Alternative Reference Rates Committee (ARRC)
Minutes for the September 5, 2019 Meeting

1. Federal Reserve staff provided a presentation (Attachment 1) on preliminary analyses on potential spread adjustment methodologies for cash products for the ARRC’s consideration as it moves to consider spread adjustments. The ARRC Chair reminded members that the Committee has committed to recommending a spread adjustment, which would account for the difference between LIBOR and fallback rates, as referenced in the ARRC’s recommended fallback language for new issuances of various cash products. A few ARRC members highlighted that confusion could arise if a spread adjustment approach for cash products diverges from the approach selected for derivatives. The ARRC Chair noted that while ideally the Committee’s recommended approach will be consistent with ISDA’s work on derivatives, the ARRC needs to perform its own analysis to determine its recommendations for what spread adjustment approach would be most appropriate for use in cash products and asked for members to contribute to this analysis.

2. Federal Reserve staff provided a presentation (Attachment 2) on the parameters they are considering for producing SOFR averages and a related index. Federal Reserve staff noted that SOFR averages would likely be produced across 30-, 90-, and 180-day tenors. Staff also noted that an index based on SOFR would allow market participants to calculate compounded SOFR averages over custom time periods. Federal Reserve staff noted that production of the proposed SOFR averages and index is anticipated to begin in the first half of 2020 and the exact timing depends on the feedback received in response to a public consultation, which would be launched soon.

3. The co-Chairs of the ARRC’s recently launched Operations/Infrastructure working group provided a presentation (Attachment 3) on the group’s mission, noting that a key function will be to monitor the industry’s readiness to ensure that appropriate steps are being taken to prepare systems for the transition away from LIBOR. A co-Chair of the Business Loans working group highlighted work being done by its Operations subgroup, including on how to build systems that could incorporate SOFR compounded in arrears.

4. The ARRC Chair noted that CME and LCH had both announced plans to move to SOFR price alignment interest (PAI) and discounting in the second half of 2020. The ARRC Chair also noted that the CFTC’s Market Risk Advisory Committee would meet on September 9, 2019 to discuss whether greater consistency in the two central counterparties’ (CCPs) planning would be beneficial to the market and ways that CCPs could coordinate their plans, while also recognizing that the CCPs will ultimately need to make decisions based on feedback from their respective members. A co-Chair of the Market Structure/Paced Transition working group noted that this issue is of particular importance for uncleared products that deliver cleared products, such as swaptions, and that working group members were examining potential solutions for these products.

5. The ARRC Chair invited Committee members to share their observations about the types of fallback language being used in recent issuances of cash products that reference LIBOR and to identify whether there was anything the ARRC should address to further support the adoption of
robust fallback language. The Chair of the Floating Rate Notes working group indicated that floating rate notes are experiencing significant uptake of the ARRC’s recommended fallback language. Several members noted it would be beneficial to have a forum where investors, issuers, and trustees can address the extent to which consistent fallback language would facilitate a smoother transition across markets. ARRC members agreed to study and publish a note on recent trends in the usage of the ARRC’s recommended fallback language.

6. The ARRC’s antitrust counsel noted that ISDA had submitted a Business Review Letter (BRL) request to the Antitrust Division of the Department of Justice (DOJ) in connection with ISDA’s work on fallbacks. The Legal working group recommended the ARRC authorize its antitrust counsel to express the ARRC’s support for the ISDA BRL request. The ARRC approved this recommendation.

7. The co-Chairs of the Legal working group and representatives from Cadwalader highlighted a potential legislative approach for dealing with certain legacy contracts that reference U.S. dollar LIBOR. The ARRC Chair requested that members provide the co-Chairs of the Legal working group with their feedback about the potential legislative approach. The ARRC Chair emphasized the need for the Committee to articulate and dimension the risks that could materialize if a legislative solution is not pursued as this would help the Committee decide on the path forward.

8. The ARRC Chair reminded Committee members to respond to the ARRC’s public consultation on fallback language for adjustable rate mortgages. The ARRC Chair also noted that momentum is building behind the Committee’s work, highlighting recent developments such as the Financial Accounting Standards Board’s (FASB) release of an exposure draft letter on modification relief and hedging relief associated with the LIBOR transition and rising SOFR-linked debt issuance.
Attendance at the September 5, 2019 Meeting

ARRC Members
American Bankers Association
AXA
Bank of America
Bank of America
Bank of America
BlackRock
Citigroup
Citigroup
CME Group
CME Group
CRE Finance Council
CRE Finance Council
Deutsche Bank
Deutsche Bank
Fannie Mae
Fannie Mae
Fannie Mae
Federal Home Loan Bank
Federal Home Loan Bank
Freddie Mac
GE Capital
Goldman Sachs
Goldman Sachs
Goldman Sachs
Goldman Sachs
Goldman Sachs
Government Finance Officers Association
HSBC
HSBC
Independent Community Bankers of America
Independent Community Bankers of America
Intercontinental Exchange
International Swaps and Derivatives Association
JP Morgan Chase & Co.
JP Morgan Chase & Co.
JP Morgan Chase & Co.
JP Morgan Chase & Co.
JP Morgan Chase & Co.
LCH
Loan Syndications and Trading Association
Loan Syndications and Trading Association
MetLife
MetLife
MetLife
Hu Benton
Julien Zusslin
Greg Todd
Sonali Theisen
Alex van Voorhees*
Jack Hattem
Dina Faenson
Jeannine Hyman
Agha Mirza
Fred Sturm*
Lisa Pendergast
Raj Aidasani
Adam Eames
Vishal Mahadkar
Bob Ives
Nadine Bates
Wells Engledow*
Kyle Lynch
Phil Scott
Ameez Nanjee
Michael Taets*
Brian Friedman*
Gigi Chavez de Arnavat
Jason Granet
Richard Chambers
Emily Brock*
Blair Selber
Shirley Hapangama
Chris Cole*
James Kendrick*
Harvey Flax
Ann Battle
Alice Wang
Andrew Gray
Emilio Jimenez
Perry Elbadrawi*
Terry Belton
Phil Whitehurst*
Meredith Coffey
Tess Virmani*
Alex Strickler*
Jason Manske
Kevin Budd*
Morgan Stanley
Morgan Stanley
National Association of Corporate Treasurers
Pacific Investment Management Company
Pacific Investment Management Company
Pacific Investment Management Company
Prudential Financial
Prudential Financial
Securities Industry and Financial Markets Association
Securities Industry and Financial Markets Association
Pacific Investment Management Company
TD Bank
TD Bank
Wells Fargo
Wells Fargo
World Bank Group

Maria Douvas-Orme
Tom Wipf
Tom Deas
Courtney Garcia*
Scott Goodman*
Tracey Jordal*
Chris McAlister
Gary Horbacz
Chris Killian
Rob Toomey *
Sairah Burki*
Greg Moore*
Priya Misra
Alexis Pederson
Brian Grabenstein
Don Sinclair

Ex-Officio ARRC Members
Commodity Futures Trading Commission
Consumer Financial Protection Bureau
Federal Deposit Insurance Corporation
Federal Housing Finance Agency
Federal Reserve Bank of New York
Federal Reserve Bank of New York
Federal Reserve Bank of New York
Federal Reserve Bank of New York
Federal Reserve Bank of New York
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Federal Reserve Board of Governors

Sayee Srinivasan*
Abhishek Agarwal
Irina Leonova
Dan Coates
Adhiraj Dutt
Alyssa Cambron*
Betsy Bourassa*
Cam Fuller*
Caren Cox
Jamie Pfeifer
Joshua Jones*
Justine Hansen
Matt Lieber*
Megan Zirinsky*
Nathaniel Wuerffel
Ray Check*
Scott Sherman
William Riordan*
Scott Nagel
Chiara Scotti*
Darren Gersh*
David Bowman
Diana Iercosan
Erik Heitfield
Evan Winerman
Matt McCormick*
Ang Middleton
U.S. Securities and Exchange Commission
David Metzman
U.S. Securities and Exchange Commission
Michelle Danis*
U.S. Treasury
Chloe Cabot
U.S. Treasury
Peter Phelan

Observers
Bank of Canada
Sheryl King
BNP Paribas
Simon Winn
Cadwalader
Jonathan Hoff
Cadwalader
Lary Stromfeld
Deloitte
Alexey Surkov
Ernst & Young
Roy Choudhury
Morgan Lewis
Jon Roellke
Oliver Wyman
Adam Schneider
U.S. Department of Housing and Urban Development
Richard Perrelli*
U.S. Department of Housing and Urban Development
Jose Fernandez
Venerable
Charles Schwartz

*Indicates participation by telephone
Preliminary Analysis of Potential Spread Adjustment Methodologies for Cash Products

Diana Iercosan and David Bowman

September 5, 2019
Motivation

- The ARRC has committed to recommend spread adjustments for cash products as part of its work to encourage more robust fallback language in new issuances of products that continue to reference LIBOR.
  - A clear majority of respondents to the ARRC’s consultations on fallback language believed that it would be helpful to the market for the ARRC to make such recommendations.

- This deck is intended to help foster a start to the ARRC’s discussions as the group considers its recommendations. We provide an analysis of the methodologies that ISDA is consulting on for derivatives and how they might work if applied to cash products.
  - Although it may ultimately be appropriate for the ARRC to select a different methodology, ISDA’s work can serve as a baseline to the ARRC’s discussions.
Method of Analysis

• The ARRC’s recommendations would fallback to a version of SOFR (either term SOFR if the ARRC has recommended such a rate, or a compound average of SOFR) plus a spread adjustment.

• Historical proxies for SOFR go back to 1998, but because the ISDA methodologies may use up to 10 years of data to calculate a long-run mean or median spread, we base the analysis here on the effective fed funds rate (EFFR) in order to understand how the methodologies might behave over a variety of economic conditions. EFFR data goes back far enough to combine with LIBOR data starting in the 1980s and to look at historical differences between LIBOR and the ISDA methodology from 1998 onward. More recent daily data on term EFFR is also used as proxy for SOFR.

• We consider a hypothetical Floating Rate Note (FRN) that pays 3-month USD LIBOR quarterly and consider what would have happened had LIBOR stopped at some point in the past, with different remaining maturities on the FRN. We compare variants of the ISDA methodology, calculating a LIBOR-EFFR spread adjustment for each, and then compare those results to what actually happened to the LIBOR spread ex post.
Preliminary Questions

• We examine the following questions about the goodness of fit of various choices that ISDA is consulting on in regards to derivatives:

  1. Does the length of the historical lookback and/or method of calculating the long-run mean/median matter if they were to be applied to a cash product?

  2. Does the choice of a best methodology depend on the form of SOFR that would be used?

  3. Does the inclusion of a 1-year transition period to the long-run mean/median spread improve the fit for a cash product?
### Historical Results for a Hypothetical FRN Paying 3-Month LIBOR Quarterly had LIBOR Stopped between 1999-2019 with 5-Years Remaining Maturity on the FRN

<table>
<thead>
<tr>
<th>Calculation Method</th>
<th>Lookback</th>
<th>MAE</th>
<th>RMSE</th>
<th>Calculation Method</th>
<th>Lookback</th>
<th>MAE</th>
<th>RMSE</th>
<th>Calculation Method</th>
<th>Lookback</th>
<th>MAE</th>
<th>RMSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>2y</td>
<td>0.21</td>
<td>0.26</td>
<td>Average</td>
<td>2y</td>
<td>0.26</td>
<td>0.36</td>
<td>Average</td>
<td>2y</td>
<td>0.21</td>
<td>0.25</td>
</tr>
<tr>
<td>Trimmed Mean</td>
<td>2y</td>
<td>0.13</td>
<td>0.17</td>
<td>Trimmed Mean</td>
<td>2y</td>
<td>0.19</td>
<td>0.25</td>
<td>Trimmed Mean</td>
<td>2y</td>
<td>0.13</td>
<td>0.17</td>
</tr>
<tr>
<td>Median</td>
<td>2y</td>
<td>0.20</td>
<td>0.24</td>
<td>Median</td>
<td>2y</td>
<td>0.23</td>
<td>0.31</td>
<td>Median</td>
<td>2y</td>
<td>0.19</td>
<td>0.24</td>
</tr>
<tr>
<td>Average</td>
<td>5y</td>
<td>0.17</td>
<td>0.19</td>
<td>Average</td>
<td>5y</td>
<td>0.23</td>
<td>0.27</td>
<td>Average</td>
<td>5y</td>
<td>0.15</td>
<td>0.17</td>
</tr>
<tr>
<td>Trimmed Mean</td>
<td>5y</td>
<td>0.10</td>
<td>0.12</td>
<td>Trimmed Mean</td>
<td>5y</td>
<td>0.15</td>
<td>0.21</td>
<td>Trimmed Mean</td>
<td>5y</td>
<td>0.13</td>
<td>0.16</td>
</tr>
<tr>
<td>Median</td>
<td>5y</td>
<td>0.16</td>
<td>0.18</td>
<td>Median</td>
<td>5y</td>
<td>0.16</td>
<td>0.23</td>
<td>Median</td>
<td>5y</td>
<td>0.14</td>
<td>0.17</td>
</tr>
<tr>
<td>Average</td>
<td>10y</td>
<td>0.11</td>
<td>0.14</td>
<td>Average</td>
<td>10y</td>
<td>0.18</td>
<td>0.21</td>
<td>Average</td>
<td>10y</td>
<td>0.14</td>
<td>0.16</td>
</tr>
<tr>
<td>Trimmed Mean</td>
<td>10y</td>
<td>0.09</td>
<td>0.11</td>
<td>Trimmed Mean</td>
<td>10y</td>
<td>0.14</td>
<td>0.19</td>
<td>Trimmed Mean</td>
<td>10y</td>
<td>0.14</td>
<td>0.16</td>
</tr>
<tr>
<td>Median</td>
<td>10y</td>
<td>0.11</td>
<td>0.14</td>
<td>Median</td>
<td>10y</td>
<td>0.15</td>
<td>0.21</td>
<td>Median</td>
<td>10y</td>
<td>0.15</td>
<td>0.18</td>
</tr>
</tbody>
</table>
Initial Conclusions

• A longer lookback period appears to produce more accurate results: The root mean square error (RMSE) and mean absolute error (MAE) improve notably when using a 5-year lookback compared to 2-year, and a 10-year lookback appears to offer some further, although more modest, improvement over 5 years.

• There are smaller difference between methods of calculating the long-run mean/median. A trimmed mean may be somewhat more accurate in this particular exercise than a median or average, and a median appears somewhat more accurate than a simple average.

• These results appear to be true whether the fallback rate is a compound average in advance, in arrears, or a term rate. Surprisingly, a spread adjustment to a compound average seems to yield slightly more accurate results than to a term rate.

• To compare whether the errors shown are large or small, we computed the root mean square difference and mean absolute difference between 3-month LIBOR and the Federal Reserve’s published 3-month financial CP rate series over the same 5-year remaining maturities: those statistics (13-14 basis points) were very close to the RMSE and MAE from the ISDA methodologies with a 10-year lookback and trimmed mean ➜ There does not seem to be much loss in accuracy from using the more robust static spread adjustments to be used by ISDA.
Looking at Different Remaining Maturities

Comparing Errors Across Hypothetical FRNs with Different Remaining Maturities (Using Trimmed Mean)

<table>
<thead>
<tr>
<th>Spread Relative to:</th>
<th>lookback</th>
<th>2 Years Remaining Maturity</th>
<th></th>
<th>5 Years Remaining Maturity</th>
<th></th>
<th>10 Years Remaining Maturity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EFFR in Advance</td>
<td>5y</td>
<td>0.17</td>
<td>0.22</td>
<td>0.10</td>
<td>0.12</td>
<td>0.06</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>10y</td>
<td>0.16</td>
<td>0.21</td>
<td>0.09</td>
<td>0.11</td>
<td>0.06</td>
<td>0.07</td>
</tr>
<tr>
<td>EFFR in Arrears</td>
<td>5y</td>
<td>0.16</td>
<td>0.27</td>
<td>0.15</td>
<td>0.21</td>
<td>0.15</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>10y</td>
<td>0.14</td>
<td>0.25</td>
<td>0.14</td>
<td>0.19</td>
<td>0.12</td>
<td>0.13</td>
</tr>
<tr>
<td>EFFR Term Rate</td>
<td>5y</td>
<td>0.12</td>
<td>0.20</td>
<td>0.13</td>
<td>0.16</td>
<td>0.12</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>10y</td>
<td>0.13</td>
<td>0.21</td>
<td>0.14</td>
<td>0.16</td>
<td>0.11</td>
<td>0.11</td>
</tr>
</tbody>
</table>

These basic conclusions appear to hold across different remaining maturities for the hypothetical FRN. In general, a longer remaining maturity leads to a lower RMSE/MAE since any errors are averaged over a longer remaining period.
Looking at the Post-Crisis Period

### Historical Results for a Hypothetical FRN Paying 3-Month LIBOR Quarterly had LIBOR Stopped in the Post Crisis Period with 5-Years Remaining Maturity on the FRN

<table>
<thead>
<tr>
<th>Calculation Method</th>
<th>Lookback</th>
<th>MAE</th>
<th>RMSE</th>
<th>Calculation Method</th>
<th>Lookback</th>
<th>MAE</th>
<th>RMSE</th>
<th>Calculation Method</th>
<th>Lookback</th>
<th>MAE</th>
<th>RMSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trimmed mean</td>
<td>5y</td>
<td>0.04</td>
<td>0.06</td>
<td>Trimmed mean</td>
<td>5y</td>
<td>0.05</td>
<td>0.06</td>
<td>Trimmed mean</td>
<td>5y</td>
<td>0.05</td>
<td>0.06</td>
</tr>
<tr>
<td>Median</td>
<td>5y</td>
<td>0.07</td>
<td>0.09</td>
<td>Median</td>
<td>5y</td>
<td>0.05</td>
<td>0.08</td>
<td>Median</td>
<td>5y</td>
<td>0.07</td>
<td>0.08</td>
</tr>
<tr>
<td>Trimmed mean</td>
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<td>0.04</td>
<td>Trimmed mean</td>
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<td>0.01</td>
<td>0.01</td>
<td>Trimmed mean</td>
<td>10y</td>
<td>0.05</td>
<td>0.06</td>
</tr>
<tr>
<td>Median</td>
<td>10y</td>
<td>0.05</td>
<td>0.05</td>
<td>Median</td>
<td>10y</td>
<td>0.04</td>
<td>0.04</td>
<td>Median</td>
<td>10y</td>
<td>0.07</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Results would have been more accurate over the post-crisis period. If economic conditions remain relatively calm, the spread adjustments could be very accurate. Because these spread adjustments would be only applied when LIBOR stopped or was found to be non-representative (i.e, no longer accurate), it would be impossible to know after the fact if there was any error.
A Transition Period

<table>
<thead>
<tr>
<th>Spread Relative to:</th>
<th>With Transition Period</th>
<th>Without Transition Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lookback</td>
<td>mae</td>
</tr>
<tr>
<td>EFFR in Advance</td>
<td>5y</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>10y</td>
<td>0.17</td>
</tr>
<tr>
<td>EFFR in Arrears</td>
<td>5y</td>
<td>0.14</td>
</tr>
<tr>
<td></td>
<td>10y</td>
<td>0.13</td>
</tr>
<tr>
<td>EFFR Term Rate</td>
<td>5y</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td>10y</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Incorporating a transition period to the long-run mean/median appears to produce more accurate results in the short term. A transition period would also help to avoid any potential cliff-edge immediate jump in rates paid by borrowers, which could be important for a cash product. Over the period examined, without a transition period, we could have seen jumps of more than 40 basis points for a compound average in arrears at some times, and much more for a compound average in advance.
SOFR Compound Averages & Index
Potential Program Parameters for Discussion at September ARRC Meeting
Scott Sherman
AVP, FRBNY Markets Group

This information is provided for illustrative and educational purposes only. The views expressed in this presentation are solely those of the author and do not necessarily represent those of the Federal Reserve, the Alternative Reference Rates Committee or its members or ex officio members.
Background

- **July 2018 ARRC Roundtable**
  - The ARRC discussed the potential benefits that backward-looking compounded averages of the SOFR could provide to facilitate adoption of the SOFR, including use in consumer loan and floating rate note (FRN) issuance
  - This, in turn, could encourage greater use of the SOFR derivatives to hedge

- **January 2019 FOMC Minutes**
  - “[FRBNY] staff had begun work aimed at publishing a series of backward-looking average secured overnight financing rates (SOFR) as a further step to support reference rate reform.”
  - “The staff planned to solicit public feedback on this effort later this year and initiate publication of these averages by the first half of 2020.”

- **April 2019 ARRC User’s Guide to SOFR**
  - The ARRC’s white paper explains how market participants can use an average of SOFR in cash products and describes the differences between compound and simple averaging
  - This presentation is to solicit feedback on certain details of how such rates, and a related index, could be constructed
### Broad Features for Discussion

<table>
<thead>
<tr>
<th>Parameter</th>
<th><strong>Compounded SOFR Averages</strong></th>
<th><strong>Compounded SOFR Index</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Targeted Use Case</strong></td>
<td>Consumer Loan Issuance</td>
<td>FRNs, Loans, and Other Products</td>
</tr>
<tr>
<td><strong>Tenors</strong></td>
<td>30-day, 90-day, 180-day</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Calendar Window</strong></td>
<td>Actual # of days vs Calendar months</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Calculation</strong></td>
<td>Daily Compounded Geometric Average</td>
<td>Daily Index, starting at 1, showing the cumulative impact of compounding the SOFR to a unit of investment over time</td>
</tr>
<tr>
<td><strong>Weekend/Holiday Treatment</strong></td>
<td>Consistent with ISDA’s compounding and the way interest is accrued by rolling overnight repo transactions, the compounding of interest applies only to business days, as defined by the SOFR publication calendar; simple interest applies to any day that is not a business day, at a rate of interest equal to the SOFR value for the last available business day. In other words, when treating weekends and holidays, the averages and index would apply the SOFR value from just before the weekend or holiday, multiply it by the relevant number of consecutive calendar days associated with that weekend and/or holiday, and compound the rate/index once by the adjusted term.</td>
<td></td>
</tr>
<tr>
<td><strong>Rounding</strong></td>
<td>To the 5th decimal place</td>
<td>TBD – Likely the 8th decimal place</td>
</tr>
<tr>
<td><strong>Publication Time</strong></td>
<td>8am ET, shortly after daily SOFR publication to include most recent print</td>
<td></td>
</tr>
<tr>
<td><strong>Publication Location</strong></td>
<td>Separate FRBNY web page dedicated to term averages and SOFR Index</td>
<td></td>
</tr>
<tr>
<td><strong>Publication Calendar</strong></td>
<td>Same as SOFR calendar, which follows SIFMA calendar</td>
<td></td>
</tr>
<tr>
<td><strong>Revision Policy</strong></td>
<td>Rates only revised upon a revision to SOFR at 2:30pm ET each publication day</td>
<td></td>
</tr>
<tr>
<td><strong>Additional Statistics</strong></td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td><strong>Lagged Quarterly Data Releases</strong></td>
<td>Not necessary; rates are based on official SOFR rates that are finalized the same day as initial publication</td>
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</tbody>
</table>
Consistent with ISDA’s compounding methodology and the way interest would be accrued by rolling overnight repo transactions in practice:

- The compounding of interest applies only to business days, as defined by the SOFR publication calendar.
- Simple interest applies to any day that is not a business day, at a rate of interest equal to the SOFR value for the last available business day.
- Interest would be calculated using the actual number of calendar days, but assuming a 360 day year.
SOFR Index

- The index would represent a compounding sequence allowing market participants to calculate compounded SOFR averages over custom time periods.

- Effectively, it would measure the cumulative impact of compounding the SOFR to a unit of investment over time, indexed to a value of “1” on April 2, 2018--the first day the SOFR was published.

- For example, a 30-day average rate calculated using the index should be similar/equivalent to the published 30-day backward average SOFR covering the same period because it employs the same compounding approach.

<table>
<thead>
<tr>
<th>SOFR Publication /Index Date</th>
<th>SOFR As-of Date</th>
<th>SOFR Calendar Days Applicable</th>
<th>Compounding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mon 4/2/2018</td>
<td>Fri 3/30/2018</td>
<td>N/A</td>
<td>1</td>
</tr>
<tr>
<td>Tue 4/3/2018</td>
<td>Mon 4/2/2018</td>
<td>a</td>
<td>(1 + a*1/360)</td>
</tr>
</tbody>
</table>
Custom term rates can be derived from the Index using the following equation:

\[
\left( \frac{SOFR_{Index_{end}}}{SOFR_{Index_{start}}} - 1 \right) \times \left( \frac{360}{calendar\ days} \right)
\]

For the term starting 12/19 and ending 12/26, the implied compounded average rate is:

\[
\left( \frac{1.00066683}{1.00011111} - 1 \right) \times \left( \frac{360}{7} \right) = 2.85767\%
\]
Operations/Infrastructure Working Group

Mission Statement and Plan
ARRC Operations/Infrastructure Working Group

Draft Mission Statement

The ARRC’s Operations/Infrastructure Working Group was formed in June to identify key infrastructure and operational changes that need to be enacted in order to allow for a smooth, market-wide transition from U.S. dollar LIBOR or to allow for the adoption and use of SOFR where desired across derivatives, cash products, and systems. Its mission is excerpted below:

- Identify key infrastructure / operational changes needed to allow a smooth, market-wide transition from US dollar LIBOR or to allow for the adoption and use of SOFR across derivatives, cash products, and systems
- Identify internal systems changes, external systems changes, or changes to market conventions that are necessary or that would help to achieve this goal
- Prepare recommendations including proposals for industry timelines, checklists, market conventions, or actions that could be taken to address specific implementation issues and will be targeted to promote broad-based transitions that minimize market disruption
- Coordinate as appropriate with other ARRC Working Groups.
The Working Group has four subgroups, each of which is likely to break into more detailed sub-groups to deal with specific issues:

- **Operations / Infrastructure Working Group**
  - Co-Chairs: Roy Choudhury (EY), Adam Schneider (Oliver Wyman), Alexey Surkov (Deloitte)

- **Subgroup: External Systems & Platforms**
  - Subgroup co-Chairs: Roy Choudhury (EY), Roger Nowakowski (FHLBOF)

- **Subgroup: Internal Systems & Processes**
  - Subgroup co-Chairs: Alexey Surkov (Deloitte), Mark Heckert (ICE)

- **Subgroup: Date “T” Readiness**
  - Subgroup co-Chairs: Adam Schneider (Oliver Wyman), Cynthia Meyn (Venerable)

- **Subgroup: Coordination**
  - Subgroup co-Chairs: David Bowman (Fed), Calvin Zunn (RBC)
The Operations/Infrastructure Working Group will focus on implementation and have a significant footprint.

**Firms Involved:** almost all industry participants will interact with this Working Group, including financial firms, external vendors, and utilities.

**Transition Planning:** ARRC has published its implementation “checklist” and there is an interest in providing more details. This could include:

- Whether to extend to other segments (insurers, asset managers…) or ensure these are created
- Whether to build a comprehensive implementation plan for firms (“stages of success” / “best practice”)
- Whether to publish an overall timeframe and guidelines for readiness

**De-risking new operational requirements:** identifying mechanisms that can simplify the newer operational work required, for example for fallbacks and for new non-LIBOR products

**Testing:** whether there is a need for a testing regime across the industry (and later on, requirements for operationalizing this testing)

**Monitoring:** There may be a need to monitor progress as we approach date “T”. Potential areas include:

- Level of LIBOR exposures / perhaps by maturity
- Non-LIBOR product availability and liquidity
- Firm transition readiness

**Other:** understand needs of industry utilities, software vendors, standards for client notification so as to identify impediments and issues
Deep Dive: External Systems/Platforms Subgroup

Identify other institutions that should be part of the subgroup.

Use the existing ARRC vendor list and industry knowledge to identify key vendors by type (software, data, loan, etc.) and systemic importance. Define tier 1, tier 2, tier 3 levels of importance, spelling out what characterizes various tiers.

Create systems for ongoing communication with the vendor community (one suggestion is to develop a set of questions to send out as a short survey), directly looping in tier 1 vendors immediately.

Develop minimum requirements for transition readiness for key external systems to ensure a consistent standard and set of business requirements for critical systems. Apply first to Tier 1 and then to others.

Create roadmap outlining the timing of when key services/infrastructures need to be or are anticipated to be provided and monitor progress against the roadmap (does vendor have test systems in place, do they have systems in production, etc.) leveraging / coordinating with Internal Systems and Date T subgroups.
Deep Dive: Internal Systems/Processes Subgroup

Identify other institutions that should be part of the subgroup

Finalize draft ARRC checklist and have distributed

Confirm type of institutions to be addressed and how widely to cover industry participants and types of firms

Develop a high-level process taxonomy highlighting the key processes impacted by IBOR transition – this is expected to provide guidance to firms to conduct a more comprehensive impact assessment across process, systems and controls

Create specific internal firm checklists and transition tools / playbooks starting with the ARRC’s example of a large financial firm

Distribute requirements for transition readiness for internal systems and processes (leveraging / coordinating with External Systems and Date T subgroups)

Maintain on-going coordination of requirements and changes with other subgroups to ensure that changes made by vendors / platforms are appropriately reflected in corresponding adjustments to internal systems / processes
Deep Dive: Date T Readiness Subgroup

Identify other institutions that should be part of the subgroup

Categorize what must be done to plan for an be ready for LIBOR end (or non-representative) date. Work to set requirements for readiness.

- Set out minimum and optimum readiness requirements and readiness playbook
- Evaluate whether to build a complete implementation plan with Internal Systems / Processes subgroup
- Evaluate whether to extend to other segments (insurers, asset managers…)

Evaluate need for monitoring industry progress. Potential areas include:

- Value of LIBOR exposures
- Availability / liquidity of non-LIBOR products
- Confirmation of transition readiness / self-certification

Evaluate and if appropriate build a testing regime including fallbacks and new products as necessary

Evaluate other mechanisms to de-risk implementation. Potential examples:

- Fallback trigger notification protocols
- Test data and expected results for fallbacks and new product implementation
- Build out / publish / centralize product specifications for the industry (a la Barclay’s/vendors/"how to use")
- Build out / publish test data and expected results for each instrument
- Standards for client notifications

Work closely with Coordination subgroup on issues relating to scheduling such as product standards and industry constraints.
Deep Dive: Coordination Subgroup

Identify other institutions that should be part of the subgroup

Coordinate with other ARRC working groups on new product specifications (example Business Loans Working Group spec sheet), vendor outreach, and solutions needed for fallbacks/legacy contracts to be workable.

Identify and coordinate with other industry groups in order to provide coverage of the wide set of industries/firm types that have LIBOR exposures (for example, AFP is beginning to work on a checklist for nonfinancial corporates), and work both with those groups and the other Operations-Infrastructure subgroups to develop industry/firm-type specific products similar to those developed by subgroups 1-3.

This could involve linking industry groups in to subgroup work, linking subgroup members in to industry work, or both.