US Rates Viewpoint

Allocations & Duration Demand - 2Q View

10 April 2023

Rates Research
United States

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

The quarter that was

1Q23 was marked by significant shifts in sentiment and ended in a risk-off tone with the highest levels of volatility since the '08 recession. A mean-variance framework applied to 1Q returns and covariances suggests optimal allocations for US and Global long only portfolios between those consistent with transition and risk-off/recession portfolios.

Sovereign bonds clearly regained their utility as a diversifier and a hedge for portfolios over 1Q. UST allocations in the optimal US portfolio are at max overweight for both balanced and risk-averse allocation profiles. The same is true but to a lesser degree for global sovereign bonds in the Global portfolio, with allocation weights between 35-39% for risk averse and balanced profiles. To some extent this is in line with our expectations going into '23 (see the report Asset Allocation & Duration Demand in '23).

Allocations expectation for 2Q

We think the market dynamic over 2Q is likely to continue to suggest optimal asset allocations profiles between those implied by risk-off/recession and transition states.

The medium-term economic impact of the recent banking events is still highly uncertain with the potential for a negative impact on bank lending standard and consumer sentiment. In the aftermath, the Fed has been priced out, slowdown scenarios have been frontloaded and hard landing probabilities have increased. All this should lead to more cautious allocation profiles, in our view still between the ones suggested by transition and outright risk-off/recession states, but likely progressively less abut transition and more about risk-off/recession as we enter the 2H.

View for duration demand and curve

Demand for duration is likely to stay robust over 2Q in our baseline view. The degree of demand may increase materially in a context where data recouples more significantly on the downside and the likelihood of harder landing scenarios increases. Allocation profiles are then likely to push away more aggressively from those consistent with transition market dynamics towards risk-off/recession ones.

We continue to recommend trading duration with a bullish bias in the 3-4% range for 10yT. Soft landing scenarios call for a convergence to levels in the 3-3.25% range. Harder landing scenarios imply mid-2% levels.

For the curve, the bull steepening dynamic is to a large extent priced in. The potential for portfolios to extend out the curve and/or for the market to start to backload some of the cuts priced in for '23 are risks to a near-term steepening bias. Medium-term, however, we think the steepening potential is still underpriced, and we continue to favor curve caps at horizons 1-2y (see 2s10s curve steepeners) as a way to leverage this view.

DM – Developed Markets

EM – Emerging Markets

UST – US Treasuries

IG – Investment Grade

HY – High Yield

For a list of our open trades as well as those closed over the past 12 months, please see our Global Rates Weekly.

Timestamp: 10 April 2023 06:35AM EDT

The quarter that was...

Investors started the year bullish risk with portfolios continuing the late '22 rotation into credit and EM, driven by near-term expectations for a shift in Fed policy towards an on-hold stance and the potential for China to un-anchor vs DM. However, as 1Q23 unfolded we saw material shifts in sentiment, and broadly 3 regimes:

- By late January valuations had converged to fundamentals from very attractive levels in late '22 (see the report Postcard from Canada & Mexico). More conviction was needed to push allocations further, but instead the degree of conviction around some of the main macro themes for '23 started to fade. DM slowdown probabilities decreased as data was showed signs of resilience; and the reopening in China proved to be more turbulent than previously thought. Volatility stayed relatively anchored, however, and we saw little rush to fade the late '22 and early '23 portfolio rotation. Portfolios became more tactical, but there was no drive to sell.

  Rates market price action snapshot: 10yT -37bp, 2yT -23bp, 1y10y vol -23bp, 1y1y vol -32bp, 1m10y vol -21bp, SPX +6%

- By February, the market focus had shifted to a higher likelihood of re-acceleration scenarios, and the potential for a higher Fed terminal (see the report Postcard from London, Scandinavia & Peru). Volatility picked up, and the headwinds for risk from tighter policy started to get priced in. By end-February we were seeing signs of a more conservative shift in allocations.

  Rates market price action snapshot: 10yT +41bp, 2yT +62bp, 1y10y vol +4bp, 1y1y vol +14bp, 1m10y vol +18bp vol, SPX -3%

- March was all about the baking crisis. Vol reached levels not seen since '08 (see the report March Madness), and fears of contagion pushed portfolios into some deleveraging and de-risking. Investors priced out central banks and priced in more accommodation to address the crisis. Even as the market avoided worst case scenarios, the dynamic of asset classes continued to reflect frontloaded slowdown expectations and higher probabilities of harder landing scenarios.

  Rates market price action snapshot: 10yT -45bp, 2yT +79bp, 1y10y vol -1bp, 1y1y vol +25bp, 1m10y vol +4bp vol, SPX -4%

Exhibit 1: Expectations for timing of the Fed pivot (y-axis in months)

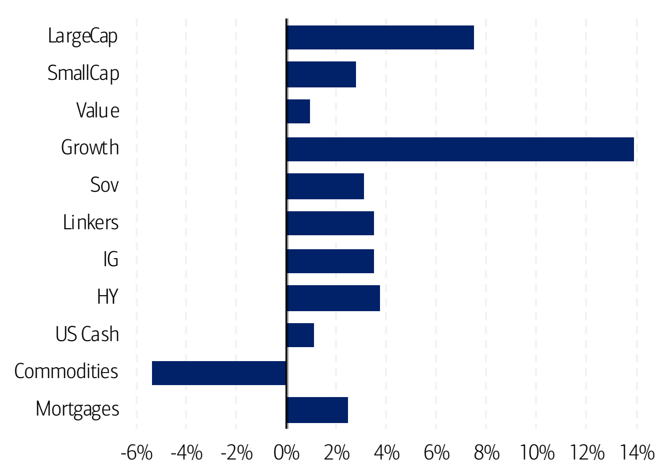
Market pricing a Fed on-hold currently

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 2: 1Q23 returns across US denominated asset classes

Performance broadly positive despite high vol context and different regimes



Source: BofA Global Research

BofA GLOBAL RESEARCH

The 1Q23 optimal allocation

We use 1Q23 asset class returns and covariances to calculate what would have been the optimal portfolios for the last quarter market dynamic in a mean variance framework. We do this for both US and Global long only portfolios.

For each portfolio (US and Global) we calculate the limiting allocation weights in a mean variance framework, i.e., the solutions that minimize the variance (a risk averse allocation profile) and maximize the returns (a risk seeking allocation profile). The balanced allocation profile is calculated to target a volatility that corresponds to the average of the limiting allocations. The solutions for the US and Global long only portfolios are show in Exhibit 3 and Exhibit 4, respectively.

Exhibit 3: Optimal US long only portfolio for 1Q23
Optimal allocation weights obtained in a mean variance framework

	Min	Max	Risk Averse	Balanced	Risk Seeking
Equities	30%	70%	30%	50%	70%
Large Cap	10%	50%	10%	20%	40%
SmallCap	5%	35%	5%	5%	5%
Value	0%	25%	15%	0%	0%
Growth	0%	25%	0%	25%	25%
Bonds	5%	50%	50%	50%	10%
Sov	0%	45%	45%	45%	5%
Linkers	0%	5%	5%	5%	5%
Credit	0%	20%	0%	0%	20%
IG	0%	20%	0%	0%	20%
HY	0%	10%	0%	0%	0%
Cash	0%	15%	15%	0%	0%
US	0%	15%	15%	0%	0%
Alt	0%	20%	5%	0%	0%
Commodities	0%	15%	4%	0%	0%
Mortgages	0%	15%	1%	0%	0%

Source: US Global Research

BofA GLOBAL RESEARCH

Exhibit 4: Optimal Global long only portfolio for 1Q23
Optimal allocation weights obtained in a mean variance framework

	Min	Max	Risk Averse	Balanced	Risk Seeking
Equities	30%	70%	30%	46%	70%
Large Cap	10%	50%	10%	16%	40%
SmallCap	5%	35%	5%	5%	5%
Value	0%	25%	15%	0%	0%
Growth	0%	25%	0%	25%	25%
EM	0%	15%	0%	0%	0%
Bonds	5%	50%	35%	39%	15%
Sov	0%	45%	35%	24%	0%
Linkers	0%	5%	0%	5%	5%
EM Hard	0%	10%	0%	0%	0%
EM Local	0%	10%	0%	10%	10%
Credit	0%	15%	0%	0%	15%
IG	0%	20%	0%	0%	5%
HY	0%	10%	0%	0%	10%
Cash	0%	15%	15%	15%	0%
US	0%	15%	15%	15%	0%
Alt	0%	20%	20%	0%	0%
Commodities	0%	15%	5%	0%	0%
Mortgages	0%	15%	15%	0%	0%

Source: US Global Research

BofA GLOBAL RESEARCH

A few observations are warranted:

- We see a maximum range of allocation weights implied by the risk-seeing and the risk-averse portfolios, for both the US and the Global portfolios (for equities, credit, and cash allocations).
- Sovereign bonds clearly regained their utility as a diversifier and a hedge for portfolios. UST allocations in the US portfolio are at max overweight for both balanced and risk-averse allocation profiles. The same is true but to a lesser degree for global sovereign bonds in the Global portfolio, with allocation weights between 35-39% for risk averse and balanced portfolios.
- Allocations to credit and EM were only justified in balanced and risk seeking allocation profiles (mostly the latter, which was significant only earlier in 1Q23).

Optimal 1Q23 portfolios Vs. a 3-state framework for asset allocation?

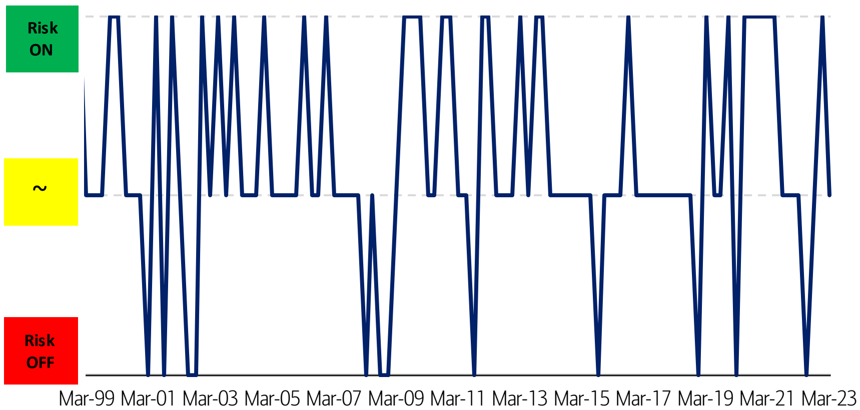
In our note on Asset Allocation & Duration Demand in '23, we described a framework for asset allocation where we grouped historical quarterly returns across asset classes into 3 states (using the cartesian distance between sets of returns). By looking at the centroids of each state it was immediately clear that they map to: (1) a risk-on market dynamic (outperformance of risky assets); (2) a risk-off/recession market dynamic (outperformance of safe-havens); and (3) a transition state between risk-on and risk-off/recession.

For each one of these three states for the market dynamic, we produced optimal portfolios in a risk variance framework. In this approach there are therefore only 3 states of the world for allocations, i.e., only 3 optimal portfolios (each with its own risk seeking, risk averse and balance profiles), one for each state: a risk-on portfolio; a risk-off/recession portfolio, and a transition portfolio.

One interesting observation that came out of this framework is that the transition probability from risk-off/recession to risk-on (57%) is much larger than the transition probability from risk-on to risk-off/recession (6%), as the latter proceeds more often through the transition state (61% – see Exhibit 5 and Exhibit 6).

Exhibit 5: Regimes for quarterly performance across asset classes

Market dynamic in 4Q22 was closer to risk on.... shift towards a transition dynamic in 1Q23



Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 6: Transition probabilities between different states for the market dynamic

Transition probability from risk-off/recession to risk-on (57%) is much larger than the transition probability from risk-on to risk-off

	Risk off	~	Risk on
Risk off	14%	29%	57%
~	16%	61%	23%
Risk on	6%	61%	32%

Source: BofA Global Research

BofA GLOBAL RESEARCH

The asset allocation profiles above (see Exhibit 3 and Exhibit 4) are consistent with a market dynamic that is intermediate between transition and risk-off/recession states (closer to the transition than the risk-off/recession state). This is clear from (1) a wide dispersion of allocation weights between the limiting risk-averse and risk-seeking profiles; (2) neutral equity allocations (c.50%) for balanced risk profiles; but (3) higher allocations to bond that are typically in risk-off/recession portfolios (transition portfolios have bond allocations c.10-25% for balanced and risk-averse profiles – see Appendix).

Significantly, when we classify the 1Q23 returns in the context of our 3-state framework (see Exhibit 5) we notice that it falls on the transition state, even if (as we noted above) the allocation weighs suggest a dynamic intermediate between transition and risk-off/recession states.

Optimal 1Q23 portfolios Vs. our expectations Vs. actual flows

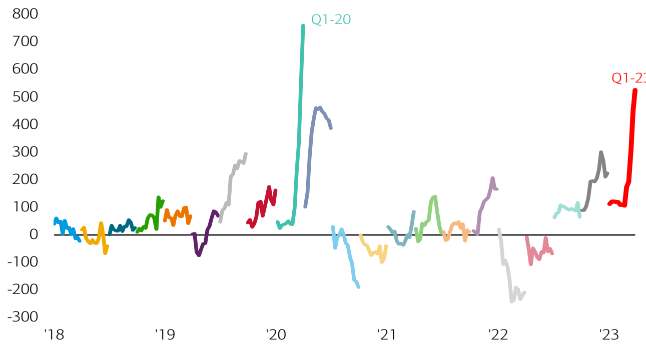
In our report [Asset Allocation & Duration Demand in '23](#) (from 13 Oct '22) we argued that: (1) allocation profiles in the year ahead were likely to "converge to a midpoint between the heavy UST allocations implied by the historical risk-off/recession allocation profiles and the lower UST allocations implied by optimal allocations in late-cycle/ transition regimes"; and (2) that we saw "slightly higher exposures to Agency MBS, IG credit and commodities", with the "traditional tradeoff between cash, USTs, Agency MBS and IG credit likely driven in '23 as much by diversification considerations as by value".

We were more right about the former than we were about the latter. Significantly also, particularly for the 2Q23 view, we see material discrepancies between the optimal portfolios above and the flows for the quarter as a whole:

- Optimal bond allocations indeed converged to levels between those implied by transition profiles and risk-off/recession profiles in line with expectations. However actual flows reflected a more significant haven bid than the optimal portfolios above suggest, e.g., highest quarterly inflow to cash since 1Q20 (see Exhibit 7).

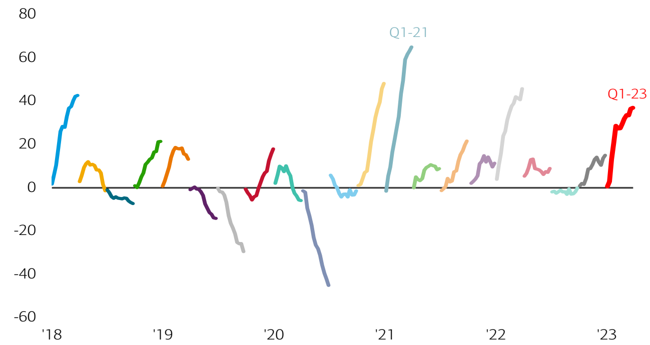
- The optimal allocations profiles above show less scope for credit and EM allocations than we had previously anticipated. However, this contrasts with significant flows into credit and EM (more in line with our view going into the quarter than with the actual optimal portfolios), with the EM flows in particular showing signs of stickiness in the face of the late-1Q uncertainly (see The Flow Show – Pop Music and Exhibit 8).

Exhibit 7: Investors add $508bn to cash in 1Q23
Cumulative quarterly inflow to cash ($bn)



Source: : BofA Global Investment Strategy, EPFR, Inflow to Money Market Funds..
BofA GLOBAL RESEARCH

Exhibit 8: Biggest quarterly inflow to EM stocks in a year
Cumulative quarterly inflow to EM stocks ($bn)



Source: BofA Global Investment Strategy, EPFR
BofA GLOBAL RESEARCH

Our view for 2Q23 and beyond: duration demand…

We think the market dynamic over 2Q is likely to continue suggest optimal asset allocations profiles between those implied by risk-off/recession and transition states.

Near term, the market may have avoided the worst-case scenarios around the recent banking crisis, but the medium-term economic impact of the crisis is still highly uncertain with real potential for a negative impact on bank lending standard and consumer sentiment. In the aftermath of the crisis the Fed has been priced out, slowdown scenarios have been frontloaded (see the report Born to Run) and hard landing probabilities have increased. All this should lead to more cautious allocation profiles, in our view still between the ones suggested by transition and outright risk-off/recession states, but likely progressively less abut transition and more about risk-off/recession as we enter the 2H (our economists baseline continue to be for a shallow recession in 2H, but the market is likely biased towards downside risks around that scenario – see the report Sentiment has stabilized, but excess tightening remains a concern).

The results in the appendix suggest:

- For US portfolios (1) a slight underweight in equities with a bias towards large caps and to some extent also into value; (2) an overweight USTs; (3) overweight cash; (4) neutral to slight overweight mortgages; and (5) allocations to HY and commodities that shift between overweight to min underweight as the profile shifts between transition and risk-off/recession states, respectively.

- Global portfolios are also likely to have a slight underweight in equities. As the profile shifts between transition and risk-off/recession states, we see: (1) as shift between HY and IG allocations; (2) overweight in commodities, EM equities and EM hard currency bonds reduced to min underweight … in favor of (3) bond allocations; and (4) a shift from neutral to slight underweight mortgages into max overweight.

Demand for duration is likely to stay robust over 2Q in our baseline view, but the degree of demand may increase materially in a context where data recouples more significantly on the downside and the likelihood of harder landing scenarios increases. Allocation profiles are then likely to push away more aggressively from those consistent with transition market dynamics towards risk-off/recession ones.

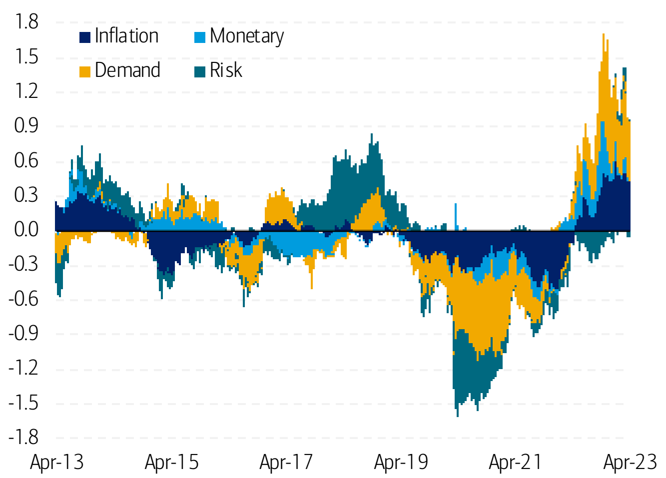
These results lend further support to this view our view on duration: trade the 3-4% range for 10yT tactically with a structural bullish bias, adding to duration exposures at the 3.75-4% top end of the range, and lightening up on those at the 3-3.25% bottom end of the range.

It is important to note that the 3-3.25% bottom end of the range is defined based on where we see the steady state for 10yT in the cycle (see Exhibit 9). In soft landing scenarios it is more likely that allocation profiles stay closer to transition-like portfolios, and this implies a more conservative call on the 10yT dynamic, reflecting a convergence back to the steady state, but limited scope for material richness beyond that.

Harder landing scenarios, however, contain the potential for a more significant richening vs. the steady state, potentially towards the mid-2% range for 10yT (see Rates forecasts and balance of risks), and a more significant allocation shift away from transition-like portfolio allocations and towards risk-off/recession ones.

Exhibit 9: Decomposition of 10yT dynamic

Steady state currently c.2.4% from c.2% in early '22. Upgrade likely reflects higher neutral expectations, and we expect further upgrade into c.2.75%.

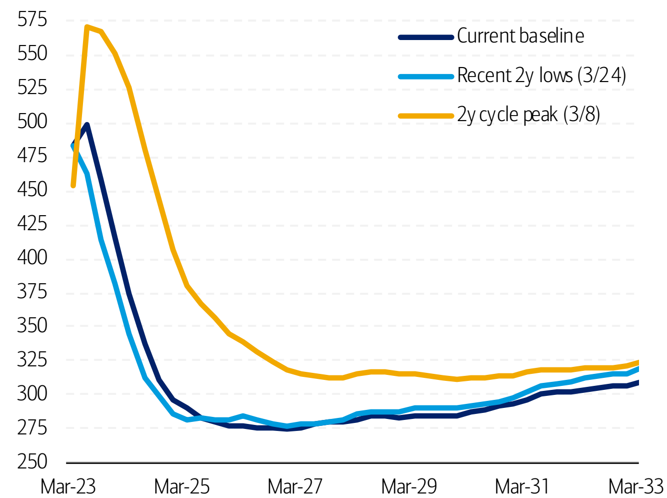


Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 10: Fed policy trajectory priced currently

Market pricing Fed convergence back to 2.75-3% by early '25



Source: BofA Global Research

BofA GLOBAL RESEARCH

... and curve dynamic

An on-hold Fed generally leaves the curve dynamic mostly driven by bull-flattening and bear-steepening moves: the bear-steepening dynamic tends to dominate with an on-hold Fed in the early stages of the cycle; while the bull-flattening dynamic tends to dominate with an on-hold Fed in the late stages of the cycle.

In terms of sequency, for both the cycle and the curve dynamic, a late-cycle Fed shift into an on-hold stance is usually followed by:

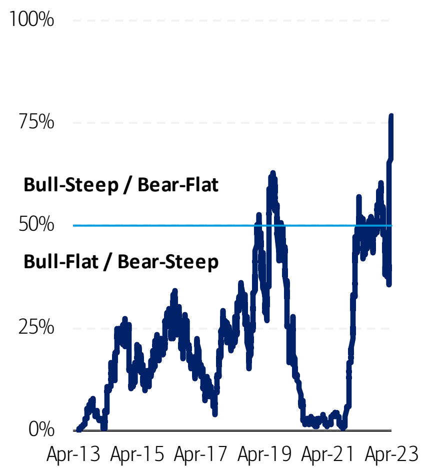
- Slowdown, recession (see the report The Dirty Dozen), policy accommodation, and a bull-steepening dynamic, initially in the 5s30s and 10s30s sector of the curve, and closer to the first cut of the cycle by 2s10s
- Subsequently, as the economy starts to bounce out of the recession but inflation lags, the Fed stays credibly on hold and the curve shifts into the bear-steepening dynamic that is typical of the early cycle expansion.

In the recent March market stress, however, we saw already a significant move towards cash and a bull steepening dynamic for the curve as the Fed signaled a near-term end to the tightening cycle (if not effectively an on-hold stance) and rate cuts got frontloaded (see Exhibit 10). However:

- The bull steepening dynamic may have been slightly overdone, particularly in soft landing scenarios for the US economy that generally imply backloaded cuts (towards early '24 in our economist's baseline scenario)
- These periods where the Fed moves to an on-hold stance late in the cycle and risks around the outlook increase generally drive portfolios to start to extend duration exposures out the curve

Everything may have happened too quickly on the curve. The bull steepening dynamic is to a large extent priced in (see Exhibit 11 and Exhibit 13), and the potential for portfolios to extent out the curve and/or for the market to start to backload some of the cuts priced for '23 are near-term risks to a steepening bias. Medium-term, however, we think the steepening potential is still underpriced, and we continue to favor the curve cap at horizons 1-2y (see [2s10s curve steepeners]) as a way to leverage this view.

Exhibit 11: 2s10s curve directionality
2s10s dynamic still dominated by the frontend



Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 12: 2s10s directionality breakdown
Shifting from bull steepening to bear flattening over the last couple of weeks

	bull-S	bear-F	bull-F	bear-S
2w	25%	75%	0%	0%
1m	60%	40%	0%	0%
2m	46%	39%	7%	8%
3m	39%	38%	12%	12%

Source: BofA Global Research

BofA GLOBAL RESEARCH

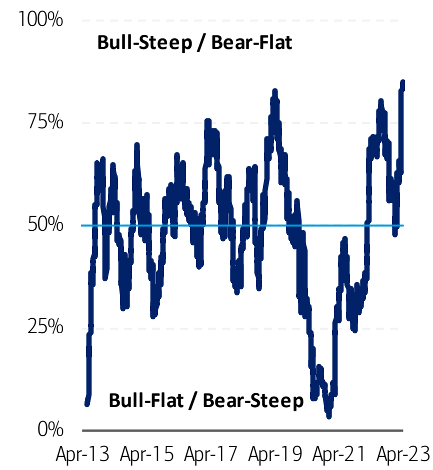
Exhibit 14: 5s30s directionality breakdown
Shifting from bull steepening to bear flattening over the last couple of weeks

	bull-S	bear-F	bull-F	bear-S
2w	36%	46%	18%	0%
1m	63%	31%	6%	0%
2m	50%	37%	9%	4%
3m	45%	39%	9%	6%

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 13: 5s30s curve directionality
5s30s dynamic still dominated by the frontend



Source: BofA Global Research

BofA GLOBAL RESEARCH

Appendix – 3-state framework for portfolios allocations

In Exhibit 15 and Exhibit 16 we show the optimal US and Global portfolios obtained under a risk-off market dynamic. For a full discussion, including the similarity between risk-off state portfolios and optimal portfolios over recession periods please see the discussion in the appendix of Asset Allocation & Duration Demand in '23.

Exhibit 15: Optimal US portfolios contingent on a risk-off dynamic
Mean variance optimization on weekly returns over risk-off periods

	Min	Max	Risk Averse	Balanced	Risk Seeking
Equities	30%	70%	30%	30%	30%
Large Caps	10%	50%	25%	12%	10%
Small Caps	5%	35%	5%	5%	5%
Value	0%	25%	0%	13%	15%
Growth	0%	25%	0%	0%	0%
Bonds	5%	50%	45%	45%	50%
Sov	0%	45%	45%	45%	45%
Linkers	0%	5%	0%	0%	5%
Credit	0%	20%	0%	0%	0%
IG	0%	20%	0%	0%	0%
HY	0%	10%	0%	0%	0%
Cash	0%	15%	15%	10%	5%
US	0%	15%	15%	10%	5%
Alt	0%	20%	10%	15%	15%
Commodities	0%	15%	0%	0%	0%
Mortgages	0%	15%	10%	15%	15%

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 16: Optimal global portfolios contingent on a risk-off dynamic
Mean variance optimization on weekly returns over risk-off periods

	Min	Max	Risk Averse	Balanced	Risk Seeking
Equities	30%	70%	30%	30%	30%
Large Caps	10%	50%	25%	10%	10%
Small Caps	5%	35%	5%	5%	5%
Value	0%	25%	0%	15%	15%
Growth	0%	25%	0%	0%	0%
EM	0%	15%	0%	0%	0%
Bonds	5%	50%	20%	40%	45%
Sov	0%	45%	20%	40%	45%
Linkers	0%	5%	0%	0%	0%
EM Hard	0%	10%	0%	0%	0%
EM Local	0%	10%	0%	0%	0%
Credit	0%	15%	20%	0%	0%
IG	0%	20%	20%	0%	0%
HY	0%	10%	0%	0%	0%
Cash	0%	15%	15%	15%	10%
US	0%	15%	15%	15%	10%
Alt	0%	20%	15%	15%	15%
Commodities	0%	15%	0%	0%	0%
Mortgages	0%	15%	15%	15%	15%

Source: BofA Global Research

BofA GLOBAL RESEARCH

In Exhibit 17 and Exhibit 18 we show the optimal US and Global portfolios obtained under a risk-off market dynamic. For a full discussion, including the similarity between transition state portfolios and optimal portfolios for a late cycle dynamic please see Asset Allocation & Duration Demand in '23.

Exhibit 17: Optimal US portfolios contingent on a transition dynamic
Mean variance optimization on weekly returns over transition periods

	Min	Max	Risk Averse	Balanced	Risk Seeking
Equities	30%	70%	30%	50%	70%
Large Caps	10%	50%	23%	43%	50%
Small Caps	5%	35%	5%	5%	5%
Value	0%	25%	2%	2%	15%
Growth	0%	25%	0%	0%	0%
Bonds	5%	50%	26%	20%	5%
Sov	0%	45%	26%	15%	0%
Linkers	0%	5%	0%	5%	5%
Credit	0%	20%	9%	10%	10%
IG	0%	20%	0%	0%	0%
HY	0%	10%	9%	10%	10%
Cash	0%	15%	15%	0%	0%
US	0%	15%	15%	0%	0%
Alt	0%	20%	20%	20%	15%
Commodities	0%	15%	8%	15%	15%
Mortgages	0%	15%	12%	5%	0%

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 18: Optimal global portfolios over transition periods
Mean variance optimization on weekly returns over transition periods

	Min	Max	Risk Averse	Balanced	Risk Seeking
Equities	30%	70%	30%	56%	70%
Large Caps	10%	50%	10%	10%	40%
Small Caps	5%	35%	10%	35%	5%
Value	0%	25%	0%	0%	0%
Growth	0%	25%	0%	11%	25%
EM	0%	15%	10%	0%	0%
Bonds	5%	50%	25%	10%	10%
Sov	0%	45%	25%	0%	0%
Linkers	0%	5%	0%	0%	0%
EM Hard	0%	10%	0%	10%	10%
EM Local	0%	10%	0%	0%	0%
Credit	0%	15%	10%	10%	10%
IG	0%	20%	0%	0%	0%
HY	0%	10%	10%	10%	10%
Cash	0%	15%	15%	4%	0%
US	0%	15%	15%	4%	0%
Alt	0%	20%	20%	20%	10%
Commodities	0%	15%	15%	13%	0%
Mortgages	0%	15%	5%	7%	10%

Source: BofA Global Research

BofA GLOBAL RESEARCH

Disclosures

Important Disclosures

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

Other Important Disclosures

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

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

respect of any matters relating to dealing in securities or provision of specific advice on securities or any other matters arising from, or in connection with, this information. Singapore recipients of this information should contact Merrill Lynch (Singapore) Pte Ltd in respect of any matters arising from, or in connection with, this information. For clients that are not accredited investors, expert investors or institutional investors Merrill Lynch (Singapore) Pte Ltd accepts full responsibility for the contents of this information distributed to such clients in Singapore.

General Investment Related Disclosures:

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

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

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

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

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

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

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

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

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

Copyright and General Information:

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

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

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

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

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

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

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

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