



ICE Term Risk Free Rates

October 2018



Contents

| | |
|---|----|
| Executive Summary | 3 |
| A Brief Introduction to Risk Free Rates | 4 |
| The Development of Term Risk Free Rates | 6 |
| Possible Methodologies for Constructing Term Risk Free Rates | 8 |
| IBA Proposals for Term SONIA: ICE Term RFR - Forward-Looking - GBP | 10 |
| ICE Term RFR - Forward-Looking - GBP: Historical Testing | 15 |
| The ICE Term Risk Free Rates (RFR) Portal | 17 |
| Disclaimers | 20 |
| Appendix 1: Overview of IBA | 22 |
| Appendix 2: ICE Term Risk Free Rates - Methodologies | 23 |



Executive summary

The introduction of alternative risk free rates is one of the most important developments in the financial markets in recent years. These alternative interest rates offer significant promise as benchmarks, as they provide a robust indication of short-term borrowing costs in some of the largest economic zones across the globe.

The alternative risk free rates measure overnight borrowing costs in either unsecured or secured financial markets. In this regard they are very different from the “IBORs” (e.g. LIBOR, EURIBOR, TIBOR), the most actively used interest rate benchmarks in financial contracts today. This is because the IBORs are typically published for multiple forward-looking tenors (or terms) which seek to measure expected wholesale, unsecured bank borrowing costs over specified periods (e.g. one, three, six and twelve months).

Although the use of alternative risk free rates in most derivative contracts is expected to be uncomplicated, their use in respect of certain other non-derivative or “cash” products may be more challenging.

Many market participants value having forward-looking term rates in their financial contracts for budgeting, cash flow and risk management purposes. Large and small businesses generally value certainty in calculating their interest expense and other contractual payments. This, and the ability to know forward-looking interest rates in advance for one, three, six and twelve month time periods, have made the IBORs attractive benchmarks in certain areas. Retail borrowers also value knowing what their obligations will cost in advance, particularly those with mortgages or long-dated student loans.

In addition, many financial planning and operating systems are designed for contracts that reference forward-looking term rates and may not be equipped to compound interest accruals on a daily basis. Re-designing these systems could prove to be an expensive and time-consuming procedure for many businesses.

Given the benefits associated with forward-looking term rates, many market participants and working groups have expressed significant interest in the development of term structures for alternative risk free rates in certain use cases, noting that these would be helpful in facilitating their adoption.

ICE Benchmark Administration Limited (IBA) is committed to helping the financial markets develop such term structures. As a market-leading provider of regulated benchmarks, administering ICE LIBOR, ICE Swap Rate and the LBMA Gold and Silver Prices, IBA is uniquely positioned to help build and publish robust and sustainable term structures for the risk free rates.

In this regard, IBA has taken two steps.

First, IBA has developed a preliminary methodology, based on futures contracts data, to derive a forward-looking term rate for SONIA (the Sterling Overnight Index Average, which was selected as the alternative risk free rate for the Sterling markets). The methodology is set out in detail in this paper. IBA has also outlined some other approaches that could be used to derive forward-looking term rates for SONIA, if market conditions and end-user demand warrant this in the future.

These solutions could also be leveraged for the other alternative risk free rates as the mathematics and processes proposed to derive forward-looking term rates for SONIA could be applied to other risk free rates as markets and user appetite develop.

Secondly, IBA has launched the [ICE Term Risk Free Rates \(RFR\) Portal](#). IBA expects this webpage to be a valuable resource for market participants, providing three key pieces of information on alternative risk free rates on a daily basis:

1. Forward-looking one, three and six month term risk free rates, initially for SONIA, derived from futures contracts and published SONIA data¹;
2. Realised simple and compounded averages for one, three and six month periods, derived from historical, published risk free rate data²; and
3. The published overnight risk free rate³.

IBA is inviting feedback from market participants on the proposed methodologies to derive forward-looking term rates set out in this paper and on the ICE Term RFR Portal. It is important to hear from stakeholders on how IBA can enhance its approach in order to support the development and adoption of term risk free rates and make the ICE Term RFR Portal as useful and informative as possible.

¹ IBA intends to publish other forward-looking term risk free rates, including term rates for SONIA derived from overnight index swaps data, when market conditions, trading infrastructure and governance permit this

² As per footnote 1

³ Initially for SONIA, SOFR (the risk free rate for the US dollar markets) and TONA (the risk free rate for the Japanese yen markets). IBA is in discussions with SIX Exchange Ltd. regarding the potential re-distribution of SARON (the risk free rate for the Swiss franc markets). If permitted to do so, IBA also intends to re-distribute ESTER (the euro area risk free rate) when this is published



A Brief Introduction to Risk Free Rates

Benchmark Reform and the Call to Develop Risk Free Rates

In February 2013, the G20 asked the Financial Stability Board (FSB) to undertake a fundamental review of major interest rate benchmarks and of plans for reform in order to ensure that these plans were consistent and coordinated and that benchmarks were robust and used appropriately. The FSB published a report in July 2014⁴ recommending the development and use of alternative nearly risk free reference rates (RFRs), particularly in markets where transactions are well-suited to such rates (e.g. derivatives).

The Selection of Risk Free Rates

Alongside a series of reform programmes for existing interest rate benchmarks, various working groups were established to identify and select RFRs for sterling, US dollar, Japanese yen, Swiss franc and the euro area currency markets.

Sterling

The Bank of England established the Working Group on Sterling Risk-Free Reference Rates (SWG), which recommended the reformed Sterling Overnight Index Average (SONIA) as its preferred Sterling RFR⁵. The Bank of England assumed the administration of SONIA from the Wholesale Market Brokers Association (WMBA) in April 2016⁶ and, following a period of consultation, began publishing SONIA with a reformed methodology from April 2018⁷.

SONIA⁸ is a measure of the rate at which interest is paid on Sterling overnight wholesale funds in circumstances where credit, liquidity and other risks are minimal. It is calculated as a trimmed mean of eligible unsecured overnight deposit transactions that are greater than or equal to £25m in value, reported as part of the Bank of England's Sterling Money Market (SMM) data collections.

US dollar

The Board of Governors of the Federal Reserve System and the Federal Reserve Bank of New York convened the Alternative Reference Rates Committee (ARRC), which identified the Secured Overnight Financing Rate (SOFR) as its recommended US dollar RFR⁹. In April 2018, in cooperation with the US Office of Financial Research, the Federal Reserve Bank of New York started to publish SOFR¹⁰.

SOFR¹¹ is a broad measure of the cost of borrowing cash overnight collateralised by US Treasury securities. It is calculated as a volume-weighted median of transaction-level tri-party repo data collected from the Bank of New York Mellon, as well as GCF Repo¹² transaction data and data on bilateral Treasury repo transactions cleared through Fixed Income Clearing Corporation's (FICC) Delivery-versus-Payment (DVP) service.

Japanese yen

In Japan the Study Group on Risk-Free Reference Rates (the Study Group) was established and identified the uncollateralised overnight call rate published by the Bank of Japan, also known as the Tokyo Overnight Average rate (TONA), as the Japanese Yen RFR¹³.

TONA¹⁴ is based on data supplied by information providers in respect of overnight transactions brokered in the uncollateralised call money markets (where financial institutions lend and borrow short-term funds). The rate is calculated as the volume-weighted average of these transactions.

Swiss franc

The National Working Group on Swiss Franc Reference Rates (NWG) was established to reform the Tom-next Overnight Index Swap (TOIS) fixing. The NWG subsequently focussed its reform efforts on Swiss Average Rate Overnight (SARON), published by SIX Swiss Exchange Ltd, which it went on to recommend as the Swiss Franc RFR¹⁵.

SARON¹⁶ represents the overnight interest rate of the secured funding market for Swiss Francs. It is calculated as a volume-weighted average based on executed repo transaction data and qualifying trade quotes from the SIX Repo Ltd. trading platform.

⁴ [Reforming Major Interest Rate Benchmarks, 22 July, 2014](#)

⁵ [Bank of England Press Release, 28 April, 2017](#)

⁶ [Bank of England Press Release, 13 April, 2016](#)

⁷ [Bank of England Press Release, 23 April, 2018](#)

⁸ [SONIA Benchmark](#)

⁹ [ARRC Press Release, 22 June, 2017](#)

¹⁰ [Federal Reserve Bank of New York Statement, 3 April, 2018](#)

¹¹ [Secured Overnight Financing Rate Data](#)

¹² [The General Collateral Finance Repo Service offered by FICC](#)

¹³ [Study Group Report on the Identification of a Japanese Yen Risk-Free Rate, December 2017](#)

¹⁴ [Call Money Market Data](#)

¹⁵ [NWG Milestones](#)

¹⁶ [Swiss Reference Rates](#)



Euro

The Working Group on Euro Risk-Free Rates (EWG) was established by the European Central Bank (ECB), the Belgian Financial Services and Markets Authority (FSMA), the European Securities and Markets Authority (ESMA) and the European Commission and recommended the Euro short-term rate (ESTER) as the euro area RFR¹⁷. The ECB will begin publishing ESTER by October 2019¹⁸.

ESTER¹⁹ will reflect the wholesale euro unsecured overnight borrowing costs of euro area banks. It will be calculated as a volume-weighted trimmed mean of overnight unsecured fixed rate euro deposit transactions over €1m in value that are reported by banks in accordance with the ECB's money market statistical reporting (MMSR) requirements.

Figure 1: The Selected Risk Free Rates

| Currency |  |  |  |  |  |
|---------------------------------|---|---|---|---|---|
| RFR | SONIA | SOFR | TONA | SARON | ESTER |
| Administrator | Bank of England | Federal Reserve Bank of New York | Bank of Japan | SIX Swiss Exchange Ltd | European Central Bank |
| Secured or Unsecured | Unsecured Rate | Secured Rate | Unsecured Rate | Secured Rate | Unsecured Rate |

¹⁷ [ECB Press Release, 13 September, 2018](#)

¹⁸ [ECB Press Release, 28 June, 2018](#). Until ESTER is available, the ECB will publish figures referred to as pre-ESTER, which market participants can use to assess the suitability of the new rate

¹⁹ [Euro short-term rate \(ESTER\)](#)



The Development of Term Risk Free Rates

Term Rates and Overnight Rates

The most actively used interest rate benchmarks are the IBORs, such as LIBOR²⁰, EURIBOR²¹ and TIBOR²². The IBOR benchmarks are typically published for multiple forward-looking tenors (or terms). Having a forward-looking term structure means the IBOR settings provide a measure of the expected average rate over a specified period (a “term rate”). These forward-looking term rates can be used to calculate upcoming contractual payments (such as interest due) at the beginning of an accrual period based on a forward-looking rate set in advance as opposed to having to wait until the end of the accrual period to calculate a payment based on overnight rates.

For example, a retailer that needs to borrow money in late September to fund increased inventory prior to the holiday season can know its floating rate cost of debt through to year-end in advance by using a three month IBOR rate rather than having to calculate this cost at the end of the period based on historical overnight rates. This feature has made the IBORs attractive to borrowers (and other financial markets participants using floating interest rates) that value a forward-looking rate, certainty and advance knowledge in respect of their contractual payments for budgeting, risk management or operational purposes.

In contrast to the IBORs, the selected RFRs are all “overnight rates”. This means that they provide a measure of interest rates paid overnight in circumstances where other risk factors are negligible. It was recognised during the RFR selection processes that the overnight rates being considered would not replicate the forward-looking term structures of the IBOR benchmarks without modification. However, the potential for developing forward-looking term rates for RFRs (“term RFRs”) was generally acknowledged by the working groups as a feature that would be desirable and aid adoption of the RFRs in markets (e.g. for non-derivative or “cash” products, such as loans and notes) where participants value forward-looking rates, certainty and advance knowledge.

Figure 2: IBOR Tenors

| LIBOR \ TENOR | ON/SN | 1W | 2W | 1M | 2M | 3M | 6M | 9M | 12M |
|----------------------------------|-------|----|-----|----|-----|----|----|-----|-----|
| LIBOR (\$, £, ¥, CHF, €) | ✓ | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ |
| EURIBOR ²³ (€) | ✗ | ✓ | [✓] | ✓ | [✓] | ✓ | ✓ | [✓] | ✓ |
| TIBOR ²⁴ (¥, euroyen) | ✗ | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ |

The Case for Developing Term RFRs

The FSB²⁵ has stated that the transition of most derivatives to RFRs is important in ensuring financial stability. However, it has acknowledged that RFRs may not be optimal for use in certain circumstances and that term rates may be suitable where it is not practicable to use a realised compounded RFR observed over, or a measure of observed RFRs set at the beginning of, an accrual period in order to determine an interest rate payment. Accordingly, the FSB has expressed support for exploring the creation of term RFRs in certain use cases in jurisdictions that have expressed a desire or need for them.

RFR working groups have also noted that the development of forward-looking term rates might assist with a transition to RFRs across the various markets.

The SWG²⁶ stated that it expects strong demand for term SONIA in corporate lending and securitisations. It also expects moderate demand in other areas such as retail loans, notes, securities lending and uncleared derivatives. Weak demand for term SONIA is expected in exchange traded and cleared derivatives markets. However, the SWG noted that market participants will require hedges for financial instruments (such as loans and bonds) which reference RFRs and so some use of term SONIA in the derivatives markets is likely to occur.

The SWG noted that many market participants would like to see forward-looking term rates due to operational and technological systems which require payment amounts to be determined at the start of an accrual period as well as the economic desire to avoid interest rate exposure over short, pre-determined periods. Market participants also highlighted that the use of term rates helps support liquidity management and cash flow planning.

²⁰ LIBOR

²¹ EURIBOR

²² TIBOR

²³ In June 2018, EMMI announced the cessation of the 2 week, 2 month and 9 month EURIBOR tenors as of 3 December, 2018 [EMMI Press Release, 6 June, 2018](#)

²⁴ On 2 October, 2018, JBA TIBOR Administration published the [1st Consultative Document on the Approach for Integrating Japanese yen TIBOR and euroyen TIBOR](#)

²⁵ [Interest rate benchmark reform – overnight risk-free rates and term rates, 12 July, 2018](#)

²⁶ [SWG Consultation on term SONIA Reference Rates, July 2018](#)



In the US dollar markets, the ARRC considers that SOFR should be relatively easy to incorporate into derivative contracts due to participants' familiarity with contracts referencing overnight rates²⁷. However, the ARRC has acknowledged that market participants using certain cash products may find overnight rates or even realised averages of overnight rates unfamiliar and may find this type of transition more difficult. This is because such rates are either not forward-looking or not predetermined at the start of an accrual period, features that certain users may be accustomed to or which their systems may require. Consequently, to seek to accommodate these participants and facilitate a transition to SOFR for such cash products, the ARRC would like to see the creation of term SOFR. This is highlighted in the ARRC's "Paced Transition Plan"²⁸, which is intended to create conditions in which a robust term rate based on derivatives referencing SOFR may be developed for use in some cash products by the end of 2021.

In Japan, the Cross-Industry Committee on Japanese Yen Interest Rate Benchmarks (the Cross-Industry Committee) was established in August 2018²⁹. The Cross-Industry Committee formed three sub-groups, including the "Sub-Group for the Development of Term Reference Rates", as it considered that the development of term rates would become necessary upon the transition of existing IBORs to RFRs²⁹.

A EWG working group level survey noted that the development of a term rate for the euro area RFR would be important for both legacy and new contracts. Interest rate derivatives, retail products and syndicated loans were considered the areas most reliant on such rates³¹.

Status of the Development of Term RFRs

Following the selection of the RFRs, the focus of the working groups has now shifted to facilitating adoption of the new rates. As the development of term rates could aid adoption in certain cases, the market appetite for term RFRs, and potential methodologies to produce these, are now being actively discussed and investigated.

In the UK, the SWG was reconstituted in January 2018 with a mandate to catalyse a broad-based transition to using SONIA as the primary Sterling interest rate benchmark in bond, loan and derivatives markets by the end of 2021³². This mandate includes developing and promoting a term rate where appropriate. Due to the important role that term rates may have in facilitating a transition to SONIA, particularly in the loan and bond markets, the SWG has published a consultation paper³³ requesting feedback on potential forward-looking term SONIA constructions, their use cases, and their role in facilitating transition. The consultation paper proposes various methodologies to derive term SONIA based on prices or quotes observed in SONIA index futures or overnight index swaps markets or a combination of these.

In the US, the ARRC was reconstituted in March 2018 to ensure the implementation of its "Paced Transition Plan"³⁴. This plan includes the development of active and robust markets in futures and/or overnight index swaps referencing SOFR, from which a term rate could be constructed. The ARRC has already discussed several potential methods for deriving term SOFR, including from SOFR futures or overnight index swap transaction data or actionable market quotes³⁵.

In Japan, the Sub-Group for the Development of Term Reference Rates³⁶ has been established to deliberate on the development of term reference rates based on TONA.

In Switzerland, the NWG has surveyed users of Swiss Franc LIBOR to assess the need for term SARON³⁷. This survey included a consideration of a backward-looking term rate based on the repo market and forward-looking term rates based on SARON futures, overnight index swaps and repos. The NWG has released a term sheet for a SARON futures contract and invited exchanges to start offering the product³⁸. Sub-working groups of the NWG are currently assessing the market's preferences regarding, and the feasibility of developing, the different term SARON approaches.

In the euro area, a sub-group of the EWG focussing on term RFRs has been established³⁹ to determine and recommend a term rate methodology for ESTER. The sub-group has already discussed various potential methodologies based on futures, OIS quotes and transactions, alongside other backward-looking methodologies.

²⁷ ARRC Second Report, March 2018

²⁸ ARRC Minutes, 31 October, 2017

²⁹ Bank of Japan Announcement, 20 July, 2018

³⁰ Cross-Industry Committee Minutes, 1 August, 2018

³¹ EWG Minutes, 11 July, 2018

³² Bank of England Press Release, 29 November, 2017

³³ SWG Consultation on Term SONIA Reference Rates, July 2018

³⁴ ARRC Press Release, 7 March, 2018

³⁵ ARRC Second Report, March 2018

³⁶ Sub-Group for the Development of Term Reference Rates - Terms of reference

³⁷ Outreach to Swiss corporates on CHF Libor, 22 June, 2018

³⁸ 3M SARON Futures Contract Specifications (NWG recommendation), 22 June, 2018

³⁹ Working group on euro risk-free rates - Terms of reference for subgroup 2 on the identification and recommendation of a term structure on RFRs, 20 April, 2018



Possible Methodologies for Constructing Term Risk Free Rates

Term RFRs

A term RFR should seek to indicate the market's expectation of the average overnight rate over a specified period (e.g. one, three or six months). It can then be used to satisfy financial and operational requirements to calculate upcoming contractual payments at the beginning of an accrual period using forward-looking rates. This would give end users of the rate (e.g. corporations, small business, retail borrowers, etc.) greater certainty and would support liquidity management and cash flow planning.

Forward-looking term rates can be derived from market data points that offer an indication of the market's expectation of future RFR settings. At the current time, the deepest sources of data from which to derive expected RFR settings come from forward-looking derivative contracts such as futures contracts and interest rate swaps that reference RFRs.

Derivatives Markets Referencing RFRs

There are two primary derivatives markets that may be appropriate for deriving term RFRs: the overnight index swaps (OIS) market and the futures market.

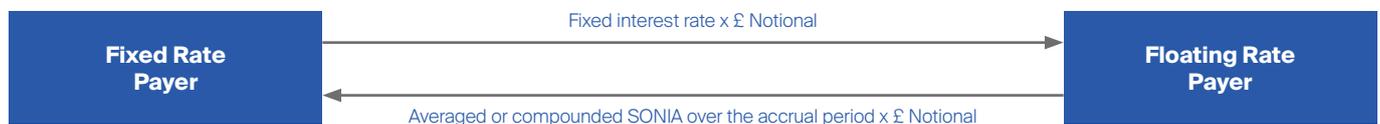
Overnight Index Swaps

OIS are interest rate swap contracts under which periodic payments calculated by applying a fixed interest rate to a given notional amount for a specified period are swapped against payments calculated by applying an overnight floating rate, such as a RFR averaged or compounded⁴⁰ over that specified period, to that same notional amount.

For example, a typical OIS contract in the Sterling markets would reference a set notional amount (e.g. £100m) with one party receiving a fixed rate multiplied by the set notional amount for a predetermined time period (e.g. one month) while paying the other party the compounded SONIA rate over the same period multiplied by the same set notional amount.

Market participants can use OIS to hedge short-term interest rate movements, to speculate on future interest rate policy or for arbitrage purposes. Generally OIS are entered into for short maturities and are traded "over-the-counter" or OTC (i.e. not executed on an exchange). OIS markets referencing some RFRs are well developed (e.g. SONIA), whereas others are developing or still to be established.

Figure 3: Example of a SONIA Overnight Index Swap



Futures

Interest rate futures are exchange-traded, cleared derivative contracts. The price of a futures contract will vary as expectations regarding the future value of the underlying reference floating interest rate (e.g. a simple average RFR) change. Futures contracts are traded in notional units and have a fixed maturity date. Participants can buy or sell the contracts on any business day.

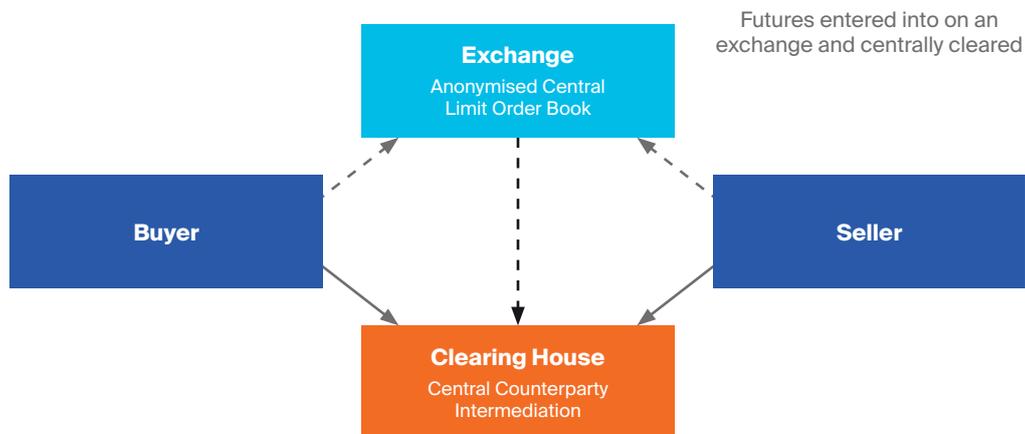
For example, a participant could enter a one month SONIA index futures contract at the prevailing market price on a given day, which would have a delivery price at maturity equal to 100 minus the simple monthly average SONIA rate.

Interest rate futures on overnight rates, such as RFRs, may be used to hedge against short-term interest rate movements, for speculation or arbitrage. Futures markets referencing RFRs are either developing (e.g. SONIA, SOFR), or are illiquid or still to be established (e.g. SARON, TONA, ESTER).

⁴⁰ Either methodology can be used



Figure 4: Example of a Futures Contract



Price Sources and Methodology Considerations for Term RFRs

There are various potential mechanisms that may be used to source prices for derivatives referencing RFRs, which can then be used to calculate expected average rates for particular tenors.

Transaction Data

Executed transaction data may be used for OIS and futures contracts referencing RFRs sourced from central counterparties, trade repositories or the trading venues themselves. These prices would need to be used alongside a financial model to generate yield curves for the required tenors (e.g. one, three and six months) as the transaction maturities are unlikely to align perfectly with the term rates required by market participants.

The feasibility of this approach depends on the development of liquid and robust underlying derivatives markets to provide sufficient price data to generate the relevant yield curves. It also requires prices to be made available on a timely basis to an administrator in order to compute the rates in an efficient manner. Furthermore, any model would need to be transparent and verifiable by users and the regulatory community.

Firm Quotes

Firm, tradable quotes from market makers may also be obtained for OIS and futures contracts referencing RFRs, sourced from trading venues. The feasibility of this approach again depends on the development of liquid, robust and transparent underlying derivatives markets. The use of firm quotes would broaden the data set substantially when compared with an approach using only transaction data. However, consideration would need to be given to maintaining the representativeness of the rate and the robustness of the underlying data. This approach would require the quotes to be made available on a timely basis to an administrator and any model would need to be transparent and verifiable (as noted above).

In addition to electronic trading venues, firm quotes could also be obtained from a point-in-time auction process for OIS trades in order to generate a term rate. Such an auction process would need sufficient interest to generate a representative price.

Hybrid

A hybrid of the above approaches, using executed transaction data alongside firm quotes, or settlement prices, could also be used to determine term RFRs. This approach could theoretically widen the data set relative to a methodology based solely on transaction data whilst retaining high levels of price transparency and representativeness of the rate. The above-mentioned considerations would apply regarding term RFRs constructed from transaction data and quotes, or settlement prices.

In all cases, the management and scope for oversight of both the data input process and the process of determining term RFRs must be considered when selecting the best approach. The potential for conflicts of interest and opportunities for manipulation to arise should be assessed and mitigated. This may be achieved by a regulated benchmark administrator through robust data submission practices, surveillance and appropriate oversight and governance (including the use of an oversight committee).



IBA Proposals for Term SONIA: ICE Term RFR - Forward-Looking - GBP

Term SONIA

In line with the considerations above, any forward-looking term rate for SONIA should seek to indicate the market's expectation of the average SONIA rate over a pre-determined time period. Market participants can then use these term rates to calculate upcoming contractual payments linked to such rates (e.g. interest payments) in advance of the relevant accrual period.

To derive term SONIA, IBA, a benchmark administrator authorised and regulated under the EU Benchmarks Regulation⁴¹, has considered both the OIS and futures derivatives markets referencing SONIA. IBA believes that any methodology used to produce forward-looking term rates for SONIA (as the RFR for the Sterling markets), or a derivation thereof, could potentially be applied to produce term rates for the other RFRs (i.e. for US dollar, Japanese yen, Swiss franc and euro currencies).

Please see Appendix 1 for further information about IBA and its activities as a benchmark administrator.

SONIA Derivatives Markets Available to Create Term Rates for SONIA

SONIA Overnight Index Swaps

The SONIA OTC OIS market is well established but episodic in nature. Trading in SONIA OIS contracts tends to be focussed around Monetary Policy Committee (MPC) meetings and other dates where public statements or information releases may impact interest rate expectations. Trading in SONIA OIS is spread across a range of tenors with the majority of contracts maturing within six months. It is also worth noting that SONIA OIS are generally forward-starting in order to coincide with MPC meeting and quarterly International Monetary Market (IMM) dates (i.e. accruals will start on a future date, not at the time the OIS contract is entered into)⁴².

It is IBA's view that the SONIA OIS market could be used to derive forward-looking term rates in the future but that it currently lacks the necessary price transparency to do this based on either transactions or firm quotes. There are also modelling challenges in trying to derive a SONIA yield curve from OIS data today due to the current prevalence of forward-starting (as opposed to spot) OIS in the market.

However, assuming developments in the SONIA OIS market lead to enhanced liquidity in spot-starting contracts and allow for transparent trading on regulated platforms, IBA would expect to be able to derive a term rate for SONIA from this market in the future.

SONIA Index Futures

In contrast to the SONIA OIS market, the SONIA index futures market is only recently established. ICE Futures Europe launched the market's first one month SONIA index futures contract in December 2017⁴³. The launch of a three month SONIA index futures contract by ICE Futures Europe followed in June 2018^{44 45}. Liquidity in ICE One Month SONIA Index Futures has increased over the intervening period, with cumulative volumes exceeding £222 billion as at the end of September 2018. In addition, open interest has continued to build, with over £26 billion notional as at the end of September 2018.

⁴¹ Regulation (EU) 2016/1011 of the European Parliament and the Council of 8 June, 2016 on indices used as benchmarks and financial contracts or to measure the performance of investment funds. IBA became authorised under the EU Benchmarks Regulation on 27 April, 2018

⁴² [SWG Consultation on Term SONIA Reference Rates, July 2018](#)

⁴³ [ICE Press Release, 26 October, 2017](#)

⁴⁴ [ICE Press Release, 18 April, 2018](#)

⁴⁵ CurveGlobal® also launched a three month SONIA index futures contract in April 2018 [CurveGlobal Press Release, 23 April, 2018](#). In addition, some market infrastructure providers have announced their intention to launch other futures contracts referencing the RFRs in the future (e.g. [CME Group Press Release, 22 August, 2018](#))



Figure 5: ICE One Month SONIA Index Futures Notional Volume

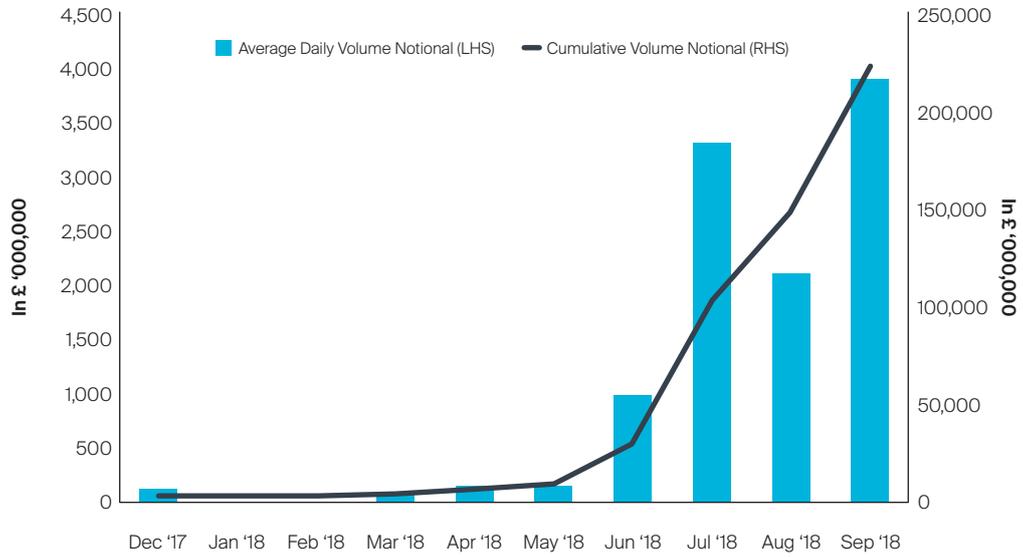
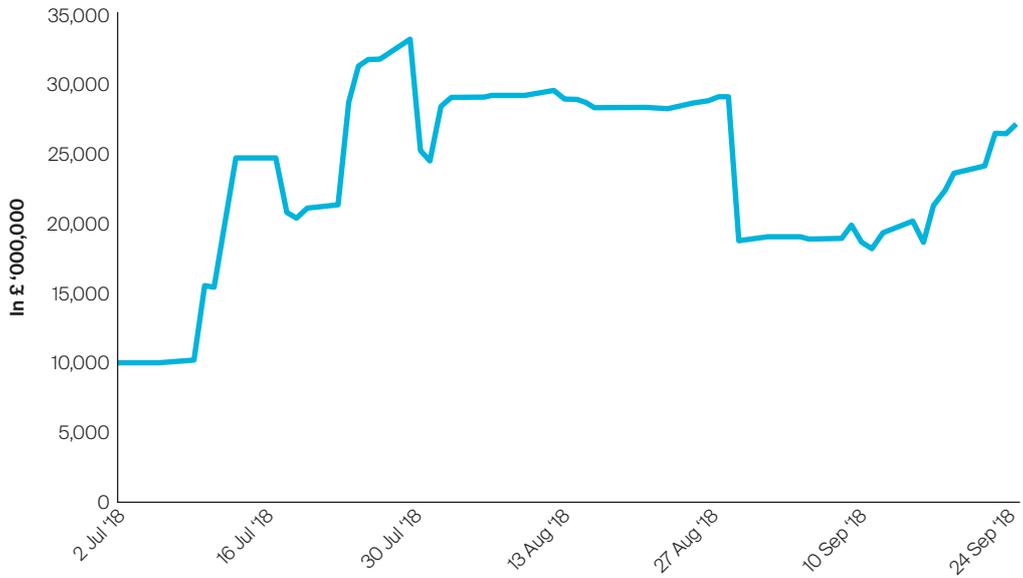


Figure 6: ICE One Month SONIA Index Futures Open Interest Notional





Although the SONIA index futures market is at a relatively early stage of development, the market provides accessibility and price transparency. Futures contracts trade every business day and have settlement prices that are published at the end of the day and made widely available. In addition, the availability of a one month SONIA index futures contract and associated prices provides more granular information from which to derive term SONIA compared to three month futures contracts or longer dated forward-starting OIS contracts. Currently a different ICE One Month SONIA Index Future covers each of the eight MPC meeting dates that are scheduled to take place each year, providing further suitable market information on interest rate policy expectations.

As a result, ICE One Month SONIA Index Futures⁴⁶ settlement prices, together with published SONIA rates, can provide the necessary data to generate a robust and representative implied yield curve on a daily basis. From this yield curve, IBA can derive and publish preliminary one, three and six month⁴⁷ forward-looking term rates for SONIA every day. As liquidity grows in the SONIA index futures market, IBA would also expect to be able to produce term SONIA from intra-day trading activity data. An attractive future outcome would be for IBA to produce term SONIA based on data from morning trading activity in SONIA index futures contracts and publish these rates later in the morning in London.

IBA's Proposed Methodologies

IBA's approaches for producing a forward-looking term rate for SONIA are set out below.

Deriving ICE Term RFR - Forward-Looking Futures Derived - GBP from ICE One Month SONIA Index Futures and Published SONIA Today

IBA will use the relevant overnight SONIA rates (published daily by the Bank of England), ICE One Month SONIA Index Futures settlement prices (published daily by ICE Futures Europe) and a methodology for identifying the MPC meeting or other dates that might result in rate changes over the relevant period in order to imply projected SONIA rates over a one, three and six month time period. These implied rates will then be compounded over the relevant period to determine the applicable term SONIA rate (ICE Term RFR - Forward-Looking Futures Derived - GBP).

IBA is proposing to publish ICE Term RFR - Forward-Looking Futures Derived - GBP for one, three and six month tenors on a daily basis.

Below are the steps that IBA will take to derive and publish the term rates:

1. Identify the following inputs:
 - a. the relevant overnight SONIA rates (i.e. the SONIA rate published on the date the term rate is being derived⁴⁸ and historical SONIA rates from the beginning of the month);
 - b. the ICE One Month SONIA Index Futures contracts maturing within each calendar month spanned by the relevant tenor period, and their associated settlement prices from the end of trading on the preceding trading day; and
 - c. the MPC meeting dates scheduled to fall during the tenors of the relevant futures contracts required to derive the term rate,
2. Calculate the rate using a step function model by:
 - a. determining, from published SONIA and the futures settlement prices, the implied average daily SONIA rates from the day the term rate is being derived by IBA until the end of the last calendar month spanned by the relevant tenor period, ascribing implied rate changes for each month to the relevant scheduled MPC meeting date⁴⁹ (or the first business day of the month where there is no scheduled MPC meeting⁵⁰); and
 - b. compounding the implied average daily rates for SONIA over the relevant tenor period to produce the term rate⁵¹, and
3. Publish the term rate on the ICE Term Risk Free Rates (RFR) Portal⁵² shortly after it is calculated, subject to quality control checks and verification.

⁴⁶ [ICE One Month SONIA Index Futures](#)

⁴⁷ IBA proposes to derive one, three and six month term rates, as these represent the most utilised sterling LIBOR tenors. Provided sufficient liquidity exists in the relevant futures market, it would also be possible to derive a twelve month term rate for SONIA where the relevant markets required this

⁴⁸ SONIA published on the date the term rate is being derived will be the SONIA rate in respect of the preceding business day (i.e. from the preceding business day overnight to the day of publication), as SONIA in respect of any given business day is published at 9:00am on the following business day

⁴⁹ The day the term rate is being derived will also be an implied rate change date, unless an MPC meeting is scheduled later in the starting month

⁵⁰ In the absence of a scheduled MPC meeting date, the futures contract will incorporate rate information for the entire calendar month

⁵¹ A forward-looking term rate should seek to indicate the market's expectation of an interest rate over a pre-determined time period. By compounding the daily derived interest rates over the relevant time period, IBA treats the daily return as being re-invested daily throughout that time period in order to calculate the term rate

⁵² See the [ICE Term RFR Portal section](#) for further information



IBA will use a modified following business day convention when calculating the term rates.

Please see Appendix 2 for further detail and information on IBA's proposed methodology to derive ICE Term RFR - Forward-Looking Futures Derived - GBP from ICE One Month SONIA Index Futures settlement prices, including a worked example.

Figure 7: ICE Term RFR - Forward-Looking Futures Derived - GBP methodology steps summary

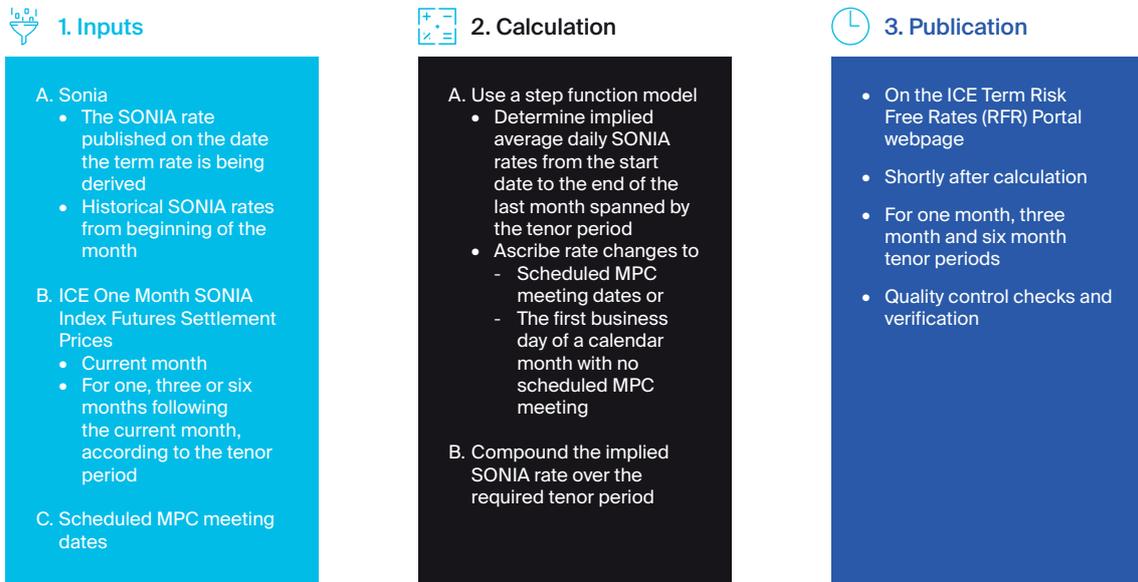
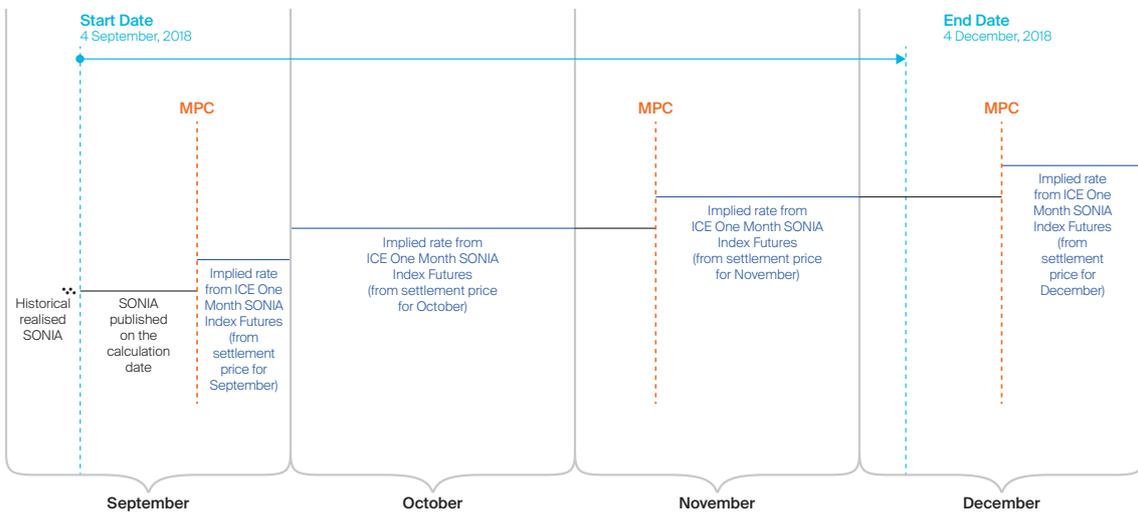


Figure 8: Example derivation of implied average daily SONIA rates for ICE Term Risk Free Rate - Forward-Looking Futures Derived - GBP 3M





Deriving ICE Term Risk Free Rate - Forward-Looking Swaps Derived - GBP from OIS Contracts in the Future

Following the required developments in the SONIA OIS market, including enhanced liquidity in spot-starting contracts and transparent trading on regulated platforms, IBA believes that a methodology similar to that used to derive ICE Swap Rate⁵³ could be used to derive forward-looking term rates for SONIA.

By way of background, ICE Swap Rate is a global benchmark for interest rate swaps and spreads, representing the mid-price of the fixed leg of interest rate swaps at particular times of the day for set tenors and currencies. It is used as the exercise value for cash-settled swaptions, to calculate close-out payments on the early termination of interest rate swaps, as a reference in some floating rate bonds and for valuing interest rate swap portfolios. It was also the first global benchmark to transition from a submission-based rate (using inputs from a panel of banks) to a rate based on tradable quotes sourced from regulated electronic trading venues.

Below are the steps that IBA would expect to take to derive and publish ICE Term RFR - Forward-Looking Swaps Derived - GBP from SONIA OIS quotes:

1. Receive multiple complete central limit order books (tradable bids and offers for the relevant SONIA OIS) from regulated trading platforms for a time window shortly before publication. Take a set number of “snapshots” from this data at randomised times;
2. Combine data for each snapshot into a global, synthetic order book and calculate a volume-weighted average mid-price (VWAMP) for that snapshot;
3. Exclude certain snapshots through integrity testing (e.g. Illiquidity, outlier and crossed order book tests); and
4. Derive the relevant term rate as the quality-weighted (by spread) average of the remaining VWAMPs.

Further information on ICE Swap Rate and its methodology can be found at <https://www.theice.com/iba/ice-swap-rate>

Producing an Intra-day ICE Term RFR - Forward-Looking - GBP

As liquidity develops in the SONIA index futures market, and where there is sufficient price transparency, it may be possible to derive term SONIA from transactions or firm quotes taken during specific time intervals instead of using futures settlement prices. For example, IBA could use data taken from the morning of publication, between 10am and 11am⁵⁴. A methodology similar to that used to derive ICE Swap Rate (as described above) could be used to compile a series of volume-weighted average mid-point prices from which the required term rates could be derived.

Combining transaction or firm quote data obtained from a broader range of products, including SONIA index futures contracts for one and three months and OIS in this manner, could also result in an enhanced methodology. Such an approach could provide additional term data and transparency, thereby increasing the availability of the data and the representativeness of the rate.

⁵³ Formerly known as ISDAFIX

⁵⁴ Economic releases in the UK are usually published at 9:30am. MPC rate decisions are typically announced at 12:00 midday



ICE Term RFR - Forward-Looking - GBP: Historical Testing

ICE Term Risk Free Rate - Forward-Looking Futures Derived - GBP and Sterling LIBOR

IBA has back-tested its calculations for term SONIA derived from ICE One Month SONIA Index Futures settlement prices for the period from June to September 2018 in order to evaluate the methodology.

See below (Figures 9, 10 and 11) for charts showing ICE Term Risk Free Rate - Forward-Looking Futures Derived - GBP for one, three and six month tenor periods together with one, three and six month Sterling LIBOR, respectively, for the period of the back-testing⁵⁵.

Figure 9: ICE Term Risk Free Rate - Forward-Looking Futures Derived - GBP 1M and One Month Sterling LIBOR (1 June, 2018–26 September, 2018)

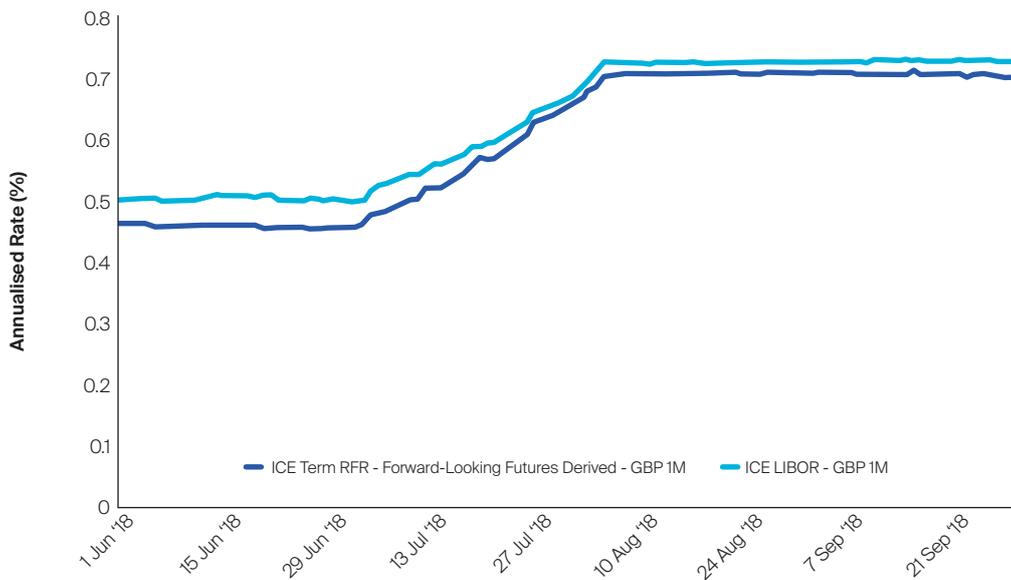
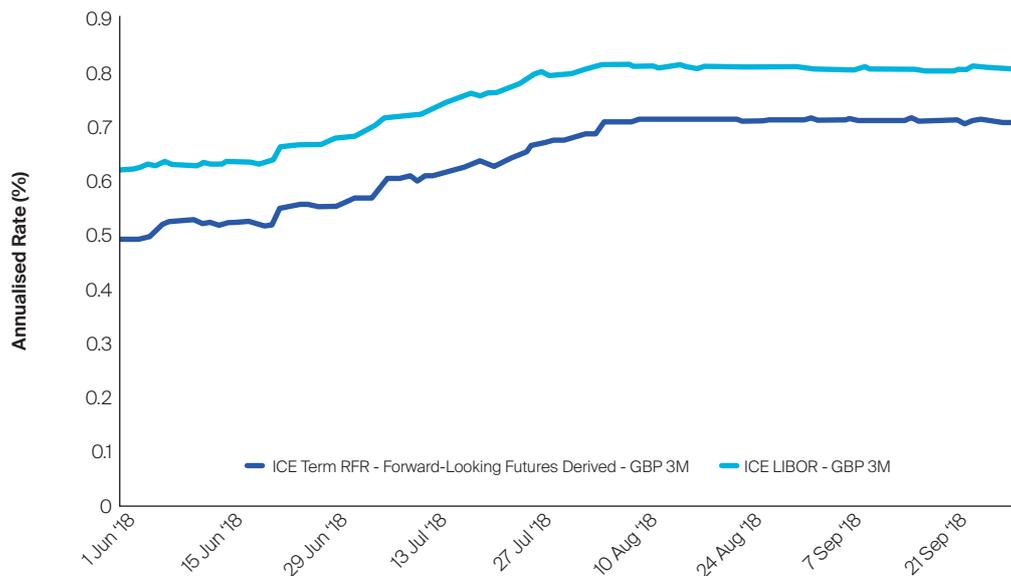


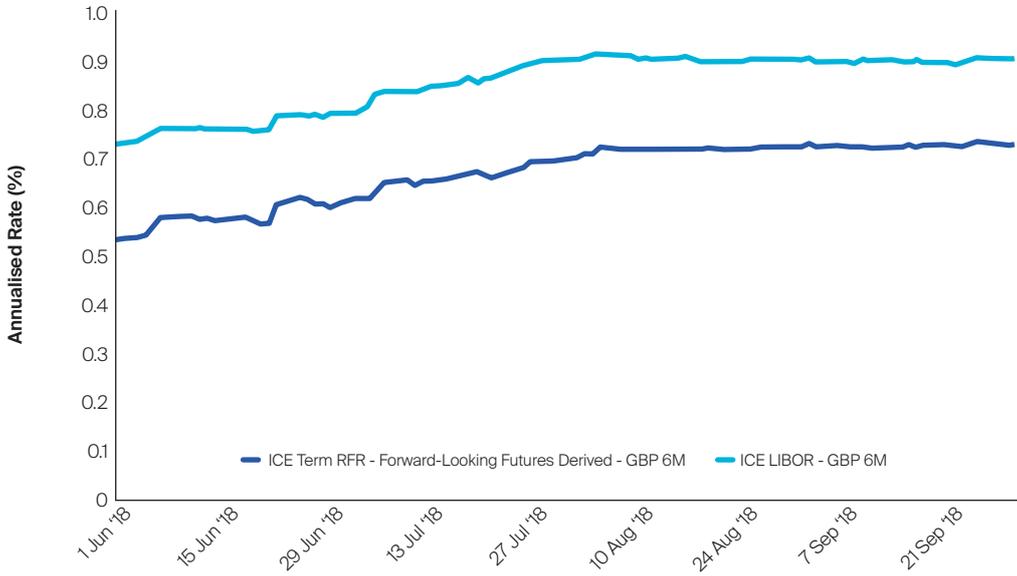
Figure 10: ICE Term Risk Free Rate - Forward-Looking Futures Derived - GBP 3M and Three Month Sterling LIBOR (1 June, 2018–26 September, 2018)



⁵⁵ Note that LIBOR and ICE Term Risk Free Rate - Forward-Looking Futures Derived - GBP are produced using different methodologies and different data sources. LIBOR is a measure of the average rates at which LIBOR panel banks could obtain wholesale, unsecured funding for set periods in particular currencies, and as such may incorporate factors such as bank credit and liquidity risk. SONIA is a measure of the rate at which interest is paid on Sterling overnight wholesale funds in circumstances where credit, liquidity and other risks are minimal. As a result, no direct comparison can or should be made between the LIBOR and ICE Term Risk Free Rate - Forward-Looking Futures Derived - GBP for any period, including the period of back-testing.



Figure 11: ICE Term Risk Free Rate - Forward-Looking Futures Derived - GBP 6M and Six Month Sterling LIBOR (1 June, 2018–26 September, 2018)





The ICE Term Risk Free Rates (RFR) Portal

Today, IBA has started publishing the [ICE Term RFR Portal](#) on a daily basis. This webpage is designed to be a comprehensive RFR data source for market participants.

Initially, the ICE Term RFR Portal will include:

- Daily one, three and six month forward-looking term rates for SONIA derived from ICE One Month SONIA Index Futures settlement prices and published SONIA rates (ICE Term Risk Free Rate - Forward-Looking Futures Derived - GBP);
- Daily realised simple and compounded averages for one, three and six month tenor periods for each available RFR derived from the historical published RFR for the relevant period; and
- The daily RFR for each currency where available for broad market distribution⁵⁶

Over time, with the required developments in the relevant underlying markets, IBA would like the ICE Term RFR Portal to also include:

- One, three and six month forward-looking term rates for SONIA derived from SONIA OIS contracts (ICE Term Risk Free Rate - Forward-Looking Swaps Derived - GBP); and
- Forward-looking term rates for the US dollar, Japanese yen, Swiss franc and euro RFRs derived from futures and/or OIS contracts.

The ICE Term RFR Portal will be updated daily at various time intervals based on the release time of the relevant RFRs and the time windows selected for calculating the relevant term RFRs.

IBA is working to develop methodologies which would allow for same-day publication of all term RFRs in the morning in the time zone of the relevant currency area.

⁵⁶ IBA is in discussions with SIX Exchange Ltd regarding re-distribution of SARON through the ICE Term RFR Portal



Figure 12: Overview of the ICE Term RFR Portal⁵⁷

Report Center

Welcome to the ICE Report Center

To view all report categories or recently viewed reports, please scroll down. Please note that the Data Tab has been renamed to FUTURES U.S. COMMODITY AND INDICES DATA below.

End Of Day report packages in .csv format and National Gas Exchange Indices are available for purchase on a subscription basis. [View Content](#)

REPORTS ▼ ICE TERM RFR PORTAL MARKET: ICE BENCHMARK ADMINISTRATION

Report Date: 09-Oct-2018 [📅](#)

[Export to Excel](#) [Show Methodology](#)

ICE Term Risk Free Rates (RFR) Portal

09-Oct-2018

| CURRENCY | RFR BENCHMARK | LAST SETTING (%) | PUBLICATION DATE | PUBLICATION TIME (LONDON TIME) |
|----------|---------------|------------------|------------------|--------------------------------|
| GBP | SONIA | 0.7021 | 09-OCT-18 | 09:00 |
| USD | SOFR | 2.1600 | 09-OCT-18 | 13:00 |
| JPY | TONA | -0.0510 | 09-OCT-18 | 02:00 |
| EUR | ESTER | - | - | - |

GBP

| TERM | ICE TERM RFR - REALISED | | ICE TERM RFR - FORWARD LOOKING | |
|------------------------------|-------------------------|-----------------|--------------------------------|-------------------|
| | AVERAGE (%) | COMPOUNDED (%) | FUTURES DERIVED (%) | SWAPS DERIVED (%) |
| 1 Month | 0.7007 | 0.7009 | 0.7023 | To be developed |
| 3 Months | 0.6373 | 0.6378 | 0.7084 | To be developed |
| 6 Months | 0.5464 | 0.5471 | 0.7446 | To be developed |
| Last Published (London Time) | 09-OCT-18 11:56 | 09-OCT-18 11:56 | 09-OCT-18 11:56 | - |

USD

| TERM | ICE TERM RFR - REALISED | | ICE TERM RFR - FORWARD LOOKING | |
|------------------------------|-------------------------|-----------------|--------------------------------|-------------------|
| | AVERAGE (%) | COMPOUNDED (%) | FUTURES DERIVED (%) | SWAPS DERIVED (%) |
| 1 Month | 2.0448 | 2.0464 | To be developed | To be developed |
| 3 Months | 1.9539 | 1.9587 | To be developed | To be developed |
| 6 Months | 1.8729 | 1.8817 | To be developed | To be developed |
| Last Published (London Time) | 09-OCT-18 16:16 | 09-OCT-18 16:16 | - | - |

JPY

| TERM | ICE TERM RFR - REALISED | | ICE TERM RFR - FORWARD LOOKING | |
|------------------------------|-------------------------|-----------------|--------------------------------|-------------------|
| | AVERAGE (%) | COMPOUNDED (%) | FUTURES DERIVED (%) | SWAPS DERIVED (%) |
| 1 Month | -0.0600 | -0.0600 | To be developed | To be developed |
| 3 Months | -0.0614 | -0.0614 | To be developed | To be developed |
| 6 Months | -0.0635 | -0.0635 | To be developed | To be developed |
| Last Published (London Time) | 09-OCT-18 11:56 | 09-OCT-18 11:56 | - | - |

EUR

| TERM | ICE TERM RFR - REALISED | | ICE TERM RFR - FORWARD LOOKING | |
|------------------------------|-------------------------|-----------------|--------------------------------|-------------------|
| | AVERAGE (%) | COMPOUNDED (%) | FUTURES DERIVED (%) | SWAPS DERIVED (%) |
| 1 Month | To be developed | To be developed | To be developed | To be developed |
| 3 Months | To be developed | To be developed | To be developed | To be developed |
| 6 Months | To be developed | To be developed | To be developed | To be developed |
| Last Published (London Time) | - | - | - | - |

DISCLAIMERS

This webpage (the ICE Term RFR Portal) is under development and is hosted on the Intercontinental Exchange, Inc. (ICE) website. The data herein is provided for information purposes and is made available only for the limited purposes set out in your user agreement.

None of ICE Benchmark Administration Limited (IBA), ICE, or any of its or their affiliates accepts any responsibility for the data herein or for any use that you may make of it and, except as otherwise expressly set out in your user agreement, all implied terms, conditions and warranties and liabilities in relation to the data and its publication on the ICE Term RFR Portal are hereby excluded to the fullest extent permitted by law. "ICE" is a trademark of ICE and/or its affiliates.

SONIA is published by the Bank of England and is republished on the ICE Term RFR Portal under licence from the Bank of England subject to the Bank of England's [Disclaimers for SONIA](#). The "SONIA" mark is used under licence from the Bank of England the benchmark administrator of SONIA, and the use of such mark does not imply or express any approval or endorsement by the Bank of England. "Bank of England" and "SONIA" are registered trademarks of the Bank of England. The Bank of England has no liability for your use of the data herein.

SOFR is published by the Federal Reserve Bank of New York (New York Fed) and is republished on the ICE Term RFR Portal subject to New York Fed [Terms of Use for Select Rate Data](#). New York Fed has no liability for your use of the data herein.

TONA is published by the Bank of Japan and is republished on the ICE Term RFR Portal subject to the Bank of Japan [Terms of Use for TONA](#). The Bank of Japan has no liability for your use of the data herein.

IBA is in discussion with SDX Exchange Ltd regarding potential re-distribution of SARBON through the ICE Term RFR Portal.

© Copyright 2018, ICE Benchmark Administration Limited

⁵⁷ The disclaimers set out in the ICE Term RFR Portal are repeated on page 21 of this paper



Realised Average Rates

IBA proposes to include realised, historical average RFRs over one, three and six month time periods as part of the ICE Term Risk Free Rates (RFR) Portal in order to provide additional RFR data to market participants. IBA expects these realised averages will provide financial market participants with useful historical rate information, alongside the daily RFRs and forward-looking term rates.

Simple average rate

IBA will publish on a daily basis the simple arithmetic average of the published RFRs for the one, three and six month periods prior to the publication date. These rates will be derived using only published overnight RFRs as inputs.

Compounded rate

In addition to a simple arithmetic average, IBA will publish on a daily basis compounded RFRs for the one, three and six month periods prior to the publication date. These rates will also be derived using only published overnight RFRs as inputs.

IBA will use a modified following business day convention when calculating these rates.

Please see Appendix 2 for further detail and information on IBA's proposed methodologies to calculate realised average rates from historical published RFRs.

Feedback Period

Please note that, at this time, the data displayed on the ICE Term RFR Portal is being provided for information purposes only. The data should not be used as a benchmark for the purposes of the EU Benchmarks Regulation or otherwise and should not be used as a measure, reference or input in financial instruments or fund performance or to create or derive other products or indices.

IBA is seeking stakeholder feedback on the design and performance of the ICE Term RFR Portal. If you would like to provide any comments or feedback (including on timing of publication, layout or IBA's proposed methodologies for determining term SONIA and other term RFRs), please contact IBA at IBA@theice.com.



Disclaimers

PLEASE READ THE FOLLOWING PROVISIONS CAREFULLY. PLEASE TAKE SPECIFIC AND PROFESSIONAL ADVICE AS APPROPRIATE BEFORE USING OR INVESTING IN ANY FINANCIAL INSTRUMENT OR ENTERING INTO ANY CONTRACT LINKED TO ICE BENCHMARK ADMINISTRATION LIMITED'S BENCHMARK, RATE OR OTHER INFORMATION.

Purpose of this paper

This paper sets out the background to ICE Benchmark Administration Limited's (IBA) proposals to produce and publish, on a preliminary basis, forward-looking term rates and realised averages for SONIA and the other alternative risk free rates and provides a summary of those proposals.

All information in this paper is provided for information purposes only and is not intended to predict, forecast or give any indication of future information or performance.

No responsibility for information or use

None of IBA, Intercontinental Exchange, Inc. (ICE), or any of its or their affiliates accepts any responsibility for the benchmark, rate or other information contained in this paper or the use that you may make of it or makes any claim, prediction, warranty or representation whatsoever, expressly or impliedly, either as to the results to be obtained from the use of IBA's benchmark, rate or other information (including the information in this paper) or otherwise or to the fitness or suitability of such information for any particular purpose to which it might be put.

The data published by IBA on the ICE Term Risk Free Rates (RFR) Portal is currently for information purposes only. You should not use, and IBA expressly prohibits the use of, such data as an index by reference to which the amount payable under a financial instrument or a financial contract, or the value of a financial instrument, is determined, or as an index that is used to measure the performance of an investment fund with the purpose of tracking the return of such index or of defining the asset allocation of a portfolio or of computing the performance fees at this time. Such data should not be used as a benchmark for the purposes of the EU Benchmarks Regulation or otherwise.

None of IBA, ICE or any of its or their affiliates will be liable in contract or tort (including negligence), for breach of statutory duty or nuisance or under antitrust laws or otherwise, in respect of any inaccuracies, errors or omissions in this paper or any damage, expense or other loss you may suffer arising out of or in connection with this paper, your use of the information contained within it or any reliance you may place upon it.

IBA, ICE and each of its and their affiliates hereby excludes, to the fullest extent permitted by law, all warranties, conditions and terms, whether express or implied by statute, common law or otherwise, including warranties or representations as to, and all liabilities whether in contract, tort (including negligence) or otherwise in relation to, the quality, fitness for purpose, accuracy, completeness or timeliness of IBA's benchmark, rate or other information (including the information in this paper) or as to the results to be attained thereby, or as to any course of action determined by you.

None of IBA, ICE or any of its or their affiliates excludes or limits liability for fraud or fraudulent misrepresentation or death or personal injury caused by negligence.

No investment activity

None of IBA, ICE or any of its or their affiliates provides investment advice and no publication of benchmark, rate or other information should be taken as constituting financial or investment advice, an invitation or inducement to engage in any investment activity or a financial promotion.

None of IBA, ICE or any of its or their affiliates makes any representation regarding the advisability of investing in any financial instrument or entering into any contract linked to IBA's benchmark, rate or other information, and any decision to invest in any such instrument or enter into any such contract should not be made in reliance on IBA's benchmark, rate or other information. No such investment or contract should be entered into without obtaining appropriate specific and professional legal, tax, accounting, regulatory and investment advice.

Intellectual Property Rights

By reviewing the material in this paper, you acknowledge that all intellectual property rights in the benchmark, rate and other information are the property of or licensed to ICE or IBA and that you have no rights in or to IBA's benchmark, rate or other information (including information in this paper) other than as may be expressly set out in any licence or sub-licence from ICE or IBA in relation thereto.



Changes and cessations in benchmarks and rates

Users of IBA's benchmark, rate or other information should produce and maintain robust written fallback provisions and plans setting out the actions that would be taken in the event of material changes to or cessation of the relevant benchmark, rate or other information. These should include, where feasible and appropriate, specifying alternative benchmarks or rates that could be referenced as a substitute with reasons as to why they are suitable alternatives. Various factors, including those beyond IBA's control, might necessitate material changes to or cessation of a benchmark, rate or other information. Please ensure that any financial instrument or contract that you invest in or are a party to which is linked to IBA's benchmark, rate or other information contains such provisions and plans and that you consider the potential impact on any relevant financial instrument or contract of a material change or cessation of the relevant benchmark, rate or other information.

Licences

IBA licenses benchmark, rate and other information to users for purposes including: valuation and pricing activities, use as a reference rate in transactions and for the creation of financial products; redistribution to third parties; trading and clearing activities; historical access; and the issuance of exchange traded products. Such benchmark, rate and other information is provided solely for the purposes specified in the relevant licence. Access to certain historical benchmark information is also provided by IBA without a specific licence for information purposes only.

The ICE Term RFR Portal

The ICE Term RFR Portal is under development and is hosted on the ICE website. The data contained in the ICE Term RFR Portal is provided for information purposes and is made available only for the limited purposes set out in the relevant user agreement.

None of IBA, ICE, or any of its or their affiliates accepts any responsibility for the data contained in the ICE Term RFR Portal or for any use that you may make of it and, except as otherwise expressly set out in the relevant user agreement, all implied terms, conditions and warranties and liabilities in relation to the data and its publication on the ICE Term RFR Portal are hereby excluded to the fullest extent permitted by law. "ICE" is a trademark of ICE and/or its affiliates.

SONIA is published by the Bank of England and is republished on the ICE Term RFR Portal under licence from the Bank of England subject to the Bank of England's [Disclaimers for SONIA](#). The "SONIA" mark is used under licence from the Bank of England (the benchmark administrator of SONIA), and the use of such mark does not imply or express any approval or endorsement by the Bank of England. "Bank of England" and "SONIA" are registered trade marks of the Bank of England. The Bank of England has no liability for your use of the data contained in the ICE Term RFR Portal.

SOFR is published by the Federal Reserve Bank of New York (New York Fed) and is republished on the ICE Term RFR Portal subject to New York Fed [Terms of Use for Select Rate Data](#). New York Fed has no liability for your use of the data contained in the ICE Term RFR Portal.

TONA is published by the Bank of Japan and is republished on the ICE Term RFR Portal subject to the Bank of Japan [Terms of Use for TONA](#). The Bank of Japan has no liability for your use of the data contained in the ICE Term RFR Portal.

IBA is in discussions with SIX Exchange Ltd regarding the potential re-distribution of SARON through the ICE Term RFR Portal.

General

IBA is authorised and regulated by the Financial Conduct Authority. LIBOR, ICE LIBOR, ICE Swap Rate and ICE Benchmark Administration are trademarks of ICE and/or its affiliates.

Intercontinental Exchange (NYSE: ICE) is a Fortune 500 and Fortune Future 50 company formed in the year 2000 to modernize markets. ICE serves customers by operating the exchanges, clearing houses and information services they rely upon to invest, trade and manage risk across global financial and commodity markets. A leader in market data, ICE Data Services serves the information and connectivity needs across virtually all asset classes. As the parent company of the New York Stock Exchange, the company raises more capital than any other exchange in the world, driving economic growth and transforming markets.

Trademarks of ICE and/or its affiliates include Intercontinental Exchange, ICE, ICE block design, NYSE and New York Stock Exchange. Information regarding additional trademarks and intellectual property rights of Intercontinental Exchange, Inc. and/or its affiliates is located at <https://www.intercontinentalexchange.com/terms-of-use>. Key Information Documents for certain products covered by the EU Packaged Retail and Insurance-based Investment Products Regulation can be accessed on the relevant exchange website under the heading "Key information Documents (KIDS)".

Safe Harbor Statement under the Private Securities Litigation Reform Act of 1995 -- Statements in this paper regarding ICE's business that are not historical facts are "forward-looking statements" that involve risks and uncertainties. For a discussion of additional risks and uncertainties, which could cause actual results to differ from those contained in the forward-looking statements, see ICE's Securities and Exchange Commission (SEC) filings, including, but not limited to, the risk factors in ICE's Annual Report on Form 10-K for the year ended December 31, 2017, as filed with the SEC on February 7, 2018.



Appendix 1 - Overview of IBA

ICE Benchmark Administration Limited (IBA) is authorised and regulated by the Financial Conduct Authority (FCA) as a benchmark administrator under the EU Benchmarks Regulation.

IBA is responsible for the end-to-end administration, operation and governance of benchmarks and similar services. It is one of the world's most experienced administrators of regulated, IOSCO-compliant benchmarks, currently administering:

- ICE LIBOR - a global benchmark for short-term interest rates, providing an indication of the average rates at which LIBOR panel banks could obtain wholesale, unsecured funding for set periods and currencies. ICE LIBOR is classified as a critical benchmark under Article 20 of the EU Benchmarks Regulation;
- ICE Swap Rate - a global benchmark for interest rate swaps and spreads, representing the mid-price of the fixed leg of interest rate swaps at particular times of the day for set tenors and currencies. ICE Swap Rate was the first global benchmark to transition from a submission-based rate, using inputs from a panel of banks, to a rate based on tradable quotes sourced from regulated electronic trading venues; and
- LBMA Gold and Silver Prices⁵⁸ - global benchmark prices for unallocated gold and silver delivered in London. Today, these important benchmarks are based on an independently administered and transparent electronic auction process.

IBA has also partnered with the International Swaps and Derivatives Association, Inc. (ISDA) to operate a crowdsourcing platform, which collates risk inputs from market participants to allow the calculation of initial margins for non-cleared derivatives under the ISDA Standard Initial Margin Model (SIMM)⁵⁹.

IBA has an in-house team with trading expertise that conducts daily surveillance on all of IBA's benchmarks, while IBA's governance structure and oversight committees oversee the correct functioning of its benchmarks.

IBA, a wholly-owned subsidiary of Intercontinental Exchange, Inc., is incorporated in England and Wales. IBA's board is comprised of a majority of independent non-executive directors and has an independent chair.

More information about IBA and its activities can be found at <https://www.theice.com/iba>.

⁵⁸ LBMA Gold Price and LBMA Silver Price are trademarks of the London Bullion Market Association

⁵⁹ ISDA and SIMM are trademarks of the International Swaps and Derivatives Association, Inc.



Appendix 2 - ICE Term Risk Free Rates - Methodologies

Realised Averages

Simple Average Rate

First, determine the start and end dates for the relevant tenor period. For the n -month tenor, the end date is the business day in respect of which the simple average rate is being determined (i.e. the simple average rate calculation and publication date) and the start date is the business day n months before the end date, based on a modified following business day convention. The start date and end date will both always be business days.

Secondly, calculate the average overnight rate over the tenor period as:

$$\sum_{i=1}^n \frac{r_i}{n}$$

Where n is the number of calendar days from (and including) the start date to (but excluding) the end date and r_i is the applicable overnight rate in respect of calendar day i . If i is a business day, then r_i will be the overnight rate in respect of that day; otherwise it will be the overnight rate in respect of the preceding business day.

Compounded Rate

First, determine the start and end dates for the relevant tenor period in the same manner as for the simple average rate.

Secondly, calculate the compounded overnight rate over the tenor period as:

$$\left[\prod_{i=1}^d \left(1 + \frac{r_i \cdot a_i}{b} \right) - 1 \right] \cdot \frac{b}{n}$$

Where n is the number of calendar days from (and including) the start date to (but excluding) the end date, d is the number of business days in the same period, b is the applicable day count fraction denominator⁶⁰, r_i is the applicable overnight rate in respect of business day i , and a_i is the number of calendar days in the period in respect of which rate r_i applies.

ICE Term Risk Free Rate - Forward-Looking Futures Derived - GBP

Term Sonia Derived from ICE One Month SONIA Index Futures Settlement Prices

First, determine the start and end dates for the relevant tenor period. For the n -month tenor, the start date is the business day in respect of which the term rate is being determined (i.e. the term rate calculation and publication date) and the end date is the business day n months following the start date, based on a modified following business day convention. The start date and end date will both always be business days.

Secondly, determine a schedule of rate change dates for the tenor period. The schedule will contain exactly one rate change date for each calendar month spanned by the tenor, including the months containing the start and end dates.

⁶⁰ 365 for Sterling



For the calendar month containing the start date, the rate change date for that month will be either:

- the scheduled MPC meeting date for that month, provided this occurs on or after the start date; or
- the start date, where this falls after the scheduled MPC meeting date for that month or there is no MPC meeting date scheduled for that month.

For subsequent calendar months (including the month containing the end date), the rate change date for that month will be either:

- the scheduled MPC meeting date for that month; or
- the first business day of that month, where there is no scheduled MPC meeting date for that month.

Note that, for the month containing the end date, the rate change date might fall after the end date.

Thirdly, for each calendar month spanned by the tenor, determine the initial rate to apply for each calendar day (if any) prior to the rate change date for that month and the new rate to apply to each calendar day from (and including) the rate change date for that month to the end of that month.

- For the month containing the start date, use SONIA in respect of the business day preceding the start date (which is published on the start date) as the initial rate. For each subsequent calendar month, the initial rate will be the new rate calculated for the rate change date for the previous month.
- To derive the new rate for each rate change date:
 - Calculate the sum of the daily interest rates in respect of each calendar day in the month from the start of the month up to (but excluding) the rate change date.
 - For the calendar month containing the start date, for each calendar day (if any) up to (but excluding) the start date, use the published SONIA rate in respect of such day. For a business day, this will be SONIA published in respect of that day⁶¹; otherwise it will be SONIA published in respect of the preceding business day. For each calendar day from (and including) the start date up to (but excluding) the first rate change date (if this is different to the start date), use published SONIA in respect of the business day preceding the start date (i.e. SONIA published on the start date).
 - For subsequent months, for each calendar day up to (but excluding) the rate change date use the rate calculated for the rate change date for the previous month.
 - Imply a sum of interest rates for the whole calendar month from the ICE One Month SONIA Index Futures settlement price for that calendar month, published at the end of trading on the preceding business day⁶².
 - Subtract the sum of the rates for the calendar days up to (but excluding) the rate change date from the implied sum for the whole month, to determine a sum of the rates for all calendar days from (and including) the rate change to (and including) the last calendar day of that month.
 - Divide this by the number of calendar days from (and including) the rate change date to (and including) the last calendar day of the month to obtain the new daily rate, which will apply from (and including) the rate change date for that calendar month.

Fourthly, having determined the new rates for each rate change date, and consequently the rate to apply to each calendar day of the tenor period, the derived term rate is calculated by daily compounding of these rates across the tenor period, using the same standard compounding approach as for the realised compound average rate:

$$\left[\prod_{i=1}^d \left(1 + \frac{r_i \cdot a_i}{b} \right) - 1 \right] \cdot \frac{b}{n}$$

Where n is the number of calendar days from (and including) the start date to (but excluding) the end date, d is the number of business days in the same period, b is the applicable day count fraction denominator⁶³, r_i is the applicable rate in respect of business day i , and a_i is the number of calendar days in the period in respect of which rate r_i applies.

⁶¹ The SONIA rate in respect of a given business day is published at 9:00am on the following business day

⁶² Note that the futures price represents a simple average of daily rates for the calendar month

⁶³ 365 for Sterling



Worked Example: Calculating ICE Term Risk Free Rate - Forward-Looking Futures Derived - GBP 3M for 8 June, 2018

Input data

Start date: 8 June, 2018

End date: 3 months following the start date. Following the modified following business day convention, this is 10 September, 2018

There are scheduled MPC meeting dates on 21 June, 2 August and 13 September, 2018

The dates in the relevant months when a rate change date occurs are:

- 21 June, 2018 (scheduled MPC meeting date)
- 2 July, 2018 (first business day of month, as there is no scheduled MPC meeting date in July)
- 2 August, 2018 (scheduled MPC meeting date)
- 13 September, 2018 (scheduled MPC meeting date⁶⁴)

The rates implied for the relevant period by ICE One Month SONIA Index Futures settlement prices on 7 June, 2018, are:

- June: 99.545, implying a rate of **0.455** and a whole month sum of $30 \times 0.455 = 13.65$
- July: 99.535, implying a rate of **0.465** and a whole month sum of $31 \times 0.465 = 14.415$
- August: 99.395, implying a rate of **0.605** and a whole month sum of $31 \times 0.605 = 18.755$
- September: 99.395, implying a rate of **0.605** and a whole month sum of $30 \times 0.605 = 18.15$

June calculation

SONIA rates for dates prior to the first rate change date:

| Date | SONIA rate to use | Number of days rate is applicable | Weighted rate |
|--------------------------------------|-------------------|-----------------------------------|---------------|
| Realised rates⁶⁵: | | | |
| Fri 01/06/18 | 0.4544 | 3 | 1.3632 |
| Mon 04/06/18 | 0.4522 | 1 | 0.4522 |
| Tue 05/06/18 | 0.4525 | 1 | 0.4525 |
| Wed 06/06/18 | 0.4519 | 1 | 0.4519 |
| Thu 07/06/18 | 0.4531 | 1 | 0.4531 |
| Projected rates⁶⁶: | | | |
| Fri 08/06/18 | 0.4531 | 3 | 1.3593 |
| Mon 11/06/18 | 0.4531 | 1 | 0.4531 |
| Tue 12/06/18 | 0.4531 | 1 | 0.4531 |
| Wed 13/06/18 | 0.4531 | 1 | 0.4531 |
| Thu 14/06/18 | 0.4531 | 1 | 0.4531 |
| Fri 15/06/18 | 0.4531 | 3 | 1.3593 |
| Mon 18/06/18 | 0.4531 | 1 | 0.4531 |
| Tue 19/06/18 | 0.4531 | 1 | 0.4531 |
| Wed 20/06/18 | 0.4531 | 1 | 0.4531 |
| Sum of weighted rates: | | | 9.0632 |

Subtract this sum from the whole month implied sum of 13.65 to get an implied aggregated rate for the 10 remaining days of June of: 4.5868

Dividing this by the number of remaining days (10) gives a daily implied rate from (and including) 21 June, 2018 of: **0.45868**

⁶⁴ Note that this is after the end date

⁶⁵ The SONIA rate to use for a given day up to (but excluding) the start date is published on the following business day

⁶⁶ The SONIA rate for the business day preceding the start date is published on the start date and is used for each day up to (but excluding) the first rate change date. In this case the SONIA rate for the 7 June is published on 8 June at 9:00 am



July calculation

Using the rate for the prior month's rate change date of 0.45868, IBA calculates the sum of rates up to (but excluding) the rate change date (2 July, 2018) as: $1 \times 0.45868 = 0.45868$

Subtract this from the whole month implied sum of 14.415 to give an implied aggregated rate for the 30 remaining days of July of 13.95632

Dividing this by the number of remaining days (30) gives a daily implied rate from (and including) 2 July, 2018 of: **0.46521**

August calculation

Using the rate for the prior month's rate change date of 0.46521, IBA calculates the sum of rates up to (but excluding) the rate change date (2 August, 2018) as: $1 \times 0.46521 = 0.46521$

Subtract this from the whole month implied sum of 18.755 to give an implied aggregated rate for the 30 remaining days of August of 18.28979

Dividing this by the number of remaining days (30) gives a daily implied rate from (and including) 2 August, 2018: **0.60966**

September calculation

There is no need to calculate a new rate for the scheduled MPC meeting date of 13 September, 2018, because this date is after the end of the three month tenor period.

The rate for the prior month's rate change date of 0.60966 will continue to be used for the 9 calendar days in September up to (but excluding) the end date.

Term SONIA derivation

This gives the following implied rates applying through the term:

| Period | Implied rate |
|------------------------------------|--------------|
| From 8 June to 20 June, 2018 | 0.4531 |
| From 21 June to 1 July, 2018 | 0.45868 |
| From 2 July to 1 August, 2018 | 0.46521 |
| From 2 August to 9 September, 2018 | 0.60966 |

Apply a daily compounding of these rates during the relevant period to derive the ICE Term Risk Free Rate - Forward-Looking Futures Derived - GBP 3M for 8 June, 2018, as: **0.5230%**