$\frac{B(t)}{B(T)}$

And E: denotes the risk neutral expectation associated to the risk neutral leisure Q.s

F_t **:** the 'information' available in the market at time t

r: denotes the instantaneous risk-free rate.

B(t) = exp ($\int_0^t r(u)\,du$) is the money market (or bank) account

We define the extended T forward measure Q^T , associated to the numeraire P(t, T), the extended zero coupon bond, that is defined fot any t.

The extended T forward measure Q^T, is a hybrid measure that combines the classic T forward measure up to the maturity time T with the risk neutral money market measure Q after T.

The risk neutral money market measure is a particular case of the extended T-forward measure, where T is equal to zero: Q=Q^0

We assume **single curve LMM**.

LMM	FMM
The fixed forward rate to be exchanged at time T_j , and calculated at time T_{j-1} F(T_{j-1}, T_j) = E^{T_j}[R(T_{j-1}, T_j)/$F_{T_{j-1}}$] = $R_j(T_{j-1})$	For each j=1 to M, we approximate the daily-compounded setting-in-arrears rate for the interval [T_{j-1}, T_j [, as follows: R (T_{j-1}, T_j)=$\frac{1}{\tau_j}$[$\int_{T_{j-1}}^{T_j} r(u)\,du - 1$]
Forward looking rates are set at the beginning of their application period. For instance, a forward-looking rate at time T_{j-1} with maturity T_j.	In-arrears rates are backward looking in nature Because one has to wait until the end of their accrual period to know their fixing value.
F_j(t): denotes the forward rate at time t.	We define the backward looking forward rate R_j(t) at time t as:

F_j(t)= R_j(t) for t≤T_{j-1} F_j(t)= F(T_{j-1}, T_j) for t>T_{j-1}	R_j(t) $= E^{T_j}$[R (T_{j-1}, T_j)/F_t] $= \frac{1}{\tau_j}[\ \frac{P_{j-1}(t)}{P_j(t)} - 1\ ]$ We also have: R_j(t)= $\frac{1}{\tau_j}[\ \int_{T_{j-1}}^{T_j} f(t,s)\ ds - 1\ ]$ Where $f(t,s) = r(s)$ for t>s. Fort<s, f (t, s) is the usual instantaneous forward rate.
	R_j(t) is a martingale under the T_j forward measure.
	R_j(t) is equal to the forward-looking sopt rate at time T_{j-1}: $R_j(T_{j-1})$= F(T_{j-1}, T_j)
	$R_j(T_j)$= R (T_{j-1}, T_j)
F_j(t) stops evolving (that is fixed), after time T_{j-1}	R_j(t) stops evolving (that is fixed), after time T_j: R_j(t)= R(T_{j-1}, T_j),t>T_j

The forward rate dynamics:

We assume the following Q^{T_j} dynamics : dR_j(t)= $\sigma g_j(t)$d$W_j(t)$

Where, for each j=1,.....,M, $\sigma_j(t)$is an adapted process and $W_j(t)$ is a standard Brownian motion such that d$W_i(t)$ d$W_j(t)$=$\varrho_{i,j}dt$. $g_j$is a piece-wise differentiable deterministic function such that

$g_j(t) = 1$ for t≤T_{j-1}, $g_j(t) = 0$ for t≥T_j and $g_j(t) = \min\left\{\frac{(T_j-t)^+}{T_j-T_{j-1}}, 1\right\}$ for T_{j-1} ≤t≤T_j.

FMM is a classic extension of the classic single-curve LMM.

It models the joint dynamics (simply compounded) forward-looking forward rates F_j(t), as in the LMM, but also of backward looking(setting-in-arrears) forward rates R_j(t),

Although the evolution of the bank account B(t) is not directly accessible within the FMM, we can still imply it by extending the FMM with a series of one-factor Cheyette (1992) models, each one covering a single accrual period.

The new valuation of a LIBOR fixed-floating swap

Consider a standard LIBOR-based swap where the floating leg pays at each time T_j,j=a+1,….,b, the LIBOR L(T_{j-1}, T_j) times the associated year fraction τ_j, and where the fixed leg pays the fixed rate K on dates T'_{c+1},……. T'_d with associated year fractions τ'_j. We set T'_c=T_a and T'_d=T_b.

Assuming OIS discounting, the swap value to the fixed-rate payer at time t< $T_{a+1}$is given by :

$$\sum_{j=a+1}^{b} \tau_j P(t,T_j) L_j(t) - K \sum_{j=c+1}^{d} \tau'_j P(t,T'_j)$$

Where:

P(t,T) : is the value at t of the zero coupon bond maturing at T, and $L_j(t) = L(T_a, T_{a+1})$ if $T_a \leq t < T_{a+1}$, the Libor rate fixed at time T_a, for the interval [T_a,T_{a+1}[. This valuation relies on Libor being published at least until the last LIBOR fixing date T_{b-1}, so that forwards $L_j(t)$ can be defined accordingly. However, soon enough this may no longer be the case. LIBOR is in fact very likely to be discontinued before the end of 2021, and ISDA started consultations with the industry on the definition of a new LIBOR fallback. This means already that swaps like the above are standard up to some payment time T_k (included), and from T_k (excluded) on become swaps written on a new interest rate index. Assuming $T_k > T_a$, the valuation of the above swap must then be modified as follows:

$$\sum_{j=a+1}^{k} \tau_j P(t,T_j) L_j(t) + \sum_{j=k+1}^{b} \tau_j P(t,T_j) \bar{L}_j(t) - K \sum_{j=c+1}^{d} \tau'_j P(t,T'_j)$$

Where $\bar{L}_j(t)$ denotes the forward at time t of the new Libor fallback $\bar{L}(T_{j-1}, T_j)$, that is :

$$\bar{L}_j(t) = E^{T_j}[\bar{L}(T_{j-1}, T_j)|F_t]$$

The methodology for the new LIBOR fallback $\bar{L}(T_{j-1}, T_j)$ has not been decided yet. However, the consensus is that it will be defined as the sum of a Risk Free Rate RFR : R(T_{j-1}, T_j), and a LIBOR RFR basis spread S(T^*) calculated at the time $T^* < T_k$ when an official announcement of LIBOR discontinuation will be given :

$$\bar{L}_j(t) = R_j(t) + E^{T_j}[\mathrm{S}(T^*)\,|F_t]$$

Where $R_j(t)$ is the time-t forward of R(T_{j-1}, T_j), that is : $R_j(t) = E^{T_j}[\mathrm{R}(T_{j-1}, T_j)\,|F_t]$

If $T_k \leq T_a$, then the (forward-start) swap will pay the LIBOR fallback on each payment date of the floating leg, leading to a simpler valuation formula.

Glossary

1. **ICE:** The Intercontinental Exchange (ICE) was founded in May 2000 in Atlanta, Georgia, to facilitate the electronic purchase and sale of energy commodities.

2. **FCA:** The Financial Conduct Authority is the conduct regulator for 59,000 financial services firms and financial markets in the UK and the prudential supervisor for 49,000 firms, setting specific standards for 19,000 firms.

3. **SFTR:** The Securities Financing Transactions Regulation (SFTR) is a body of European legislation for the regulation of securities lending and repo. It was published in the EU Official Journal on 23 December 2018.

4. **RFR:** The acronym 'RFR' was introduced by the Financial Stability Board (FSB) in their 22 July 2014 publication on benchmark interest rate reform. The terminology 'risk free rate' or 'nearly risk-free rate' has become generally accepted in Europe; however, other jurisdictions may refer to these as 'alternative reference rates'. Both define reference rates which are being developed by international, central bank led, working groups as alternatives to LIBOR.

5. **PRA:** The Prudential Regulation Authority (PRA) is a United Kingdom financial services regulatory body, formed as one of the successors to the Financial Services Authority (FSA). The authority is structured as a limited company wholly owned by the Bank of England and is responsible for the prudential regulation and supervision of banks, building societies, credit unions, insurers and major investment firms. It sets standards and supervises financial institutions at the level of the individual firm.

6. **LMM:** The LIBOR Market Model (LMM) is an interest rate model based on evolving LIBOR market forward rates.

7. **RFR working group:** To identify the alternative rates, global regulators formed currency-specific working groups to assess market conditions, examine alternatives and consider next steps. Members of these working groups include banks, asset managers, insurance companies, and corporates. Industry bodies and trade associations representing various segments of the market are also actively engaged. Barclays is supportive of, and is participating in, several of these working groups.

8. **SONIA:** The Sterling Overnight Index Average (SONIA), is the effective overnight interest rate paid by banks for unsecured transactions in the British sterling market. It is used for overnight funding for trades that occur in off-hours and represents the depth of overnight business in the marketplace.

9. **ARRC:** The ARRC is a group of private-market participants convened to help ensure a successful transition from USD LIBOR to a more robust reference rate, its recommended alternative, the Secured Overnight Financing Rate (SOFR).

10. **Paced Transition Plan:** The Paced Transition Plan presents the ARRC's work, which outlines the steps for an effective transition to SOFR and is designed to be used alongside the ARRC's User's Guide to SOFR.

11. **ISDA:** The International Swaps and Derivatives Association (ISDA) is a trade organization created by the private negotiated derivatives market that represents participating parties. This association helps to improve the private negotiated derivatives market by identifying and reducing risks in the market.

12. **Primary Economic Terms (PET):** A sum of the high-level technical terms of a trade required by CFTC to be reported.

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Contacts

Raven meets Efficiency | Asset Management – Capital Markets – Lending Teams

Paris

Anastasija Gerasimenko

Functional Lead – Asset Management | Capital Markets

agerasimenko@efficiency-mc.com

Anas Laaouini

Functional Consultant – Asset Management | Capital Markets

alaaouini@efficiency-mc.com

Mohcine Lambribahe

Functional Consultant – Asset Management | Capital Markets

mlamribeh@efficiency-mc.com

Casablanca

Mouad Lakloumi

Functional Consultant– Asset Management | Capital Markets

mlakloumi@efficiency-mc.com

Soumaya Bidah

Functional Consultant– Asset Management | Capital Markets

sbidah@efficiency-mc.com

Mohamed Amine El Hamdi

Functional Consultant– Asset Management | Capital Markets

aelhamdi@efficiency-mc.com

Amsterdam

Camila Capassi Malagodi

Functional Consultant – Lending

camila.capassi@ravenconsulting.eu

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