European Rates Viewpoint

Is the market complacent on liquidity?

19 May 2023

Rates Research
Europe

European Rates Research
MLI (UK)

Ronald Man
Rates Strategist
MLI (UK)
+44 20 7995 1143
ronald.man@bofa.com

Sphia Salim
Rates Strategist
MLI (UK)
+44 20 7996 2227
sphia.salim@bofa.com

Fundamental Equity Research
Alastair Ryan >>
Research Analyst
MLI (UK)
+44 20 7996 4806
alastair.ryan@bofa.com

See Team Page for List of Analysts

For a list of our open rates trades and those closed over the past 12 months, see the latest [Global Rates Weekly, 12 May 2023](#).

Key takeaways

- The market is pricing in a smooth return of term premium in money markets as excess liquidity declines
- But this is challenged by supply and demand changes, regulatory issues, and uncertainty over the ECB's operational framework
- We like front-end spread wideners to express our view of the market being complacent on liquidity

Big changes in supply and demand

Bank demand for liquidity has increased. Recent global bank stress made reserves an even more valuable form of high quality liquid assets (HQLA). Structural demand for reserves increased on regulatory changes. But reserve supply will continue to fall as the European Central Bank (ECB) reduces its balance sheet through maturing targeted longer-term refinancing operation (TLTRO) and quantitative tightening (QT).

QT a bigger risk for LCR

Our calculations show banks' liquidity coverage ratio (LCR) could be very close to 100% by end-2024 if banks do not raise HQLA elsewhere. But a LCR of 100% may not be enough for the market. Banks are likely to need to raise more liquidity. We believe QT is a bigger risk for LCR than near-term TLTRO maturities, and also for the ECB when the central bank does not know banks' real demand for liquidity.

ECB's approach to be decided

The ECB aims to review its operational framework by the end of this year. The framework will ultimately determine medium term liquidity in the euro area. ECB Governing Council member Schnabel provided three systems the central bank may consider. We discuss what each scenario could look like and their potential implications for the euro short-term rate (€str), the euro interbank offered rate (Euribor), repo rates, and peripheral spreads.

We like front-end spread wideners

Excess liquidity is projected to fall to pre-Covid levels by the end of 2024. The money market is pricing in a smooth return of front-end term premium to pre-Covid levels over the same period. We believe the market may be complacent on liquidity. It either does not account for bank liquidity demand being higher than before or implicitly assumes the central bank will provide persistent liquidity on attractive terms. The risks are skewed towards reserve supply being much less than demand. We like Euribor-€str spread wideners.

Big changes in supply and demand

Excess liquidity, defined in the euro area as reserves beyond the minimum reserve requirement, will decline as the Eurosystem reduces its balance sheet. But bank demand for reserves may be structurally higher than before.

TLTRO and QT to reduce reserve supply

The ECB signalled its intent to fully stop reinvestments under its asset purchase programme (APP) from July 2023 (see Euro Area Watch). We incorporate the potential end of APP reinvestments into our Eurosystem balance sheet forecasts. Our calculations show the Eurosystem's balance sheet will fall from €8.0trn at end-2022 to €6.9trn at end-2023 and to €6.1trn at end-2024. Excess liquidity would fall from €3.8trn at end-2022 to €3.1trn at end-2023 and to €2.2trn at end-2024.

The expected decline in the Eurosystem's balance sheet and excess liquidity is due to the decline in TLTRO outstanding and QT. As the TLTROs mature, QT will play a bigger and increasing role in reducing excess liquidity from June 2024 (Exhibit 1).

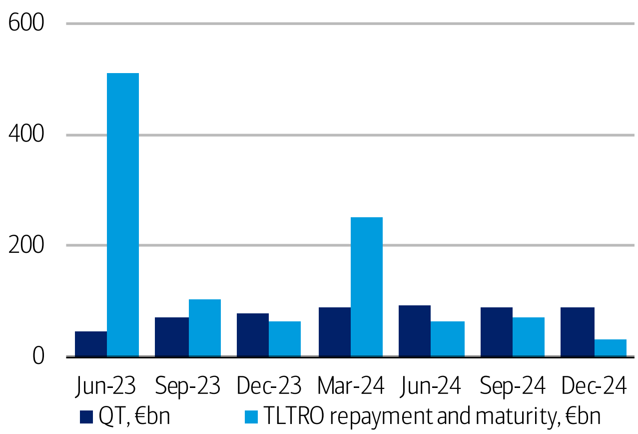
Reserve demand may be higher than before

While excess liquidity is set to decline, reserve demand structurally increased. Regulatory changes implemented in recent years, including the LCR and changes to over-the-counter derivatives regulations, prompted banks to hold more HQLA than before.

Reserves accounted for an increasing share of banks' HQLA. As of December 2022, cash accounted for 73% of banks' HQLA, up from less than 52% before the Covid shock (Exhibit 2). The ability of banks to use more reserves to satisfy HQLA requirement was largely provided by the central bank's monetary policy: quantitative easing (QE) and new TLTROs with particularly attractive terms. So even as demand for HQLA increased, it was easily satiated by the much larger increase in supply.

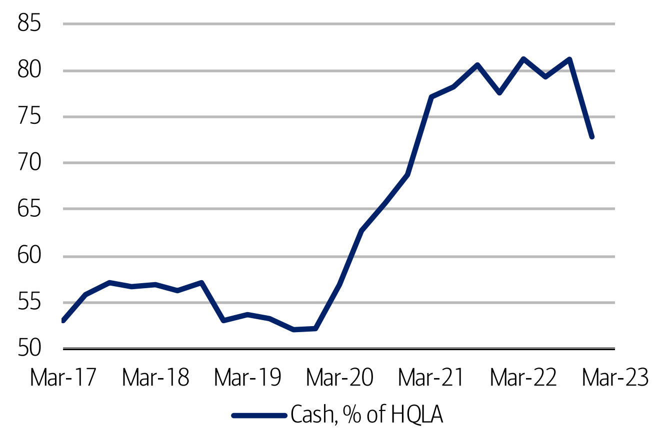
The main uncertainty is whether the reverse of monetary easing would leave banks with sufficient liquidity to satiate demand. In addition to regulatory requirements, recent stresses in the global banking system may have increased banks' precautionary demand for reserves. Some may argue reserves have become an even more preferred form of HQLA even when compared to certain government bonds. The prospect of structurally higher reserve demand means what was deemed sufficient excess liquidity for the banking system before may no longer be true today.

Exhibit 1: Reduction in excess liquidity due to QT and TLTRO
QT to play an increasing grow in reducing excess liquidity from 2Q24



Source: BofA Global Research, ECB
BofA GLOBAL RESEARCH

Exhibit 2: Cash as a share of banks' HQLA
Cash increased its share of banks' HQLA significantly since Covid



Source: ECB. Cash refers to cash, cash balance at central bank, and other demand deposits
BofA GLOBAL RESEARCH

QT a bigger risk for LCR

The LCR is defined as unencumbered HQLA divided by expected net liquidity outflows over a 30-calendar day stress period. Our calculations suggest banks' LCR will fall close to 100% by end-2024 assuming:

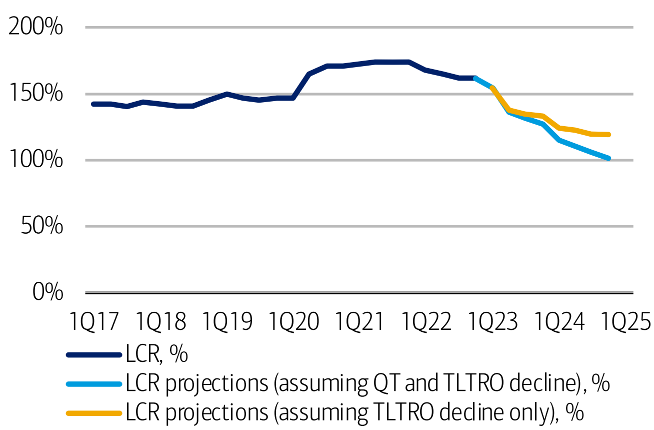
- TLTRO repayments and QT activities, as per the ECB's latest guidance, lead to a one-for-one decline in bank reserves
- Banks do not raise HQLA elsewhere
- Expected net liquidity outflows do not change

A LCR near 100% would be meaningfully lower than the c. 140% reported by banks pre-Covid (Exhibit 3). While this would still be above the regulatory requirement of 100%, we have our concerns over whether the market will be comfortable with this in practice. By way of illustration, to bring the LCR back towards 140% by the end of 2024 and assuming expected net liquidity outflows do not change, we calculate banks would need to raise an additional €1.2trn of unencumbered HQLA. To raise additional HQLA, banks may increase issuance or substitute non-HQLA for HQLA.

We believe QT could be the bigger medium-term risk for banks with respect to the LCR. QT will be a larger driver of reserve decline than TLTROs from 2Q24. At the extreme, if there were no QT, our assumptions imply banks' LCR would be around 120% by the end of 2024 and this will be driven by the TLTRO decline alone. But if QT is sustained beyond 2024 in line with current ECB guidance, the LCR would fall below 100% from 2025, and continue to decline further while QT persists. Furthermore, if the ECB stops full reinvestments under its pandemic emergency purchase programme (PEPP) sooner than planned, the speed of the decline in excess liquidity and banks' LCR would increase.

Beyond LCR, sustained QT may be a meaningful risk for the ECB because underlying bank demand for excess liquidity is unknown. Prior to the Covid shock, the overnight indexed swap (OIS) rate was notably sensitive to changes in excess liquidity levels when excess liquidity was below €1trn (Exhibit 4). But demand for underlying reserves has changed as discussed and this quantum is currently unknown to policymakers and the market. We do not know how much excess liquidity can really decline to before day-to-day functioning of the banking system and the smooth functioning of money markets are impaired. Sustained QT, in the absence of further changes by the central bank, could mean money markets find out the hard way.

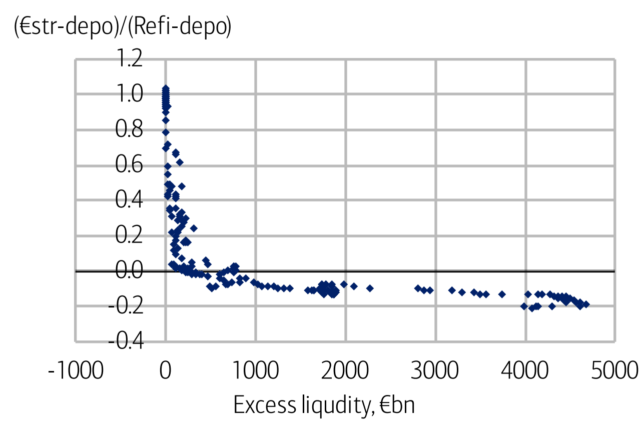
Exhibit 3: LCR projections
LCR could fall to 100% by end-24 on TLTRO maturities and QT



Source: BofA Global Research, ECB

BofA GLOBAL RESEARCH

Exhibit 4: Relationship between OIS rate and excess liquidity
Excess liquidity may impact OIS rates sooner as reserve demand is higher



Source: BofA Global Research, ECB. Monthly average data since 2005. €str pre-Oct19 defined as euro overnight index average (Eonia) minus 8.5bp.

BofA GLOBAL RESEARCH

ECB's approach to be decided

The ECB aims to conclude its operational framework review this year, which would determine the medium-term level of excess liquidity (see Liquid Insight). In a March 2023 speech, ECB Governing Council (GC) Member Schnabel discussed three systems the ECB may consider. We believe these approaches can lead to different levels of medium-term excess liquidity and market implications (Exhibit 5):

Corridor system, supply driven

A corridor system would be a return to the ECB's framework before the 2008 financial crisis. A corridor system means €str would trade between the refi and depo rate. Excess liquidity would ultimately be as close to zero as possible, which would increase bank reliance on the wholesale market for funding. Even if the QE portfolio may still exist, it is likely to be small. This system may support a more active interbank market to distribute reserves efficiently across the euro area. A tight reserve environment may also improve monetary policy transmission. ECB GC Member Holzmann, a hawk, has signalled his preference for this system.

As excess liquidity approaches zero, we expect €str to trade much closer to the refi rate. Euribor is expected widen significantly versus €str in a tight reserve environment as banks funding demand increases and the cost of term funding rises. Repo rates are expected to ultimately trade close to €str if QT brings central bank holdings of government bonds to a very low level and banks become much more cash-poor. Peripheral spreads are likely to widen gradually if this system is interpreted as a signal of sustained decline the ECB's QE portfolio via passive QT.

Floor system, supply driven

A supply driven floor system is currently used by the ECB and the Federal Reserve. The idea is for reserve supply to continue overwhelming demand, keeping banks cash rich and €str close to the floor of the corridor, i.e. the depo rate. This system would be operationally simple for the central bank and would maintain a high reserve supply in the banking system. But repo operations may be required by the central bank to address the cash-rich collateral-scarce imbalance. As the central bank would need to maintain a large QE portfolio to keep reserve levels high, keeping the current system would effectively signal a foreseeable end to QT. The central bank and the market would still not know what the real demand of banks for excess liquidity is.

We would expect €str to trade close to the depo rate, and possibly remaining below it. An ample reserve environment means bank funding demand in the wholesale market would stay low, which would keep Euribor very close to €str. Repo rates are likely to stay rich vs €str as the cash-rich collateral-scarce environment would be supported by a large QE portfolio. The announcement of this system is likely to keep peripheral spreads compressed given the prospect of a foreseeable end to QT against the backdrop of TLTRO maturities mechanically reducing excess liquidity by a further €1.1trn.

Floor system, demand-driven

A demand-driven floor system was the approach taken by the ECB between 2008 and 2013 and is currently used by the Bank of England (BoE). In this system, excess liquidity would decline and then stabilise at a sufficiently abundant level where banks would then actively use open market operations (OMOs) to borrow any further reserves they may need from the central bank. It is probable the ECB may need to introduce new types of OMOs to support bank demand for term funding, given existing OMOs only allow banks to borrow at overnight, one-week, and three-month tenors. This system would allow the ECB to continue reducing its QE portfolio, and arguably at a faster pace via active QT. It would also allow the ECB and the market to discover the real excess liquidity demand of banks. ECB GC Member Schnabel, a hawk, signalled her preference for this system.

The impact on €str and Euribor will depend on the specific details of the OMOs used by banks to satiate the reserve demand, in particular the price and term. We believe €str will be close to the price of the OMOs used by banks to satiate reserve demand. The impact on Euribor would depend on the price and term. Euribor fixings that have a term equal or less than the OMOs used to satiate reserve demand are likely to fix close to the price of the OMOs. Euribor fixings whose term is greater than such OMOs are likely to fix at a higher level than the price of the OMO. Repo rates are ultimately likely to still trade below €str, being somewhat rich vs €str, as central banks will still have a QE portfolio that may contribute to a certain degree of collateral scarcity. We believe the announcement of this system could prompt the market to price in the possibility of active QT, which may put strong widening pressures on peripheral spreads.

Exhibit 5: Potential operational frameworks and market implications

We summarise three potential systems that the ECB may consider in its operational framework review

	Corridor system: tight reserves	Floor system: ample reserves	
	Supply driven	Supply driven	Demand driven
Excess liquidity	Low, targeting a level as close to 0 as possible	Theoretically abundant, amount decided by the central bank	Sufficiently abundant, amount ultimately determined by banks' demand
Examples	ECB framework before 2008 financial crisis	ECB and Fed currently	ECB 2008-13, BoE currently
Considerations in framework review			
Pros	- Supports a more active interbank market - Supports monetary policy transmission - Reduces bank risk to depositors - Leaner central bank and balance sheet - Central bank can learn about banks' underlying liquidity preference	- Operationally simple - Maintains high reserve level	- Can continue to reduce QE portfolio without knowing banks' demand for excess reserves - Reduce likelihood of surge in money market rates - More even distribution of excess reserves - Leaner central bank and bank balance sheet - Central bank can gradually learn about banks' underlying liquidity preference
Cons	- Difficult to accurately predict the reserves needed to steer €str to the middle of the corridor, if desired - Not clear whether the interbank market will recover once excess reserves become scarcer - Banks might want to hold much higher liquidity buffers than in the past - Higher operational burden for the ECB and banking system	- High uncertainty about excess liquidity level below which overnight rates can suddenly surge - ECB QE bond portfolios would likely have to remain large - Excess liquidity can be large but not well distributed	- Reduces the likelihood of a revival of the interbank market
Risks	- Risk of large swings in overnight rate	- Risk of a sudden surge in overnight rate - Floor on market rates could be leaky - Unsecured money market disintermediation - Pressure on banks' balance sheet	- Floor on market rates could be leaky - Stigma may limit banks' participation - Unexpected liquidity shocks
Technical aspects			
Need for additional tools	Fine tuning operations	ECB bills / reverse repurchase agreement (RRP) if repo rates are too rich	New collateralised lending operations
Composition of ECB balance sheet	A mix of QE portfolios and ECB repo operations	Mostly QE portfolios	A mix of QE portfolios and ECB repo operations
Expected market reaction			
€str: endgame	Trading between the depo rate and refi rate, and ultimately close to the refi rate	Theoretically trading close to, and possibly below, the depo rate	Trading close to the rate at which banks can borrow the excess reserves
Euribor: endgame	Significantly widen vs €str	Close to €str	Close to €str to the extent term of lending operations is greater than or equal to Euribor fixing tenors
Repo (one-day): endgame	Trade close to €str if QE portfolio is very small and banks are much more cash-poor	Trade a lot below €str as cash-rich collateral-scarce environment persists	Trade below €str as QE portfolio means central banks may still contribute to a certain degree of collateral scarcity
Periphery spreads: upon announcement	Widen gradually if interpreted as implying sustained passive QT	Stay compressed if interpreted as a signal of a foreseeable end to QT	Widen significantly if interpreted as implying active QT or rapid decline in PEPP portfolio

Source: BofA Global Research, ECB

BofA GLOBAL RESEARCH

We like front-end spread wideners

The market has priced in a gradual widening of 3M Euribor-€str spread of 14bp by end-2024. This would represent a return of that spread towards 2018-2019 levels. On the surface, this may appear consistent with expected profile of excess liquidity, which we expect to also decline towards 2018-19 levels (Exhibit 6). But we believe the market may be complacent on the liquidity outlook. If the market pricing of the Euribor-€str spread is driven by the excess liquidity outlook, our interpretation is:

- Increased structural demand for reserves has not been factored in. Reserve demand today is arguably larger than that in 2018-19. This would mean Euribor-€str would theoretically be wider for any given level of excess liquidity, and that sensitivity is likely to increase as excess liquidity declines.

- Even if the market accounted for the increased structural demand for reserves, the smooth widening of Euribor-€str may be implicitly assuming the central bank will ensure sufficient liquidity before any pressures build. If so, we think there are risks that the market would be surprised.

- The market may have completely different assumptions on excess liquidity where the impact from TLTRO maturities and QT are offset.

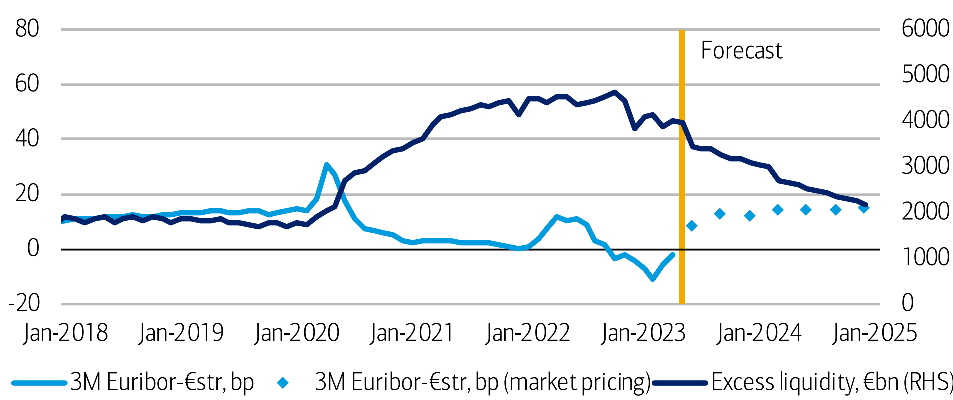
While we believe the Jun23 TLTRO maturity may not necessarily cause abrupt movements in front-end rates, the fact some banks currently have a shortfall of reserves vs TLTRO borrowings leaves us cautious over the medium-term path of Euribor-€str spreads (see Liquid Insight, 15 May 2023). The largest TLTRO maturity after Jun23 will be in Mar24: the operation that matures in Mar24 accounts for 46% of TLTROs outstanding excluding the operation that matures in Jun23. In our view, it is probable that some banks with the reserves-to-TLTRO shortfall will need to cover that shortfall by Mar24, and this would increase their borrowing demand.

We recommend Mar24 3M Euribor futures vs €str wideners, entry: 14bp, target: 25bp, stop: 8bp. Our recommendation may also benefit from a rise in global front-end rates when the debt limit in the US is resolved and the Treasury issues a large amount of bills to help rebuild their depleted cash balance (see US Rates Viewpoint, 16 May 2023).

Risks to our recommendation are bridging operations introduced by the ECB that allow banks to rollover TLTRO borrowings, the ECB ending QT or pre-emptively ensuring reserve supply continues to overwhelm demand, and strong reduction in banks' net expected liquidity outflows that would support their LCR even if their HQLA declines.

Exhibit 6: 3M Euribor-€str and excess liquidity

Structural changes suggest a mirror image as expected may not hold



Source: BofA Global Research, Bloomberg, ECB

BofA GLOBAL RESEARCH

Analyst Certification

I, Ronald Man, hereby certify that the views expressed in this research report accurately reflect my personal views about the subject securities and issuers. I also certify that no part of my compensation was, is, or will be, directly or indirectly, related to the specific recommendations or view expressed in this research report.

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

European Rates Research

Ralf Preusser, CFA
Rates Strategist
MLI (UK)
+44 20 7995 7331
ralf.preusser@bofa.com

Sphia Salim
Rates Strategist
MLI (UK)
+44 20 7996 2227
sphia.salim@bofa.com

Mark Capleton
Rates Strategist
MLI (UK)
+44 20 7995 6118
mark.capleton@bofa.com

Ronald Man
Rates Strategist
MLI (UK)
+44 20 7995 1143
ronald.man@bofa.com

Erjon Satko
Rates Strategist
BofASE (France)
+33 1 8770 0304
erjon.satko@bofa.com

Agne Stengeryte
Rates Strategist
MLI (UK)
+44 75 41694477
agne.stengeryte@bofa.com