

## FX Viewpoint

## The EUR struggle: outlook for the rest of the year

**EUR outlook and drivers: weak vs. USD for now**

The EUR is not weak, the USD is strong. Weak Eurozone data point to short-term EUR risks. Despite weak data, Eurozone inflation remains persistent. ECB monetary policy not tight enough to support the EUR. Eurozone fiscal policy not tight enough to help the ECB reduce inflation. Eurozone inflation expectations have increased. Real rate differentials would justify a weaker EURUSD. We stick to our end-year EURUSD forecast of 1.05, vs. a recently revised downward consensus of 1.10. Main risks have to do with timing and details of necessary landing.

**Flows & positioning: EUR selling but Real Money still long**

EUR flows have been negative this year, not only for investors and particularly Hedge Funds, but also for officials and corporates. Yet EUR positioning remains modestly long, driven by Real Money, who have only modestly pared back their EURUSD longs this year. This is the position around which we see risks going forward.

**Quant: bearish EURUSD signals**

Option flow shows notable shift from greater demand for EURUSD calls to puts around mid-May. More recently, positioning analysis also flagged the first bearish continuation signal for EURUSD in 2023. In addition to bearish EURUSD, fading EUR strength vs G10 high-betas is also worth considering from a quant perspective.

**Vol: long-dated EUR vol show value at current level**

After having bottomed out in first half of 2023, 1y EUR implied vols picked up quickly amid EUR spot-to-vol correlation turning negative. We still see value in owning long-dated EUR vols vs CAD, GBP, USD, NZD and AUD.

**Technical: EUR to struggle into year-end**

We see EUR sideways to lower into yearend. EUR uptrend since October 2022 bottom broke in August 2023. Sell rallies/fade resistance levels for decline to 1.0635 / 1.0516.

07 September 2023

G10 FX Strategy  
Global

**Athanasios Vamvakidis**  
FX Strategist  
MLI (UK)  
+44 20 7995 0279  
[athanasios.vamvakidis@bofa.com](mailto:athanasios.vamvakidis@bofa.com)

**Paul Ciana, CMT**  
Technical Strategist  
BofAS  
[paul.ciana@bofa.com](mailto:paul.ciana@bofa.com)

**Howard Du, CFA**  
G10 FX Strategist  
BofAS  
[yuhao.du@bofa.com](mailto:yuhao.du@bofa.com)

**Michalis Rousakis**  
FX Strategist  
MLI (UK)  
[michalis.rousakis@bofa.com](mailto:michalis.rousakis@bofa.com)

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 12 to 13.**

12600357

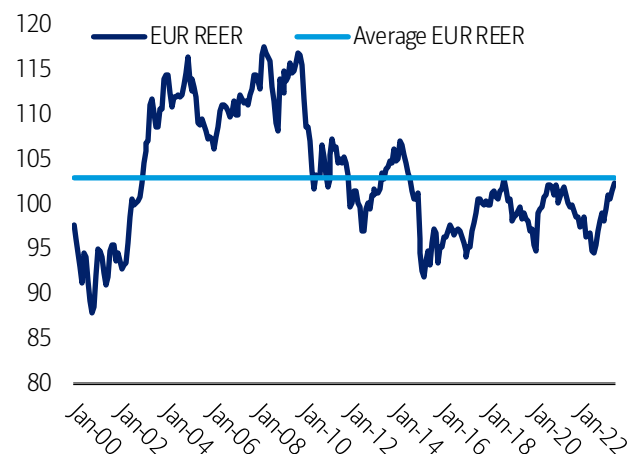
Timestamp: 07 September 2023 01:00AM EDT

## EUR outlook and drivers: weak vs. USD for now

The EUR is not weak, the USD is strong. EURUSD is almost where it started the year, after having gone through a roller-coaster. EURUSD is stronger than last year, but most of this move took place by December. In real effective terms (REER), the EUR is at its historic average (Exhibit 1). In nominal effective terms (NEER), the EUR is historically strong (Exhibit 2)—the difference has to do with historically lower Eurozone inflation compared with its trading partners.

### Exhibit 1: EUR Real Effective Exchange Rate (REER)

EUR Real Effective Exchange Rate (REER) back at historic average

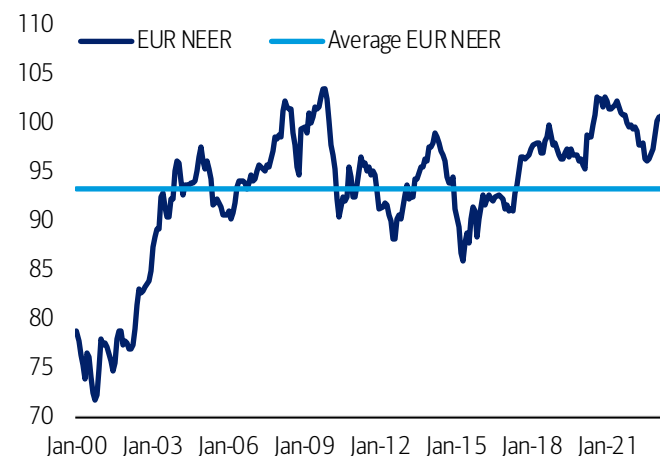


Source: BIS

BofA GLOBAL RESEARCH

### Exhibit 2: EUR Nominal Effective Exchange Rate (NEER)

EUR Nominal Effective Exchange Rate (NEER) historically strong



Source: BIS

BofA GLOBAL RESEARCH

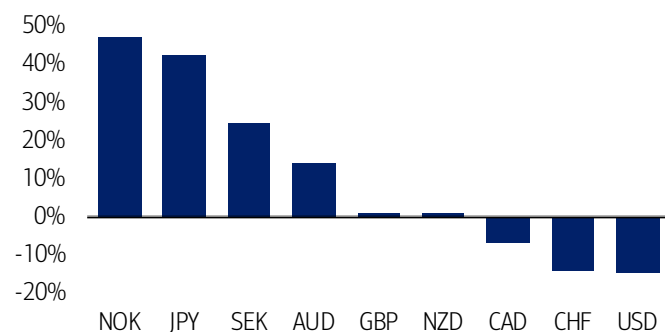
Indeed, equilibrium estimates confirm that the EUR is not weak across the board.

Estimates from our BEER model suggest that the EUR is overvalued against NOK, JPY, SEK, AUD, undervalued against USD, CHF, CAD, and broadly at equilibrium against GBP and NZD (Exhibit 3). Against the USD, the EUR is undervalued by about 14% (Exhibit 4).

(for details on methodology, please see [FX Viewpoint: Updating G10 FX equilibrium 20 April 2023](#)). To a large extent, EURUSD weakness has to do with USD strength.

### Exhibit 3: EUR overvaluation estimates based on BEER model

EUR overvalued vs. NOK, JPY, SEK, AUD, undervalued vs. USD, CHF, CAD

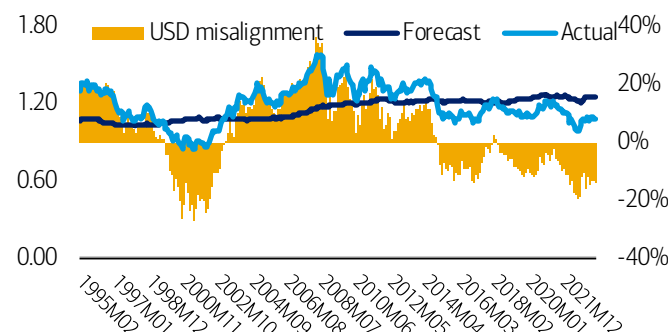


Source: BofA Global Research

BofA GLOBAL RESEARCH

### Exhibit 4: EURUSD misalignment estimates based on BEER model

EURUSD undervalued by about 14%



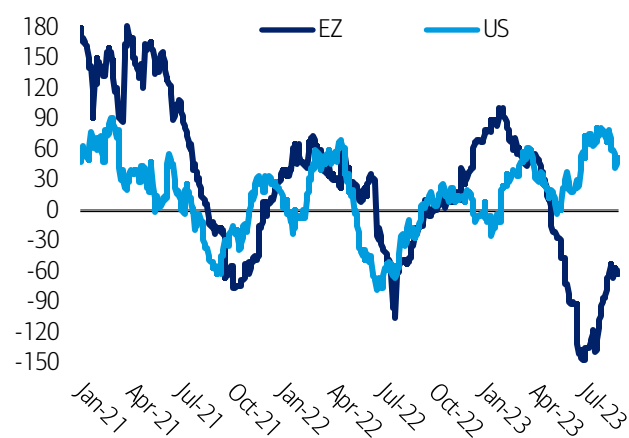
Source: BofA Global Research

BofA GLOBAL RESEARCH

Weak Eurozone data point to short-term EUR risks. The Eurozone data has consistently surprised negatively in recent months, particularly compared with data in the US (Exhibit 5). PMIs point to weaker growth in both, but more so in the Eurozone (Exhibit 6). China's very weak recovery during the reopening could weigh on Eurozone data even more in the rest of the year. The recent increase in energy prices will cause a deterioration of the Eurozone's terms of trade, compared with an improvement earlier this year.

**Exhibit 5: Data surprises**

Eurozone data has been surprising negatively, particularly vs. the US

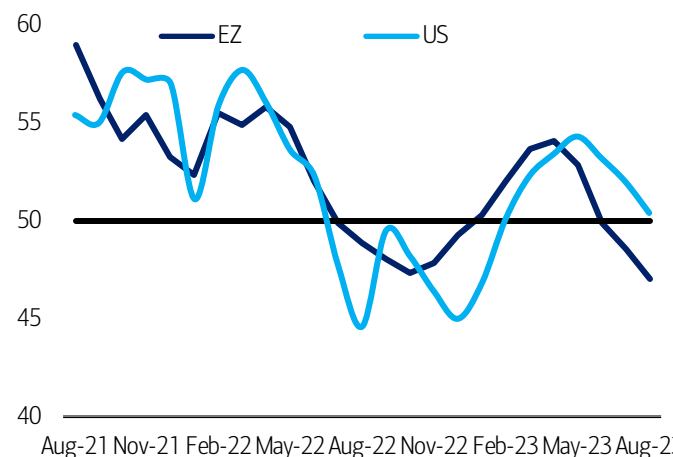


Source: Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 6: Composite PMI**

Eurozone PMIs weaker than in the US



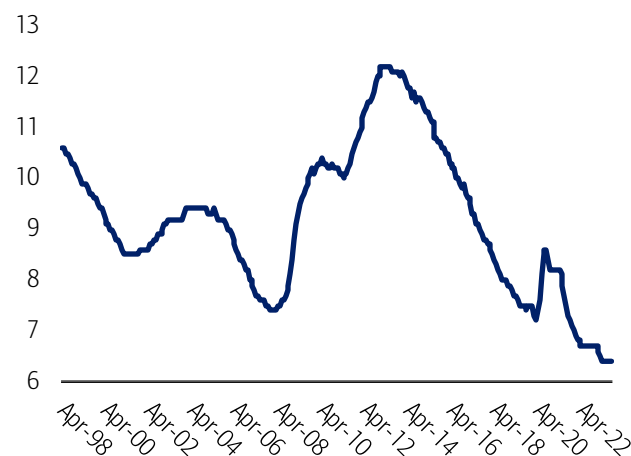
Source: Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

Despite weak data, Eurozone inflation remains persistent. The Eurozone labor market remains stretched, with the unemployment rate at an all-time-low (Exhibit 7). Headline inflation has dropped, but this is mainly because of the drop in energy prices earlier in the year, which is now reversing. Core inflation remains stuck well above 5% and higher than in the US (Exhibit 8).

**Exhibit 7: Eurozone unemployment rate**

Eurozone unemployment rate at an all-time low

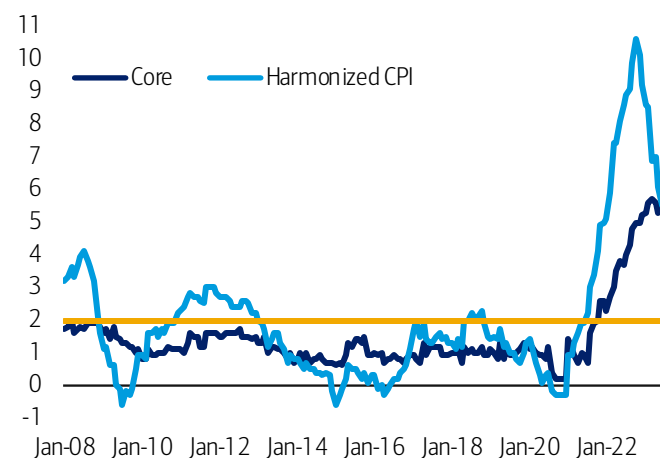


Source: Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 8: Eurozone inflation**

Eurozone headline inflation has declined, but core inflation seems stuck



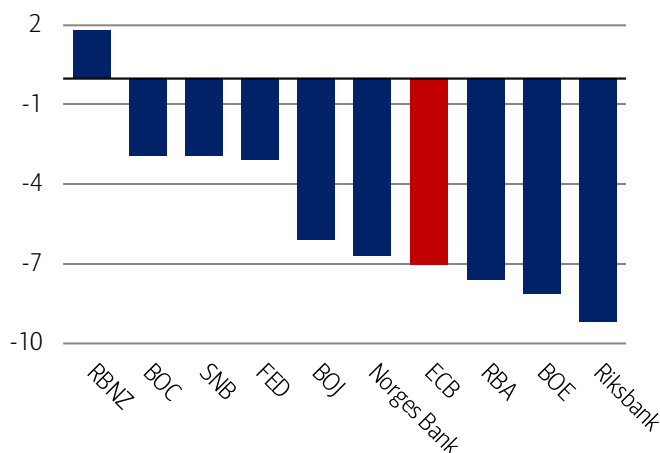
Source: Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

ECB monetary policy is not tight enough to support the EUR. Although the ECB has been more hawkish since last December, after being in denial for most of last year about persistent inflation risks and being the last G10 central bank except of the BoJ to stop QE and start hiking, it is hard to argue that they are doing more than other G10 central banks today. A Taylor rule spread suggests that the ECB monetary policy stance is not tight compared with the rest of G10, and particularly compared with that of the Fed (Exhibit 9). The same conclusion applies when we look at z-score Taylor spreads, which compares the monetary policy stance with its history for each G10 central bank (Exhibit 10). This is because of relatively high core inflation (which is what we use for the Taylor rule spread), historically low unemployment, and a policy rate that is still lower in the Eurozone than in a number of other G10 central banks, particularly that of the Fed.

**Exhibit 9: Taylor rule spread**

ECB monetary policy not tight vs. rest of G10 and particularly the Fed

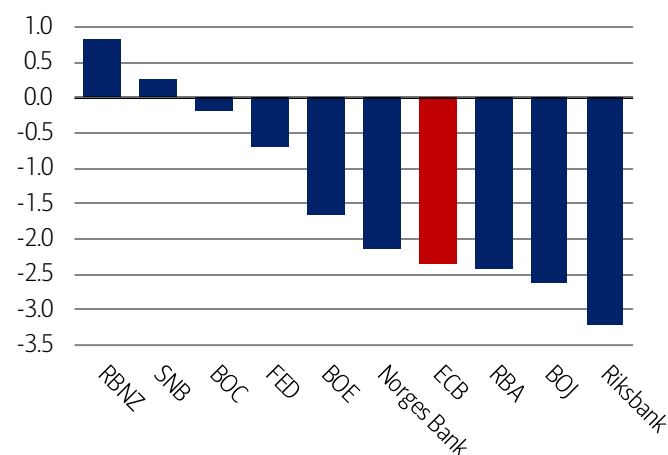


Source: Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 10: Taylor rule spread z-score**

ECB monetary policy not tight vs. rest of G10 or its own history, and particularly vs. the Fed



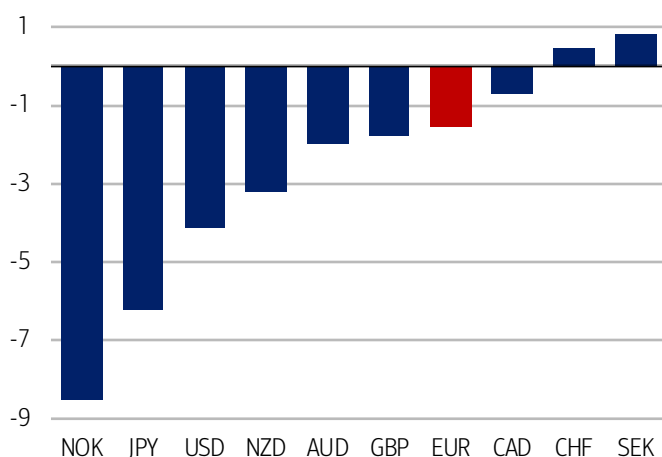
Source: Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

Eurozone fiscal policy is not tight enough in terms of what may be necessary to help the ECB reduce inflation. To be fair, fiscal policy is much looser in most other G10 economies and particularly in the US, based on the structural primary balance—primary balance adjusting for the cycle, as a share of potential GDP (Exhibit 11). However, this does not mean that Eurozone fiscal policy is appropriate given high and persistent inflation. Indeed, the Eurozone structural primary deficit is historically high (Exhibit 12). According to this measure, the Eurozone fiscal policy stance was too tight in the years after the global financial crisis and during the Eurozone crisis, which was an obvious and severe policy mistake. It was loose during the pandemic, which was clearly necessary to support the economy during the rolling lockdowns. However, it now remains loose, despite the recovery during the reopening, the drop in energy prices this year and persistent inflation. Looking forward, a lot depends on the reintroduction and reform of the EU fiscal rules, which however remains uncertain. For now, loose fiscal policy seems to be doing the ECB's job more difficult.

**Exhibit 11: G10 primary structural balance, 2023**

Eurozone fiscal policy not as loose as in some others in G10, but still loose

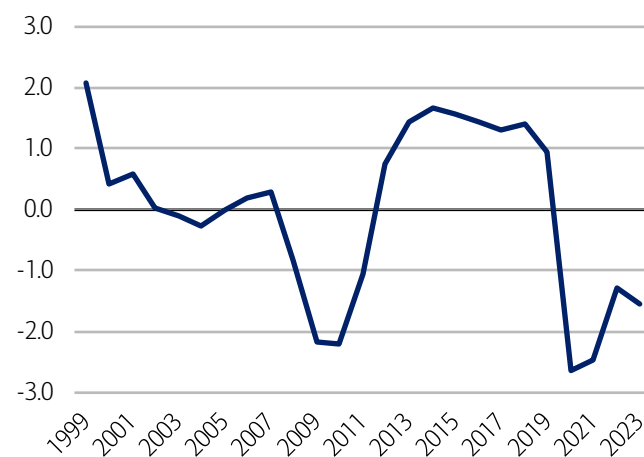


Source: IMF

BofA GLOBAL RESEARCH

**Exhibit 12: Eurozone primary structural balance**

Eurozone fiscal policy historically loose



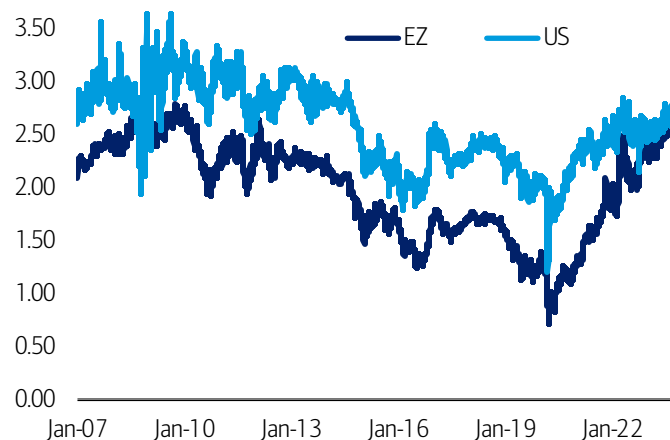
Source: IMF

BofA GLOBAL RESEARCH

Eurozone inflation expectations have increased. Market pricing based on 5y5y inflation swap rates suggests inflation expectations are at historically high levels (Exhibit 13). For the first time, they are equal to that in the US. The market does not seem to expect the ECB to reach/stick to its inflation target.

**Exhibit 13: 5y5y inflation swap rate**

Eurozone long-term inflation expectations at historic high

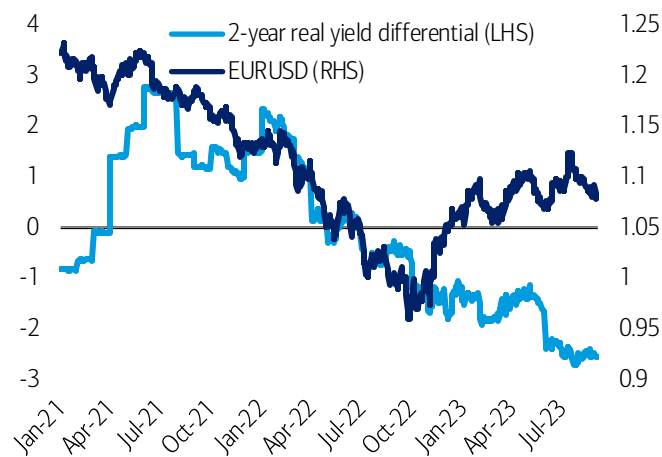


Source: Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

**Exhibit 14: EURUSD and real yield differentials**

Real yield differentials negative for EURUSD



Source: Bloomberg, BofA Global Research. Note: Real yields using latest core inflation rate.

BofA GLOBAL RESEARCH

Following the faster drop in US inflation, real rate differentials would justify a weaker EURUSD (Exhibit 14). Earlier in the year, higher inflation was supporting the EUR, as the ECB was still catching up. Now that both the ECB and the Fed are almost at their terminal rates—we expect one last hike from each by the end of the year—the market has shifted to pricing a higher probability for a hard(er) landing when inflation is sticky, weighing on the currency. If both central banks stick to their inflation target, which we assume they will, stickier Eurozone inflation needs a weaker economy to come down, which in turn is negative for the EUR. Indeed, compared with the US, the Eurozone seems on a path for a harder landing. This also points to a lower  $r^*$  (neutral rate of interest) in the Eurozone than in the US.

We stick to our end-year EURUSD forecast of 1.05, vs. a consensus of 1.10—we note that the consensus forecast has been revised down from 1.15 earlier this year. Although we expect EURUSD to eventually weaken, from our forecast of 1.05 this year to 1.15 next year and to the historic average and equilibrium estimate of 1.20 in 2025, this is mainly because we expect the USD to eventually weaken across the board, back to its long-term equilibrium. It is hard to argue for overall EUR strength based on where the EUR stands compared with most of the rest of G10—it is not weak—and the weak Eurozone data.

The main risk has to do with timing. Our key thesis remains. We need some landing of the economy, meaning higher unemployment, to get inflation all the way down, close to the target, in G10 economies. The timing and details of such landing compared with the rest of G10 are key risks for the EUR path forward.

**Flows & positioning: EUR selling but Real Money still long**

EUR positioning is modestly long and the second longest in G10 (Exhibit 15, Exhibit 16), according to our estimates. This is driven by Real Money, both according to our own data and the TFF (Traders in Financial Futures) report data for asset managers.

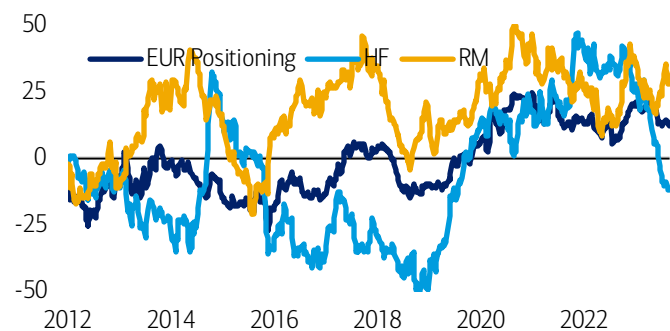
But investors—particularly Hedge Funds—have been selling the EUR this year, turning short EUR (Exhibit 17-Exhibit 19), with official and corporate flows also negative overall (Exhibit 20). Hedge Funds have sold the EUR mostly vs. GBP, USD, Scandies, and CAD. Real Money have somewhat pared back their EURGBP shorts and have also favoured JPY—but not the USD.

The bottom line is we see risks around the Real Money EURUSD longs given the much stronger US data and our disagreement with the pace of rate cuts priced for the Fed next year, both in absolute terms and relative to the ECB.



**Exhibit 15: EUR positioning**

EUR positioning modestly long, driven by Real Money. Hedge Funds short

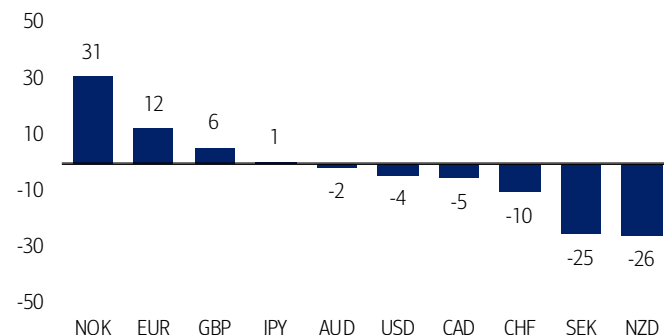


**Source:** BofA Securities, Bloomberg. Note: +50 (-50) represents a max long (short) positioning level relative to Jan-2012. Aggregate positioning for G10 currencies takes into BofA Securities proprietary FX flows data as well as CFTC and BofA Global Research FX & Rates Sentiment Survey data. For details, please see [Liquid Cross Border Flows: new look, same content 26 May 2021](#).

BofA GLOBAL RESEARCH

**Exhibit 16: Latest aggregate G10 FX positioning**

EUR positioning second longest in G10 but very modest

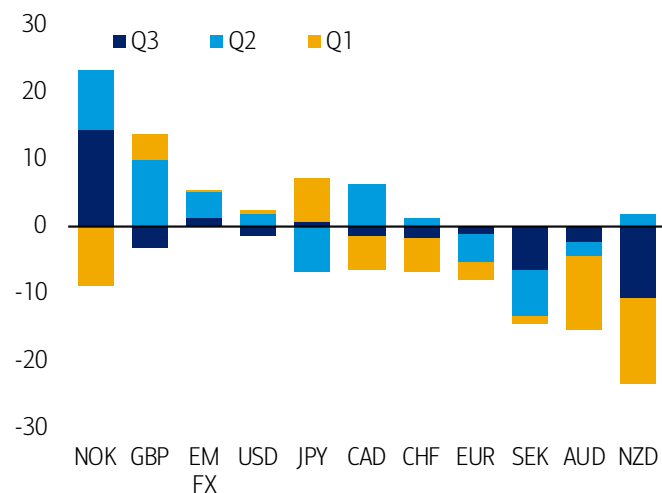


**Source:** BofA Securities, Bloomberg. Note: +50 (-50) represents a max long (short) positioning level relative to early 2012. Aggregate positioning for G10 currencies takes into BofA Securities proprietary FX flows data as well as CFTC and BofA Global Research FX & Rates Sentiment Survey data. For details, please see [Liquid Cross Border Flows: new look, same content 26 May 2021](#).

BofA GLOBAL RESEARCH

**Exhibit 17: Aggregate positioning changes by quarter this year**

EUR flows negative throughout 2023...

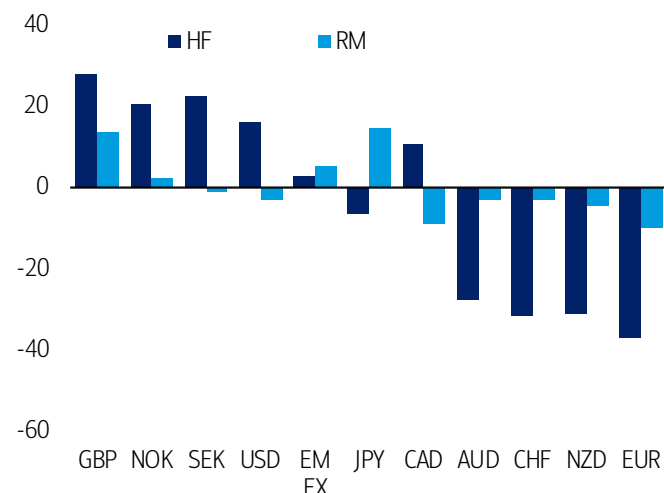


**Source:** BofA Securities, Bloomberg. We show changes in aggregate positioning by quarter. Currencies ranked on their year-to-date positioning change. For details, please see [Liquid Cross Border Flows: new look, same content 26 May 2021](#).

BofA GLOBAL RESEARCH

**Exhibit 18: Positioning changes by BofA investor type this year**

...with this true both for Real Money and, especially, Hedge Funds

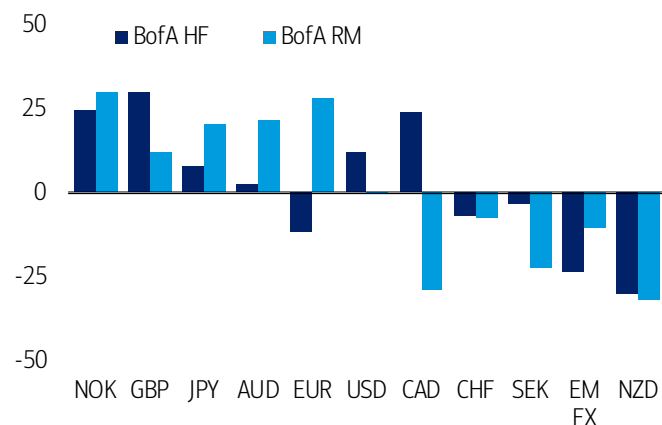


**Source:** BofA Securities. We show changes in aggregate positioning by quarter. Currencies ranked on the BofA investor year-to-date positioning change. For details, please see [Liquid Cross Border Flows: new look, same content 26 May 2021](#).

BofA GLOBAL RESEARCH

**Exhibit 19: Latest BofA investor FX positioning levels**

We see risks around the Real Money's EURUSD longs going forward

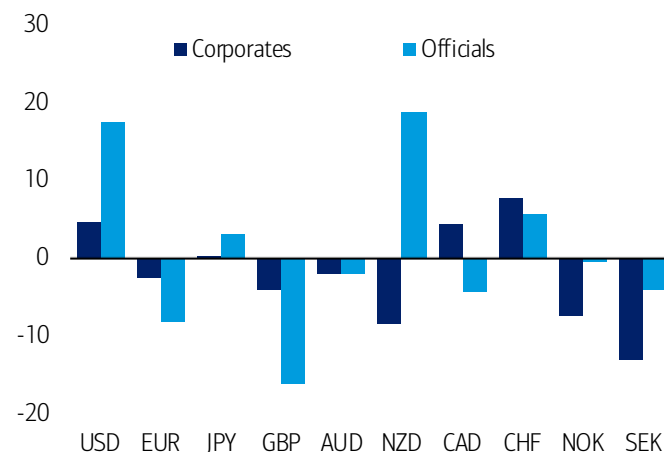


**Source:** BofA Securities. Note: +50 (-50) represents a max long (short) positioning level relative to early 2012. For details, please see [Liquid Cross Border Flows: new look, same content 26 May 2021](#).

BofA GLOBAL RESEARCH

**Exhibit 20: BofA corporate and official FX flows year-to-date (z-scores)**

Corporate and official EUR flows have been negative year-to-date



**Source:** BofA Securities. We sum the weekly (2-year) z-scores by currency and client type. For details, please see [Liquid Cross Border Flows: new look, same content 26 May 2021](#).

BofA GLOBAL RESEARCH

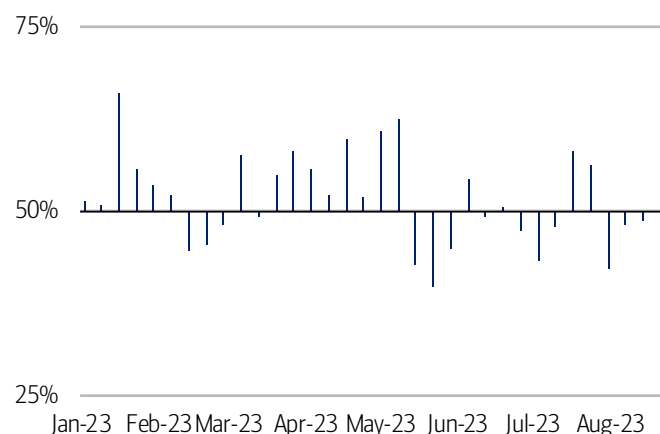
**Quant: bullish EUR sentiment is fading****EUR positioning turn notably bearish for the first time in 2023**

While the EUR had been one of the top performing currencies in G10 for most of this year, the bullish sentiment has petered out. From January to first week of May, weekly SDR option flow showed more demand for EURUSD calls than puts in 15 out of 19 weeks (Exhibit 21). Since then, the weekly call percentage ratio has skewed to below 50% (more demand for puts than calls) in 11 of the 15 weeks.

With EURUSD recently dedining back to a 1.08-handle, the pair entered a downtrend, according to MAA (moving average aggregate). Our positioning analysis shows bearish EURUSD signal for the first time in 2023 (Exhibit 22), as both up/down vol (UD) and residual put skew (RS) indicators rose to above 50<sup>th</sup> percentile while downtrend formed for spot. Higher realized volatility to the downside and rising put skew vs spot depreciation suggest more short-term weakness for the EUR.

**Exhibit 21: SDR flow shows more demand for EURUSD put started to emerge after May 2023**

Weekly EURUSD call percentage ratio

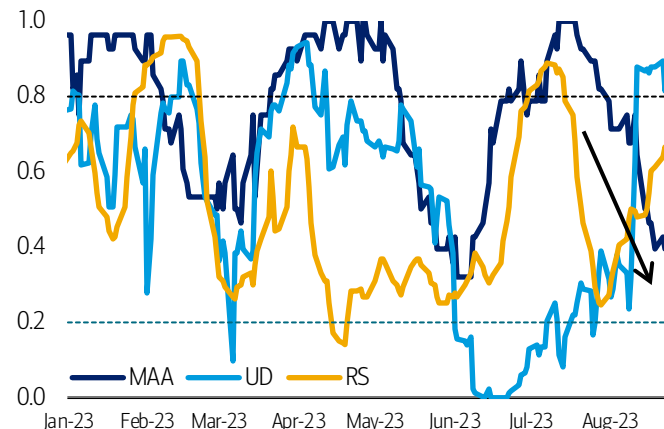


Source: BofA Global Research, Bloomberg, DTCC.

BofA GLOBAL RESEARCH

**Exhibit 22: For the first time in 2023, positioning turns bearish for EURUSD with MAA below 50, up/down vol and residual skew above 50<sup>th</sup> percentiles**

EUR/USD positioning analysis



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

**Also consider fading EUR strength vs the high-beta currencies in G10**

Even more notable than the gain for EURUSD, the EUR trade-weighted index has reached its highest level since 1999 (Exhibit 23). Beyond EURUSD, the EUR has also made sizable gains vs AUD, NZD, and NOK this year. The combination of US recession concerns and weak economic data in China had weighed on these high-beta currencies. But with our US economists raising US growth outlook out of a mild recession ([US Economic Viewpoint: 02 August 2023](#)) and CNY already weakening close to our current peak USD/CNY forecast ([Asia FI & FX Strategy Watch: 24 August 2023](#)), investors could also consider fading EUR strength vs these G10 high-beta peers, in our view.

**Exhibit 23: EUR TWI reached the highest level since 1999**

EUR trade-weighted index

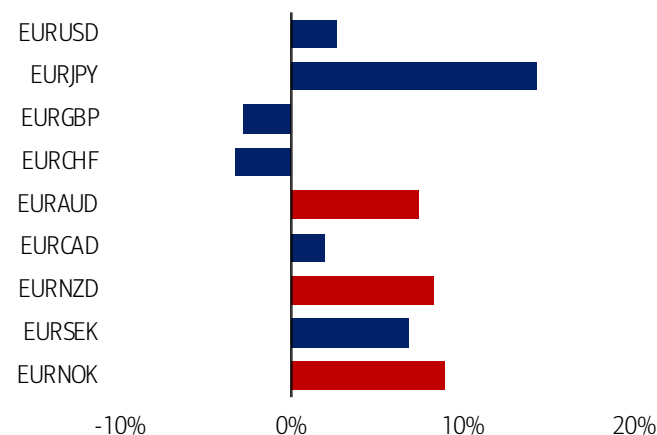


Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

**Exhibit 24: Investors could consider fading EUR strength vs G10 high-betas**

EUR/G10 year-to-date returns



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

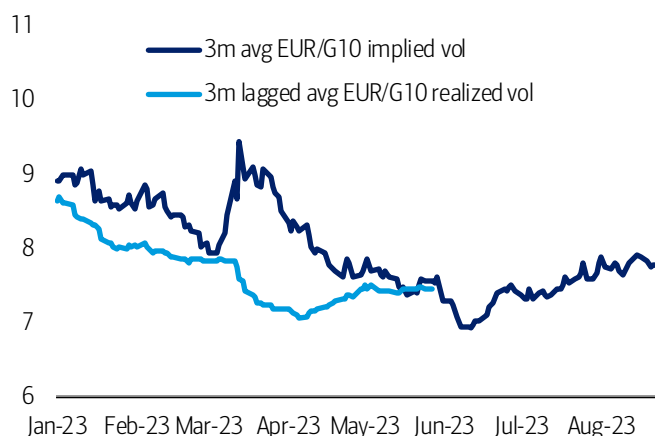
**Vol: increased demand for long-dated EUR vol****EUR vols found bottom after underperforming in first half of 2023**

In the first half of 2023, realized vols for EUR/G10 pairs have largely underperformed implied vols (Exhibit 25). As a result, EUR implied vols broadly declined but have started to pick-up after June. The rise of EUR implied vols at the 1y tenor is particularly notable, as the 2m change averaging +0.42 vols across EUR/G10 pairs would rank at 79<sup>th</sup> percentile over the past decade (Exhibit 26).



**Exhibit 25: EUR realized vol has largely underperformed implied in 2023**

3m avg implied and lagged realized EUR/G10 vols

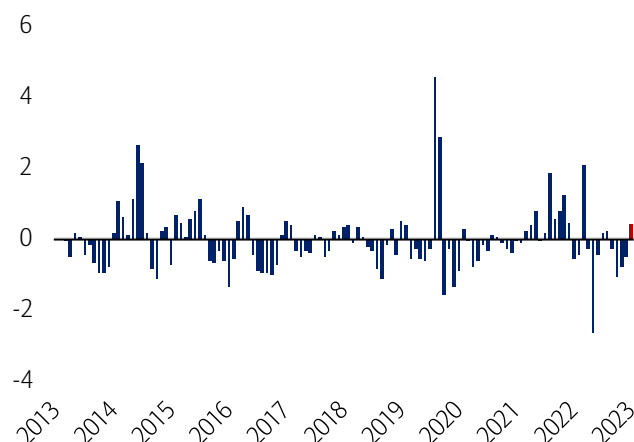


Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

**Exhibit 26: 1y EUR implied vol saw decent pick up since it bottomed in mid-June**

2m change of avg 1y EUR/G10 implied vols



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

**1y implied still worth owning for EUR vs USD, GBP, and liquid G10 high betas**

The bottom for EUR implied vols this year coincided with the turn in spot-to-vol correlation. Average EUR/G10 1m spot-to-vol correlations have started to reverse lower since June and is now below 0. The negative spot-to-vol correlation suggests further EUR selloff would be accompanied by higher volatility. Across EUR/G10 pairs, current level of 1y implied vols are still at low percentiles vs long-term realized vol ranges for EUR vs CAD, GBP, USD, NZD and AUD (Exhibit 28). So, owning long-dated EUR vega in these pairs at current level would hedge against further EUR depreciation, in our view.

**Exhibit 27: Spot-to-vol correlation has turned negative for EUR**

Avg EUR/G10 spot-to-vol correlation

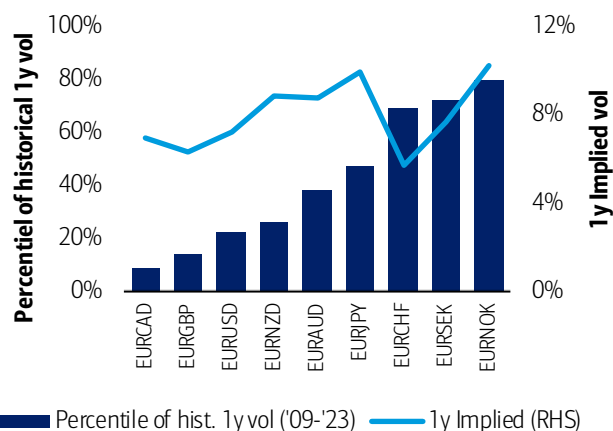


Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

**Exhibit 28: 1y EURCAD, EURGBP, and EURUSD implied vols stand out as the cheapest relative to historical range of realized vols**

Current levels of 1y EUR/G10 implied vols and percentile to historical range of 1y realized vols



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

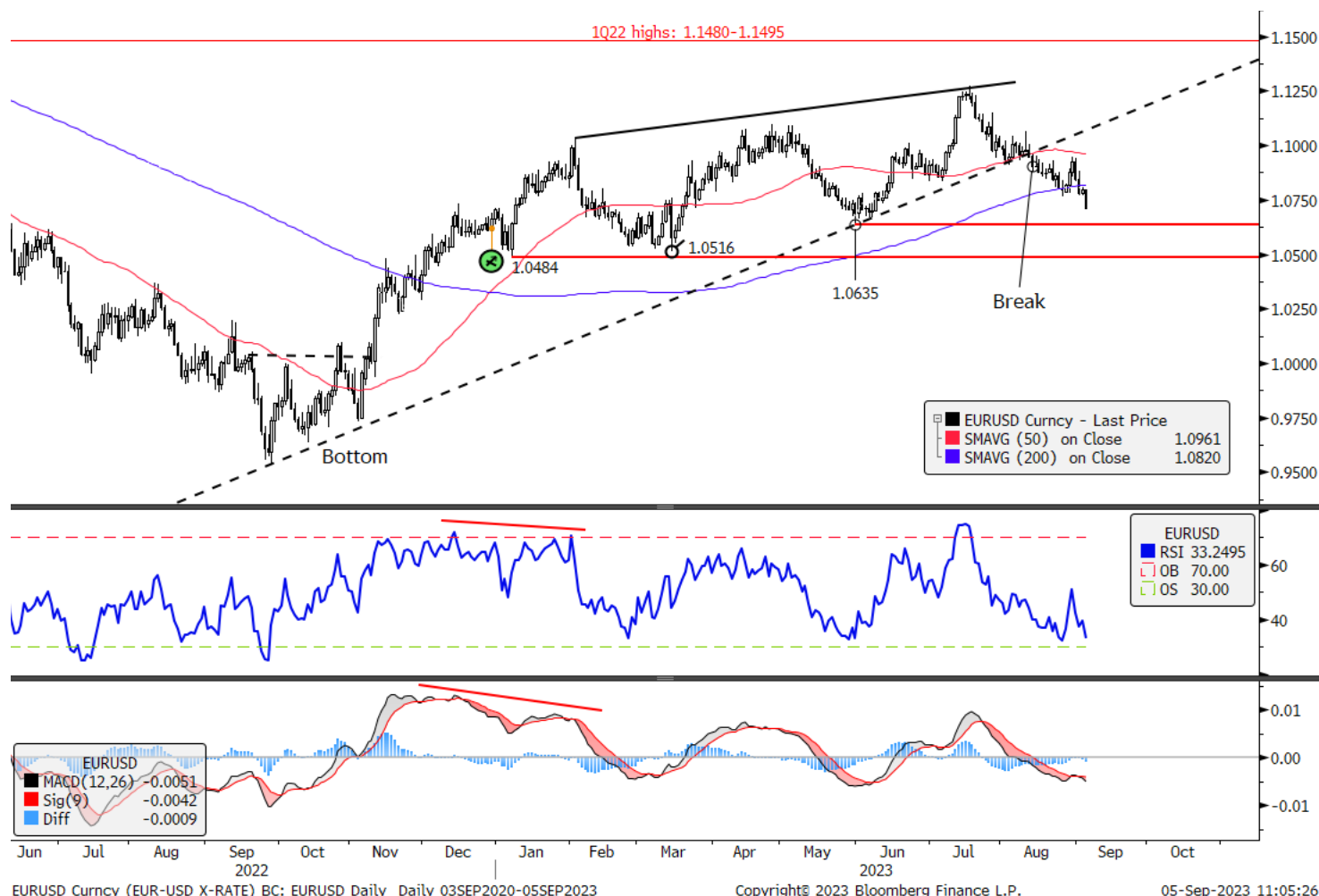
**Technical: Euro to struggle into year-end****Euro short term: Uptrend broke on Aug 15, sell rallies for year end downside**

The uptrend in euro beginning from the bottom in Oct-2022 broke in August 2023. This means the uptrend has turned sideways or lower. We favor lower euro by selling rallies for a decline to the low end of YTD range of 1.0635 / 1.0516 / 1.0484.



**Chart 1: EURUSD Daily chart**

Uptrend from Oct 2022 base ended in August 2023. Sell a rally for end of year retracement lower to, for example, 1.0635, 1.0516 and 1.0484.



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

**Euro medium term: Downside risk greater while < 200wk SMA**

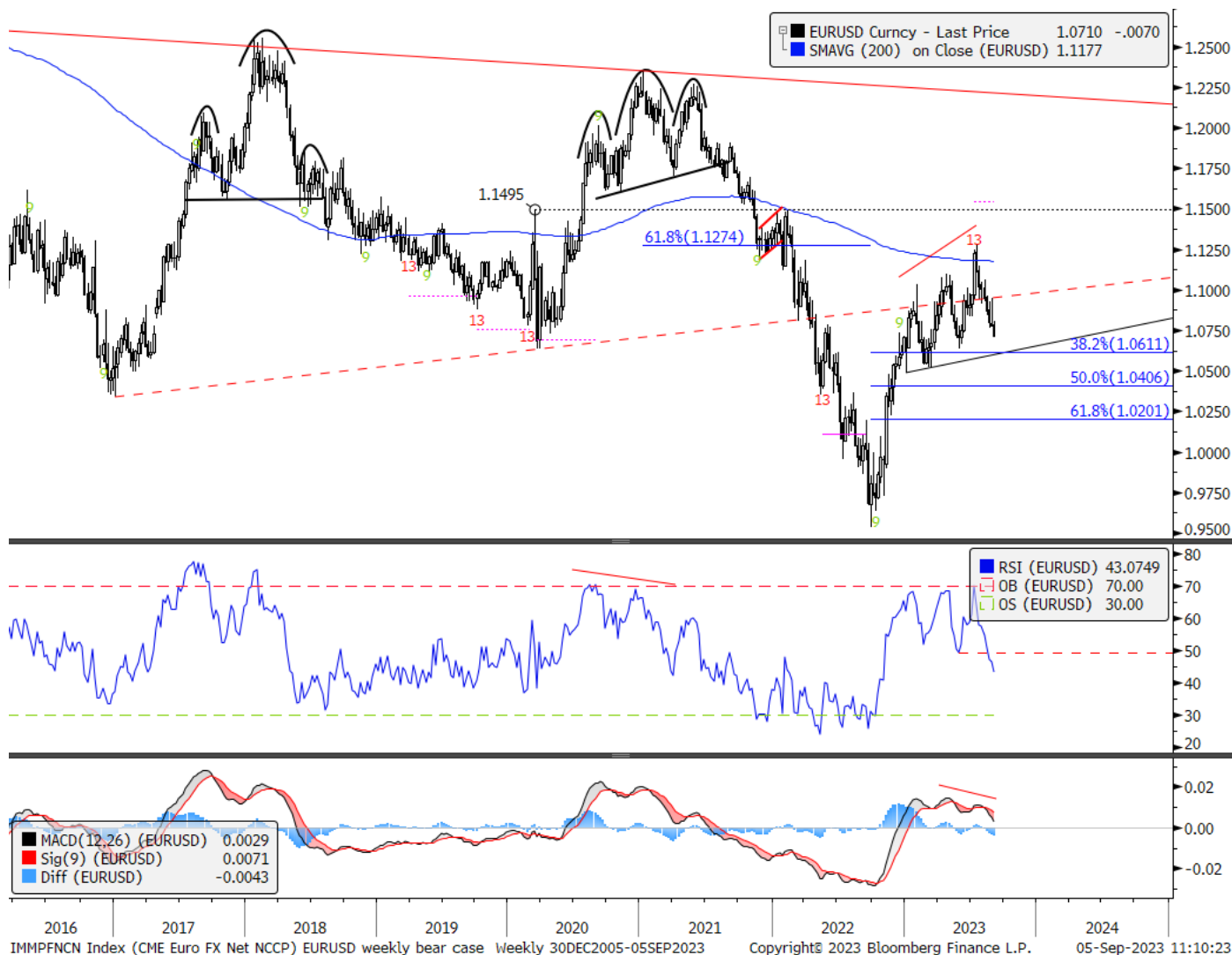
Spot euro remains below the 200wk moving average which from the bigger picture is one bearish trend condition that remains. A timely systematic TD Sequential sell signal had occurred when euro was at the YTD highs (13). Price action has confirmed it by declining. Weekly RSI (momentum) has broken to a new YTD low and MACD is declining. Use rallies to sell as trend turns sideways or lower into year end. The risk is a deeper Fibonacci retracement such as the 50% level at 1.0406 and/or the 61.8% level at 1.0201.

**Euro support:** 1.0635, 1.0516, 1.0484, 1.0406, 1.0201

**Euro resistance:** 1.0966, 1.1065, 1.1150, 1.1274, 1.1480

**Chart 2: EURUSD Weekly**

Use rallies to sell as trend turns sideways to lower into yearend 2023.



Source: BofA Global Research, Bloomberg

BofA GLOBAL RESEARCH

# Disclosures

## Important Disclosures

Due to the nature of the market for derivative securities, the issuers or securities recommended or discussed in this report are not continuously followed. Accordingly, investors must regard this report as providing stand-alone analysis and should not expect continuing analysis or additional reports relating to such issuers and/or securities.

Due to the nature of strategic analysis, the issuers or securities recommended or discussed in this report are not continuously followed. Accordingly, investors must regard this report as providing stand-alone analysis and should not expect continuing analysis or additional reports relating to such issuers and/or securities.

Due to the nature of quantitative analysis, the issuers or securities recommended or discussed in this report are not continuously followed. Accordingly, investors must regard this report as providing stand-alone analysis and should not expect continuing analysis or additional reports relating to such issuers and/or securities.

Due to the nature of technical analysis, the issuers or securities recommended or discussed in this report are not continuously followed. Accordingly, investors must regard this report as providing stand-alone analysis and should not expect continuing analysis or additional reports relating to such issuers and/or securities.

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 BofA 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 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.bofam.com/BofASEdisclaimer](http://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 (HKSCF); 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 HKSCF; 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.