

AMERIBOR® Term-90 White Paper

This paper draws heavily from the AMERIBOR® Term-30 White Paper published on March 30th, 2021.

April 8th, 2021

(Version 90.18.0)

INTRODUCTION

The American Financial Exchange is proud to introduce the AMERIBOR® Term-90 index for immediate use by financial institutions in need of forward-looking short term interest rates as the planned LIBOR-cessation approaches. AMERIBOR® Term-90 is designed to capture wholesale funding costs for American financial institutions over a ninety-day period at a specific moment in time. The AMERIBOR® Term-90 rates shall be calculated following market close and published and delivered to data distributors at 6:30 P.M. CST that same day. AMERIBOR Term-90 is designed to be a “plug-in and play” replacement for Three-Month Libor. It will look, act, and feel similar to Three-Month Libor, fostering an easy transition for operations and accounting departments, and making it easy to explain to lenders and customers.

AMERIBOR® Term-90 is the result of 5 years of research, testing, analysis, and consensus-building to offer an alternative to Three-Month LIBOR. The AMERIBOR® Term-90 methodology is patent-pending and is derived from lessons learned from our successfully patented and thriving overnight market. This index is calculated using a broad data set of real-world primary issuances of wholesale commercial deposits and commercial paper of U.S.-domiciled financial institutions of every size.

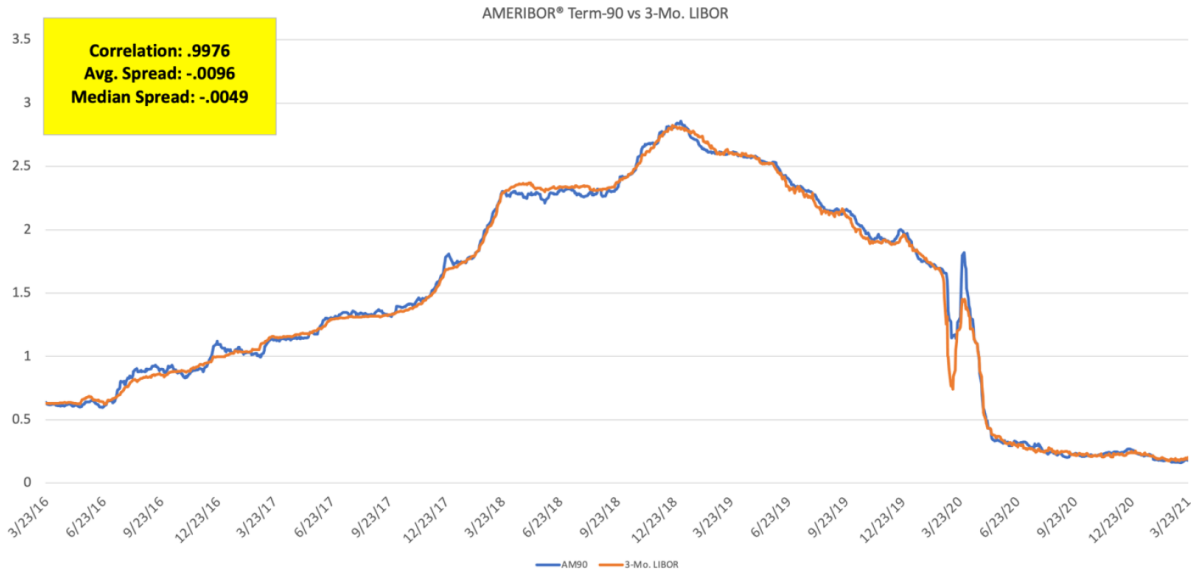
AMERIBOR® Term-90® is representative of ninety-day funding costs for all banks and financial institutions both large and small across America.

AMERIBOR® Term-90 is designed to be not readily susceptible to manipulation, drawing from a vast and diverse pool of wholesale funding data with a minimum volume of \$10 billion, and utilizing a unique weighting methodology without having to rely on any form of regression or predictive analysis in order to generate a rate indicative of 90-day wholesale funding costs at a specific moment in time. 90 days is the *numeraire*, or base value, for AMERIBOR® Term-90 calculations; all eligible transactions are weighted by basis point value and notional amount.

A key component to our approach was the member-driven process to build consensus and apply the real-world feedback of members of the American Financial Exchange to the development of AMERIBOR® Term-90. As part of our exchange rules, we formed a Benchmark Committee which was responsible for providing the Exchange with input on the design and development of the benchmark. This committee is comprised of a dozen AFX members with direct responsibility for areas such as Treasury and Risk Management. These members met for over six months and analyzed, discussed and opined on over thirty-six different models throughout the development of AMERIBOR® Term-90.

AFX believes we offer a more transparent and representative short-term LIBOR-alternative for most market-participants and AMERIBOR® Term-90 is designed as a successor for Three-Month LIBOR to be utilized in both new and existing contracts. AMERIBOR® Term-90 is derived using a robust data set with a minimum volume threshold of \$10 billion. The underlying transaction data in this set is designed to not be readily susceptible to manipulation or fabrication, which has historically been a problem with indices calculated using data only from a select panel of banks. Instead, we believe our broad approach offers a simpler and more elegant solution, representative of wholesale funding costs for American financial institutions and showing a strong historical correlation (.9976 from March 23rd 2016-March 23rd 2021) with Three-Month LIBOR. AMERIBOR® Term-90 was highly correlated to Three-Month LIBOR for the 5-year period between March 23rd, 2016 and March 23rd, 2021 and is a meaningful representation of the wholesale funding cost at the time. Similar methodology has been developed for 180 and 365-day term rates as well. When published, this suite of rates will enable AFX members and financial markets to have access to a fully developed AMERIBOR® one-year term structure of interest rates.

As financial innovators at the American Financial Exchange (AFX), we have been designing overnight and term lending markets since 2011 and publish the AMERIBOR® overnight rate as an alternative to the comparable one-day LIBOR tenor since December 2015. This market has grown significantly, averaging over a billion dollars a day as the AMERIBOR® overnight rate sees increased adoption in commercial loans, deposits, and debt issuance throughout the United States. We believe the success of our market is derived from our core principles of transparency, equity, and inclusion. These core principles, plus price design innovation principles invented by our team and adopted by other commodity and financial markets worldwide, further guided our inventive activity.



OVERVIEW

The AMERIBOR® Term-90 index is calculated using only real-world transactions data, utilizing primary market wholesale, unsecured USD-denominated commercial paper and commercial deposit issuances from US-based financial institutions. Commercial paper and commercial deposit issuances are collected into a database by the Depository Trust & Clearing Corporation (DTCC), a registered clearing agent regulated by the U.S. Securities and Exchange Commission. Commercial paper and commercial deposit issuances are trimmed for eligibility on a variety of parameters.

This vast dataset averages billions of dollars in volume and over hundreds of transactions a day, with its proprietary methodology designed to ensure both that AMERIBOR® term-rates are robust and not readily susceptible to manipulation due to their high volume threshold and that they capture the true wholesale funding costs for over specific time periods for American financial institutions. The transactions data includes all eligible transactions reported over the past five AFX business days; if a minimum volume threshold of \$10 billion is not met an additional AFX business day/day is then included as a fallback. An AFX business day refers to any day in which the AFX's unsecured interbank lending markets are open. From here, each relevant transaction's interest rate is weighted by volume and basis point value. The combined sum of these weighted interest rates is the AMERIBOR® Term-90 rate.

Historically, LIBOR term rates have been the most commonly used benchmarks by market participants in need of forward-looking interest rates. Market participants of all sizes are in need of an alternative as the LIBOR transition looms closer. In historical back-testing as far back as the DTCC's database allows, AMERIBOR® Term-90 has maintained a strong correlation with Three-Month LIBOR (.9976). AMERIBOR® Term-90 has historically had a slight premium to Three-Month LIBOR, roughly 1 basis point on average, ensuring a minimal and smooth adjustment to any products currently marked to Three-Month LIBOR.

PROPRIETARY AND PATENTED METHODOLOGY

AMERIBOR's® patented methodology informed the design of a complementary term structure of interest rates. AMERIBOR® Term-90 is calculated using only wholesale funding transactions occurring within the past five American Financial Exchange business days.

Commercial paper and commercial lending transactions aggregated by the DTCC are trimmed according to a variety of criteria. A commercial paper or commercial deposit transaction is deemed eligible for inclusion if it is at least \$1 million in principal, issued and settled on the same day, between 41-120 days in duration, delivered at a fixed interest rate within 250 basis points of the previous day's AMERIBOR® Term-90 rate, and the issuer is an American financial company.

At this point, for AMERIBOR® Term-90 if a total included transaction volume of \$10 billion is not met, an additional trailing American Financial Exchange business day's worth of transactions data from both the DTCC's aggregated database and AMERIBOR® unsecured overnight and 90-day lending markets is included. If the addition of a single American Financial Exchange business day does not result in sufficient volumes, this process is repeated until transaction thresholds are met. In the event that the database of commercial paper and commercial deposit transactions aggregated by the DTCC is unavailable at the

normal time of publication for AMERIBOR® Term-90, the previous day's AMERIBOR® Term-90 rate is published with an accompanying notice distributed to data vendors.

Once the data set is trimmed to include only eligible transactions, a dollar basis point value is calculated for each transaction according to the following formula:

$$\rho = \text{Dollar Basis Point Value}$$

$$\alpha = \text{Principal Amount}$$

$$\beta = \text{Days to Maturity}$$

$$\rho_n = \alpha_n * \beta_n$$

Each transaction's interest rate is weighted according to percentage of total dollar basis point value amongst all eligible transactions that each transaction makes up using the following formulas:

$$\gamma = \text{Total Dollar Basis Point Value}$$

$$\gamma = \sum_{i=0}^n \rho$$

$$\delta = \text{Weighted Interest Rate}$$

$$\varepsilon = \text{Transaction's Interest Rate}$$

$$\delta_n = \varepsilon_n * \left(\frac{\rho_n}{\gamma}\right)$$

These weighted interest rates are then summed, and the resulting total is the AMERIBOR® Term-90 rate on a given day, represented by this formula:

$$\theta = \text{AMERIBOR Term - 90}$$

$$\theta = \sum_{i=0}^n \delta$$

This number will be published at 6:30 P.M. CST immediately following the index's calculation.² The concept of basis point value indicates that the longer a loan is in effect, the longer interest accrues and thus a single basis point of change in interest rate will have a higher dollar value change (e.g., a \$1mm 120-day loan has a basis point value of 2x that of a \$1mm 60-day loan). Although the basis or numeraire is 90 days, it allows for a delivery window of 41 up to 120 days. This concept has precedence in other established interest rate futures markets and is informed by the idea of "yield maintenance" and "cheapest to deliver" (i.e., in the 90-year Treasury futures contract, there is a set window in which they can deliver a shorter duration with a comparable yield). Although the AMERIBOR Term-90 methodology is unique, this design ² If the DTCC data is not received by 6:30 p.m., the AMERIBOR Term-90 value that would be disseminated is the AMERIBOR Term-90 value from the previous AFX business day.

feature has been successfully utilized for over 40 years and has eliminated all concerns about manipulation. Using this approach allows us to maximize and properly weight the number of eligible transactions entering our data pool, with durations from 41 to 120 days being considered in our calculation of a representative ninety-day term rate. This approach has been successfully used to limit potential manipulation in treasury futures and provides market participants of all sizes with an elegant, fair, and transparent solution to the problem of LIBOR-cessation that accurately reflects short-term funding costs at a specific moment in time. In the event that the database of commercial paper and commercial deposit transactions aggregated by the DTCC is unavailable at the normal time of publication for AMERIBOR® Term-90, the previous day's AMERIBOR® Term-90 rate is published with an accompanying notice distributed to data vendors.

An example calculation can be found at the end of this white paper in Appendix A.

CONCLUSION

The AFX is incredibly pleased and thrilled to introduce the AMERIBOR® Term-90 index to the world. Rooted in our core values of transparency, academic rigor, and fairness, we feel as if we have derived a creative and more democratic ninety-day index for financial market participants of all sizes, small and large.³ In the near future, the AFX will be expanding our forward-looking curve at additional AMERIBOR tenors. Cboe Futures Exchange® plans to launch futures on the AMERIBOR Term-90®, subject to regulatory review.

³ We would like to thank all those outside the AFX family involved in the intensive months-long research and development process, including but not limited to Antje Berndt, V.V. Chari, Carl DeFranco, Viktor Todorov, Pietro Veronesi, Tim Watson, and all the members of the AMERIBOR® Panel-Associated Bank-Brian Klaus, Brookline Bank-Reed Whitman, City National Bank-John Coscia, Frost National Bank-Bill Perotti, Jeff Beckel, and Mark Brell, Flagstar Bank-Patrick Brennan, Hancock Whitney Bank-Alan Ganucheau, HomeStreet Bank-Darrell van Amen, Pacific Western Bank-Scott Wallace, Regions Bank-Tyler Zinder, ServisFirst Bank-Tom Broughton and Rodney Rushing, Signature Bank (NY)-Peter Quinlan, Zions Bank-Matthew Tyler. Ad hoc Citi Bank-Karl Abdelnour, ED&F Man-David Hoffman. A special thanks to Bank of America-Sonali Theisen and Wells Fargo-Jen Imler.

Appendix A

EXAMPLE AMERIBOR® TERM-90 CALCULATION

AMERIBOR® Term-90 is a benchmark interest rate weighted by volume and tenor. Eligible transactions are commercial paper and commercial deposit issuances over the past 5 AFX business days deemed eligible according to certain criteria.

Principal	Days to Expiration	Interest Rate
10,000,000	45	0.23
40,000,000	100	0.3
14,000,000	116	0.22
19,000,000	59	0.26
22,000,000	69	0.19
8,000,000	97	0.16
33,000,000	100	0.24
4,600,000	84	0.22

Take this hypothetical example with only 8 transactions.

Principal	Days to Expiration	Interest Rate	Principal*Days
10,000,000	45	0.23	450,000,000
40,000,000	100	0.3	4,000,000,000
14,000,000	116	0.22	1,624,000,000
19,000,000	59	0.26	1,121,000,000
22,000,000	69	0.19	1,518,000,000
8,000,000	97	0.16	776,000,000
33,000,000	100	0.24	3,300,000,000
4,600,000	84	0.22	386,400,000
			13,175,400,000

For each transaction, multiply the principal amount times the days to expiration. For example, in transaction #1, multiply days to expiration (45) times the principal amount (\$10,000,000). The result of this is \$450,000,000, listed in the fourth column. Do this for each eligible transaction. The sum of these numbers is listed at the bottom of the fourth column.

Principal	Days to Expiration	Interest Rate	Principal*Days	% of Principal*Days
10,000,000	45	0.23	450,000,000	3.4%
40,000,000	100	0.3	4,000,000,000	30.4%
14,000,000	116	0.22	1,624,000,000	12.3%
19,000,000	59	0.26	1,121,000,000	8.5%
22,000,000	69	0.19	1,518,000,000	11.5%
8,000,000	97	0.16	776,000,000	5.9%
33,000,000	100	0.24	3,300,000,000	25.0%
4,600,000	84	0.22	386,400,000	2.9%
			13,175,400,000	

Divide each transactions principal*days which you have just calculated by the aggregate sum of principal*days from your sample in order to generate the percentage of overall principal*days. For transaction #1, divide the principal*days (450,000,000) by the total principal*days for the sample (13,175,400,000), resulting in 3.4%, visible in the fifth column. This percentage is the weight you will give each transaction's interest rate in the final AMERIBOR® Term-90 interest rate.

Principal	Days to Expiration	Interest Rate	Principal*Days	% of Principal*Days	Weighted IR (Interest Rate * % of Principal*Days)
10,000,000	45	0.23	450,000,000	3.4%	0.0079
40,000,000	100	0.3	4,000,000,000	30.4%	0.0911
14,000,000	116	0.22	1,624,000,000	12.3%	0.0271
19,000,000	59	0.26	1,121,000,000	8.5%	0.0221
22,000,000	69	0.19	1,518,000,000	11.5%	0.0219
8,000,000	97	0.16	776,000,000	5.9%	0.0094
33,000,000	100	0.24	3,300,000,000	25.0%	0.0601
4,600,000	84	0.22	386,400,000	2.9%	0.0065
			13,175,400,000		0.2461

Multiply each transaction's interest rate by the percentage of principal*days in order to generate a principal*days-weighted interest rate for each transaction. For transaction #1, multiply the interest rate (.23) times the % of principal*days (3.4%) to get .0079, visible in the sixth column. The sum of these numbers will be the AMERIBOR® Term-90 rate, highlighted in yellow at the bottom of the sixth column.

While on any given day the AMERIBOR® Term-90 rate is made up of hundreds of transactions reaching a cumulative minimum volume threshold of \$10 billion, the calculations and methodology are the same as in this simple eight transaction exercise.