US Rates Watch

Bill & SOFR impact from UST debt shift

03 November 2023

Rates Research
United States

Mark Cabana, CFA
Rates Strategist
BofAS
mark.cabana@bofa.com

Katie Craig
Rates Strategist
BofAS
katie.craig@bofa.com

US Rates Research
BofAS
+1 646 855 8846

See Team Page for List of Analysts

UST bill shift: slightly lower ON RRP, slightly higher SOFR

Treasury's shift in issuance strategy does not meaningfully impact our Q4 '23 bill supply estimates since their lower financing need and smaller coupon issuance roughly offset each other. Treasury's shift will only marginally speed up the pace of ON RRP depletion due to Fed QT pace and recent bank depositor behavior. SOFR/FF impact should also be modest but risks skew to a sooner and faster increase in SOFR than our forecasts imply.

Bill supply: lower financing need offsets lower coupons

Treasury surprised us this week in 2 ways: (1) lower than expected long-end supply (2) lower financing needs (see: November refunding). The smaller coupons and financing need largely offset each other and leave our bill supply projections little changed; on net, our Q4 bill projections only increased $4bn to $448b (Exhibit 1 and supplemental charts). We also revised our CY '24 bill supply forecast lower due to a change in our TGA assumption; we had previously grown TGA with nominal GDP expectations but now pencil it flat at $750b to match UST guidance thru Q1 '24. We acknowledge we will eventually need to refine our TGA forecasts based on debt limit implications that come back into play in early '25.

Pace of ON RRP depletion: only marginally faster

Clients have also asked if Treasury's shift in issuance strategy impacts our outlook for QT drain from ON RRP and reserves. Our answer: only marginally. We have long expected the Fed's liquidity drain to be distributed approximately 90/10 from ON RRP / reserves. To date, this liquidity drain has been distributed 92/0/8 from ON RRP / reserves / other (Exhibit 2). Going forward, we now expect this liquidity drain to be closer to 100/0 for ON RRP / reserves or 90/0/10 for ON RRP / reserves / other. We elaborate on our expectations for the pace of ON RRP depletion using T-tables on page 2.

SOFR/FF impact: modest but risks skew to higher SOFR

Clients have also asked what Treasury's shift in issuance strategy means for the SOFR/FF basis. Our answer is similar to the liquidity drain composition question: only marginally. Higher bill supply should mean more cheapening pressure on bills vs other UST coupons but we think the impact on SOFR/FF basis will largely be a function of how much faster ON RRP declines. Overall, the implications for SOFR/FF are marginal but skew in the direction of a higher SOFR rate sooner than we expected. We still expect SOFR to meaningfully rise within the Fed target range around mid '24 or 2H '24. The shift in Treasury's issuance strategy means this could occur slightly sooner and faster than our projections suggest. We elaborate on the SOFR/FF impact on page 2.

UST = Treasury

QT = quantitative tightening

TBAC = Treasury Borrowing Advisory Committee

FY = fiscal year

CY = calendar year

WAM = weighted average maturity

RRP = reverse repo facility

TGA = Treasury General Account

ON RRP explainer: why still slow with more bills

Higher bill supply does not mean a materially sharper pace of ON RRP reduction or meaningfully higher reserves due to (1) pace of Fed QT (2) bank depositor behavior.

Pace of Fed QT: basic Fed balance sheet accounting implies the pace of liability reduction will be governed by the extent to which assets also decline. The Fed's asset reduction is pre-set with the only material variation driven by speed of their MBS pre-payments or shifts in emergency bank lending programs. If Fed asset reduction pace remains $75-95b/m, then total liabilities must fall by a similar amount. The distribution of liability reduction may change but we expect nearly all the liquidity drain to continue drawing from ON RRP until it is at or near zero.

Bank depositor behavior: recent bank depositor behavior should limit the ability to which the ON RRP decline accelerates. Bank depositors have proven sensitive to higher rates & shifted out of low yielding deposits & into higher yielding alternatives (including MMF). We expect this behavior to hold even as Treasury bill issuance rises.

To better understand this dynamic, consider the following example. Treasury issues $100 of new bills instead of 30Y bonds. A MMF with cash at ON RRP shifts $100 of their investment away from the Fed & into the bill. The Treasury then takes the $100 bill proceed and pays a depositor. The depositor receives the $100 Treasury payment in their bank account but prefers higher yielding alternatives. The depositor moves the recently received $100 into a MMF. The MMF takes the $100 and invests back into ON RRP. At the end of this Treasury debt outstanding rose $100, the depositor is $100 wealthier, MMF AUM increased by $100 (MMF assets increased with $100 more bills), and bank deposits & reserves are unchanged. Exhibit 3 shows this in clearer detail.

Not every bank depositor is similarly rate sensitive to the example above. It is possible that more bill issuance drains ON RRP & Treasury payments to depositors end up as reserves. We just think this impact will be marginal, in-line with the shift in our Fed QT liquidity drain composition from 90/10 to 100/0 for ON RRP / reserves. We are open to the notion that the QT liquidity drain might realize closer to 105/-5 or 110/-10 ON RRP / reserves but would be surprised to see a materially faster pace of ON RRP reduction or sharp increase in reserve balances.

SOFR/FF framework: liquidity similar, SOFR slightly higher

If we are right and ON RRP declines only marginally faster, the impact on SOFR should be small. Our preferred framework for estimating SOFR/FF looks at the historical settings of SOFR & FF to IORB as a function of "liquidity / GDP" (we define "liquidity" as ON RRP + reserves) (Exhibit 4). We assume that lower ON RRP would mean higher reserves & vice versa. Therefore, a faster ON RRP drain & offsetting reserve impact would result in a limited change to SOFR / FF.

We acknowledge there may be some shift in MMF preference to own bills vs repo with higher front-end supply. This would mean slightly more upward pressure on SOFR vs the prior Treasury issuance practice. We do not account for this in our standard SOFR / FF framework but it would shift the distribution of risks to cheaper SOFR vs FF.

Bottom line: Treasury's shift in issuance strategy does not meaningfully impact our Q4 '23 bill supply estimates since their lower financing need & smaller coupon issuance roughly offset each other. Our bill forecasts for FY or CY '24 are similarly offset, though a change in our TGA assumption at end '24 means slightly less bill supply over the year. Treasury's shift will only marginally speed the pace of ON RRP depletion due to Fed QT pace & recent bank depositor behavior. SOFR/FF impact should also be modest but risks skew to a sooner & faster increase in SOFR than our forecasts imply.

Exhibit 1: Bill and coupon issuance estimates by month ($bn)

Marketable borrowing needs will need to grow to meet higher deficits

	Financing Need 1	TGA EOP	TGA Change 2	Marketable Borrowing 3 = 1 +2	Buybacks 4	Net Coupon 5	Net Bills 6	Fed Coupon maturities 7	Fed Bill maturities 8	Net Coupons to the Public 9 = 5 + 7	Net Bills to the Public 10 = 6 + 8
Oct-23	54	832	175	229	0	33	196	52	8	85	204
Nov-23	380	750	-82	298	0	49	249	60	0	109	249
Dec-23	108	750	0	108	0	127	-19	46	14	173	-5
Jan-24	-96	750	0	-96	0	7	-103	53	7	60	-96
Feb-24	366	750	0	366	0	81	285	60	0	141	285
Mar-24	367	750	0	367	0	157	210	45	15	201	226
Apr-24	-272	750	0	-272	0	66	-338	60	0	126	-338
May-24	283	750	0	283	10	103	180	60	0	163	180
Jun-24	67	750	0	67	10	166	-99	36	24	202	-75
Jul-24	267	750	0	267	10	98	169	0	0	98	169
Aug-24	267	750	0	267	10	141	126	0	0	141	126
Sep-24	-68	750	0	-68	10	196	-264	0	0	196	-264
Oct-24	257	750	0	257	10	100	157	0	0	100	157
Nov-24	330	750	0	330	10	143	187	0	0	143	187
Dec-24	42	750	0	42	10	202	-160	0	0	202	-160

Source: BofA Global Research, US Treasury, Federal Reserve. Gray indicates projections.

BofA GLOBAL RESEARCH

Exhibit 2: Fed balance sheet evolution since QT start ($bn)

Fed assets have declined $1tn+ but reserves balances are unchanged

		Assets			Liabilities					
	Total	USTs	Agy MBS	Other	Reserves	UST Cash Balance	ON RRP	Foreign RRP	Currency	Other
5/25/2022	8964	5769	2707	487	3315	802	1996	262	2276	313
11/1/2023	7917	4873	2463	582	3315	753	1079	317	2325	128
Post QT Δ	-1046	-897	-245	95	0	-49	-916	55	49	-185

Source: Bloomberg

BofA GLOBAL RESEARCH

Exhibit 3: Balance sheet example scenario

At the end of this Treasury debt outstanding rose $100, the depositor is $100 wealthier, MMF AUM increased by $100

Stage 1

Money Market Fund			
Assets		Liabilities	
ON RRP	-$100		
T-bill	+$100		
Total Change, Stage 1			$0

Bank Depositor			
Assets		Liabilities	
Deposit	+$100	Net Wealth	+$100
Total Change, Stage 1			+$100

Commercial Bank			
Assets		Liabilities	
Reserves at Fed	+$100	Deposits	+$100
Total Change, Stage 1			+$100

Stage 2

Money Market Fund			
Assets		Liabilities	
ON RRP	+$100	Depositor Inflow	$100
Total Change, Stage 2			+$100

Bank Depositor			
Assets		Liabilities	
Deposit	-$100		
MMF Holding	+$100		
Total Change, Stage 2			$0

Commercial Bank			
Assets		Liabilities	
Reserves at Fed	-$100	Deposits	-$100
Total Change, Stage 2			-$100

Net change

Money Market Fund			
Assets		Liabilities	
ON RRP	$0	Depositor Inflow	$100
T-bill	+$100		
Total Change, Stage 1+2			$100

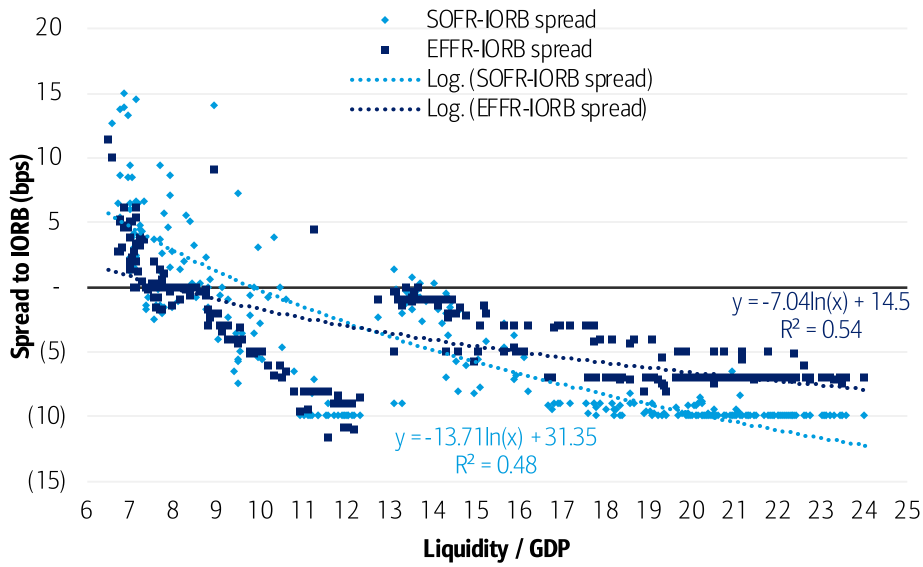
Bank Depositor			
Assets		Liabilities	
MMF Holding	+$100	Net Wealth	+$100
Total Change, Stage 1+2			$100

Commercial Bank			
Assets		Liabilities	
Reserves at Fed	$0	Deposits	$0
Total Change, Stage 1+2			$0

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 4: SOFR and EFFR spread to IORB vs liquidity to GDP
If we are right and ON RRP declines only marginally faster, the impact on SOFR should be small

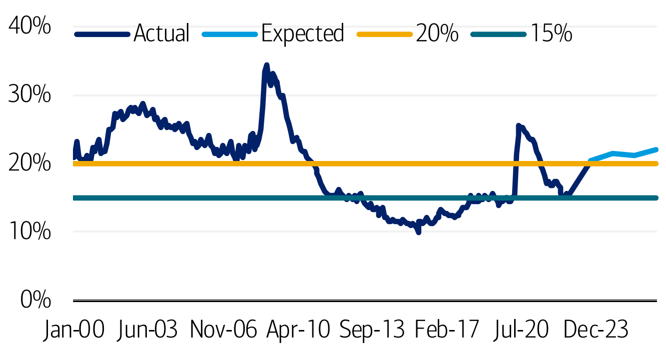


Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Supplemental charts

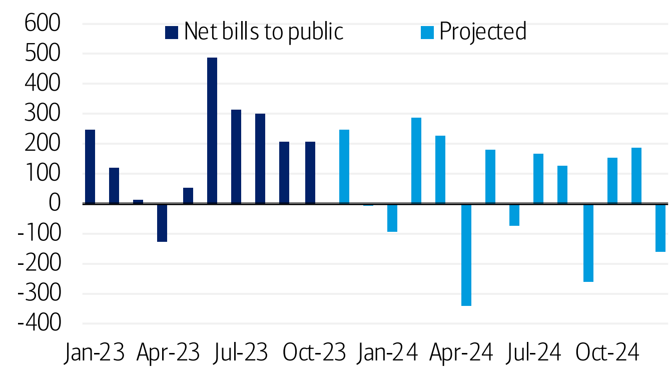
Exhibit 5: Bills as a % of marketable debt
Given our expectations for deficit and QT ending in Jun '24, bills as a share of marketable debt should increase through FY '26



Source: BofA Global Research, US Treasury

BofA GLOBAL RESEARCH

Exhibit 6: Monthly net bill issuance and projections ($bn)
We forecast $448b in bill issuance in Q4 '23, $415bn in Q1 '24



Source: BofA Global Research, US Treasury

BofA GLOBAL RESEARCH

Exhibit 7: BofA bill forecast vs TBAC recommended ($bn)
Our T-bill forecast is roughly in line with TBAC's recommendation

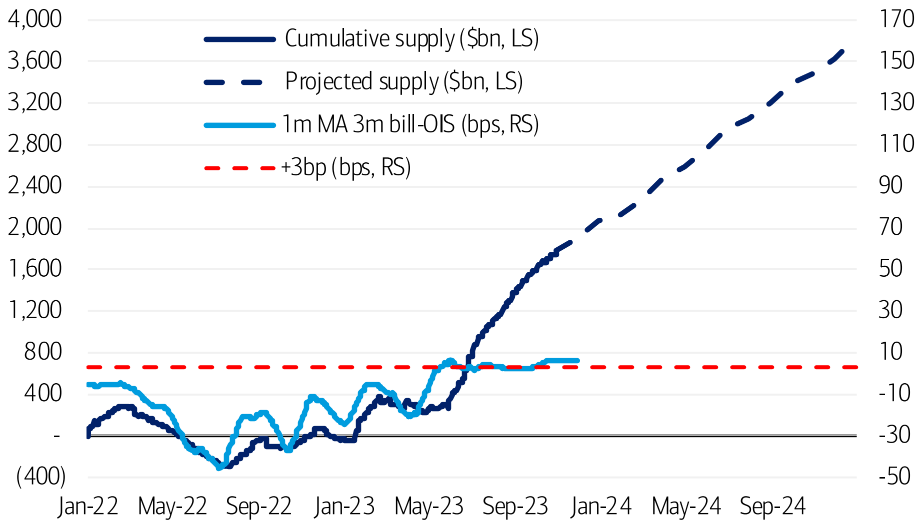
	Q4'23	Q1'24	Total
BofA Bill forecast	448	415	863
TBAC recommended bill issuance	437	468	905
Difference	11	-53	-42

Source: BofA Global Research, US Treasury

BofA GLOBAL RESEARCH

Exhibit 8: Projected bill supply vs 1mo moving avg of 3m bill-OIS

Investors have been buying up 3m bills at just 3bps cheap to OIS

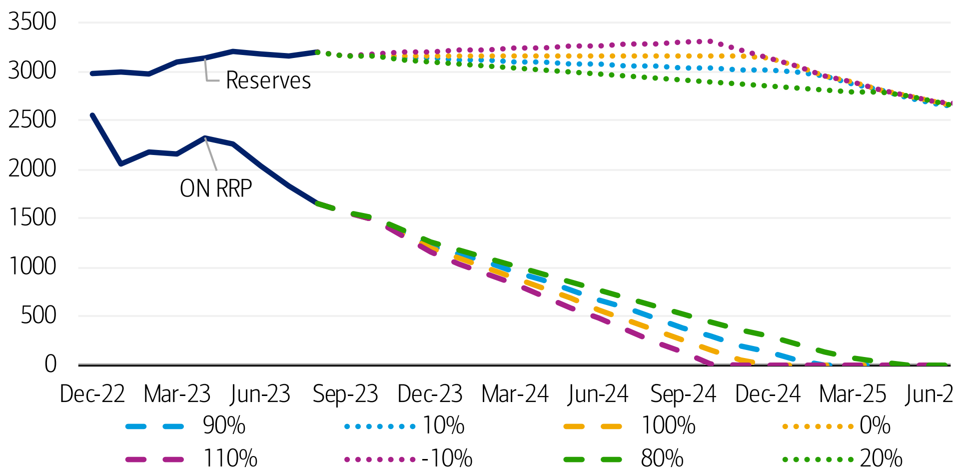


Source: BofA Global Research, Treasury

BofA GLOBAL RESEARCH

Exhibit 9: Projected Fed ON RRP and reserve balances ($bn)

We forecast ON RRP to fall to $0 sometime between Q4'24 to Q2 '25



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Disclosures

Important Disclosures

BofA Global Research personnel (including the analyst(s) responsible for this report) receive compensation based upon, among other factors, the overall profitability of Bank of America Corporation, including profits derived from investment banking. The analyst(s) responsible for this report may also receive compensation based upon, among other factors, the overall profitability of the Bank's sales and trading businesses relating to the class of securities or financial instruments for which such analyst is responsible.
BofA Securities fixed income analysts regularly interact with sales and trading desk personnel in connection with their research, including to ascertain pricing and liquidity in the fixed income markets.

Other Important Disclosures

Prices are indicative and for information purposes only. Except as otherwise stated in the report, for any recommendation in relation to an equity security, the price referenced is the publicly traded price of the security as of close of business on the day prior to the date of the report or, if the report is published during intraday trading, the price referenced is indicative of the traded price as of the date and time of the report and in relation to a debt security (including equity preferred and CDS), prices are indicative as of the date and time of the report and are from various sources including BofA Securities trading desks.
The date and time of completion of the production of any recommendation in this report shall be the date and time of dissemination of this report as recorded in the report timestamp.

This report may refer to fixed income securities or other financial instruments that may not be offered or sold in one or more states or jurisdictions, or to certain categories of investors, including retail investors. Readers of this report are advised that any discussion, recommendation or other mention of such instruments is not a solicitation or offer to transact in such instruments. Investors should contact their BofA Securities representative or Merrill Global Wealth Management financial advisor for information relating to such instruments.
Rule 144A securities may be offered or sold only to persons in the U.S. who are Qualified Institutional Buyers within the meaning of Rule 144A under the Securities Act of 1933, as amended.
SECURITIES OR OTHER FINANCIAL INSTRUMENTS DISCUSSED HEREIN MAY BE RATED BELOW INVESTMENT GRADE AND SHOULD THEREFORE ONLY BE CONSIDERED FOR INCLUSION IN ACCOUNTS QUALIFIED FOR SPECULATIVE INVESTMENT.
Recipients who are not institutional investors or market professionals should seek the advice of their independent financial advisor before considering information in this report in connection with any investment decision, or for a necessary explanation of its contents.
The securities or other financial instruments discussed in this report may be traded over-the-counter. Retail sales and/or distribution of this report may be made only in states where these instruments are exempt from registration or have been qualified for sale.
Officers of BofAS or one or more of its affiliates (other than research analysts) may have a financial interest in securities of the issuer(s) or in related investments.
This report, and the securities or other financial instruments discussed herein, may not be eligible for distribution or sale in all countries or to certain categories of investors, including retail investors.
Refer to BofA Global Research policies relating to conflicts of interest.
"BofA Securities" includes BofA Securities, Inc. ("BofAS") and its affiliates. Investors should contact their BofA Securities representative or Merrill Global Wealth Management financial advisor if they have questions concerning this report or concerning the appropriateness of any investment idea described herein for such investor. "BofA Securities" is a global brand for BofA Global Research.
Information relating to Non-US affiliates of BofA Securities and Distribution of Affiliate Research Reports:
BofAS and/or Merrill Lynch, Pierce, Fenner & Smith Incorporated ("MLPF&S") may in the future distribute, information of the following non-US affiliates in the US (short name: legal name, regulator): Merrill Lynch (South Africa): Merrill Lynch South Africa (Pty) Ltd., regulated by The Financial Service Board; MLI (UK): Merrill Lynch International, regulated by the Financial Conduct Authority (FCA) and the Prudential Regulation Authority (PRA); BofASE (France): BofA Securities Europe SA is authorized by the Autorité de Contrôle Prudentiel et de Résolution (ACPR) and regulated by the ACPR and the Autorité des Marchés Financiers (AMF). BofA Securities Europe SA ("BofASE") with registered address at 51, rue La Boétie, 75008 Paris is registered under no. 842 602 690 RCS Paris. In accordance with the provisions of French Code Monétaire et Financier (Monetary and Financial Code), BofASE is an établissement de crédit et d'investissement (credit and investment institution) that is authorised and supervised by the European Central Bank and the Autorité de Contrôle Prudentiel et de Résolution (ACPR) and regulated by the ACPR and the Autorité des Marchés Financiers. BofASE's share capital can be found at www.bofaml.com/BofASEdisclaimer; BofA Europe (Milan): Bank of America Europe Designated Activity Company, Milan Branch, regulated by the Bank of Italy, the European Central Bank (ECB) and the Central Bank of Ireland (CBI); BofA Europe (Frankfurt): Bank of America Europe Designated Activity Company, Frankfurt Branch regulated by BaFin, the ECB and the CBI; BofA Europe (Madrid): Bank of America Europe Designated Activity Company, Sucursal en España, regulated by the Bank of Spain, the ECB and the CBI; Merrill Lynch (Australia): Merrill Lynch Equities (Australia) Limited, regulated by the Australian Securities and Investments Commission; Merrill Lynch (Hong Kong): Merrill Lynch (Asia Pacific) Limited, regulated by the Hong Kong Securities and Futures Commission (HKSFC); Merrill Lynch (Singapore): Merrill Lynch (Singapore) Pte Ltd, regulated by the Monetary Authority of Singapore (MAS); Merrill Lynch (Canada): Merrill Lynch Canada Inc, regulated by the Investment Industry Regulatory Organization of Canada; Merrill Lynch (Mexico): Merrill Lynch Mexico, SA de CV, Casa de Bolsa, regulated by the Comisión Nacional Bancaria y de Valores; Merrill Lynch (Argentina): Merrill Lynch Argentina SA, regulated by Comisión Nacional de Valores; BofAS Japan: BofA Securities Japan Co., Ltd., regulated by the Financial Services Agency; Merrill Lynch (Seoul): Merrill Lynch International, LLC Seoul Branch, regulated by the Financial Supervisory Service; Merrill Lynch (Taiwan): Merrill Lynch Securities (Taiwan) Ltd., regulated by the Securities and Futures Bureau; BofAS India: BofA Securities India Limited, regulated by the Securities and Exchange Board of India (SEBI); Merrill Lynch (Israel): Merrill Lynch Israel Limited, regulated by Israel Securities Authority; Merrill Lynch (DIFC): Merrill Lynch International (DIFC Branch), regulated by the Dubai Financial Services Authority (DFSA); Merrill Lynch (Brazil): Merrill Lynch S.A. Corretora de Títulos e Valores Mobiliários, regulated by Comissão de Valores Mobiliários; Merrill Lynch KSA Company: Merrill Lynch Kingdom of Saudi Arabia Company, regulated by the Capital Market Authority.
This information: has been approved for publication and is distributed in the United Kingdom (UK) to professional clients and eligible counterparties (as each is defined in the rules of the FCA and the PRA) by MLI (UK), which is authorized by the PRA and regulated by the FCA and the PRA - details about the extent of our regulation by the FCA and PRA are available from us on request; has been approved for publication and is distributed in the European Economic Area (EEA) by BofASE (France), which is authorized by the ACPR and regulated by the ACPR and the AMF; has been considered and distributed in Japan by BofAS Japan, a registered securities dealer under the Financial Instruments and Exchange Act in Japan, or its permitted affiliates; is issued and distributed in Hong Kong by Merrill Lynch (Hong Kong) which is regulated by HKSFC; is issued and distributed in Taiwan by Merrill Lynch (Taiwan); is issued and distributed in India by BofAS India; and is issued and distributed in Singapore to institutional investors and/or accredited investors (each as defined under the Financial Advisers Regulations) by Merrill Lynch (Singapore) (Company Registration No 198602883D). Merrill Lynch (Singapore) is regulated by MAS. Merrill Lynch Equities (Australia) Limited (ABN 65 006 276 795), AFS License 235132 (MLEA) distributes this information in Australia only to 'Wholesale' clients as defined by s.761G of the Corporations Act 2001. With the exception of Bank of America N.A., Australia Branch, neither MLEA nor any of its affiliates involved in preparing this information is an Authorised Deposit-Taking Institution under the Banking Act 1959 nor regulated by the Australian Prudential Regulation Authority. No approval is required for publication or distribution of this information in Brazil and its local distribution is by Merrill Lynch (Brazil) in accordance with applicable regulations. Merrill Lynch (DIFC) is authorized and regulated by the DFSA. Information prepared and issued by Merrill Lynch (DIFC) is done so in accordance with the requirements of the DFSA conduct of business rules. BofA Europe (Frankfurt) distributes this information in Germany and is regulated by BaFin, the ECB and the CBI. BofA Securities entities, including BofA Europe and BofASE (France), may outsource/delegate the marketing and/or provision of certain research services or aspects of research services to other branches or members of the BofA Securities group. You may be contacted by a different BofA Securities entity acting for and on behalf of your service provider where permitted by applicable law. This does not change your service provider. Please refer to the Electronic Communications Disclaimers for further information.
This information has been prepared and issued by BofAS and/or one or more of its non-US affiliates. The author(s) of this information may not be licensed to carry on regulated activities in your jurisdiction and, if not licensed, do not hold themselves out as being able to do so. BofAS and/or MLPF&S is the distributor of this information in the US and accepts full responsibility for information distributed to BofAS and/or MLPF&S clients in the US by its non-US affiliates. Any US person receiving this information and wishing to effect any transaction in any security

discussed herein should do so through BofAS and/or MLPF&S and not such foreign affiliates. Hong Kong recipients of this information should contact Merrill Lynch (Asia Pacific) Limited in respect of any matters relating to dealing in securities or provision of specific advice on securities or any other matters arising from, or in connection with, this information. Singapore recipients of this information should contact Merrill Lynch (Singapore) Pte Ltd in respect of any matters arising from, or in connection with, this information. For clients that are not accredited investors, expert investors or institutional investors Merrill Lynch (Singapore) Pte Ltd accepts full responsibility for the contents of this information distributed to such clients in Singapore.

General Investment Related Disclosures:

Taiwan Readers: Neither the information nor any opinion expressed herein constitutes an offer or a solicitation of an offer to transact in any securities or other financial instrument. No part of this report may be used or reproduced or quoted in any manner whatsoever in Taiwan by the press or any other person without the express written consent of BofA Securities.

This document provides general information only, and has been prepared for, and is intended for general distribution to, BofA Securities clients. Neither the information nor any opinion expressed constitutes an offer or an invitation to make an offer, to buy or sell any securities or other financial instrument or any derivative related to such securities or instruments (e.g., options, futures, warrants, and contracts for differences). This document is not intended to provide personal investment advice and it does not take into account the specific investment objectives, financial situation and the particular needs of, and is not directed to, any specific person(s). This document and its content do not constitute, and should not be considered to constitute, investment advice for purposes of ERISA, the US tax code, the Investment Advisers Act or otherwise. Investors should seek financial advice regarding the appropriateness of investing in financial instruments and implementing investment strategies discussed or recommended in this document and should understand that statements regarding future prospects may not be realized. Any decision to purchase or subscribe for securities in any offering must be based solely on existing public information on such security or the information in the prospectus or other offering document issued in connection with such offering, and not on this document.

Securities and other financial instruments referred to herein, or recommended, offered or sold by BofA Securities, are not insured by the Federal Deposit Insurance Corporation and are not deposits or other obligations of any insured depository institution (including, Bank of America, N.A.). Investments in general and, derivatives, in particular, involve numerous risks, including, among others, market risk, counterparty default risk and liquidity risk. No security, financial instrument or derivative is suitable for all investors. Digital assets are extremely speculative, volatile and are largely unregulated. In some cases, securities and other financial instruments may be difficult to value or sell and reliable information about the value or risks related to the security or financial instrument may be difficult to obtain. Investors should note that income from such securities and other financial instruments, if any, may fluctuate and that price or value of such securities and instruments may rise or fall and, in some cases, investors may lose their entire principal investment. Past performance is not necessarily a guide to future performance. Levels and basis for taxation may change.

BofA Securities is aware that the implementation of the ideas expressed in this report may depend upon an investor's ability to "short" securities or other financial instruments and that such action may be limited by regulations prohibiting or restricting "shortselling" in many jurisdictions. Investors are urged to seek advice regarding the applicability of such regulations prior to executing any short idea contained in this report.

This report may contain a trading idea or recommendation which highlights a specific identified near-term catalyst or event impacting a security, issuer, industry sector or the market generally that presents a transaction opportunity, but does not have any impact on the analyst's particular "Overweight" or "Underweight" rating (which is based on a three month trade horizon). Trading ideas and recommendations may differ directionally from the analyst's rating on a security or issuer because they reflect the impact of a near-term catalyst or event.

Foreign currency rates of exchange may adversely affect the value, price or income of any security or financial instrument mentioned in this report. Investors in such securities and instruments effectively assume currency risk.

BofAS or one of its affiliates is a regular issuer of traded financial instruments linked to securities that may have been recommended in this report. BofAS or one of its affiliates may, at any time, hold a trading position (long or short) in the securities and financial instruments discussed in this report.

BofA Securities, through business units other than BofA Global Research, may have issued and may in the future issue trading ideas or recommendations that are inconsistent with, and reach different conclusions from, the information presented herein. Such ideas or recommendations may reflect different time frames, assumptions, views and analytical methods of the persons who prepared them, and BofA Securities is under no obligation to ensure that such other trading ideas or recommendations are brought to the attention of any recipient of this information.

In the event that the recipient received this information pursuant to a contract between the recipient and BofAS for the provision of research services for a separate fee, and in connection therewith BofAS may be deemed to be acting as an investment adviser, such status relates, if at all, solely to the person with whom BofAS has contracted directly and does not extend beyond the delivery of this report (unless otherwise agreed specifically in writing by BofAS). If such recipient uses the services of BofAS in connection with the sale or purchase of a security referred to herein, BofAS may act as principal for its own account or as agent for another person. BofAS is and continues to act solely as a broker-dealer in connection with the execution of any transactions, including transactions in any securities referred to herein.

Copyright and General Information:

Materials prepared by BofA Global Research personnel are based on public information. Facts and views presented in this material have not been reviewed by, and may not reflect information known to, professionals in other business areas of BofA Securities, including investment banking personnel. BofA Securities has established information barriers between BofA Global Research and certain business groups. As a result, BofA Securities does not disclose certain client relationships with, or compensation received from, such issuers. To the extent this material discusses any legal proceeding or issues, it has not been prepared as nor is it intended to express any legal conclusion, opinion or advice. Investors should consult their own legal advisers as to issues of law relating to the subject matter of this material. BofA Global Research personnel's knowledge of legal proceedings in which any BofA Securities entity and/or its directors, officers and employees may be plaintiffs, defendants, co-defendants or co-plaintiffs with or involving issuers mentioned in this material is based on public information. Facts and views presented in this material that relate to any such proceedings have not been reviewed by, discussed with, and may not reflect information known to, professionals in other business areas of BofA Securities in connection with the legal proceedings or matters relevant to such proceedings.

This information has been prepared independently of any issuer of securities mentioned herein and not in connection with any proposed offering of securities or as agent of any issuer of any securities. None of BofAS any of its affiliates or their research analysts has any authority whatsoever to make any representation or warranty on behalf of the issuer(s). BofA Global Research policy prohibits research personnel from disclosing a recommendation, investment rating, or investment thesis for review by an issuer prior to the publication of a research report containing such rating, recommendation or investment thesis.

Any information relating to the tax status of financial instruments discussed herein is not intended to provide tax advice or to be used by anyone to provide tax advice. Investors are urged to seek tax advice based on their particular circumstances from an independent tax professional.

The information herein (other than disclosure information relating to BofA Securities and its affiliates) was obtained from various sources and we do not guarantee its accuracy. This information may contain links to third-party websites. BofA Securities is not responsible for the content of any third-party website or any linked content contained in a third-party website. Content contained on such third-party websites is not part of this information and is not incorporated by reference. The inclusion of a link does not imply any endorsement by or any affiliation with BofA Securities. Access to any third-party website is at your own risk, and you should always review the terms and privacy policies at third-party websites before submitting any personal information to them. BofA Securities is not responsible for such terms and privacy policies and expressly disclaims any liability for them.

All opinions, projections and estimates constitute the judgment of the author as of the date of publication and are subject to change without notice. Prices also are subject to change without notice. BofA Securities is under no obligation to update this information and BofA Securities ability to publish information on the subject issuer(s) in the future is subject to applicable quiet periods. You should therefore assume that BofA Securities will not update any fact, circumstance or opinion contained herein.

Certain outstanding reports or investment opinions relating to securities, financial instruments and/or issuers may no longer be current. Always refer to the most recent research report relating to an issuer prior to making an investment decision.

In some cases, an issuer may be classified as Restricted or may be Under Review or Extended Review. In each case, investors should consider any investment opinion relating to such issuer (or its security and/or financial instruments) to be suspended or withdrawn and should not rely on the analyses and investment opinion(s) pertaining to such issuer (or its securities and/or financial instruments) nor should the analyses or opinion(s) be considered a solicitation of any kind. Sales persons and financial advisors affiliated with BofAS or any of its affiliates may not solicit purchases of securities or financial instruments that are Restricted or Under Review and may only solicit securities under Extended Review in accordance with firm policies.

Neither BofA Securities nor any officer or employee of BofA Securities accepts any liability whatsoever for any direct, indirect or consequential damages or losses arising from any use of this information.

Research Analysts

Ralph Axel
Rates Strategist
BofAS
ralph.axel@bofa.com

Bruno Braizinha, CFA
Rates Strategist
BofAS
bruno.braizinha@bofa.com

Mark Cabana, CFA
Rates Strategist
BofAS
mark.cabana@bofa.com

Katie Craig
Rates Strategist
BofAS
katie.craig@bofa.com

Meghan Swiber, CFA
Rates Strategist
BofAS
meghan.swiber@bofa.com

Anna (Caiyi) Zhang
Rates Strategist
BofAS
caiyi.zhang@bofa.com