U.S. Dollar
ICE Bank Yield Index

January 2019

Contents

Executive Summary

ICE Benchmark Administration (IBA), a leading provider of global interest rate and other financial benchmarks, is introducing the U.S. Dollar ICE Bank Yield Index for review and comment by market participants. This preliminary methodology for a new interest rate index has been designed to measure the yields at which investors are willing to invest U.S. dollar funds in large, internationally active banks on a wholesale, unsecured basis over one-month, three-month and six-month periods.

The index will be derived entirely from two types of U.S. dollar-denominated transactional input data: primary market wholesale, unsecured funding transactions for large, internationally active banks; and secondary market transactions in wholesale, unsecured bonds issued by large, internationally active banks. This input data will be refined and processed to construct a yield curve from which one-month, three-month and six-month term settings can be obtained, providing an indication of average investment yields for short-term, unsecured bank debt obligations.

The U.S. Dollar ICE Bank Yield Index has been developed to meet the potential short-term interest rate benchmark needs of lenders, borrowers and other users of non-derivative (or "cash") products.

Lenders and borrowers have typically sought interest rate benchmarks that reference the average funding rate of a broad group of large banks. This allows a lender to price loans based upon an assessment of a borrower's creditworthiness, rather than the lender's own particular funding profile. It also provides borrowers with a rate linked to the funding costs of a set of large banks, rather than having to take the cost-of-funds risk of a specific lender or narrow collection of lenders. Such users have also generally valued the functional and operational benefits afforded by benchmarks with a forward-looking term structure.

Historically, LIBOR has been the most widely-used such benchmark. However, today LIBOR faces an uncertain future due to a reduction in the amount of transactional activity that has historically underpinned its determination, primarily as a result of banks modifying their funding models. These circumstances have prompted regulators to advocate for a transition away from LIBOR to alternative interest rate benchmarks for both new and outstanding contracts in all markets.

IBA believes the U.S. Dollar ICE Bank Yield Index could potentially help to satisfy the interest rate benchmark needs of lenders, borrowers and other users of cash market contracts for several reasons:

- First, the index seeks to measure the average yields at which investors are willing to invest in the unsecured debt obligations of a broad set of large, internationally active banks for specified forward-looking tenors. These are key elements of interest rate benchmarks that users in the cash markets have historically sought.

- Secondly, the index is underpinned entirely by transaction data representing short-term, unsecured bank investment yields. This solid transactional foundation should make the index robust, avoiding any requirement for expert judgement to be used in the methodology.

- Thirdly, the index utilizes data from both primary funding markets and the secondary bond market. This enables the index to better represent yields on short-term, unsecured bank debt, given the increased use of the bond market for bank funding since the financial crisis.

IBA has conducted a period of preliminary testing on the U.S. Dollar ICE Bank Yield Index over the course of the past year. The results are set out in the *Testing Results* section and are also available on IBA's website.

IBA is now asking market participants and stakeholders to review and provide feedback during the first quarter of 2019 on the U.S. Dollar ICE Bank Yield Index and its proposed methodology. IBA intends to consider and take account of this feedback in finalizing the construction of the index before conducting a production-standard test in the second half of 2019. If the market's response is encouraging and future testing is successful, IBA anticipates launching the U.S. Dollar ICE Bank Yield Index in early 2020.
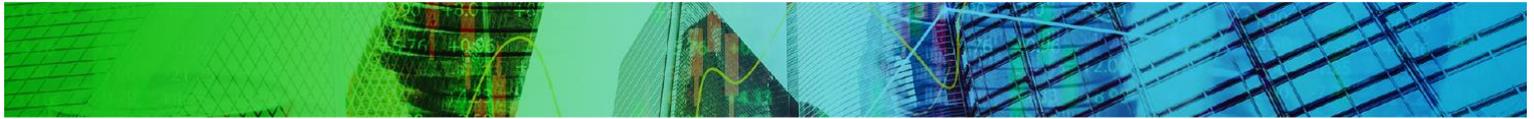
There is no guarantee that IBA will continue to test the U.S. Dollar ICE Bank Yield Index, be able to source data to derive the Index or publish the Index in the future. Users of LIBOR should not rely on the potential publication of the U.S. Dollar ICE Bank Yield Index when developing and executing transition or fallback plans.

Background and Rationale for the Index

Benchmarks for lending

In general, banks offering funded and unfunded lending commitments have sought short-term interest rate benchmarks exhibiting a correlation with their marginal unsecured funding costs to price their lines of credit. The reason for this is to seek to manage the bank's asset-liability risks by reducing exposures during periods of divergence between lending yields and its own funding costs.

From the bank's perspective, it would be preferable to price loans based on its own marginal cost of funds. However, clients of banks will generally not accept being exposed to the specific cost-of-funds risk of their own individual lender. Lenders and borrowers have typically compromised by using short-term interest rate benchmarks that reference the average funding rate of a group of large banks in order to reduce risks for both parties to a lending transaction, with the most widely-used being LIBOR.

Benchmark transition and the rationale for a new index

Following the financial crisis, it came to light that a number of institutions were responsible for serious misconduct in relation to their LIBOR submissions (which were used to determine LIBOR rates) over a number of years. As a result, regulators initiated a thorough review and reform program for significant benchmarks in order to boost confidence in, and restore integrity to, financial markets. Although new principles and legislation governing financial benchmarks (including LIBOR) have since been widely adopted[1] and ICE Benchmark Administration[2] (IBA), which became LIBOR's administrator in 2014, has made significant investment in strengthening the governance and improving the sustainability of the benchmark, LIBOR faces an uncertain future.

The key driver of this uncertainty is a decline since 2008 in the volume of short-term, unsecured transactional activity that has historically underpinned LIBOR, resulting from changes in bank funding models and behaviors. Consequently, banks making submissions to LIBOR have to rely on their own "expert judgement" in some instances to generate submissions for certain settings, when they would prefer to base these submissions on transactions. Given these circumstances, regulators have advised market participants of the need to transition new and outstanding contracts in all markets away from LIBOR to alternative rates by the end of 2021[3].

Derivatives market participants are generally expected to be able to transition from using LIBOR to alternative rates without too much difficulty. This is because the new overnight, nearly risk-free alternative reference rates are regarded as being well-suited to most instances of this type of product[4]. However, participants in lending and other cash markets may face greater challenges in effecting a transition. This is because such users have typically relied on certain important features of interest rate benchmarks:

- Lenders value a benchmark that incorporates an average bank's arm's-length funding costs. This enables banks to price loans primarily based upon an assessment of a borrower's creditworthiness, rather than a bank's individual funding profile. It also results in a rate that generally moves in the same direction as a lender's own marginal sources of funding.

- Borrowers value a benchmark linked to the average cost of funds of a set of large banks, rather than having to take the cost-of-funds risk of their specific lender or a small or concentrated group of lenders.

- Cash product users generally value the availability of forward-looking tenors for their benchmarks, which provide certainty when setting rates at the outset of an accrual period. This is also a key requirement for certain budgeting and risk management exercises and in many operational systems.

The regulatory impetus to transition away from LIBOR and the potential challenges facing users of cash products in achieving this have created a need to explore the development of new indices to meet the potential needs of lenders, borrowers and other cash market participants.

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[1] https://www.iosco.org/library/pubdocs/pdf/IOSCOPD415.pdf, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R1011&from=EN
[2] IBA was appointed as LIBOR's administrator as part of this reform program
[3] https://www.fca.org.uk/news/speeches/interest-rate-benchmark-reform-transition-world-without-libor , http://www.fsb.org/wp-content/uploads/P120718.pdf. The UK Financial Conduct Authority (the FCA) intends that it will no longer be necessary for it to sustain LIBOR through its influence or legal powers beyond 2021. See, https://www.fca.org.uk/news/speeches/the-future-of-libor
[4] See, for example, https://www.newyorkfed.org/medialibrary/Microsites/arrc/files/2018/ARRC-Second-report

U.S. Dollar ICE Bank Yield Index Methodology

Overview

In light of the challenges and considerations outlined in the previous section, IBA, a regulated benchmark administrator[5] and subsidiary of Intercontinental Exchange, Inc., has developed a preliminary methodology for a new interest rate index that has been designed to meet certain requirements of cash market participants that have historically used LIBOR and other short-term interest rate benchmarks as a reference rate in their contracts.

The U.S. Dollar ICE Bank Yield Index (the "Index") seeks to measure the average yields at which investors are willing to invest U.S. dollar funds on a senior, unsecured basis in large, internationally active banks operating in the wholesale U.S. dollar markets. Based entirely on transactional data and produced daily on a preliminary basis for one-month, three-month and six-month tenors, the Index has been designed to incorporate those features that cash market users of short-term interest rate benchmarks find most important. Its underpinnings are comparable to the approaches followed by the most popular fixed income performance benchmarks that are widely used in the marketplace.

Input data and eligibility

The Index is derived wholly from two types of U.S. dollar-denominated transactional input data representing unsecured bank investment yields: wholesale primary market funding transactions (e.g. inter-bank deposits, institutional certificates of deposit and commercial paper) and secondary market bond transactions. IBA has chosen to reference data points relating to these obligations as they represent where investors have invested on a senior, unsecured and uninsured basis in the underlying banks referenced in the Index.

For the purposes of the testing period, the primary market funding transaction data has been sourced daily directly from 13 large, internationally active banks[6]. The secondary market bond transaction data has been sourced daily from the Financial Industry Regulatory Authority's™ (FINRA™) Trade Reporting and Compliance Engine™ (TRACE™)[7] in respect of bonds issued by a list of large, internationally active banks that meet certain eligibility criteria set by the administrator[8].

For each day in respect of which the Index is calculated, the administrator will source primary market funding and secondary market bond transactions executed during an input window beginning at 11:00am (London time) / 6:00am (New York time) on the previous calculation day through to 11:00am (London time) / 6:00am (New York time) on the current calculation day. These transactions are then filtered by reference to specified eligibility criteria, including: funding transaction type; funding transaction counterparty, funding location; number of funding transactions; number of funding transaction counterparties; funding/bond transaction size; bond type (coupon type and call eligibility); coupon range; days to maturity of the bond; and bond issuance size[9], which are designed to ensure the input data is representative of the economic reality the Index is designed to measure.

The eligible transaction data for this initial input window is then sorted by days to maturity (of the funding transaction or the relevant bond) and allocated into specified maturity ranges (e.g. for one-month, the range is 20 to 49 calendar days), each of which has a target number of transactions[10]. Where the target number of transactions is not achieved for any maturity range (i.e. insufficient transactions are available during the input window that runs through to 11:00am (London time) / 6:00am (New York time) on that calculation day), then eligible transaction data from input windows for up to five previous calculation days may also be allocated to that maturity range in order to seek to reach the target number of transactions (see the *Weighting and adjustments* sub-section below).

Weighting and adjustments

IBA initially assigns a weighting of 100 percent to each primary market funding transaction and 50 percent to each secondary market bond transaction that is allocated to a maturity range[11]. The rationale for assigning a greater

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[5] IBA is authorised and regulated by the FCA as a benchmark administrator under the EU Benchmarks Regulation (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)

[6] 81 percent of USD LIBOR panel banks have consented to IBA using their funding transaction data for the purposes of the paper and the period of testing.

[7] Financial Industry Regulatory Authority, FINRA, Trade Reporting and Compliance Engine, and TRACE are trademarks of Financial Industry Regulatory Authority, Inc. (FINRA), in the US and/or other countries. All rights reserved. See http://www.finra.org/industry/trace for further details regarding TRACE. The U.S. Dollar ICE Bank Yield Index is not associated with, or endorsed or sponsored by, FINRA.

[8] See Appendix 1 (*Draft Term Sheet*)

[9] See Appendix 1 (*Draft Term Sheet*)

[10] See Appendix 1 (*Draft Term Sheet*)

[11] For the U.S. Dollar ICE Bank Yield Index calculation, we include eligible funding transactions with a minimum size of USD 10m and eligible bond transactions with a minimum size of USD 2m. Bond transactions are, on average, smaller than funding transactions. Over 90 percent of bank bond transactions reported to TRACE

weighting to primary market funding data is that these transactions tend to be of a larger size than secondary market transactions in bank bonds, and should lead to an index that better represents where investors are willing to invest in the unsecured credit of large, internationally active banks.

Where transactions from previous calculation days are allocated to a maturity range, these are also assigned a reduced weighting relative to transactions from the current calculation day and are then adjusted by reference to movements in market rates (e.g. Overnight Index Swaps / OIS) since the date of the relevant transaction[12]. This is designed to result in the utilization of more input data that is representative of yields associated with unsecured bank investments in order to construct the Index, whilst also ensuring the impact of this data is appropriate and that the Index remains responsive to market changes occurring on a day-to-day basis.

Eligible bond transactions are also weighted, where necessary, to ensure that no single bond issuer represents over 10 percent of the bond transactions used to construct the Index for any given calculation day[13]. This is done to reduce the risk that trading in one particular bank's bonds might unduly skew the Index on any given day.

All bond transaction data is converted to an annualized money market basis prior to curve-fitting.

See Appendix 1 (*Draft Term Sheet*) for further details on the Index methodology, including data sources, eligibility criteria and weightings/adjustments.

Curve-fitting and rate determination

At this stage, all the eligible primary market funding and secondary market bond transactions that have been allocated to each maturity range (weighted, adjusted and/or converted, as applicable) are used to plot a daily yield curve. The yield curve seeks to measure the average yields at which investors are willing to invest U.S. dollar funds on a senior, unsecured basis in large, internationally active banks operating in the wholesale U.S. dollar markets for a time horizon of up to one year.

For the purposes of the testing period, the yield curve has been constructed using a weighted least squares best fit of all eligible data points to a third order polynomial. As an example, the fitted curve for July 30th 2018 is shown (as a light blue line) in Figure 1 below, alongside all eligible transaction data points (gray dots) for that calculation day.

Figure 1: U.S. Dollar ICE Bank Yield Index for July 30th 2018

USD ICE Bank Yield Index for 30-Jul-2018

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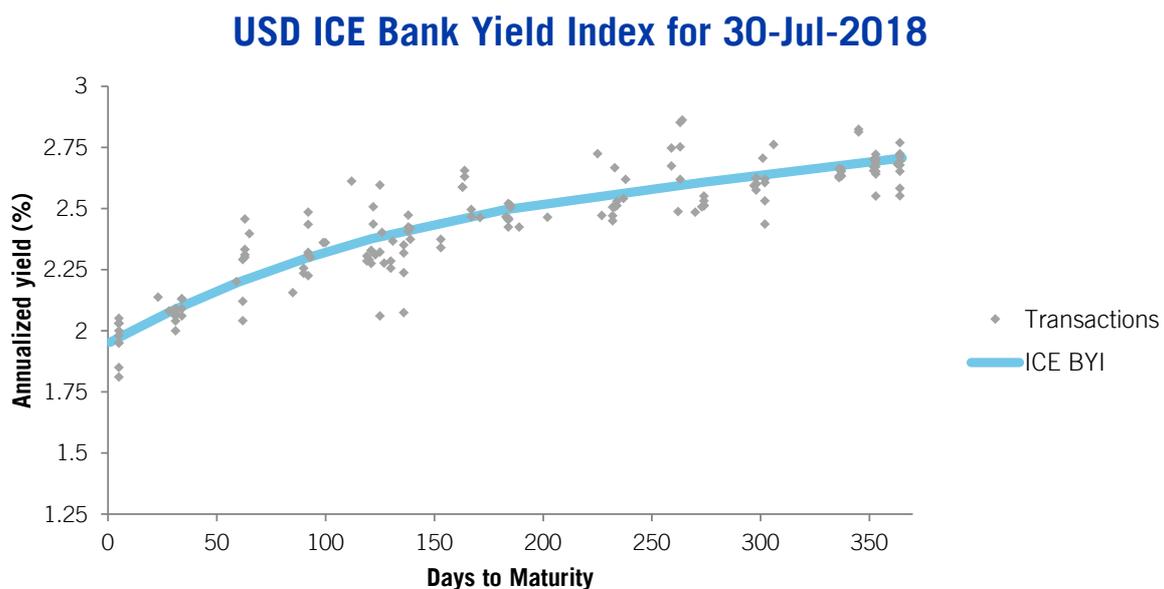
are below USD 2m. Of the bond transactions we consider, two thirds are between USD 2m and USD 5m, with an average size of USD 3.2m. The overall average including larger transactions is not ascertainable, as these transaction sizes are not published. In comparison, the average size of the funding transactions used in the calculation is USD 94m.
[12] See Appendix 1 (*Draft Term Sheet*)
[13] See Appendix 1 (*Draft Term Sheet*)

Once the fitted curve has been constructed, then forward-looking settings for the one-month, three-month and six-month tenors may be obtained at the 30, 91 and 182 days-to-maturity points, provided that the target number of transactions for the maturity range associated with the relevant publication tenor has been achieved[14]. As an example, the one-month, three-month and six-month settings for July 30th 2018 are shown (as light blue circles) in Figure 2 below, alongside the U.S. Dollar LIBOR yield curve for the same day[15].

Figure 2: U.S. Dollar ICE Bank Yield Index for July 30th 2018

USD ICE Bank Yield Index for 30-Jul-2018
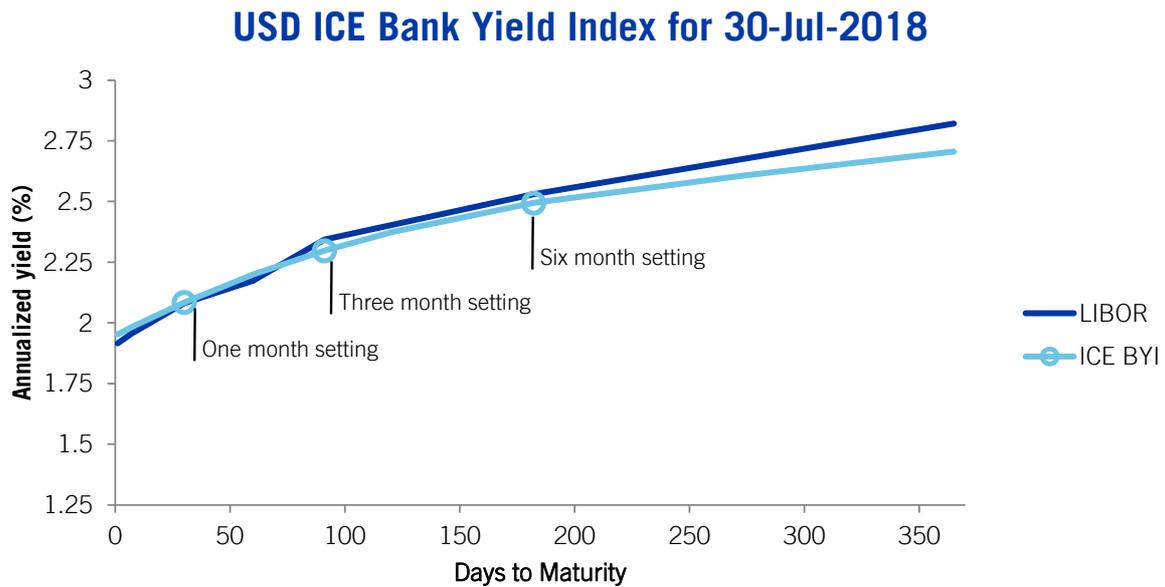
See Appendix 2 (*Curve-fitting Methodology*) for further details on the curve-fitting methodology and some potential alternative approaches, on which we are seeking feedback.

Publication
IBA proposes to publish each of the one-month, three-month and six-month settings for the Index daily, during the morning New York time on the business day following the day in respect of which the yield curve is calculated.

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[14] If the target number of transactions is not achieved for a maturity range associated with a publication tenor (one-month, three-month or six-month), then the administrator would not obtain and publish a setting for this tenor from the yield curve. The administrator would instead publish a contingency rate in respect of that tenor (See Appendix 1 (*Draft Term Sheet*) for further details).
[15] Note that yield curves for U.S. Dollar LIBOR and the U.S. Dollar ICE Bank Yield Index are produced using different methodologies and different data sources. As a result, care should be taken when comparing U.S. Dollar LIBOR and the U.S. Dollar ICE Bank Yield Index for any day, including days during the period of testing.

Testing Results

IBA undertook testing of the U.S. Dollar ICE Bank Yield Index methodology for a period covering the whole of 2018 and into 2019. For each day of the testing period IBA took all the eligible primary market funding and secondary market bond transactions that could be allocated to each maturity range and applied the Index methodology to this data to generate a yield curve. From each daily fitted curve IBA took one-month, three-month and six-month settings (as described in the previous section) for the entire testing period in order to generate the line charts shown in Figures 3, 4 and 5 below. The line charts are shown together with the corresponding U.S. Dollar LIBOR settings for the same time period[16].

It is worth noting that the curve-fitting process used to calculate the test results does not exclude or otherwise seek to adjust for any "outlier" data points (i.e. those markedly different in value from the calculated curve). IBA has observed that, at certain times, outliers can have a material impact on the value of the Index, particularly during periods of illiquidity or market-stress[17].

Figure 3: U.S. Dollar ICE Bank Yield Index: 1M

USD ICE Bank Yield Index : 1M

Averages
1 month IBYI as calculated: 2.03%
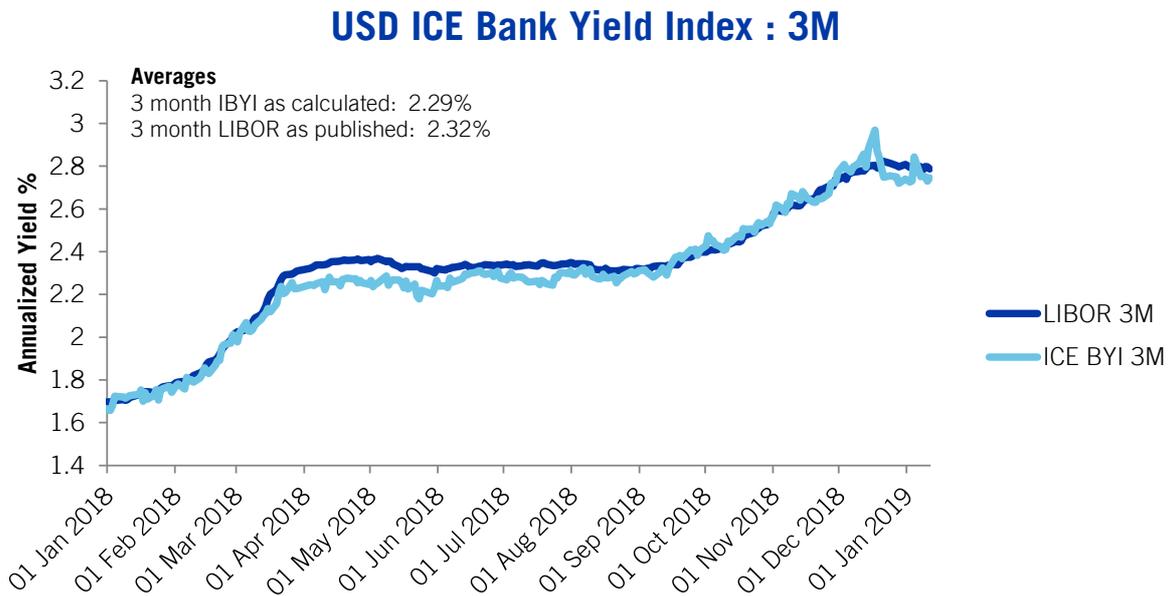1 month LIBOR as published: 2.04%

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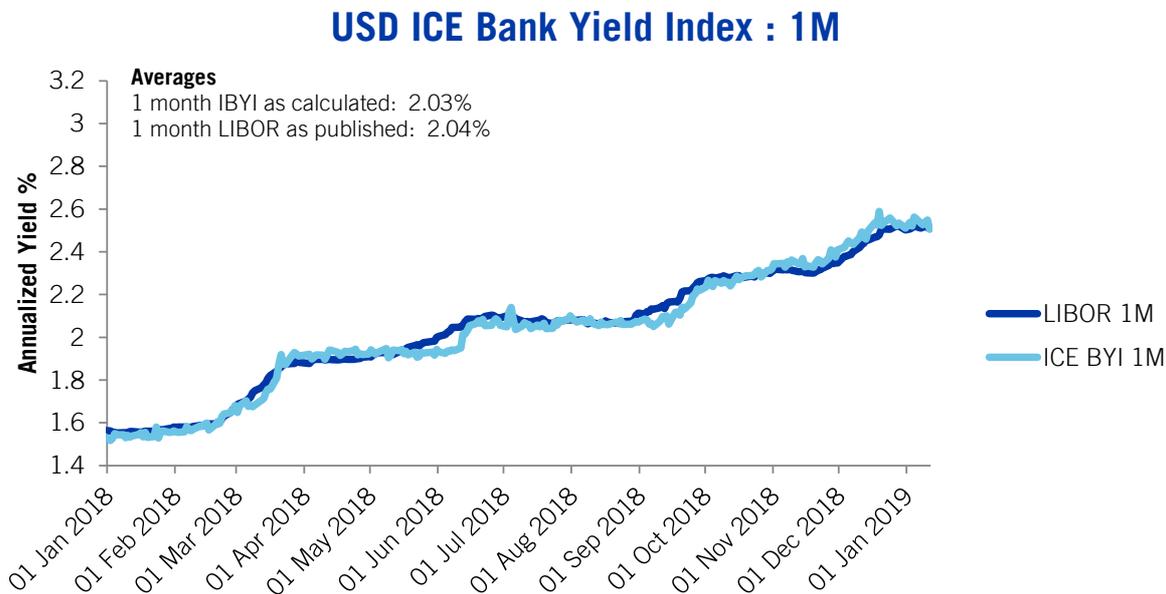
[16] Note that U.S. Dollar LIBOR and the U.S. Dollar ICE Bank Yield Index are produced using different methodologies and different data sources. As a result, care should be taken when comparing U.S. Dollar LIBOR and the U.S. Dollar ICE Bank Yield Index for any period, including the period of testing.
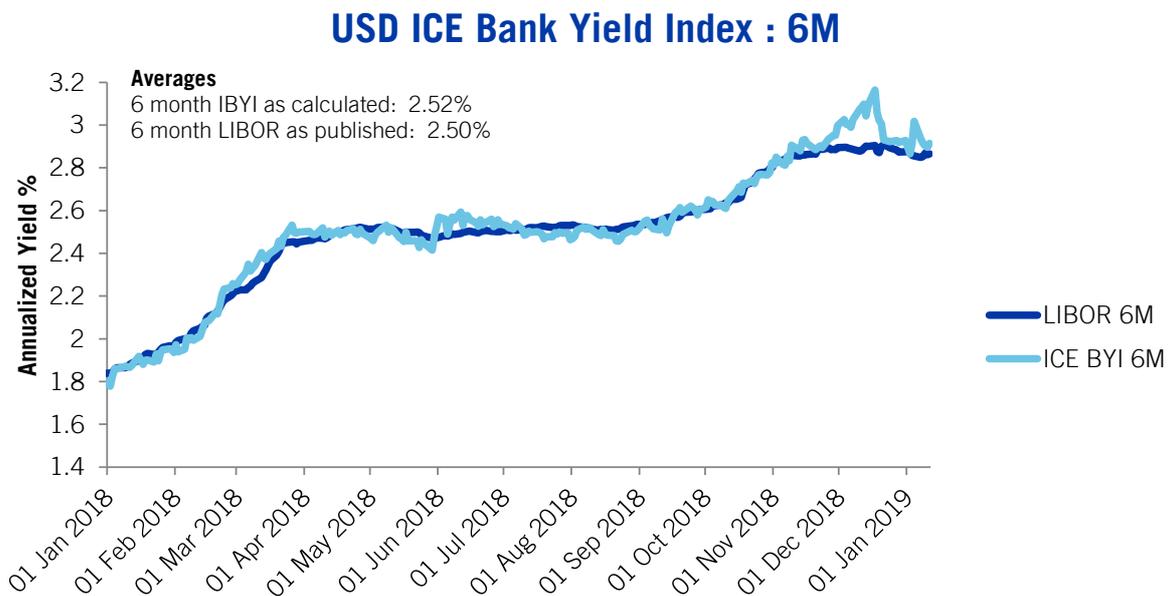[17] We are seeking feedback on potential techniques for handling outliers. These are discussed further in Appendix 2 (*Curve-fitting Methodology*).

Figure 4: U.S. Dollar ICE Bank Yield Index: 3M

USD ICE Bank Yield Index : 3M

Averages
3 month IBYI as calculated: 2.29%
3 month LIBOR as published: 2.32%

Legend: LIBOR 3M, ICE BYI 3M

Figure 5: U.S. Dollar ICE Bank Yield Index: 6M

USD ICE Bank Yield Index : 6M

Averages
6 month IBYI as calculated: 2.52%
6 month LIBOR as published: 2.50%

Legend: LIBOR 6M, ICE BYI 6M

During the testing period, the Index was based on an average of 153 transactional inputs per day. Figure 6 below shows the number of eligible primary market funding and secondary market bond transactions used to generate the daily one-month, three-month and six-month Index settings over the course of the testing period.

Figure 6: U.S. Dollar ICE Bank Yield Index Count of Transactions Used per Day
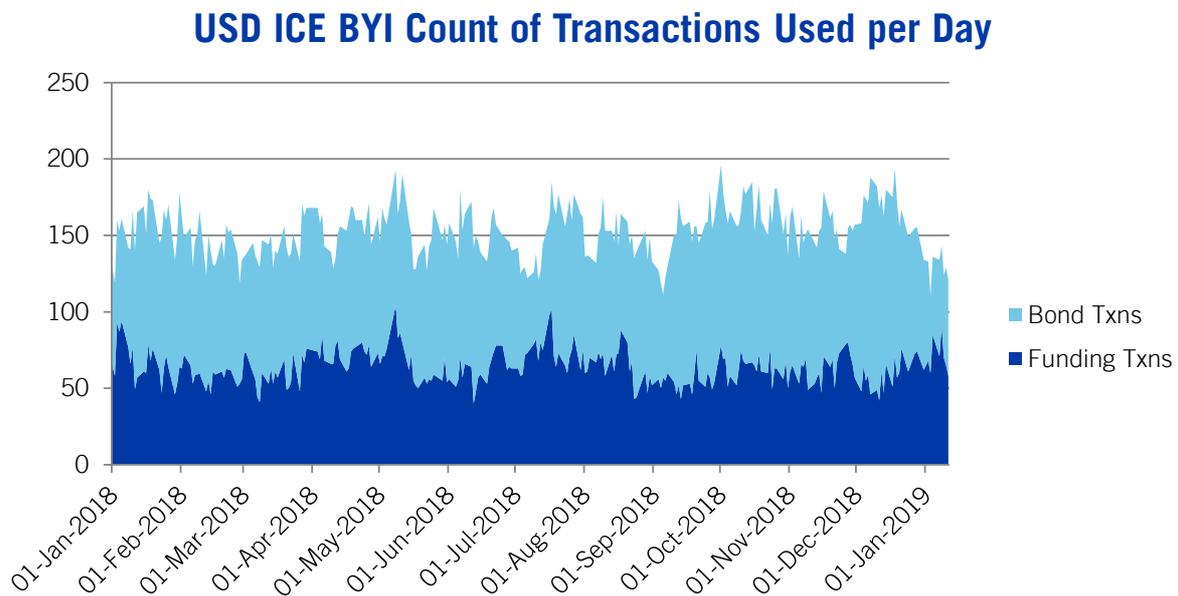
The transaction target for the maturity ranges associated with the publication tenors (one-month, three-month and six-month) was achieved for every day during the testing period using eligible transaction data from the input windows for the current calculation day and up to five previous calculation days.

Figure 7 below shows how many calculation days' transactions were required to meet the target number of transactions for each maturity range during the testing period. Maturity ranges associated with the publication tenors (one-month, three-month and six-month) are shown in green.

Figure 7: % Breakdown of the Number of Calculation Days' Transactions Needed to Achieve the Target Number of Transactions for Each Maturity Range Over the Testing Period

Maturity Range	Current day	+ Previous day	+ 2 Previous days	+ 3 Previous days	+ 4 Previous days	+ 5 Previous days	Target not achieved
1W	70.5%	15.7%	5.0%	5.0%	3.1%	0.4%	0.4%
1M	40.6%	53.3%	5.7%	0.4%	0.0%	0.0%	0.0%
2M	10.3%	35.2%	28.0%	11.5%	6.9%	4.2%	3.8%
3M	50.2%	44.4%	5.0%	0.4%	0.0%	0.0%	0.0%
4M	1.1%	8.4%	19.9%	13.4%	13.8%	11.5%	31.8%
5M	1.1%	3.1%	5.4%	5.7%	7.3%	9.2%	68.2%
6M	14.9%	50.6%	27.6%	5.7%	0.4%	0.8%	0.0%
7M	0.4%	4.2%	7.7%	10.3%	11.9%	13.0%	52.5%
8M	0.4%	3.1%	8.4%	8.4%	8.4%	10.7%	60.5%
9M	0.8%	4.6%	12.3%	11.9%	11.9%	12.3%	46.4%
10M	0.4%	3.4%	8.8%	13.4%	18.8%	9.6%	45.6%
11M	1.5%	9.6%	11.5%	16.9%	14.9%	10.0%	35.6%
12M	31.0%	42.1%	20.3%	4.6%	1.5%	0.4%	0.0%

Next Steps and Timeline

Feedback

IBA is seeking feedback on the U.S. Dollar ICE Bank Yield Index and its methodology from all market participants and stakeholders, and in particular cash market participants that use interest rate benchmarks in their financial contracts.

Specific questions in respect of which IBA is requesting responses are set out in the *Feedback Questions* section. However, respondents are encouraged to submit any and all feedback they have on the Index and its methodology.

Respondents are requested to provide their feedback by email to IBA at IBA@theice.com on or before March 31st 2019.

Refining the Index for publication

During the feedback period IBA will also be communicating directly with members of the global banking industry, cash market participants and regulators and central banks to discuss the U.S. Dollar ICE Bank Yield Index and its potential use as an interest rate benchmark for the cash markets.

Following the conclusion of the feedback period, IBA intends to collate and review all responses and feedback. IBA expects to use this feedback to refine the U.S. Dollar ICE Bank Yield Index and its methodology during the second quarter of 2019.

IBA then intends to model and test any refinements in order to finalize the Index methodology during the third quarter of 2019, before commencing a period of production-standard testing of the finalized Index methodology during the fourth quarter.
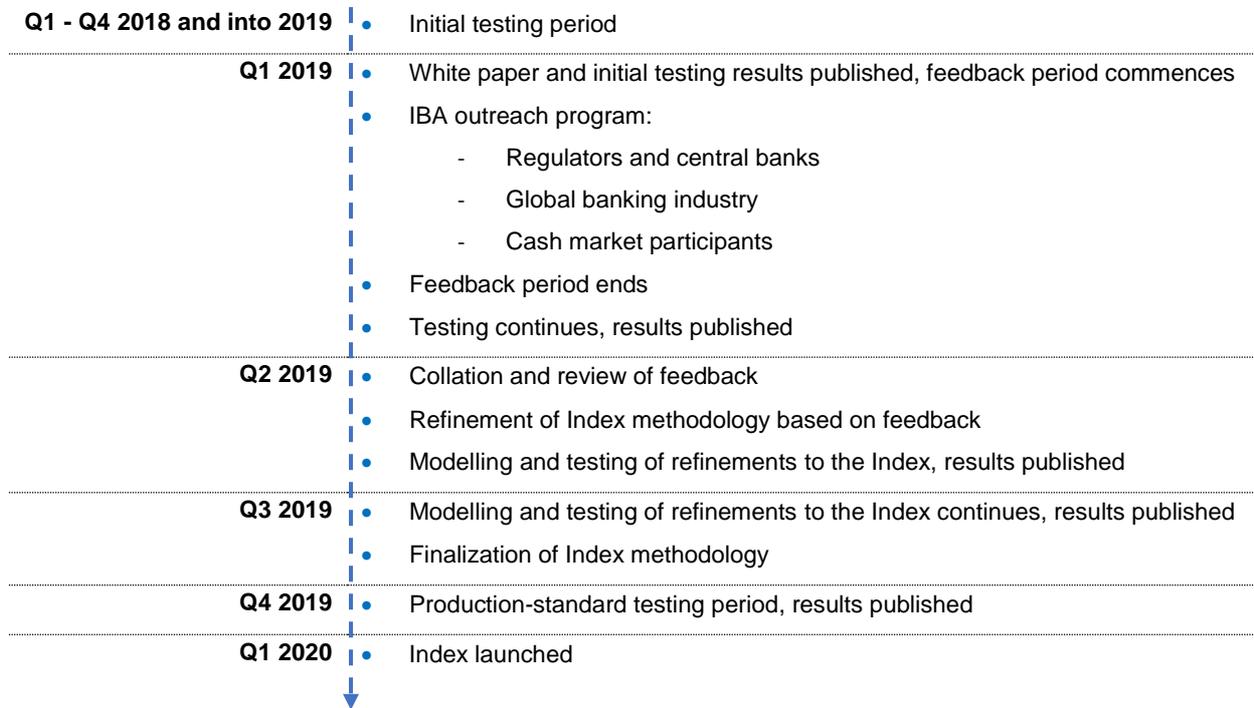
IBA expects to continue testing the Index throughout 2019 and to publish the results of these tests during the course of the year.

Assuming a positive response from market participants and stakeholders, and successful testing, IBA intends to seek to launch the Index and commence publication during the first quarter of 2020.

There is no guarantee that IBA will continue to test the U.S. Dollar ICE Bank Yield Index, be able to source data to derive the Index or publish the Index in the future. Users of LIBOR should not rely on the potential publication of the U.S. Dollar ICE Bank Yield Index when developing and executing transition or fallback plans.

Figure 8: Timeline

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Q1 - Q4 2018 and into 2019	• Initial testing period
Q1 2019	• White paper and initial testing results published, feedback period commences
	• IBA outreach program:
	- Regulators and central banks
	- Global banking industry
	- Cash market participants
	• Feedback period ends
	• Testing continues, results published
Q2 2019	• Collation and review of feedback
	• Refinement of Index methodology based on feedback
	• Modelling and testing of refinements to the Index, results published
Q3 2019	• Modelling and testing of refinements to the Index continues, results published
	• Finalization of Index methodology
Q4 2019	• Production-standard testing period, results published
Q1 2020	• Index launched

Feedback Questions

Please see below the specific questions in respect of which IBA is requesting feedback from market participants and stakeholders regarding the U.S. Dollar ICE Bank Yield Index and its methodology.

Please see Appendix 1 (*Draft Term Sheet*) for details on the Index methodology, including data sources, eligibility criteria and weightings/adjustments. Please see Appendix 2 (*Curve-fitting Methodology*) for details on the curve-fitting methodology and some potential alternative approaches. Both appendices should prove helpful when considering the questions below.

1. Do you agree that the U.S. Dollar ICE Bank Yield Index will be representative of the average yields at which investors are willing to invest U.S. dollar funds on a senior, unsecured basis in large internationally active banks operating in the wholesale U.S. dollar markets?

2. Do you agree that the U.S. Dollar ICE Bank Yield Index should be published for one-month, three-month and six-month tenors, or should other tenors be included?

3. a. Do you agree with the curve-fitting methodology described in this paper (i.e. a least squares best fit of all eligible data points to a third order polynomial), or would a different curve-fitting model (such as a spline-based approach) be more appropriate?

    b. Should IBA seek to address or exclude outlier transaction yields when constructing the yield curve, either through the use of a robust regression model or by imposing a +/- 100bps sensitivity test relative to the calculated curve?

    See below an example of an extreme outlier transaction at the short-end of the yield curve during a less liquid market period noticeably influencing the curve-fitting process on July 3rd 2018 (Figure A) and resulting in a visible spike in the one-month rate chart over both July 3rd and July 4th 2018 (Figure B). Figure B also shows the effect on the rate of applying a robust regression model and a +/- 100bps sensitivity.
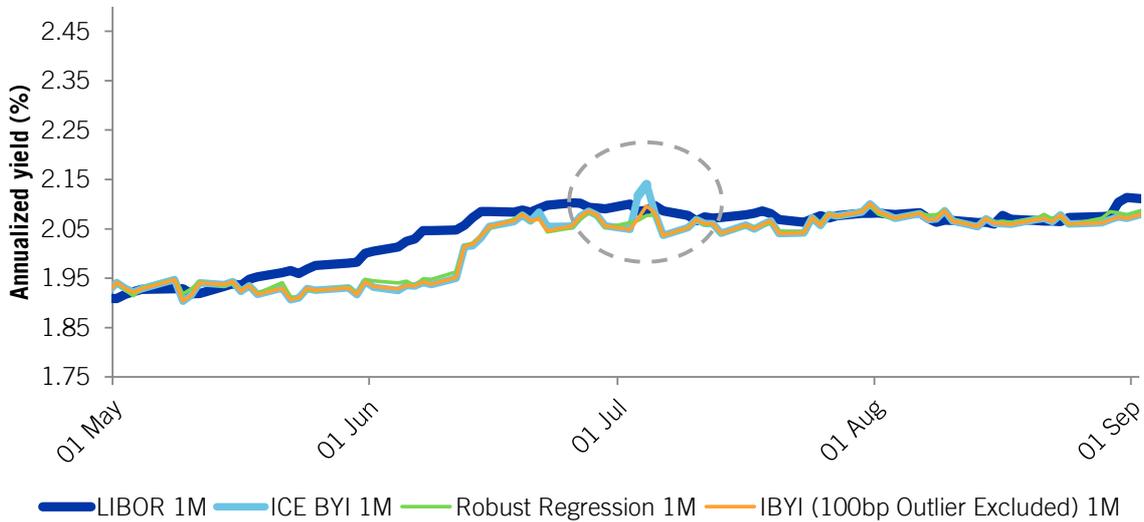
Figure A: U.S. Dollar ICE Bank Yield Index: July 3rd 2018

USD ICE Bank Yield Index for 03-Jul-2018
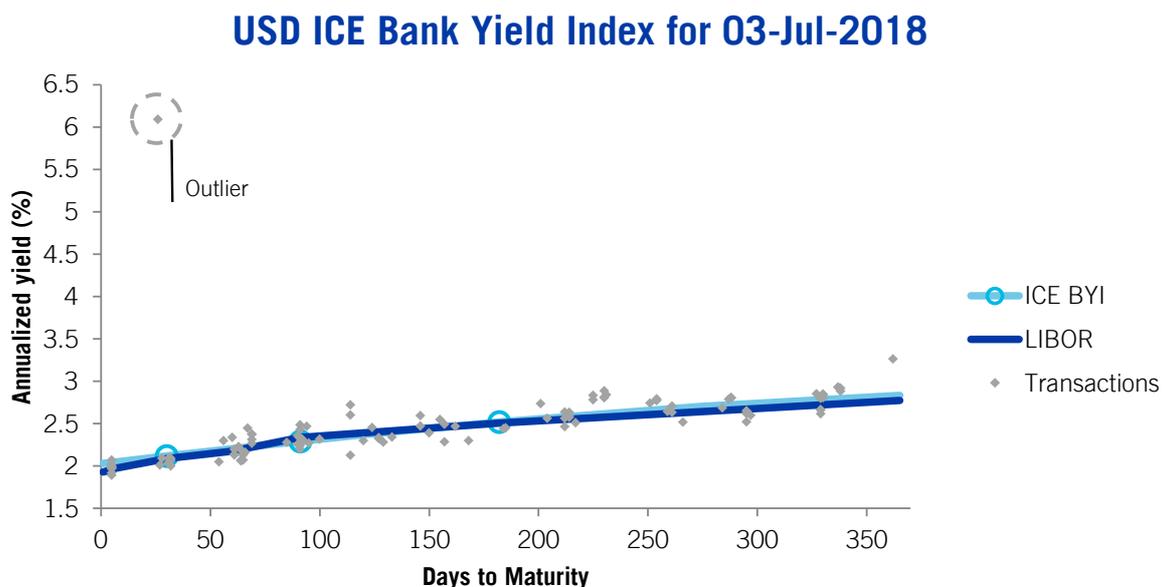
Figure B: U.S. Dollar ICE Bank Yield Index: 1M

USD ICE Bank Yield Index : 1M

Legend: LIBOR 1M — ICE BYI 1M — Robust Regression 1M — IBYI (100bp Outlier Excluded) 1M

See below a further example of outlier transactions at the middle of the yield curve during a period of market volatility noticeably influencing the curve-fitting process during December 2018, with December 17th 2018 used as an example date (Figure C). This was a factor resulting in a visible spike in the three-month rate chart during mid-December 2018 (Figure D). Figure D also shows the effect on the rate of applying a robust regression model and a +/- 100bps sensitivity.[18]

Figure C: U.S. Dollar ICE Bank Yield Index: December 17th 2018

USD ICE Bank Yield Index for 17-Dec-2018

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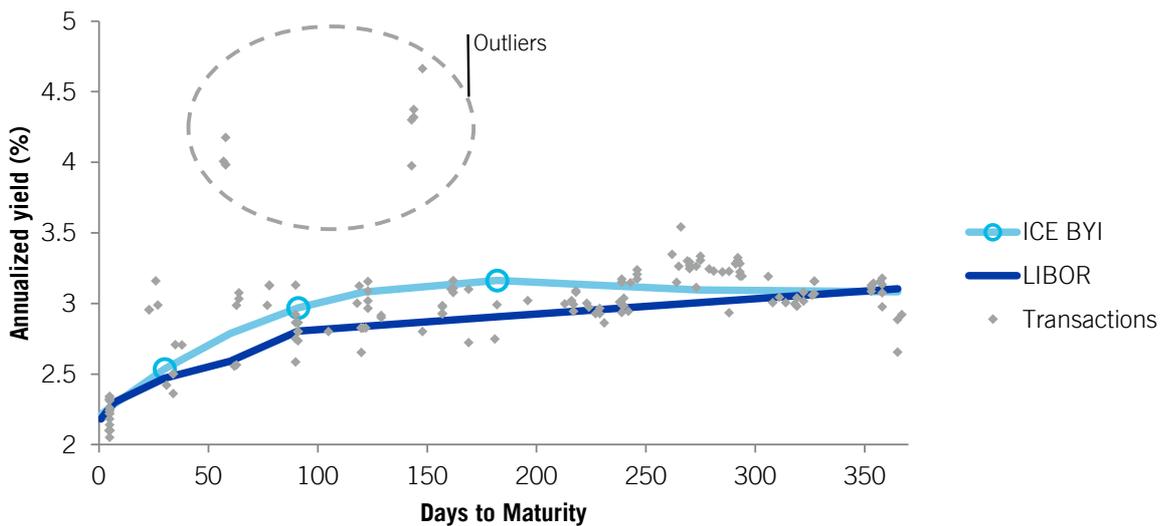
[18] The charts in Figures A to D are shown together with the corresponding U.S. Dollar LIBOR settings/yield curves. Note that U.S. Dollar LIBOR and the U.S. Dollar ICE Bank Yield Index are produced using different methodologies and different data sources. As a result, care should be taken when comparing U.S. Dollar LIBOR and the U.S. Dollar ICE Bank Yield Index for any period, including the period of testing.

Figure D: U.S. Dollar ICE Bank Yield Index: 3M

USD ICE Bank Yield Index : 3M

Legend: LIBOR 3M, ICE BYI 3M, Robust Regression 3M, IBYI (100bp Outlier Excluded) 3M
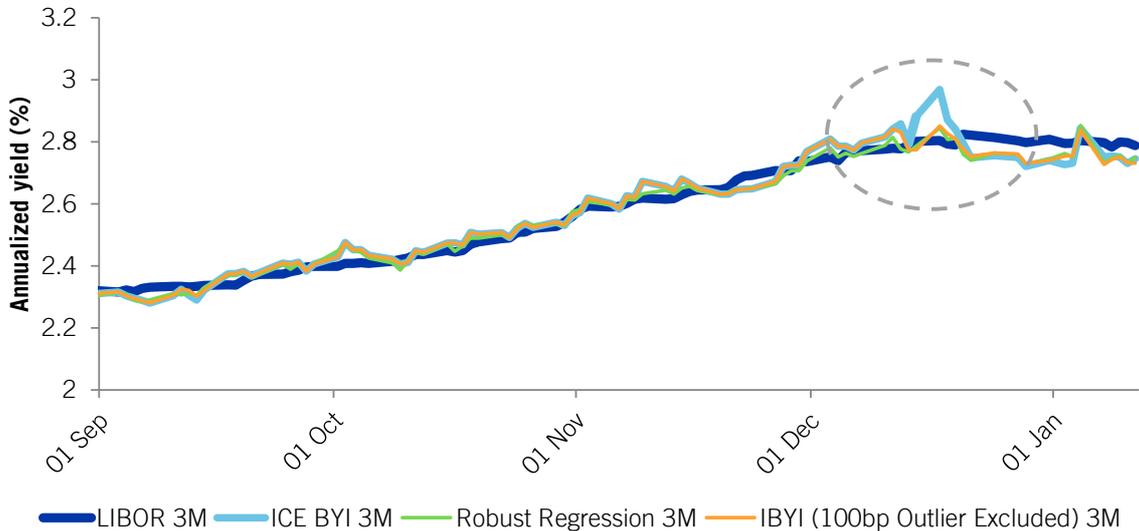
See Appendix 2 (*Curve-fitting Methodology*) for further details on alternative curve-fitting methodologies and approaches to handling outliers.

4. Do you agree with a target of ten (10) transactions per maturity range, or should this target be increased for some/all maturity ranges? When responding to this question please consider the curve-fitting methodology, which incorporates all eligible data points across the curve on any given day to construct a "best fit" yield curve.

5. Do you agree with using eligible transactions from input windows for up to five (5) previous calculation days where the target number of transactions for a particular maturity range is not achieved using only the input window for the current calculation day? Would it be more appropriate to use transactions from a greater/smaller number of previous days' input windows for any or all of the maturity ranges where the target is not achieved using the current day's window? Would it be more appropriate to use transactions from previous days' input windows irrespective of whether the target is reached using the current day's window?

6. Do you agree that primary market funding transactions should be assigned an initial weighting of 100 percent and that secondary market bond transactions should be assigned an initial weighting of 50 percent because funding transactions tend to be of a larger size than secondary market transactions in bank bonds? Would an alternative weighting or no weighting be more appropriate?

7. Do you agree that transactions from input windows for previous calculation days should be given a lower weighting than transactions from the current day's input window? Do you have any comments on the weightings suggested?

8. Where transactions from input windows for previous calculation days are allocated to a maturity range, is an OIS-based adjustment sufficient or should other factors be taken into consideration?

9. Do you agree that no single bond issuer should be able to represent more than ten (10) percent of the number of bond transactions used to construct the U.S. Dollar ICE Bank Yield Index for any given calculation day?

10. Should IBA include transactions for bank holding companies in any circumstances? For example, should the methodology include the holding company debt of Goldman Sachs Group Inc. and Morgan Stanley or The Bank of New York Mellon Corporation given their business profiles and the minimal amount of bond issuance at the bank operating company level for each of these institutions?
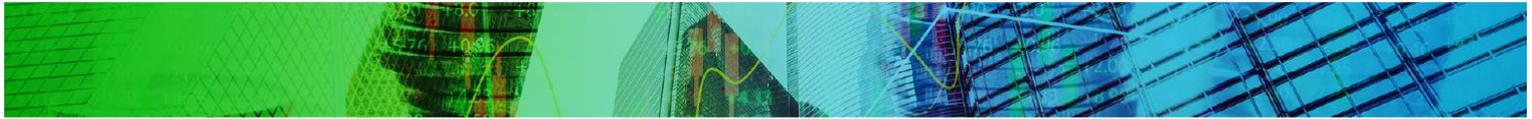
11. Please provide feedback on any of the eligibility criteria for:

   a. Primary market funding transactions (i.e. transaction type, counterparty type, funding location, transaction size, minimum number of transactions, minimum number of counterparties); and

   b. Secondary market bond transactions (i.e. bond type (coupon type and call eligibility), coupon range, bond issuance size, transaction size, days to maturity of bond).

12. Should IBA use evaluated prices and associated yields for bonds that otherwise satisfy the input data eligibility criteria for the Index but in respect of which there are no secondary market transactions that are eligible for the purposes of constructing the yield curve for a particular calculation day? The purpose of incorporating evaluated prices would be to expand the input data set that is used to calculate the Index on any given day (note that evaluated prices are widely used in the calculation of fixed income benchmarks incorporating corporate bonds given the liquidity characteristics of the corporate bond market).

13. Do you agree with publishing the U.S. Dollar ICE Bank Yield Index daily in the morning New York time on the day following the day in respect of which the yield curve is calculated?

14. Should the administration and calculation of the U.S. Dollar ICE Bank Yield Index be undertaken in the United Kingdom, in the United States or in another jurisdiction?

15. Please provide any other feedback you have on the U.S. Dollar ICE Bank Yield Index or its methodology.

16. Please provide any feedback you have on IBA's proposed timeline and next steps for the launch of the U.S. Dollar ICE Bank Yield Index.

Appendix 1 - Draft Term Sheet

U.S. Dollar ICE Bank Yield Index[19]

Overview

The U.S. Dollar ICE Bank Yield Index (the "Index") seeks to measure the average yields at which investors are willing to invest U.S. dollar funds on a senior, unsecured basis in large, internationally active banks operating in the wholesale U.S. dollar markets for specified tenor periods.

The Index methodology will do this by using: (i) specified U.S. dollar-denominated primary market unsecured funding transactions of internationally active banks operating in the wholesale U.S. dollar markets, and (ii) specified secondary market transactions in senior, unsecured USD-denominated bonds issued by internationally active banks operating in the wholesale U.S. dollar markets. These transactions will be used to generate a daily yield curve from which the relevant tenor period settings can be obtained and used to produce the Index on a daily basis.

The administrator for the Index (the "Index Administrator") will be ICE Benchmark Administration Limited ("IBA") or an affiliate.

Underlying economic reality

Economic reality the Index seeks to measure	The average yields at which investors are willing to invest USD funds on a senior, unsecured basis in large, internationally active banks operating in the wholesale U.S. dollar markets for specified tenor periods
Publication Tenor Periods	• One-month • Three-month • Six-month
Publication currency	United States dollar (USD)

Selection criteria for internationally active banks

Internationally active banks in respect of which primary market funding transactions or secondary market bond transactions can be included in the Index	Selected by the Index Administrator, subject to the following minimum criteria: • Consolidated group assets greater than USD 250bn or its equivalent in other currencies; and • Investment grade credit ratings at a group parent level or at the level of the largest banking (operating company) subsidiary where the parent does not have credit ratings. Ratings will be provided by at least two credit rating agencies that are widely-used in the United States, European and/or Asian debt capital and loan markets. Other relevant factors when selecting internationally active banks will include: • The bank's current or historical participation at the group parent level or by one of its subsidiaries as a submitter/contributor to one of the widely-used IBORs; • The formation of an 'Intermediate Holding Company' in the United States as a result of having greater than USD 50bn in assets in the United States; • The bank's presence in wholesale USD capital, loan or money markets; and

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[19] The U.S. Dollar ICE Bank Yield Index methodology set out in this draft term sheet has been used for the purposes of generating the Index during the testing period referred to in the paper

	• Other factors that the Index Administrator deems relevant over time to ensure the Index remains representative of the economic reality it seeks to measure. See the current list of internationally active banks in respect of which secondary market bond transactions can be included in the Index in Appendix B (together with the relevant parent entity and eligible ISINs for the testing period). Internationally active banks in respect of which primary market funding transactions can be included in the Index are not currently listed and are to be confirmed. However, 81 percent of USD LIBOR panel banks have consented to IBA using their funding transaction data for the purposes of the paper and the period of testing.

Index methodology

Eligible input data - funding transactions	• The Index incorporates rates for eligible USD-denominated primary market senior, unsecured wholesale funding transactions of eligible internationally active banks. • Transaction data is provided by the relevant banks themselves on an annualized money market basis. • The transaction eligibility criteria are specified by the Index Administrator, subject to review and amendment with appropriate stakeholder consultation. • Current eligibility criteria (relating to transaction provider, transaction currency, transaction size, number of transactions, transaction type, number of counterparties, counterparty type and funding location) are set out in Appendix A. • Funding transactions that satisfy the eligibility criteria are "Eligible Funding Transactions".

Eligible input data - bond transactions	• The Index incorporates yields for eligible secondary market transactions in eligible senior, unsecured fixed rate USD-denominated wholesale bonds issued by internationally active banks listed in the middle column of Appendix B (parent entities and eligible ISINs for the testing period are also listed).
	
	• Sourced from the Financial Industry Regulatory Authority's[TM] (FINRA[TM]) Trade Reporting and Compliance Engine[TM] (TRACE[TM])[20].
	
	• Yields are converted to an annualized money market basis.
	
	• Bond and transaction eligibility criteria are specified by the Index Administrator, subject to review and amendment with appropriate stakeholder consultation.
	
	• Current eligibility criteria are set out in Appendix C:
	
	    o Bond eligibility criteria relate to bond issuer, issuance currency, issuance size, obligation type (coupon type and call eligibility) and coupon range;
	
	    o Transaction eligibility criteria relate to transaction size and days to maturity of the bond.

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[20] Financial Industry Regulatory Authority, FINRA, Trade Reporting and Compliance Engine, and TRACE are trademarks of Financial Industry Regulatory Authority, Inc. (FINRA), in the US and/or other countries. All rights reserved. See http://www.finra.org/industry/trace for further details regarding TRACE. The USD ICE Bank Yield Index is not associated with, or endorsed or sponsored by, FINRA.

	• Bond transactions satisfying the eligibility criteria are "Eligible Bond Transactions".
Input Data Window	• For any day in respect of which the Index is being calculated (an "Index Calculation Day"), the "Input Data Window" for that day is the period starting at 11:00am London time / 6:00am New York time on the preceding Index Calculation Day though to 11:00am London time / 6:00am New York time on the current Index Calculation Day. • Subject to adjustment in exceptional market circumstances by the Index Administrator.
Input data collection and filtration	• For any Index Calculation Day, Eligible Funding Transactions and Eligible Bond Transactions (together "Eligible Transactions") that are executed during the Input Data Window for that day are sourced and collected by the Index Administrator. • Eligible banks currently provide primary market funding transaction data that satisfies the relevant eligibility criteria (i.e. Eligible Funding Transactions), so the Index Administrator does not need to further filter the data. • In contrast, bond transactions sourced from TRACE are filtered according to the relevant eligibility criteria by the Index Administrator to produce Eligible Bond Transactions.

Input data sorting and allocation	• The Eligible Transactions are then sorted by days to maturity (of the funding transaction or the relevant underlying bond) based on the transaction settlement date and allocated into specified "Maturity Ranges", identified in accordance with Appendix D.
	
	 • Each Maturity Range has a "Target Number of Transactions" (also identified in Appendix D). Where the number of Eligible Transactions executed during the Input Data Window for an Index Calculation Day and allocated to a Maturity Range is less that the Target Number of Transactions for that Maturity Range, then Eligible Transactions executed during the Input Data Window for the preceding Index Calculation Day will also be allocated to that Maturity Range in order to seek to achieve the Target Number of Transactions.
	
	 • If the number of Eligible Transactions that have been allocated to that Maturity Range is still less that the Target Number of Transactions, then Eligible Transactions from the next preceding Index Calculation Day may also be allocated to that Maturity Range in order to achieve the Target Number of Transactions, and the Index Administrator may continue in this fashion until either:
	
	    (i) At least the Target Number of Transactions for that Maturity Range has been achieved, or
	
	    (ii) Eligible Transactions executed during the Input Data Windows for the five (5) preceding Index Calculations Days have been allocated to the relevant Maturity Range.
	
	 • Additional adjustments may apply in the event of central bank rate changes or exceptional market circumstances.

Weighting and adjustments	• Eligible Funding Transactions allocated to a Maturity Range are initially assigned a weighting of 100 percent and Eligible Bond Transactions allocated to a Maturity Range are initially assigned a weighting of 50 percent (in each case, in accordance with Appendix E).
	
	• Where Eligible Transactions executed during the Input Data Window for any preceding Index Calculations Days are allocated to any Maturity Range, this data will also be:
	
	    (i) Assigned a (further) reduced weighting relative to Eligible Transactions executed during the Input Data Window for the current Index Calculation Day (also in accordance with Appendix E), and
	
	    (ii) Adjusted by reference to observed changes in selected risk free market rates (such rates to be determined by the Index Administrator, e.g. Overnight Index Swaps / OIS) over the period between execution of the relevant transaction and the current Index Calculation Day.
	
	• Eligible Bond Transactions are also additionally weighted in order to ensure that no single issuer of bonds represents more than ten (10) percent (the "Threshold Percentage") of the Eligible Bond Transactions that are included in the Index calculation for any given Index Calculation Day. If, on any given Index Calculation Day, there are fewer than ten (10) issuers of bonds represented in the Index, then the Threshold Percentage will be increased to (100 ÷ number of issuers) percent.
	
	• The Eligible Bond Transactions weighting process utilizes an iterative approach:
	
	    (i) Assign each issuer a "token count" equal to the number of Eligible Bond Transactions in respect of that issuer that are used to calculate the Index for a given Index Calculation Day;
	
	    (ii) Determine the maximum token count any individual issuer is permitted for a given Index Calculation Day as (Threshold Percentage × aggregate of the token counts across all issuers for that day) rounded down to the nearest whole number (≥1);
	
	    (iii) If the token count for any individual issuer exceeds this maximum token count, then assign that issuer a reduced token count equal to the maximum (if not, no weighting process is necessary);
	
	    (iv) If a reduction occurs for any issuer, repeat steps (i) - (iii); and
	
	    (v) Once no reduction occurs after repeating steps (i) - (iii), then set the weight for each transaction of each issuer as (reduced token count for that issuer ÷ original token count for that issuer). The weighting will be one (1) for issuers that were not subject to a reduction; and <1 for those that were.
	
	• Subject to adjustment in exceptional market circumstances by the Index Administrator.

Curve construction	• All Eligible Transaction data points (appropriately weighted, adjusted and/or converted, as applicable) that have been allocated to a Maturity Range for a given Index Calculation Day are used to plot the yield curve for that Index Calculation Day, as illustrated in Appendix F.

	- The yield curve is generated using a least squares best fit of all Eligible Transaction data points to a third order polynomial, also as illustrated in Appendix F. - The rates for the Publication Tenors (one-month, three-month, and six-month) for the Index Calculation Day (excluding any in respect of which the Maturity Range contained fewer than the Target Number of Transactions) are then identified from the yield curve at the 30, 91 and 182 days-to-maturity points, also as illustrated in Appendix F. - If any of the Maturity Ranges associated with a Publication Tenor contains fewer than the Target Number of Transactions after allocating Eligible Transactions executed during the Input Data Windows for up to five (5) preceding Index Calculation Days, then the Contingency Policy will apply and the Index Administrator will publish a contingency rate for that Publication Tenor. - Additional adjustments may apply in the event of central bank base rate changes or exceptional market circumstances.
Contingency Policy	- The Contingency Policy will be determined by the Index Administrator, subject to review and amendment with appropriate stakeholder consultation, and may initially require the re-publication of the prior Index Calculation Day's rate for the relevant Publication Tenor Period. - The Contingency Policy may also be applied in exceptional market circumstances. - The market would be informed and, where appropriate, relevant governance committees and stakeholders would be consulted with regard to any application of the Contingency Policy.

Publication

Publication	The Index Administrator will publish a daily Index rate for each of the one-month, three-month and six-month Publication Tenor Periods during the morning New York time on the business day following the relevant Index Calculation Day.

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Term Sheet Appendix A

Funding Transaction Eligibility Criteria

Category	Criteria
Transaction provider[21]	List of eligible providers of funding transaction data to be confirmed. 81 percent of USD LIBOR panel banks have consented to IBA using their funding transaction data for the purposes of the paper and the period of testing
Transaction currency	USD
Transaction size	≥USD 10m
Number of transactions	≥2 per transaction provider
Transaction type	Unsecured term deposits, commercial paper (fixed rate and primary issuance), certificates of deposit (fixed rate and primary issuance)
Counterparty type	• Banks; • Central banks; • Governmental entities; • Multilateral development banks; • Non-bank financial institutions; • Sovereign wealth funds; • Supranationals; and • Corporations (for transaction maturities > 35 days).
Number of counterparties	≥2 per transaction provider
Funding location	• Canada; • USA; • EU; • EFTA; • Hong Kong; • Singapore; • Japan; • Australia; and • Cayman Islands.

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[21] The deposit taking / issuer bank (and its associated branches). The list of deposit taking / issuer banks may be amended by the Index Administrator from time to time.

Term Sheet Appendix B

Eligible Issuers identified by IBA in respect of Bond Transaction Data and associated ISINs for the testing period

Group Parent	Issuer Bank (and associated branches)[22]	Eligible ISINs (as of January 11th 2019)[23]
Bank of America Corporation	Bank of America, N.A.	US06050TLY63 US06050TMC35 US06050TME90
Bank of Montreal	Bank of Montreal	US06366RE765 US06366RU787 US06367T4W71 US06367T7H77 US06367TJX90 US06367TYL87 US06367XF305 USC06156KT62 US06367TF964 US06367THQ67 US06367TJW18 US06367TPX27 US06367VHL27
Bank of New York Mellon Corporation	The Bank of New York Mellon	None[24]
Barclays PLC	Barclays Bank Plc	US06739FHT12 US06739FJJ12
BNP Paribas SA	BNP Paribas SA	US05567LT315 US05574LPT97 US05574LTX63 US05574LXH67 US05579TED46
Capital One Financial Corporation	Capital One N.A.	US14042E3Y48 US14042RBT77
Capital One Financial Corporation	Capital One Bank	US140420NE62 US140420NH93 US140420NK23

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[22] List of issuer banks may be amended by the Index Administrator from time to time
[23] To be refreshed every two weeks
[24] None means that the issuer bank has no eligible bonds at the current time

Group Parent	Issuer Bank (and associated branches)[22]	Eligible ISINs (as of January 11th 2019)[23]
		US14042E4A52
		US14042RBS94
		US14042RFH93
Citigroup Inc.	Citibank, N.A.	US17325FAA66
		US17325FAE88
		US17325FAF53
		US17325FAJ75
		US17325FAL22
		US17325FAN87
		US17325FAQ19
Credit Agricole SA	Credit Agricole SA	US22532LAH78
		US22532LAJ35
		US22532LAL80
		US22532LAR50
		US22532MAH51
		US22532MAJ18
		US22532MAL63
		US22532MAR34
		USF2R125AH86
		US225313AG07
Credit Suisse Group AG	Credit Suisse AG	US22546QAF46
		US22546QAN79
		US22546QAR83
		US22546QAT40
		US22546QAV95
Deutsche Bank AG	Deutsche Bank AG	US25152R5D13
		US25152RVS92
		US251541AN81
		US251541AQ13
		US25152RYD96
		US25152R2U64
		US25152R2X04
		US25152R5F60
		US251525AT85
		US251526BP38
		US251526BV06
		US251526BW88

Group Parent	Issuer Bank (and associated branches)[22]	Eligible ISINs (as of January 11th 2019)[23]
		US251526BX61
Goldman Sachs Group Inc.	Goldman Sachs Bank USA	US38148PP843
HSBC Holdings Plc	HSBC Bank Plc	US44328MAC82
		US44328MAK09
		USG4639DVV48
		USG4639DWC57
		US44328MBT09
HSBC Holdings Plc	HSBC Bank USA, N.A.	US4042Q1AE77
ING Groep	ING Bank NV	US44987CAC29
		US44987CAE84
		US44987CAJ71
		US44987CAN83
		US44987DAC02
		US44987DAE67
		US44987DAJ54
		US44987DAN66
		US44987CAB46
		US44987DAB29
		US449786AP75
		US449786BJ07
		US44987CAG33
		US44987CAM01
		US44987DAG16
		US44987DAM83
		USN45780CZ97
		USN4578BQA53
JPMorgan Chase & Co.	JPMorgan Chase Bank, N.A.	US48125LRF12
		US48125LRG94
Lloyds Banking Group Plc	Lloyds Bank Plc	US53944VAA70
		US53944VAB53
		US53944VAE92
		US53944VAJ89
		US53944VAK52
		US53944VAM19
		US53944VAP40
Mizuho Financial Group, Inc.	Mizuho Bank, Ltd.	US60688XAC48

Group Parent	Issuer Bank (and associated branches)[22]	Eligible ISINs (as of January 11th 2019)[23]
		US60688XAL47
		USJ45992NP56
		USJ45992PQ12
		USJ45992PU24
		USJ46186AU66
		USJ46186BA93
		US60688XAS99
		US60688XAW02
		US60688XAV29
Mitsubishi UFG Financial Group Inc.	MUFG Bank, LTD.	US064255AL60
		US064255AQ57
		US064255AU69
		US064255BC52
		US064255BG66
		US064255BL51
		US064255BP65
		US06538PAA03
		US06538PAC68
		USJ0423YBJ22
		USJ0423YBN34
		USJ0423YBU76
		USJ0423YBW33
		USJ0423YCB86
		USJ04306AA49
		USJ04306AC05
Mitsubishi UFG Financial Group Inc.	Mitsubishi UFJ Trust & Banking Corporation	US60682VAB62
		USJ4506XAN87
		US60682VAD29
		USJ4506XAR91
Morgan Stanley	Morgan Stanley Bank N.A.	None
PNC Financial Services Group Inc.	PNC Bank N.A.	US69353RCH93
		US69353RDD70
		US69353RDZ82
		US69353REP91
		US69353RES31
		US69353RET14
		US69353REU86

Group Parent	Issuer Bank (and associated branches)[22]	Eligible ISINs (as of January 11th 2019)[23]
		US69353REW43
		US69353REY09
		US69353REV69
		US69353REX26
		US69353REZ73
		US69353RFC79
		US69353RFH66
Rabobank Group	Cooperative Rabobank U.A.	US21685WBT36
		US74977RCA05
		US74977SCA87
		US74977EPZ06
Rabobank Group	Cooperative Centrale Raiffeisen-Boerenleenbank B.A.	US21688AAA07
		US21688AAD46
		US21688AAF93
		US21688AAG76
		US21688AAN28
Royal Bank of Canada	Royal Bank of Canada	US780082AA14
		US780082AC79
		US780082AE36
		US78008S7D27
		US78008SVD51
		US78010USN80
		US78011DAF15
		US78011DAG97
		US78012KC627
		US78012KCB17
		US78012KJA60
		US78012KJZ12
		US78012KKU06
		US78012KNL79
		US78012KRK50
		US78012KFU60
		US78012KPY72
		US78013GKN42
		US78013XKG24
Royal Bank of Scotland Group	Royal Bank of Scotland Group Plc	None

Group Parent	Issuer Bank (and associated branches)[22]	Eligible ISINs (as of January 11th 2019)[23]
Banco Santander S.A.	Santander UK Plc	US80283LAF04 US80283LAH69 US80283LAK98 US80283LAM54 US80283LAN38 US80283LAP85 US80283LAR42 US80283LAT08
Societe Generale SA	Societe Generale SA	US83368RAD44 US83368RAF91 US83368TAC27
Standard Chartered plc	Standard Chartered Bank	None
Sumitomo Mitsui Financial Group, Inc.	Sumitomo Mitsui Banking Corporation Europe Limited	None
Sumitomo Mitsui Financial Group, Inc.	Sumitomo Mitsui Banking Corporation	US865622BG88 US865622BM56 US865622BR44 US865622BV55 US865622BY94 US865622CA00 US865622CC65 US865622CE22 US865622CH52 US865622CJ19
Sumitomo Mitsui Financial Group, Inc.	Sumitomo Mitsui Trust Bank Ltd	US86563VAE92 US86563VAG41 US86563VAH24 US86563VAL36 USJ7771YAB32 USJ7772GAM71 USJ7772GAY10 USJ7772GBA25
Toronto-Dominion Bank	Toronto-Dominion Bank	US8911453Y83 US891145W592 US89114QAM06 US89114QAS75

Group Parent	Issuer Bank (and associated branches)[22]	Eligible ISINs (as of January 11th 2019)[23]
		US89114QAV05
		US89114QBE70
		US89114QBJ67
		US89114QBN79
		US89114QBU13
		USC8888LBA73
		USC8888LBB56
		US8911457V09
		US89114QBC15
		US89114QBG29
		US89114QBL14
		US89114QBT40
		US89114QBX51
		US89114QBY35
		US89114QBZ00
		USC88660FF47
		US89114QAG38
		US89114QAZ19
		US89114QB643
UBS Group AG	UBS AG	US90261XHE58
		US90261XHK19
		US90261XGD84
		US90261XHH89
USBancorp	US Bank N.A.	US90331HML41
		US90331HMY61
		US90331HNB59
		US90331HNG47
		US90331HNJ85
		US90331HNP46
		US90331HNU31
Wells Fargo & Company	Wells Fargo Bank N.A.	US94988J5A16
		US94988J5G85
		US94988J5L70
		US94988J5D54
		US94988J5F03
		US94988J5N37

Term Sheet Appendix C

Bond Transaction Eligibility Criteria

Category	Criteria
Bond issuer	Any of the issuer banks listed in column 2 of Appendix B
Issuance currency	USD
Issuance size	≥USD 500m
Transaction size	≥USD 2m
Bond type	Fixed coupon bond No economic calls greater than 30 days
Coupon range	≥1 percent and ≤5 percent, subject to adjustment over time by the Index Administrator based upon the current interest rate environment
Days to maturity of the bond at settlement of transaction	≥20 and ≤500

Term Sheet Appendix D

Maturity Ranges for Tenor Periods[25]

Tenor Period	Maturity Range From (calendar days except where noted)	Maturity Range To (calendar days except where noted)	Target Number of Transactions
1W	5 (business days)	19	10
1M (Publication Tenor Period)	**20**	**49**	**10**
2M	50	79	10
3M (Publication Tenor Period)	**80**	**100**	**10**
4M	101	125	10
5M	126	149	10
6M (Publication Tenor Period)	**150**	**210**	**10**
7M	211	234	10
8M	235	258	10
9M	259	282	10
10M	283	305	10
11M	306	329	10
12M	330	390	10
>12M	≥391		N/A

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[25] Subject to adjustment in exceptional market circumstances by the Index Administrator

Term Sheet Appendix E

Weightings for Eligible Transaction Data dependent upon whether it is: (i) an Eligible Funding Transaction or an Eligible Bond Transaction; and/or (ii) executed during the Input Data Window for the current or a preceding Index Calculation Day[26]

Eligible Transaction type	Weighting
Eligible Funding Transaction	1.0
Eligible Bond Transaction	0.5

Index Calculation Day Input Data Window	Weighting
Current Index Calculation Day	1.0
Preceding Index Calculation Day	0.7
Second Preceding Index Calculation Day	0.5
Third Preceding Index Calculation Day	0.35
Fourth Preceding Index Calculation Day	0.25
Fifth Preceding Index Calculation Day	0.2

Weightings are applied cumulatively. For example, an Eligible Bond Transaction executed during the Input Data Window for the preceding Index Calculation Day would be assigned a weighting of 0.5 x 0.7 = 0.35 (35 percent).[27]

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[26] Subject to adjustment in exceptional market circumstances by the Index Administrator
[27] This transaction could also be subject to an additional weighting in order to ensure that no single issuer of bonds represents more than the Threshold Percentage of the Eligible Bond Transactions that are included in the Index calculation for any given Index Calculation Day
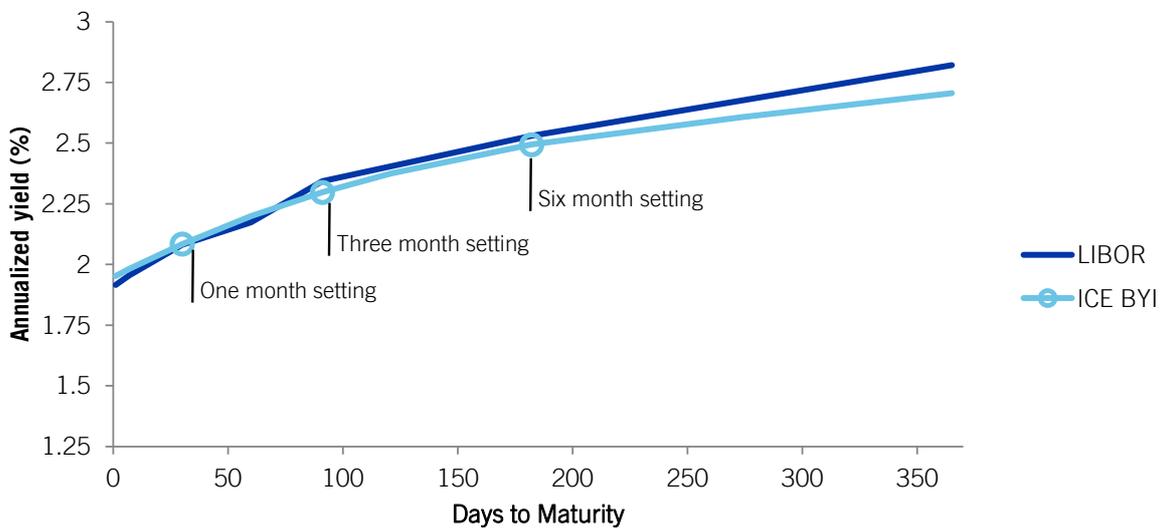
Term Sheet Appendix F

Curve Construction[28]

USD ICE Bank Yield Index for 30-Jul-2018
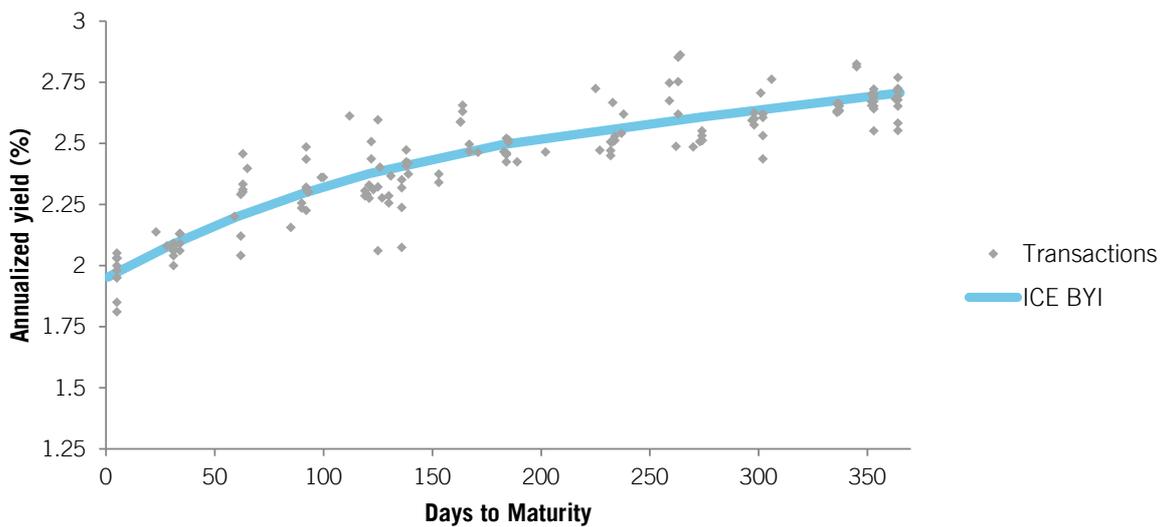
USD ICE Bank Yield Index for 30-Jul-2018

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[28] The yield curve is shown together with the corresponding USD LIBOR yield curve. Note that yield curves for USD LIBOR and the USD ICE Bank Yield Index are produced using different methodologies and different data sources. As a result, care should be taken when comparing USD LIBOR and the USD ICE Bank Yield Index for any day, including days during the period of testing.

Appendix 2 - Curve-fitting Methodology

Introduction

The U.S. Dollar ICE Bank Yield Index methodology produces a daily short-term yield curve (up to one year, although only one-month, three-month and six-month tenor period settings are currently expected to be published) through a process of curve-fitting to a number of eligible transaction data points.

Actual transaction rates/yields will vary, even for transactions with the same time to maturity/time to bond maturity that are executed on the same day, and so the curve cannot simply be drawn through the known data points. IBA must rather "fit" a single curve to the known data points for a given day using a pre-determined methodology that best represents the range of eligible transaction rates/yields at each applicable maturity point.[29]

Curve selection

The selection of a curve-fitting approach in part depends upon assumptions that can reasonably be made regarding the underlying data and the resulting yield curve. For instance, a straight line (shown in dark blue in the below chart), a simple parabola (shown in gray) or an oscillating curve (shown in light blue - in this case a 6th order polynomial) might each be considered a "good fit" to the same data, depending on initial assumptions.

Curve comparisons
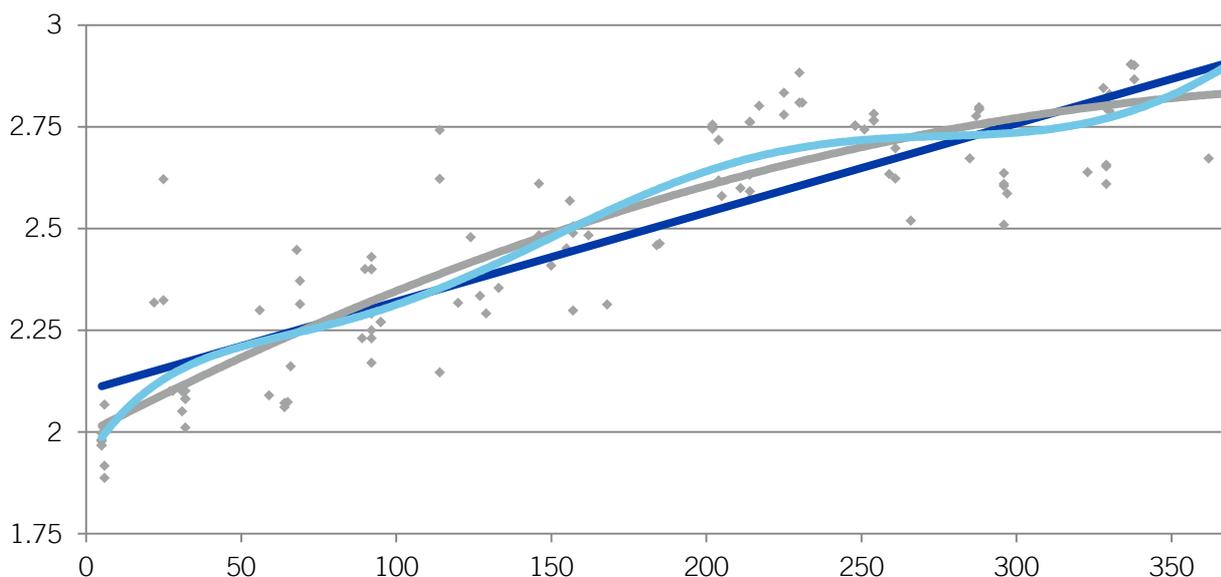
For the U.S. Dollar ICE Bank Yield Index, IBA started from the assumption that, whilst the shape of the yield curve will vary according to market conditions, it will be a smooth, continuous curve and will not oscillate.

Two classes of curve-fitting algorithms were considered:

- Parametric, where the entire curve is represented by a single function with a set of parameters which determine its shape; and

- Spline-based, where a number of localized fitted curves are smoothly joined together.

In each case, curve-fitting is a method of finding a "best fit" curve that best represents the available data points; which is to say, minimizing some measure of net distance of the data points from the curve. A typical approach is to

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[29] The calculation methodology initially assigns different weightings to funding transactions and bond transactions. It also gives previous days' transactions a lower weighting than current day's transactions and adjusts them to cater for changes in market rates. Bond transactions are further weighted as necessary to reduce the impact of any issuer having an excessively high proportion of any particular day's inputs. Bond transaction yields are converted to an annualized money market basis.

seek a curve that minimizes the average (mean) of the squares of the vertical (y-axis) distances between each data point and the curve; this is known as a "least squares" regression.

In the case of a parametric model, a change to any individual data point can affect the shape of the entire curve, but the curve itself will remain smooth. In the case of a spline-based model, individual data points will have less impact on the shape of the whole curve, because each localized curve section is able to move largely independently of the others, but the resulting curve will be more likely to oscillate. In either case, responsiveness to erroneous or outlier data, such as transactions far from the consensus yield, can distort the curve.

IBA has based the preliminary U.S. Dollar ICE Bank Yield Index yield curve used during the testing period for the purposes of the published test results on a parametric model, fitting to a third order polynomial ($y = ax^3 + bx^2 + cx + d$). This allows the curve to have one or two turning points and some variation in curvature, whilst still being a relatively simple function. Least-squares fitting to a polynomial can also be readily performed using statistics software packages or spreadsheet tools, such as Microsoft Excel.

Handling outliers
One consideration that applies to any curve-fitting method is how to handle outliers. Although IBA has not sought to exclude or otherwise address outliers for the purposes of the curve-fitting methodology used during the testing period for the purposes of the published test results, IBA is seeking feedback on whether this would be appropriate going forwards.

During the testing period IBA observed an example of an extreme outlier transaction during a less liquid market period having a noticeable effect on the curve-fitting process. This can be seen in the chart for the one-month tenor period setting, where there is a significant spike in the rate on July 3rd and July 4th 2018, as indicated in the chart below[30].
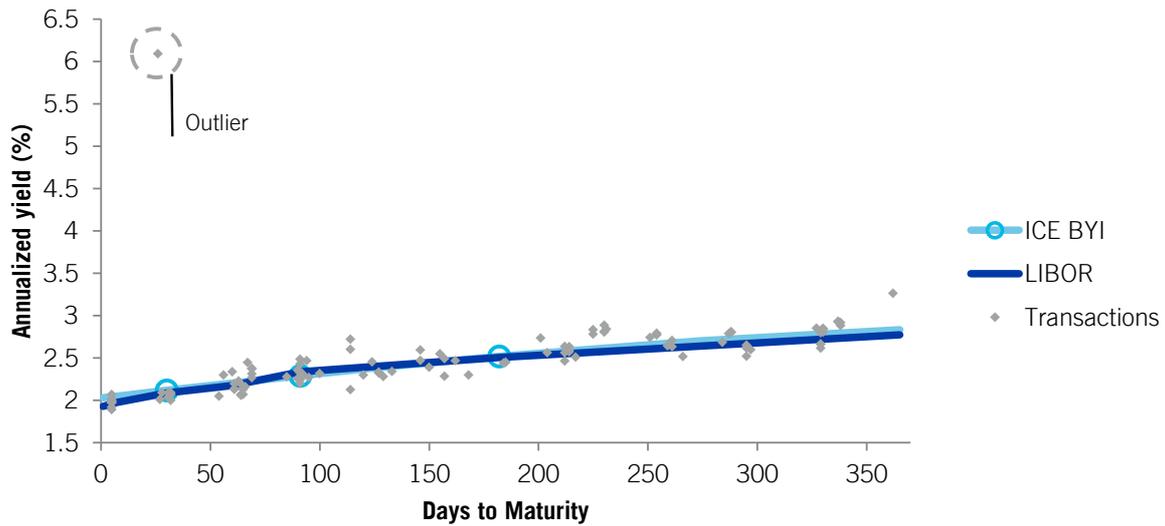

USD ICE Bank Yield Index : 1M

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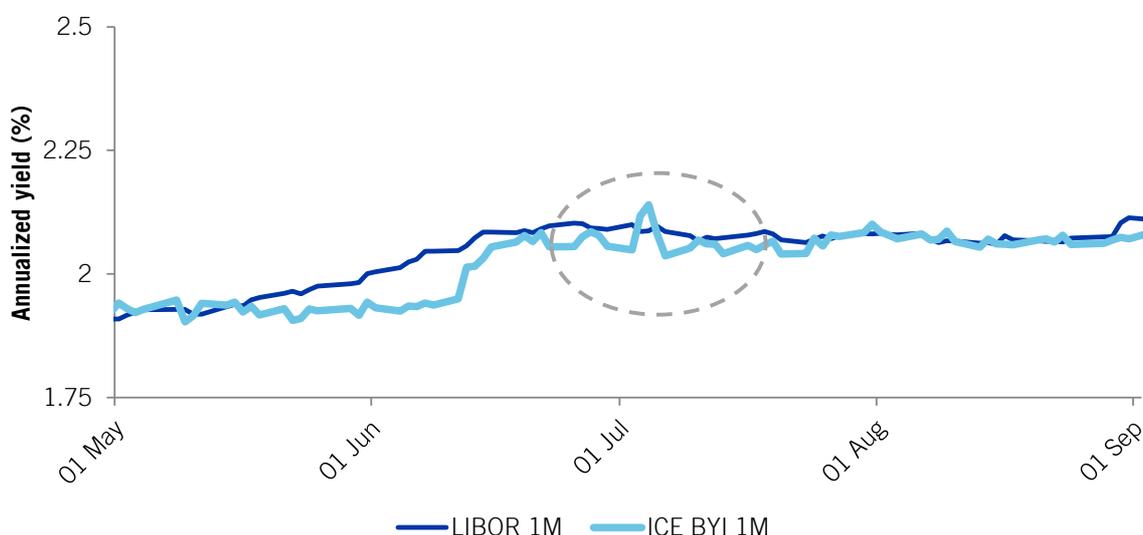
[30] The rate charts in this appendix are shown together with the corresponding U.S. Dollar LIBOR settings for the same time period. Note that U.S Dollar LIBOR and the U.S. Dollar ICE Bank Yield Index are produced using different methodologies and different data sources. As a result, care should be taken when comparing U.S. Dollar LIBOR and the U.S. Dollar ICE Bank Yield Index for any period, including the period of testing.
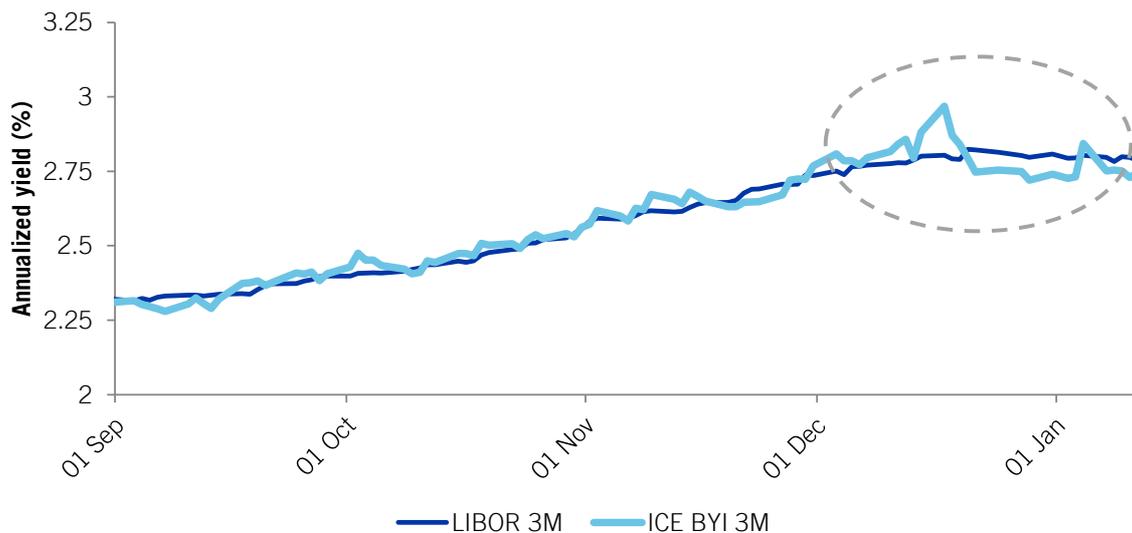
This spike arises because the short-end of the curve is pulled higher by a single extreme outlier transaction, as indicated in the example chart below for July 3rd 2018[31]. The transaction occurred on July 2nd 2018 and was used in the curve-fitting calculations on both July 3rd and July 4th 2018. With a yield of just over six (6) percent, it is around 400 basis points above the calculated curve at the same maturity point for that calculation day.

USD ICE Bank Yield Index for 03-Jul-2018

Another example of outlier transactions during a period of market volatility having a noticeable effect on the curve-fitting process can be seen in the chart for the three-month tenor period setting, where there is a significant spike in the rate in mid-December 2018, as indicated in the chart below.

USD ICE Bank Yield Index : 3M

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[31] The yield curves in this appendix are shown together with the corresponding U.S. Dollar LIBOR yield curves. Note that U.S. Dollar LIBOR and the U.S. Dollar ICE Bank Yield Index are produced using different methodologies and different data sources. As a result, care should be taken when comparing U.S. Dollar LIBOR and the U.S. Dollar ICE Bank Yield Index for any day, including days during the period of testing.

This spike arises in part because the middle of the curve is pulled higher by several outlier transactions, as indicated in the example chart below for December 17th 2018. The transactions occurred between December 11th and December 14th 2018 and were used in the curve-fitting calculations between December 12th and December 24th 2018. With yields of around 4 percent and higher, they are around 100 to 140 basis points above the calculated curve at the same maturity point for that calculation day.

USD ICE Bank Yield Index for 17-Dec-2018
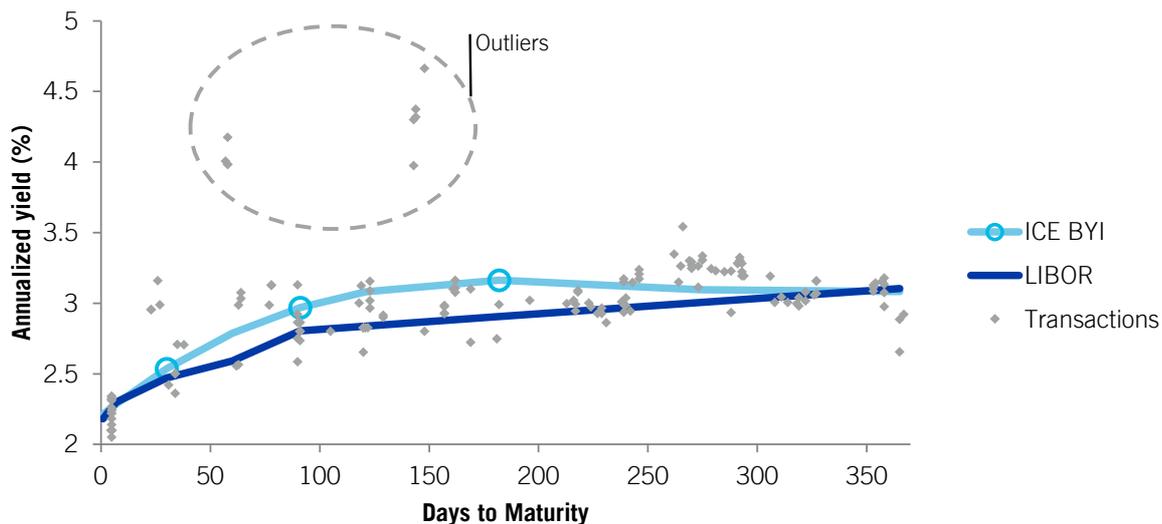
One method of handling outliers is to exclude them based on their (vertical) distance from the calculated curve. If the outlier transactions discussed above are excluded as part of a +/- 100bps sensitivity, then the one-month tenor period rates for July 3rd and July 4th 2018 fall to a similar level to the surrounding days, with only a moderate rise seen, as indicated in the chart below.
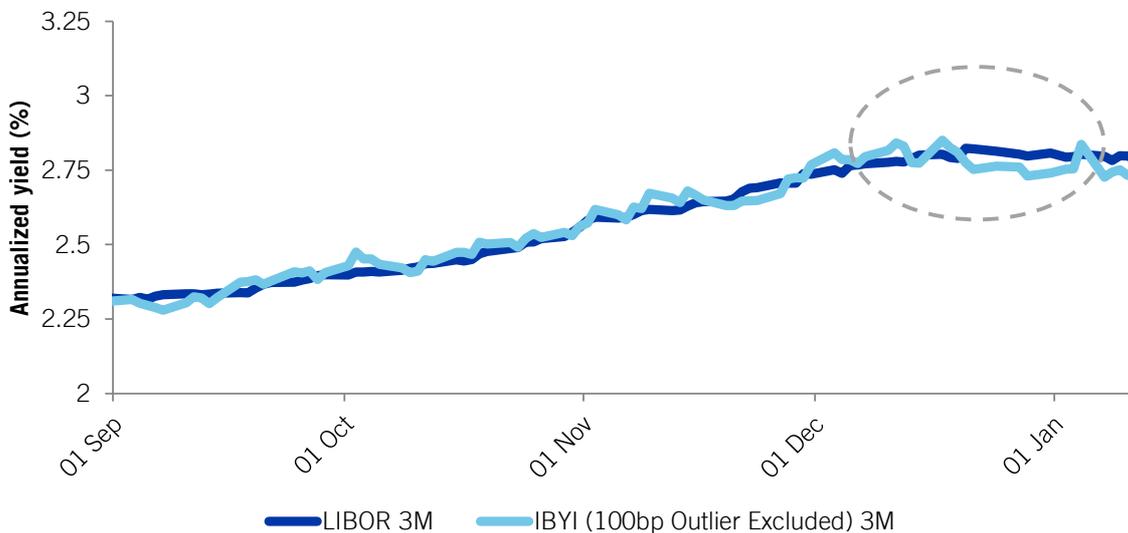
USD ICE Bank Yield Index : 1M
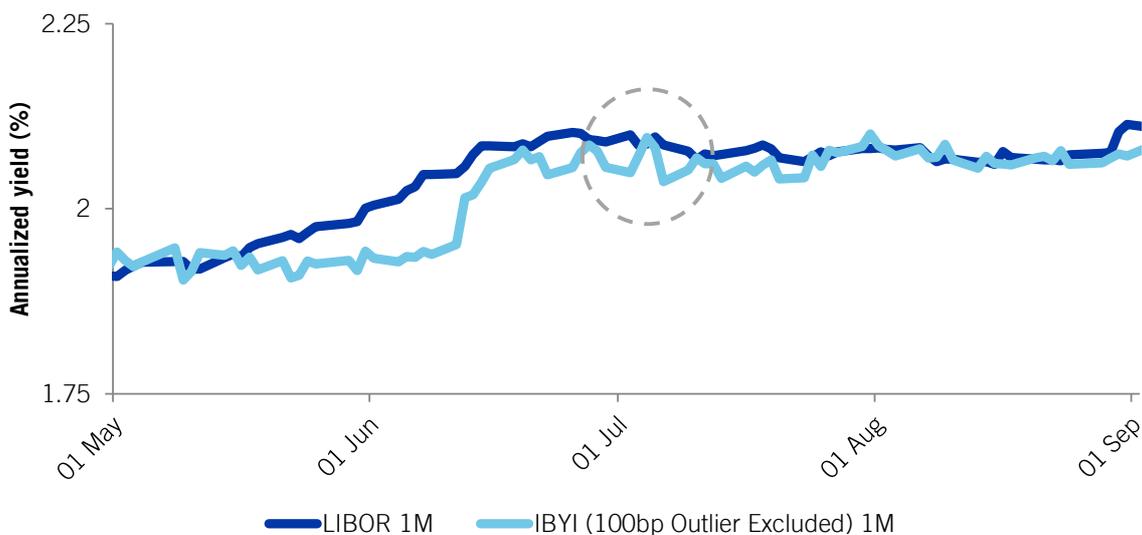
The three-month tenor period rates for mid-December 2018 also fall to a similar level to the surrounding days using this approach, with only a moderate rise seen, as indicated in the chart below.

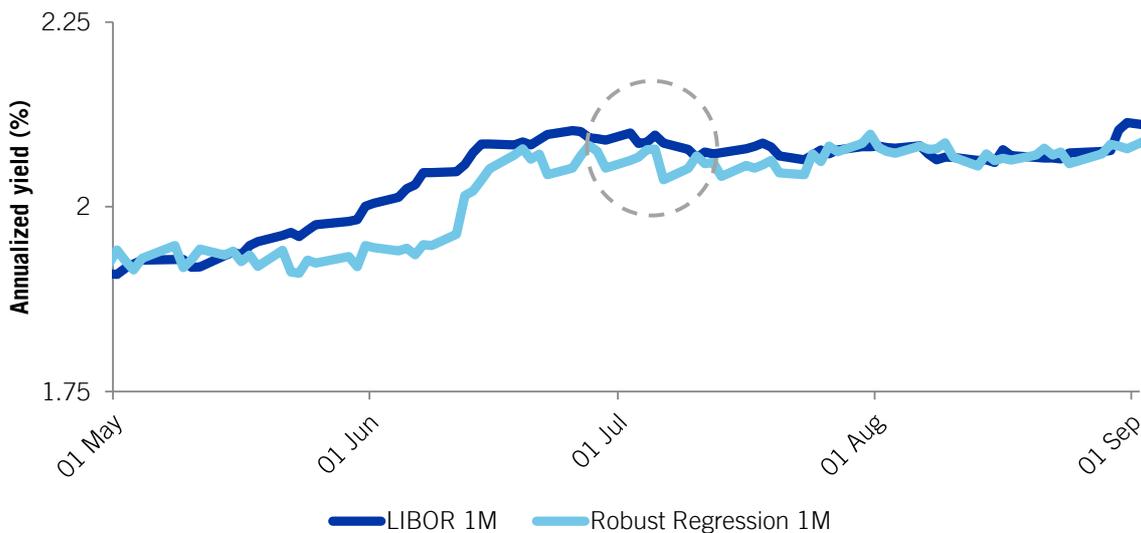**USD ICE Bank Yield Index : 3M**

If all outliers with a yield in excess of 100bps greater or less than that day's calculated curve for the same maturity are excluded, then 87 eligible transactions (out of 39835 in total) are omitted from the least squares cubic parametric curve-fitting process over the course of the testing period. If the sensitivity is increased to +/- 50bps, then 435 eligible transactions are excluded. Increasing the sensitivity of the outlier exclusion process could be expected to further reduce the incidence of outlier-dependent spikes in the rate charts. However, increasing the sensitivity could also be expected to reduce the number of eligible transactions incorporated into the curve-fitting process for any given calculation day.

Another approach to handling outliers is to adopt a robust regression method. This gives greater weight to data points nearer to the estimated curve and a correspondingly lower weight to those further from the curve (e.g. the RLM function in the R statistics tool[32]), thereby reducing the impact of outliers.

See below a chart showing the one-month tenor period rates generated using the RLM curve-fitting model and the resulting reduced impact of the July 2nd 2018 outlier on the July 3rd and July 4th 2018 rates.

USD ICE Bank Yield Index : 1M

LIBOR 1M — Robust Regression 1M

The three-month tenor period rates for mid-December 2018 also show a reduced impact using this approach, with only a moderate rise seen, as indicated in the chart below.

USD ICE Bank Yield Index : 3M

LIBOR 3M — Robust Regression 3M

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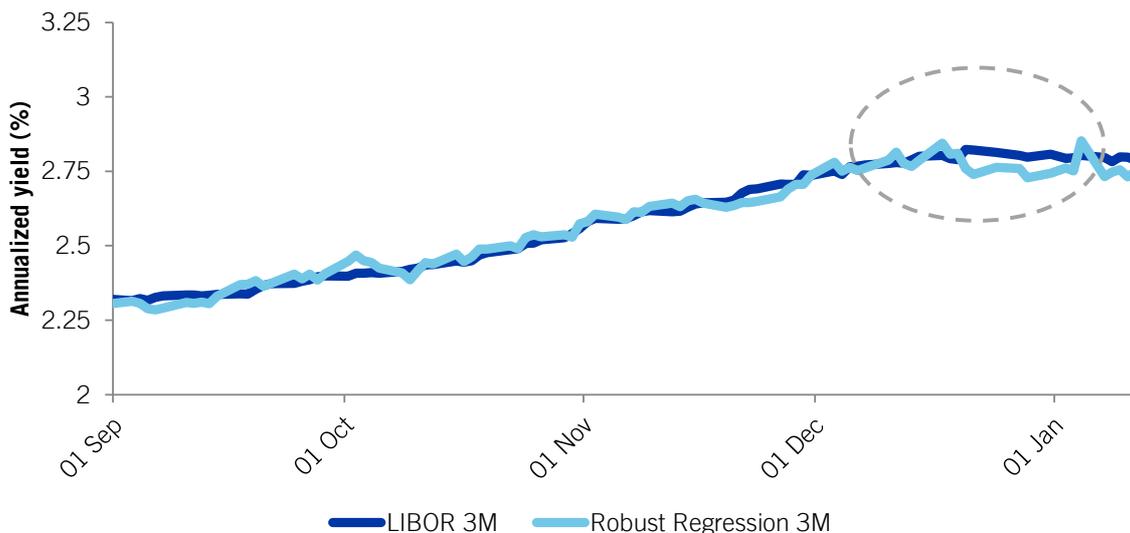
[32] The R platform is a product of The R Project for Statistical Computing; see https://www.r-project.org/ for further details. The 'RLM' function is contained in the MASS package, see http://www.stats.ox.ac.uk/pub/MASS4/.

Curve comparisons

Finally, we show some examples of the effects of using different curve-fitting approaches on the rates generated for the U.S. Dollar ICE Bank Yield Index during the testing period.

The charts below show one-month and three-month tenor period rates over the course of testing period generated using the least squares cubic parametric model (used for the purposes of the published test results) and a spline-based model.

USD ICE Bank Yield Index : 1M
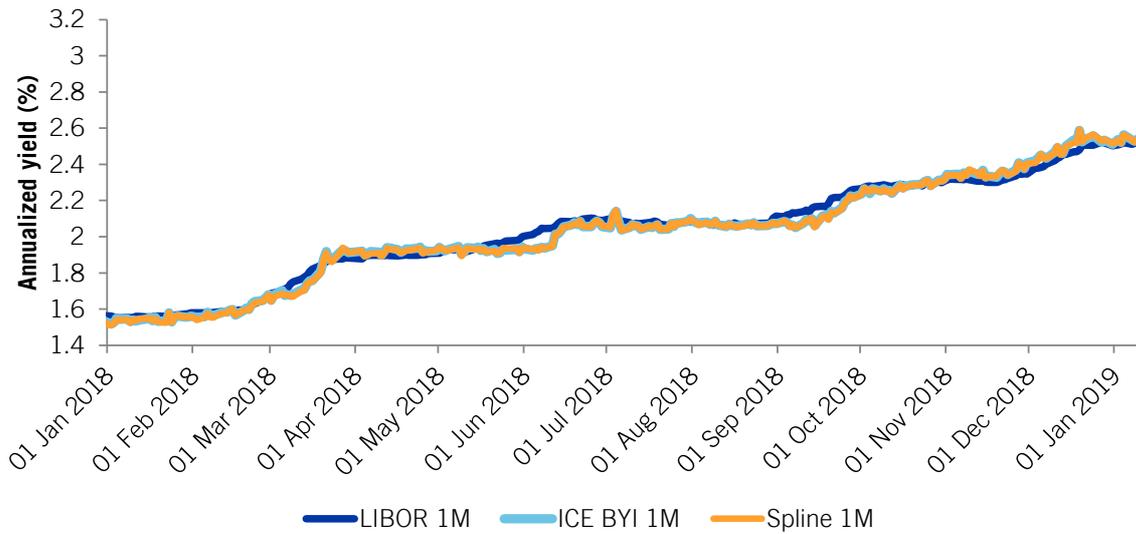
USD ICE Bank Yield Index : 3M
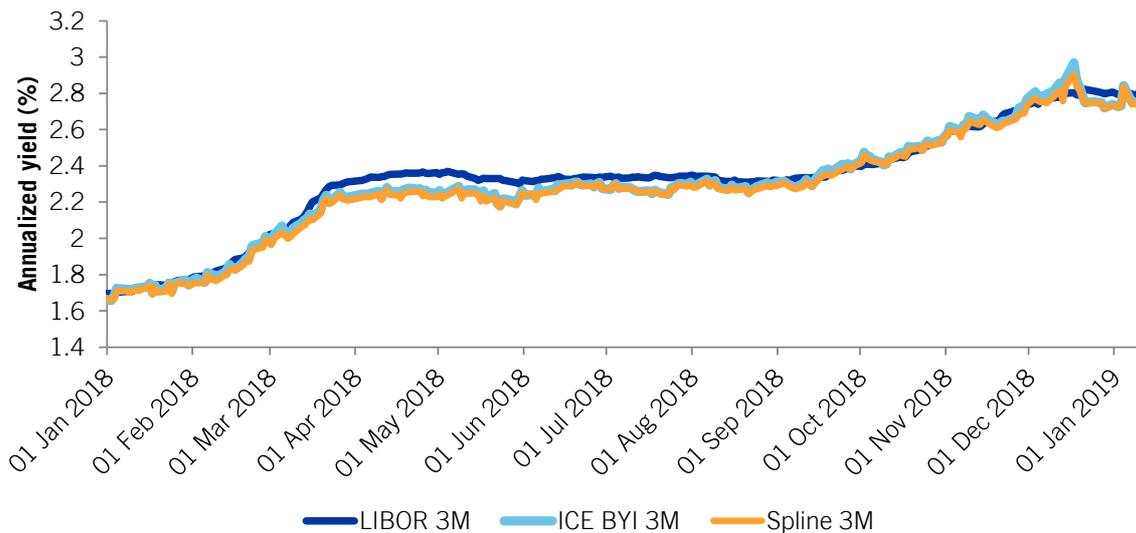
Appendix 3 - Disclaimers

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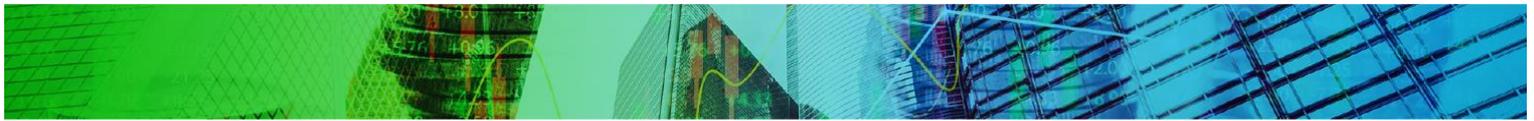
those contained in the forward-looking statements, see ICE's Securities and Exchange Commission (SEC) filings, including, but not limited to, the risk factors in ICE's Annual Report on Form 10-K for the year ended December 31st 2017, as filed with the SEC on February 7th 2018.