

FX Viewpoint

Various landing scenarios & the USD

Key takeaways

- Debate over landing scenarios (hard, soft, no) continues; which one is realized will determine the USD's direction this year.
- We see 2 of the 3 scenarios (hard and no landing) as constructive for the USD, posing upside risks to our USD forecasts.
- A soft landing should see the USD's depreciation trend resume, as policy rates decline amid constructive risk appetite.

How will we land?

Challenging inflation and growth dynamics point to rising policy uncertainty as the global monetary tightening cycle matures. As the data has evolved, so too has the debate over which landing scenario will ultimately come to fruition later this year: “hard landing,” “soft landing,” or “no landing.” Each one presents notably distinct economic conditions, with differing implications for the dollar. We see two of these three scenarios as constructive for the dollar, posing upside risks to our USD forecasts.

Soft landing: Does not bode well for the USD

While definitions may vary, a “soft landing” would essentially see gradual disinflation in concert with the monetary tightening currently in the system already, while a broad recession would be avoided. Payroll growth would likely decline but remain positive, and no wage-price spiral would materialize. Here, the USD would likely resume its downtrend observed during Q4 2022 and January 2023.

Hard landing: USD to be supported as risk assets decline

A “hard landing” implies a recession, potentially a deep one. Here, inflation could either decline along with activity or stay uncomfortably elevated on lingering structural/supply-related factors. While the specific economic conditions (and the Fed's reaction function) will be telling, the dollar would likely find support amid elevated volatility and risk aversion.

No landing: Here but for how long?

US data releases in February have been clear – the labor market is still tight, and disinflation is not a straight line. Fed expectations have re-priced higher, and the USD has rallied accordingly. While this “no landing” scenario likely implies either a hard or soft landing down the road, the longer it persists, the better the dollar should do.

01 March 2023

G10 FX Strategy
Global

Alex Cohen
FX Strategist
BofA
alex.cohen2@bofa.com

DXY = US Dollar Index

FRBNY = Federal Reserve Bank of
New York

PMI = Purchasing Managers Index

FRBNY = Federal Reserve Bank of
New York

Trading ideas and investment strategies discussed herein may give rise to significant risk and are not suitable for all investors. Investors should have experience in relevant markets and the financial resources to absorb any losses arising from applying these ideas or strategies.

BofA Securities does and seeks to do business with issuers covered in its research reports. As a result, investors should be aware that the firm may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision.

Refer to important disclosures on page 10 to 11.

12524278

Timestamp: 01 March 2023 01:00AM EST

Various landing scenarios and the USD

The dollar has performed a hard U-turn to start the year, as a wave of upside US data has injected uncertainty over which path of inflation and growth will be realized and how the Fed will respond.

Challenging inflation and growth dynamics point to rising policy uncertainty as the global monetary tightening cycle matures. As the data has evolved, so too has the debate over which landing scenario will ultimately come to fruition later this year. These can generally be bucketed into A) “hard landing,” B) “soft landing,” and the emerging C) “no landing” scenarios. Each one presents notably distinct economic conditions, with differing implications for the dollar.

While market consensus and our own forecasts (see the report, [World at a Glance: The Hot Winter 22 February 2023](#)) call for the dollar to depreciate later this year and next, the current economic backdrop suggests potentially more upside risks to our forecasts into 2H 2023, as two of these three scenarios would likely be constructive for the dollar.

How we got here

The reasons for the dollar’s decline from cyclical highs in the fall of 2022 are justifiable. Passing peak inflation in the US amid China reopening and improved economic and energy prospects in Europe has served to notably reduce the risk premium that supported the dollar in 2022. Global energy prices have fallen, and supply chains have thawed. And financial market volatility across FX, rates and equities has reduced. As far as currency markets are concerned, as we move further into 2023, these factors will likely have diminished impact on price action, particularly as new risks emerge.

Among the most influential factors for the dollar has been the evolution of inflation and the concurrent assessment and impact of Fed policy. Passing peak inflation saw a market narrative evolve from the Fed “pivoting” to a smaller magnitude of hikes, to “pivoting” to a possibly lower terminal rate, to “pivoting” to expected rate cuts in H2 2023. As the magnitude of Fed hikes declined from 75 to 50 to 25 bp increments, so too did the dollar.

The dollar’s recent low corresponded with the February Federal Open Market Committee (FOMC) press conference, where markets latched on to Chair Powell’s lack of pushback on market pricing, his clear recognition of deflationary forces, and a step back from rigid “higher-for-longer” forward guidance. Since that time, however, top-tier US data surprises have served to remind the market that passing peak inflation is not the same as a straight-line move to the 2% target. Both pricing and the dollar have adjusted higher accordingly.

A closer look at the landing scenarios

As noted, the three broad scenarios of “hard,” “soft,” or “no” landing pose different paths for the dollar. While stopping short of taking on the fool’s errand of prescribing hard probabilities to each one, looking at them in turn can nonetheless be helpful in framing possible outcomes for the dollar later in the year.

The following table (Exhibit 1) summarizes the general characterization of these scenarios and their possible implications for the Fed, risk assets, and the dollar.

Exhibit 1: “Soft,” “hard,” and “no landing”

Hard and no landing should be constructive for the USD

Scenario	Growth	Inflation	Fed Policy	Risk Asset Performance	USD
Soft Landing	Lower growth but recession avoided; payrolls remain positive	Gradual disinflation towards 2%	lower terminal rate; pivot to rate cuts	Supported on 'no recession' and monetary easing	Declines on better risk appetite and lower rates
Hard Landing	Recession; negative payroll growth	Either a) persistent (stagflation) or b) disinflation with decreased activity	Faster pivot to rate cuts	Entering recession weighs on risk assets	Despite rate cuts, dollar appreciates on broader 'risk off'
No Landing	Activity remains robust; payroll growth elevated	Remains sticky on the way down	"Data dependent" stance keeps policy tighter for longer	Opposing forces: risk supported by growth resilience; weighed on by higher rates and potential hard landing	Supported by higher rates and increased probability of risk aversion down the road

Source: BofA Global Research

BofA GLOBAL RESEARCH

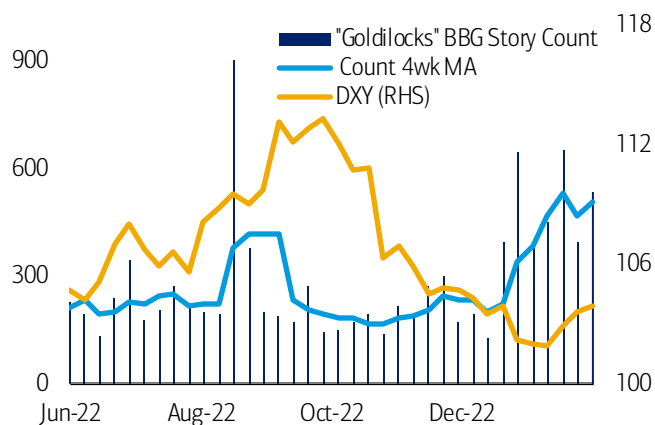
A soft landing:**Bodes well for risk assets, not so much the USD**

A soft landing (so-called “Goldilocks” in market parlance) would likely be the most constructive for risk assets and least constructive for the dollar (Exhibit 2). Here, the inflation situation more or less works itself out gradually, along with the monetary tightening currently in the system already, and broad recession is avoided. Payroll growth declines but remains positive, and wage pressure is alleviated, thus ensuring that a wage-price spiral is avoided.

Arguably, this was a prevailing or at least growing base case for markets at the start of the year (before the clear surge in US data). Equities rose ~9% over the first 5 weeks of the year, Treasury yields were relatively rangebound, and the dollar (DXY) declined to cyclical lows (Exhibit 3).

Exhibit 2: BBG’s “Goldilocks” story count & USD

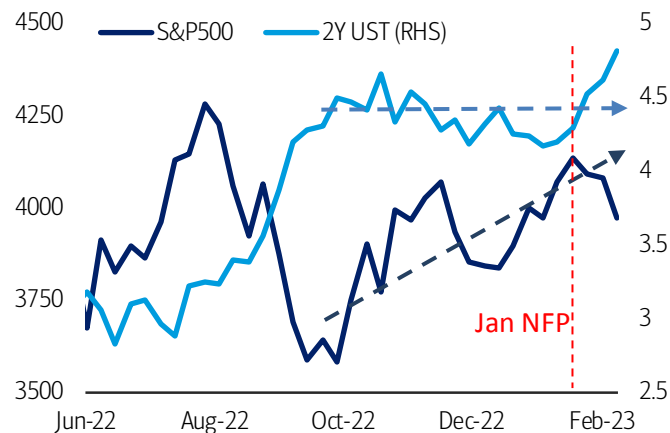
Dollar depreciates amid January soft-landing narrative



Source: BofA Global Research, Bloomberg. BBG = Bloomberg. 4w MA = 4-week moving average.
BofA GLOBAL RESEARCH

Exhibit 3: S&P 500 & 2Y UST

Steady rates and rising equities in Q4 2022 and early 2023



Source: BofA Global Research, Bloomberg. Y = year. UST = US Treasury.

BofA GLOBAL RESEARCH

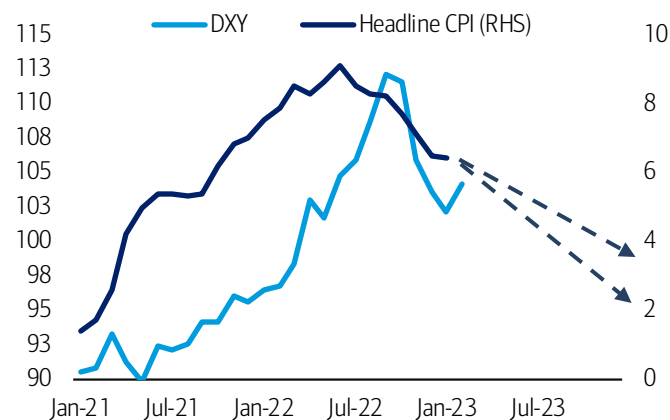
Assumes steady disinflation...

From an inflation perspective, realization of a true soft landing would arguably correspond with inflation trending down towards the 2-3% range sometime towards the end of the year (Exhibit 4). In this scenario, using the current 5.27% market-implied Fed Funds effective rate for the December 2023 FOMC meeting date would produce a real effective Fed Funds rate of roughly 2-3%. By today's conventional wisdom, this would

be seen as still highly restrictive, as the [Fed continues to assess the long-run Fed Funds rate \(nominal\) at 2.5%](#), implying a real neutral rate of 0.5%. As inflation peaked, expectations for a soft landing are one reason why the market was pricing rate cuts from the terminal rate in H2 2023 (Exhibit 5). Much of the dollar's decline since October, and many forward-looking derepcaiton forecasts, were predicated on this scenario. However, as Exhibit 5 shows, these cuts have been pushed further out, and terminal has repriced higher, suggesting reduced expectations for steady disinflation.

Exhibit 4: CPI & DXY

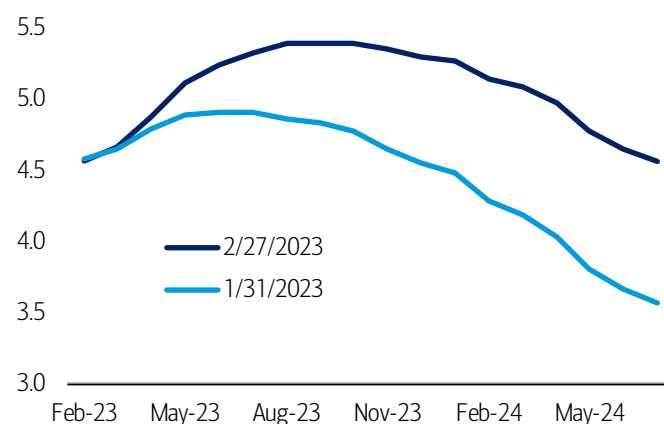
Steady inflation decline likely to correspond with dollar depreciation



Source: BofA Global Research, Bloomberg. CPI = Consumer Price Index. DXY = Dollar Index.
BofA GLOBAL RESEARCH

Exhibit 5: Fed Funds futures curve

Rapid Fed cuts from terminal priced to start the year; gradually pushed out since



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

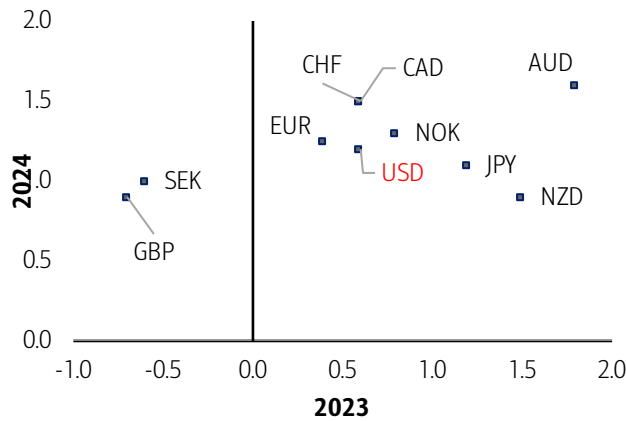
... And low but non-recessionary growth

From a growth perspective, soft landing scenarios continue to be reflected in economic forecasts to a large degree. Looking at gross domestic product (GDP), this is evident not just for the US but for many other G10 economies as well. Median real GDP projections for 2023 and 2024 suggest expectations for positive real growth for all G10 countries in 2024 and in 2023, for all except the UK and Sweden, countries where various structural and cyclical headwinds are prevalent (Exhibit 6; see also the reports, [FX Viewpoint: GBP in 2023: More of the same? 13 February 2023](#) and [FX Viewpoint: SEK in 2023: threat now, opportunity \(maybe\) later 12 January 2023](#)). Countries where GDP forecasts are the highest – perhaps unsurprisingly – are those with greater proximity to China (Japan, Australia, New Zealand). This is consistent with the “China reopening” theme, which was also a notable factor bringing the dollar lower in Q4 2022.

Unemployment forecasts, however, paint a more mixed picture. For some economies (the Euro area, Switzerland, and Japan), forecasts call for little or only a moderate rise in the unemployment rate from current levels into 2024, while other countries do not look as favorable. Here, the US does stand out, as 2024 median forecasts imply a rate of 4.8%, higher than the current, albeit historically low, reading of 3.4% (Exhibit 7). However, as relates to the dollar itself, this is likely a supportive factor, given the dollar's inverse relationship with risk – i.e., the other half of the “dollar smile” (see below).

Exhibit 6: Consensus growth projections

Modest but positive growth projections for most countries in 2023 & 2024

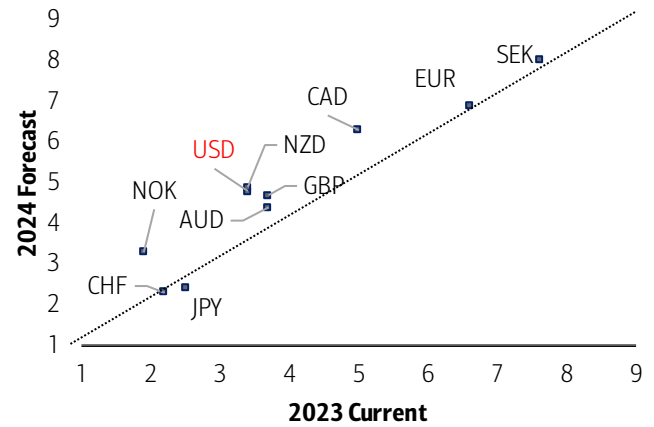


Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 7: Current unemployment versus consensus projections

US unemployment expected to rise in 2024



Source: BofA Global Research, Bloomberg

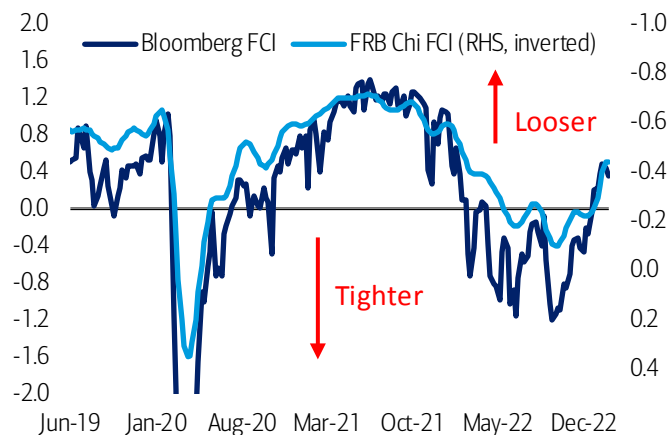
BofA GLOBAL RESEARCH

Risks to a soft landing are... a hard landing, of course

One plausible way that a soft landing can become a hard one is the financial conditions virtual (vicious?) circle. Financial conditions have long been cited by Fed officials as an essential watchpoint. Too loose financial conditions (buoyant equities, easy credit, weak dollar, etc.) introduce challenges to fighting inflation, as they can serve as a catalyst for upside wage pressure. While Chair Powell has frequently cited the net tightening in financial conditions over the past year in the Fed's attempt to rein in inflation, the looser trend over the past few months should speak to an even tighter policy stance as inflation expectations rise, all else equal (Exhibit 8). Indeed, [minutes to the February FOMC meeting](#) indicated that "a number of participants observed that financial conditions had eased in recent months, which some noted could necessitate a tighter stance of monetary policy." Thus far, market-based measures of inflation expectations remain relatively anchored, though implied rates based on US inflation swaps have crept up recently amid upside US data surprises (Exhibit 9).

Exhibit 8: US financial conditions

Financial conditions starting to ease, following notable tightening over past year

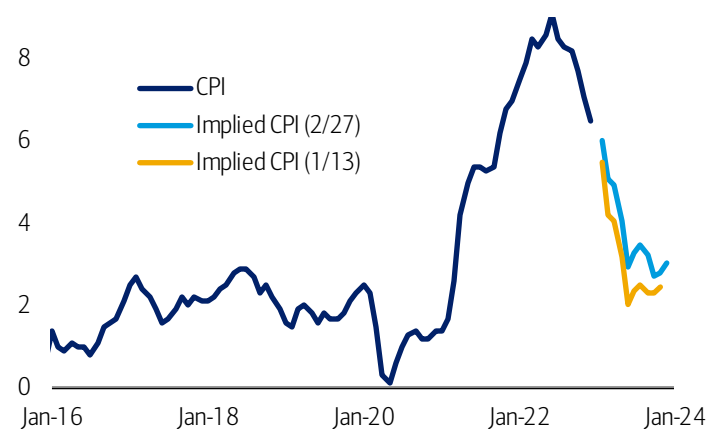


Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 9: CPI & inflation swap pricing

Market-implied inflation expectations contained yet creeping higher



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

A hard landing:

Could see differing inflation paths...

In a hard landing, the ultimate path of inflation is more ambiguous. In one state of the world, the Fed hikes (and subsequently cuts) generally in line with its stated guidance/market expectations. Here, inflation and aggregate demand both roll over concurrently, as monthly payrolls start to trend negative, and growth data reflects further contraction. Deeper rate cuts are realized in this environment, which would only partly weigh on the dollar to the extent that they are not offset by similar cuts abroad and broad risk aversion.

Another possible path, and one that is even less desirable is where inflation remains highly sticky for more structural or supply-side reasons. This scenario would present clear policy challenges for central banks. A Fed committed to bringing inflation down would need to keep rates at restrictive levels, potentially even more than is currently priced. This would likely be done to bring the labor market into balance in a more concerted way, potentially forcing an even deeper recession.

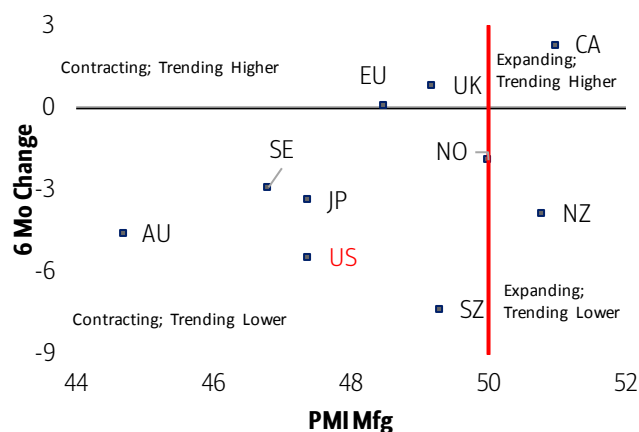
...As growth contracts

While not portending a hard landing in and of itself, global Purchasing Manager Index (PMI) data does suggest that some recessionary forces are at play. Contractionary conditions (sub-50 reading) in manufacturing PMIs are prevalent for all G10 economies, except Canada and New Zealand, and all but Canada have been trending lower over the past 6 months (Exhibit 10). In contrast, services PMIs imply expansion in each economy, except Australia and the UK (Exhibit 11). While this dichotomy implies more balanced activity, it clearly introduces difficult tradeoffs for central banks. With inflation driven by the services sector, tighter monetary policy responses would still serve to further tighten manufacturing activity, all else equal.

Looking at a broader set of economic supports this view. In our report ([Liquid Insight: One-of-a-kind recession 13 February 2023](#)), we show that leading indicators have now turned negative for the first time since COVID. Historically, this has led to negative QoQ GDP 90% of the time, along with a clear dollar uptrend over the ensuing 12-month horizon.

Exhibit 10: G10 Manufacturing PMIs

PMI Manufacturing readings sub-50 and trending lower in most G10 economies

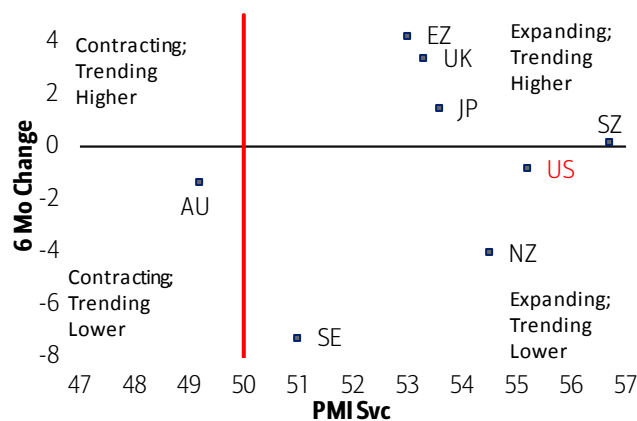


Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 11: G10 Services PMI

PMI Services readings above 50 in most G10 economies



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

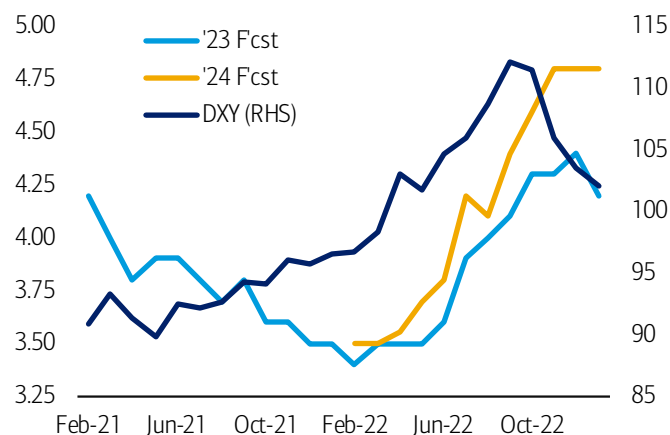
With the USD supported regardless

Indeed, irrespective of the inflation path, flight to safety and liquidity would be a sizable tailwind for the dollar on net, despite the potential for a drop in interest rates. This assumes that such a state of the US would be felt similarly, if not more severely elsewhere (i.e., no “decoupling”). As forecasts for future US unemployment have risen (see discussion

above), so too has the dollar (Exhibit 12). Policy uncertainty and presumable financial market volatility would clearly correspond to dollar strength (Exhibit 13).

Exhibit 12: DXY & US Unemployment Forecasts

As unemployment forecasts rise, so too does the dollar

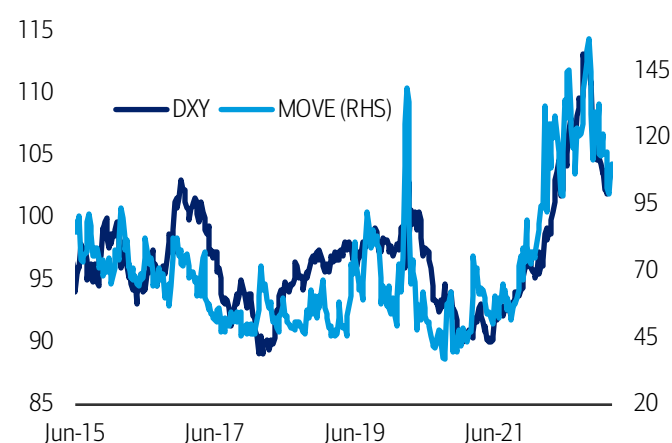


Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 13: DXY and MOVE Index

Policy uncertainty, as measured by rate volatility, benefits the dollar



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Hard landing could bring back “Fed put” and/or further fiscal support

A hard landing scenario would likely see the Fed cut rates significantly in an attempt to steer back towards a soft-landing outcome. In this scenario, perhaps the more significant risk factors would be more long term and structural in nature. Depending on the state on inflation, Fed (and other central bank) credibility could come into question, if they are seen as choosing to set policy more in line with the “Fed put.” Preserving inflation fighting credibility would entail relatively tighter policy, risking an even deeper recession down the road. Elsewhere, a hard landing raises the potential for even more fiscal stimulus on top of what is already viewed as a relatively loose stance, which likely would not be as constructive for the dollar, all else equal.

No landing:

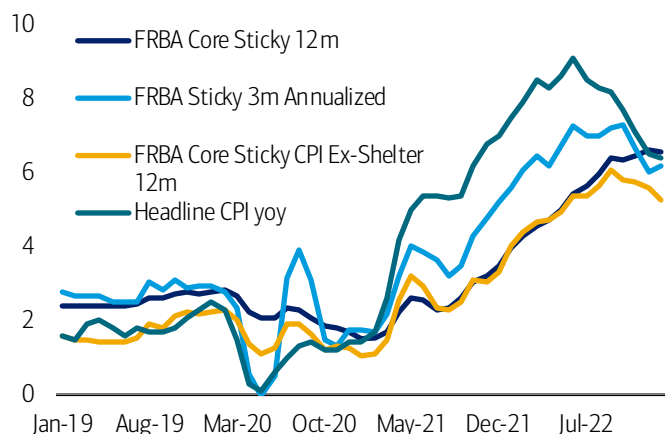
Here but for how long?

Finally, a scenario getting a lot of attention recently, mainly due to recent signs of US economic resilience, is the “no landing” scenario. Here, inflation stays elevated or declines only modestly, while activity and employment data remain elevated, even amid more aggressive Fed policy. However, “no landing” is possibly a misleading term in relation to the others. Unlike “soft” and “hard” landings, “no landing” arguably refers to the journey, rather than the destination. One could safely assume that it would only be a matter of time before either inflation is forced lower or a policy-induced recession emerges. Or both.

Headline and core Inflation has declined, of course, but has thus far been uneven and sticky. As has been widely noted, going from, say, 6% to 4%, for example, is much easier than going from 4% to 2% – particularly when energy has already fallen significantly and the beneficiary impulse from thawing of supply chains has mostly occurred already. As Dallas Fed President Logan recently remarked, “Supply chains can’t recover twice, so I don’t see 3 percent deflation in core goods as sustainable.” The presence of sticky services inflation that we have been citing for some time is persisting. Readings in the Atlanta Fed series appear to be topping out but clearly have not come down with CPI (Exhibit 14). Likewise, year-ahead expectations (both Federal Reserve Bank of New York and University of Michigan surveys), another key watchpoint for the Fed, have not de-anchored but are still well above 2% (Exhibit 16).

Exhibit 14: Headline CPI & sticky inflation

Inflation has peaked but remains sticky

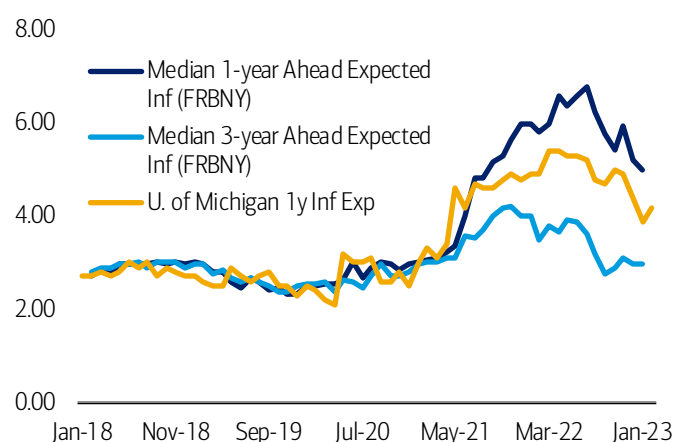


Source: BofA Global Research, Atlanta Fed, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 15: Inflation expectations

inflation expectations are not unanchored but still above 2%



Source: BofA Global Research, FRBNY, Bloomberg

BofA GLOBAL RESEARCH

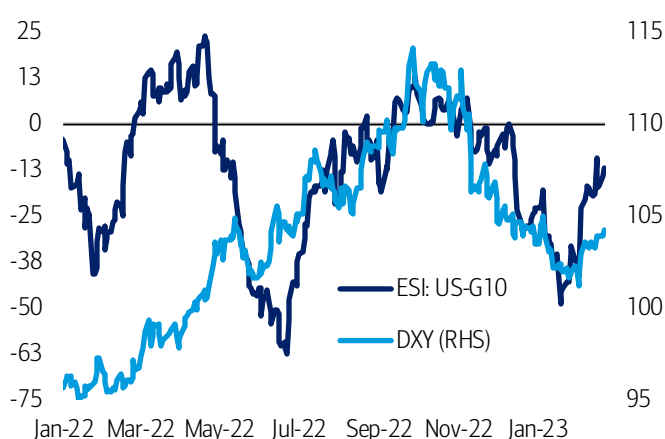
Has been dollar supportive

As for the dollar, its recent (albeit nascent) appreciation could be viewed through the “no landing” lens, with equities and credit losing momentum but not collapsing, as higher terminal and less short-end curve inversion (see the report, [Liquid Insight: US rates and re-acceleration risk 22 February 2023](#)) support the dollar.

Indeed, as US data surprises have both materialized and surpassed those of other G10 economies, interest rates have adjusted accordingly, with the DXY-weighted 1y1y overnight index swap (OIS) rate differentials rising back to levels last observed in December 2022 (Exhibit 16, Exhibit 17). This suggests some two-way risk for the USD in this scenario, partly as “data dependence” can impact markets in either direction, partly as “no landing” can keep some investors in a “risk-on” mentality.

Exhibit 16: Economic surprises & the DXY

Dollar supported by recent US growth outperformance

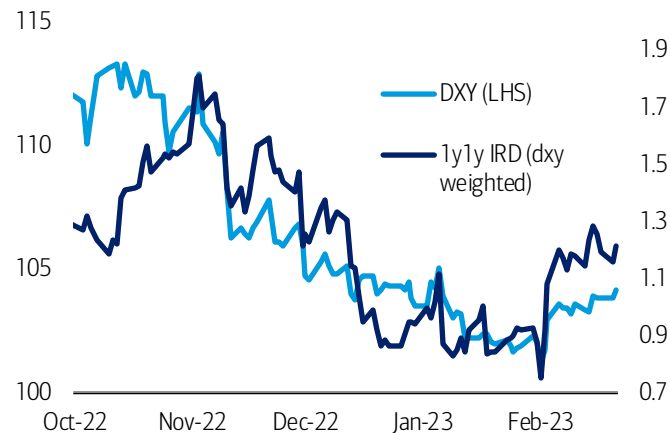


Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 17: Interest rate differentials & the DXY

Dollar rising with rate differentials



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Risks to the “no landing” scenario are inherent, as either a soft or hard landing should ultimately materialize. BofA Global Research’s economists expect a recession starting sometime in mid-2023. And while our Fed terminal rate call has recently been upwardly revised by 25 basis points to a target range 5.50-5.75%, we are not calling for cuts until March 2024 (see the report, [Federal Reserve Watch: February FOMC minutes: The bar for 50bp remains high 22 February 2023](#)). BofA Global Research’s Global Investment Strategy

team sees the “no landing” scenario playing out through H1, before giving way to “hard landing” in H2 (see the report, [The Flow Show: Next stop 3.8k 16 February 2023](#)).

Looking ahead

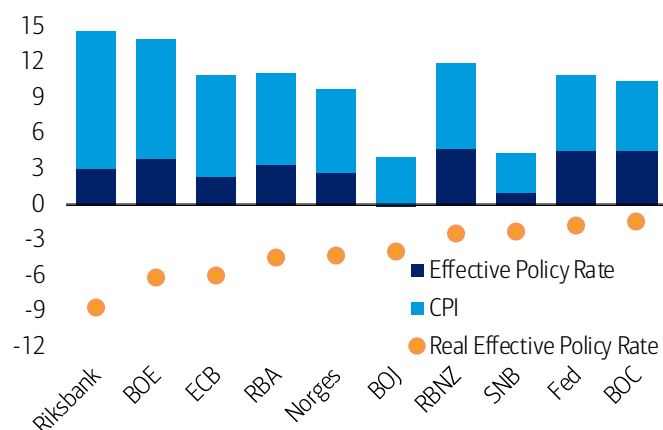
Real rate support should continue

Contemplating the potential scenarios above and how global policymakers might react suggest a potentially narrowing path towards dollar depreciation and hence upside risks. As we have been arguing, currencies should do well where monetary policy is seen as committed to staying the course on inflation fighting (see the report, [Global FX Weekly: Waiting for landing 17 February 2023](#)). If current and projected policy stances are any indication, we can make some inferences about where the market sees vulnerabilities. In this regard, Fed credibility does not appear to be in question at present. With the G-10, Fed policy is among the tightest relative to current inflation readings (Exhibit 18). Consensus projections for both monetary policy and inflation imply expectations for the US and Canada to be the only economies with positive real policy rates in 2023 and 2024 and the Fed to be the highest this year (Exhibit 19).

Shorting the dollar (versus G-10) is a negative carry proposition and risks exposure to risk-off moves. Also, it would be likely be associated with an investment thesis predicated on other central banks (CBs) bringing real policy rates notably closer in line with the Fed, amid challenging economic conditions. Absent clear signs on which landing we will get, the choppiness that we have seen thus far in the currency markets is likely to continue, and upside dollar risks should persist.

Exhibit 18: G10 real effective policy rates

Real fed funds among tightest in G10; still negative

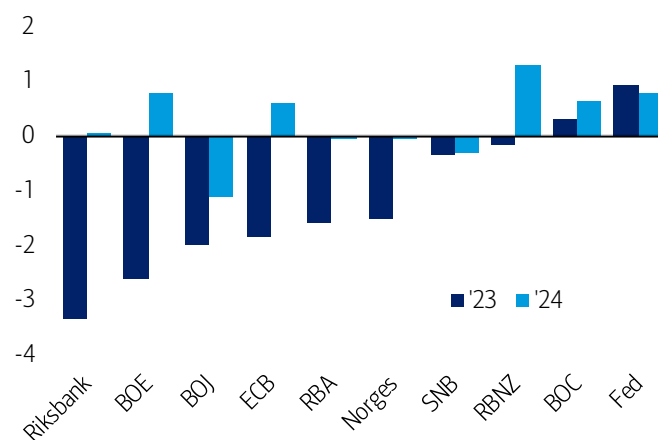


Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

Exhibit 19: 2023 & 2024 real policy rate forecasts

Forecasts imply positive real Fed Funds in 2023 & 2024



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.

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.

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.

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 n° 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.bofam.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 (HKSF); 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 HKSF; 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.

Futures and options are not appropriate for all investors. Such financial instruments may expire worthless. Before investing in futures or options, clients must receive the appropriate risk disclosure documents. Investment strategies explained in this report may not be appropriate at all times. Costs of such strategies do not include commission or margin expenses.

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.

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:

Copyright 2023 Bank of America Corporation. All rights reserved. iQdatabase® is a registered service mark of Bank of America Corporation. This information is prepared for the use of BofA Securities clients and may not be redistributed, retransmitted or disclosed, in whole or in part, or in any form or manner, without the express written consent of BofA Securities. BofA Global Research information is distributed simultaneously to internal and client websites and other portals by BofA Securities and is not publicly-available material. Any unauthorized use or disclosure is prohibited. Receipt and review of this information constitutes your agreement not to redistribute, retransmit, or disclose to others the contents, opinions, conclusion, or information contained herein (including any investment recommendations, estimates or price targets) without first obtaining express permission from an authorized officer of BofA Securities.

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 or 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.