US Rates Watch

FX intervention: another potential headwind to UST demand

17 August 2023

Rates Research
United States

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

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

Shusuke Yamada, CFA
FX/Rates Strategist
BofAS Japan
shusuke.yamada@bofa.com

Claudio Piron
Emerging Asia FI/FX Strategist
Merrill Lynch (Singapore)
claudio.piron@bofa.com

US Rates Research
BofAS
+1 646 855 8846

See Team Page for List of Analysts

FX Intervention concerns ramp up

Client questions around FX intervention have picked up this week alongside continued USD strength and widening real interest rate differentials. This is a particular concern for the UST market as it could drive official sector selling and widen the supply demand gap. We do not yet see signs of UST sales for intervention purposes from Fed custodial & foreign RRP data, but further USD appreciation esp vs CNY & JPY pose risks.

FX intervention risks & key thresholds

The need for FX intervention is a function of speed of move in addition to overall level. CNY intervention is dictated by a combination of levels and stress in FX market. So far, the PBOC has been allowing for stronger fixings, which may indicate a preference to intervene. JPY intervention is a risk if the yen's undervaluation becomes extreme while the move becomes volatile, and/or external conditions make a weak yen more costly. The MoF can afford more JPY weakness today than in 2022 due to the differences in the macroeconomic and market environment. We think the MoF would escalate verbal intervention in the 145-150 range and prepare for intervention in the 150-155 range.

Sources of intervention: not just UST sales

Both the MoF and PBoC have several tools to help stem currency depreciation in addition to selling USTs. The PBoC can use macroprudential measures such as window guidance (i.e. PBoC guidance to banks) to access USD and adjustments to FX reserve requirements. The official sector can also draw down cash held at the Fed's foreign RRP rather than reduce securities. Compared with 2H 2022, we think a drawdown in repo balances may be more preferred based on relative attractiveness vs short-dated USTs.

Rates impact today: likely cheaper front end USTs

We think the rates market reaction to any FX intervention from the Japanese MoF or PBoC would be tighter front end & intermediate dated UST swap spreads. The details of any intervention matter, especially how it is funded. The rates market is likely to assume that any USD selling would be funded by UST sales. However, the official sector could choose to fund USD selling by drawing down their very large cash holdings at the Fed foreign RRP. Intervention conducted through securities paydowns rather than outright sales may also have a more minimal impact on the UST market and swap spreads.

Potential interventions could add another seller to the mix

Threat of official selling contributes further to fears around the end buyer of USTs alongside heavy supply. USD strength not only sparks official sector sales but contributes to extremely high hedging costs for private investors. This puts more weight on domestic buying, potentially challenged should fixed income inflows slow and conviction waver in the long duration. The most direct impact of any intervention-related reduced UST holdings is likely to be most concentrated at the US front end.

MoF = ministry of finance

RRP= reverse repo program

FX = foreign exchange

UST = US Treasury

TIC = Treasury International Capital

PBoC = People's Bank of China

CNY = Chinese yuan

JPY = Japanese yen

 12594784

Timestamp: 17 August 2023 03:15PM EDT

FX Intervention concerns ramp up

Client questions around FX intervention have picked up this week alongside continued USD strength and widening real interest rate differentials. This is a particular concern for the UST market as it could drive official sector selling and widen the supply demand gap further. We do not yet see signs of UST sales for intervention purposes, but further USD appreciation particularly vs CNY and JPY pose risks.

Recent headlines suggest that Chinese authorities are already directing banks to take actions reducing FX volatility. We see risks to more aggressive activity from the PBoC may be in store and potential direct intervention from the Japanese MoF.

FX intervention risks & key thresholds

CNY intervention is dictated by a combination of levels and stress in FX market. On a micro daily FX management basis there is the issue of maintaining the integrity of the +/- 2% trading band around the daily fixing for USDCNY. This week onshore USD/CNY has been trading 130-160bps on the strong side and approaching the 2% limit of intraday weakness. The PBOC has two choices: use moral suasion on the banks to submit weaker CNY fixings or intervene. So far, the PBOC may be allowing for stronger fixings, with a preference to intervene. This would be consistent with forward points turning less negative, despite a recent marginal cut in rates.

Intervention may intensify if we see widening of the spot basis between the onshore CNY and CNH as well as the PBOC 24 currency trade-weighted fixing and its spot levels. This widening basis is approaching levels we saw last October/November and represents a source of market divergence with official FX fixing. This test of credibility may mean the central bank will have to intervene more aggressively.

However, there are two challenges to this PBOC intervention strategy. The first challenge is that the PBOC CFETS basket has been appreciating by about 2% since late July as other EM peers have performed even worse than CNY. We believe if the CFETS basket appreciated another 2-3% to approach 99 on the CFETS basket the central bank may have to allow USDCNY to adjust higher.

The second challenge is that by allowing a more meaningful adjustment beyond our current USD/CNY 7.40 forecast would likely trigger a second round of spillover depreciation among neighboring Asian currencies. This in turn will result in FX intervention by other Asian central banks as well as the PBOC.

JPY intervention is a risk if the yen's undervaluation becomes extreme while the move becomes volatile, and/or external conditions make a weak yen more costly. As discussed in Yen weakness in '22 = headache for MoF; Yen weakness in '23 = tailwind for BoJ 07 June 2023, the MoF can afford more JPY weakness today than in 2022 due to the differences in the macroeconomic and market environment and the yen weakness could help the BoJ's policy normalization down the road as the cost-benefit balance of the weak yen for Japan's economy has improved.

But after the BoJ tweaked YCC in the Jul MPM, the BoJ does not have meaningful tools to defend JPY near-term and the MoF would once again manage the FX market volatility.

We watch the following three levels:

1. **USD/JPY spot**: If USD/JPY rises above 150 and exceeds the 2022 high, public concern may arise as the yen's purchasing power declines irrespective of its impact on the economy and as losers of a weak yen would become more vocal.

2. **Volatility**: If the yen weakness becomes more volatile and self-fulfilling, policymakers may consider slowing down the pace. The key level to watch may be a combination of USD/JPY's 3m implied volatility above 12 - level above which the MoF intervened in Sep 2022 - and the positive options skew for USD/JPY.

3. **Terms of trade**: If Brent crude oil rises back above $100/barrel, leading to a wide trade deficit and diminished current account surplus, a weak yen may be seen as adding fuel to the fire.

In terms of the sequence of policy response, we think the MoF would start to escalate verbal intervention in the 145-150 range and prepare for intervention in the 150-155 range while we see more limited risk of actual intervention with USD/JPY below 150 vs 2022, although it depends on volatility and external conditions.

Sources of intervention

CNY intervention: The central bank is using several tools to help contain excessive CNY depreciation. Among them macroprudential measures such as window guidance (i.e. PBoC guidance to banks) to access USD and adjustments to FX reserve requirements.

Beyond macro prudential measures, state owned banks and corporations can reduce the holdings of their USD and net foreign asset holdings and deposits that have risen considerably over the 5 years. Indeed, the central banks own FX reserves have been remarkably stable over the same period.

Currently, the PBOC has approximately $3.2tn USD in FX reserves which is formidable. Under the IMF's Reserve Adequacy ratio this would be more than sufficient to defend a managed float FX regime with macroprudential measures but insufficient to maintain a fixed exchange rate arrangement. Ultimately, the central bank will have to use a combination of measured intervention to reduce volatility and speculation but accept that the market requires a nominal adjustment in the exchange rate.

Depreciation pressure on the CNY will likely end when China's policymakers deliver a more forceful fiscal stimulus to stabilize economic confidence and when the market is confident the Fed's last hike is delivered.

JPY intervention: Japan has $1.3tn USD in FX reserves, split into $136bn in deposits and $1.0tn in securities, and the rest in other assets. The MoF kept the deposit balance largely unchanged through FX intervention in 2H22, implying it liquidated or redeemed securities to finance intervention. We believe the MoF financed intervention mainly via US T-bills and short-dated US Treasuries, likely through redemptions rather than outright sales (see: How did Japan's MoF finance FX intervention?).

As of Mar 2022, securities held in reserves consisted of 75.7% government securities and 24.3% non-government. The maturity breakdown was 14.7% in 1yr or shorter, 42.6% in longer than 1yr and 5yr or shorter, 42.6% in longer than 5yr.

Rates impact today: likely cheaper front end USTs

We think the rates market reaction to any FX intervention from the Japanese MoF or PBoC would be tighter front end & intermediate dated UST swap spreads. The market would likely be reflecting risk of foreign official UST sales & associated UST cheapening.

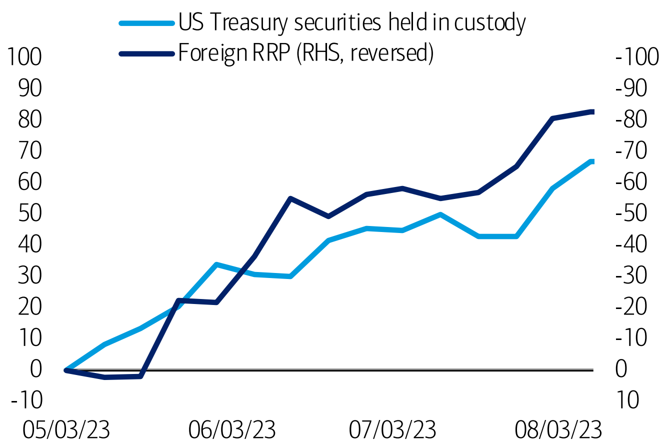
The details of any intervention matter, especially how the activity is funded. The rates market is likely to assume that any USD selling would be funded by UST sales. However, the official sector could choose to fund USD selling by drawing down its very large cash holdings at the Fed foreign RRP. Intervention conducted through securities paydowns rather than outright sales would also have a more limited impact on the UST market and swap spreads.

Limited signs of intervention so far through UST sales

We can monitor a portion of official institutions USD holdings on a weekly basis using data from the Fed's balance sheet. Both custodial holdings and the foreign RRP pool give us a sense of how foreign official accounts may be allocating funds. Custodial holdings and the RRP pool have recently tended to move in reverse directions (Exhibit 1); official accounts move into [out of] securities and out of [into] the RRP facility.

Exhibit 1: Cumulative change in custody holdings and foreign RRP since May 2023 ($bn)

Increase in custody holdings occurred alongside drop in RRP

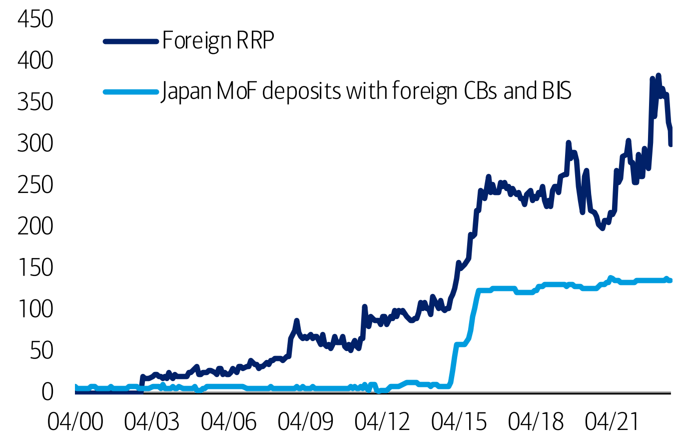


Source: BofA Global Research, Federal Reserve, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 2: Japanese deposits with other central banks and Fed foreign repo pool ($bn)

Vast majority of $135bn in MoF deposits likely at Fed's foreign repo pool



Source: Japan MoF, Federal Reserve, Bloomberg

BofA GLOBAL RESEARCH

Since the start of May, official institutions have pulled about $80bn out of repo and put $70bn into UST securities. This may reflect buying T-bills and short-term UST securities that they view as relatively attractive given (1) expectations for the Fed to be nearing the end of its hiking cycle (2) recent increase in bill supply & modest amount of bill cheapening vs the expected foreign RRP path (note: this behavior is very similar to MMF who use the Fed's larger ON RRP facility). Neither source recently indicate material intervention activity; the foreign RRP and custodial holdings together have increased about $75bn over the past year.

The last time the Japanese MoF intervened they funded their USD selling via a reduction of UST securities holdings. We think this time may be different. The decision by the Japanese MoF in fall '22 to raise USD liquidity via securities reductions vs foreign RRP was likely heavily influenced by market levels. Recall, in Sept '22 1 & 3m UST bill to OIS levels traded rich by 60-70bps & 30-40bps, respectively. In fall '22 the Japanese MoF likely decided to reduce their relatively low yielding bill holdings & retain their relatively high earning cash in foreign RRP. The MoF rationally maximized USD returns.

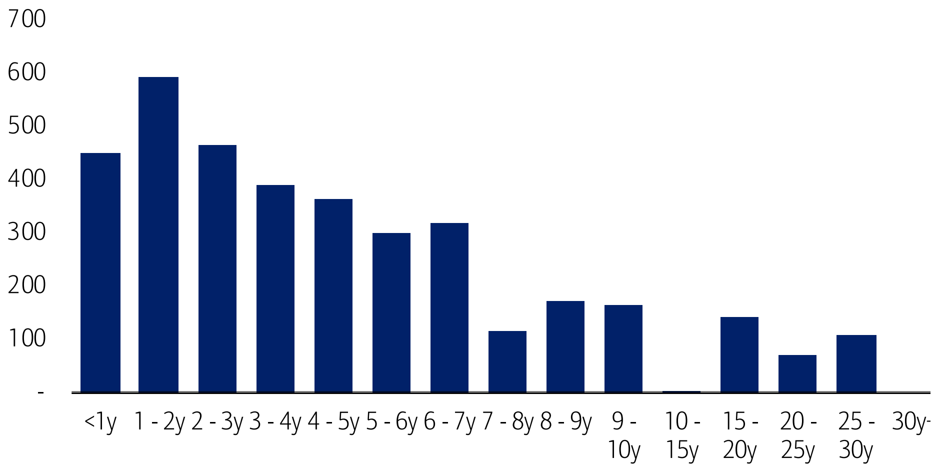
While the MoF may want to maintain cash buffers for non-economic purposes, we see greater potential for funding intervention through cash at RRP (Exhibit 2) vs securities. Market levels are different today vs Sept '22. Today UST bills trade very modestly cheap vs the Fed's foreign RRP facility. As a result, we would not be surprised to see more of any Japanese MoF intervention funded by reduced cash vs securities holdings. Mechanically this impacts distribution of excess liquidity in the banking system. We suspect that any sustained reduction in foreign RRP activity would either be used to (1) fund Fed QT (2) result in modestly higher excess reserves levels in the banking system, i.e. MoF buys JPY / sells USD to bank & bank retains that excess liquidity at Fed IORB.

Potential interventions could add another seller to the mix

While signs are limited so far of material intervention financed through UST sales, the prospect raises additional concerns about the broader UST supply/ demand backdrop.

As shown in Exhibit 3, most recent TIC data suggests that official holdings are largely concentrated in the <5y sector—any intervention conducted using security sales would therefore have a more magnified impact at the front-end of the curve. However, reports of intervention-related sales could negatively impact UST demand sentiment further out the curve.

Exhibit 3: Maturity composition of foreign official UST holdings
About 65% of total UST holdings are <5y



Source: BofA Global Research, TIC, June 2022 report

BofA GLOBAL RESEARCH

Historically, the correlation between interventions & USTs is relatively weak but intuitive. As discussed in [Yen intervention US rate impact: USTs likely cheaper but watch foreign RRP], our analysis suggests for every ¥1tn of USD/JPY buying 2/5/10Y UST rates were lowered by 2-3bp while the spread impact was less significant. Following the most recent intervention episode of MoF selling on September 22, 2y swap spreads fell in the days following the intervention. This may have been less directly related to outright selling and more so related to concerns around further intervention activity.

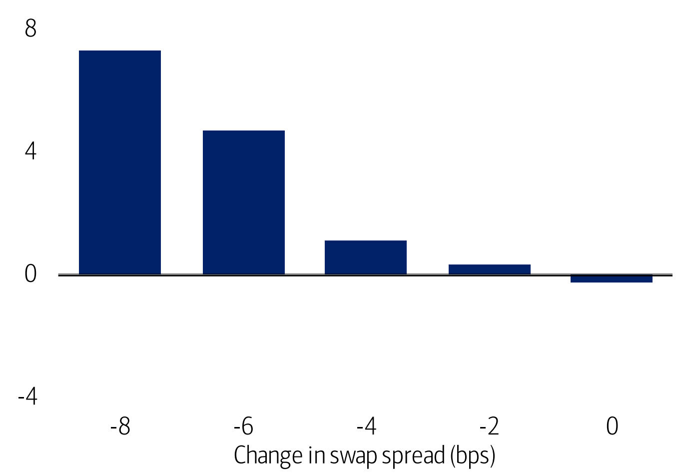
While the official sector may be marginally less inclined to finance intervention using security sales given cheap front-end securities vs repo rates, we have seen reserve holdings diverge notably from exchange rates. As shown in Exhibit 4, renminbi depreciation has happened without a decline in foreign exchange reserves. This suggests either that (1) PBOC is using different intervention methods vs the past (2) incremental action form the official sector may be in store.

Exhibit 4: China FX Reserves ($bn) and CNY
Reserves typically decline when currency weakens

Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 5: Average change in 2y real yield for change in swap spread (bps)
Real yields typically increase when swap spreads narrow



Source: BofA Global Research, Bloomberg, Note: daily changes since 2010

BofA GLOBAL RESEARCH

If foreign officials do sell UST securities to help stem depreciation, this may exacerbate USD pressures more broadly. As shown in Exhibit 5, instances when 2y swap spreads compress, tend to correspond with an increase in 2y real yields increase. Because recent

USD appreciation has been led by real interest rate differentials (see: Growth-inflation trade-off and FX), selling may pressure USD higher and exacerbate CNY/ JPY depreciation.

Threat of official selling contributes further to fears around the end buyer of USTs alongside heavy supply (see: August refunding: off with a bang). USD strength not only sparks official sector sales but contributes to extremely high hedging costs for private investors. This puts more weight on domestic buying, potentially challenged should fixed income inflows slow and conviction waver in the long duration view (see: Positioning varies by investor type, fund flows may underpin auction performance).

Bottom line: recent depreciation of CNY/CNH and JPY vs the USD may drive FX intervention from the PBoC and Japanese MoF. FX intervention can take several forms; what would be most impactful for the UST market is official selling of securities, likely concentrated at the front-end of the curve. Intervention funded through securities holdings may be less likely vs 2H 22 due to relative attractiveness vs repo, but still contributes to concerns around the broader UST supply/ demand backdrop.

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

US Rates Research
BofAS

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

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

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

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

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