

# Systematic Flows Monitor

## CTAs could continue adding support to recent rallies in USD and bond yields

### Trend follower longs in SPX, NDX, NKY holding strong

Both the S&P 500 and NASDAQ-100 ended the week at new all-time highs and correspondingly our CTA model indicates that trend follower longs are well supported with stop-loss triggers now relatively out of reach at least over the next week. Positions in both the S&P 500 and NASDAQ-100 have room to grow as the sharp decline in the first week of the year is currently weighing negatively on short-term trend calculations but could be less determinantal to the price trend as we move forward in time. Last week we noted that positions in the Russell 2000 and EURO STOXX 50 were at risk of stop loss unwinds and indeed this week our model's triggers were hit. Notably both indices lagged the equity rallies in the S&P and NASDAQ. Actual CTAs which operate with less aggressive stop loss triggers could still have meaningful unwinds in R2K and ESTX50 in the upcoming week. In Japan, we see CTAs long the Nikkei 225 with the position expected to increase in size next week.

### CTAs could be unwinding their US Treasury bond longs

With another large move higher in 10Y US bond yields this week, the trend strength in TY futures is deteriorating and correspondingly our CTA model is set to unwind its long position relatively faster next week. Our model is already neutral on Bund futures but actual CTAs could still be in the process of unwinding their longs. Similarly, next week we see unwinds in KTB futures as well.

### CTA model looks to flip long USDJPY next week

Like bond yields, the US dollar also staged another impressive rally this week and our CTA model implies that trend followers have been adding support to the upside. This week our model saw outsized selling in AUD, CHF, and CAD and next week we expect selling in JPY and EUR. Notably, CTAs could turn long USDJPY next week.

### Outside Gold, trend followers getting short commodities

After next week our CTA model is expected to be short each commodity future we track except for Gold. However, even in Gold our model's long is subject to unwinds next week and in any price path.

### Equity vol control leverage at highest levels since Omicron

Alongside the new high in the S&P 500, it's likely the case that S&P 500 equity vol control overlays have leverage at their highest levels since the Omicron sell-off in late November 2021. Leverage is certainly elevated but can still go higher should realized volatility continue to decline. Risk parity leverage held mostly firm on the week.

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.

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**Refer to important disclosures on page 23 to 24.**

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Timestamp: 19 January 2024 08:14PM EST

19 January 2024

Equity Derivatives  
Global

BofA

Data  
Analytics



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**Global Equity Derivatives Rsch**  
BofAS

**Chintan Kotecha**  
Equity-Linked Analyst  
BofAS  
+1 646 855 5478  
[chintan.kotecha@bofa.com](mailto:chintan.kotecha@bofa.com)

**Nicholas Dunne**  
Equity-Linked Analyst  
BofAS  
+1 646 855 2631  
[nicholas.dunne@bofa.com](mailto:nicholas.dunne@bofa.com)

**Benjamin Bowler**  
Equity-Linked Analyst  
BofAS  
[benjamin.bowler@bofa.com](mailto:benjamin.bowler@bofa.com)

**Nitin Saxena**  
Equity-Linked Analyst  
BofAS  
[nitin.saxena@bofa.com](mailto:nitin.saxena@bofa.com)

**Abhinandan Deb >>**  
Equity-Linked Analyst  
MLI (UK)  
[abhinandan.deb@bofa.com](mailto:abhinandan.deb@bofa.com)

**Lars Naeckter >>**  
Equity-Linked Analyst  
Merrill Lynch (DIFC)  
[lars.naeckter@bofa.com](mailto:lars.naeckter@bofa.com)

See Team Page for List of Analysts

# Trend Following (CTA) Model

For each component we apply our CTA model over the next five trading sessions under bullish, neutral, and bearish price paths. Exhibit 1 summarizes our model applied to 13 common CTA underlyings within equities, fixed income, commodities and FX.

To illustrate how to interpret Exhibit 1, using the first row as an example, the takeaways are: (1) Our CTA model's S&P 500 position is long, (2) The current trend signal is 81% where -100% is max short and +100% is max long, (3) Over the next 5 trading sessions and based on price paths using historical data, the trend signal is projected to decline, and (4) a full unwind (sell trigger) of the long position could come with a 3.5% decline (4672 index level).

## Exhibit 1: Summary of BofA Trend Following (CTA) Model Positions, Projections, and Key Levels

An important consideration with buy & sell triggers is they are hard to model as they can vary based on trend-following model construction. Our analysis supports the idea that the further we get from our model's trigger, it's increasingly likely more (and eventually most) CTAs will have executed their position. Please see the appendix for details on how we determine trend strength, bearish/median/bullish price projections, and buy & sell triggers.

Asset Class	Underlying	Model CTA Position	Trend Strength	5-day Trend Projection			Current Spot	Sell Trigger	%age	Buy Trigger	%age
				Bearish	Median	Bullish					
Equities	S&P 500	Long	81%	72%	77%	80%	4840	4672	-3.5%	--	--
	NASDAQ-100	Long	77%	71%	77%	77%	17314	--	--	--	--
	Russell 2000	Neutral	82%	35%	66%	63%	1944	--	--	--	--
	SX5E	Neutral	64%	34%	48%	56%	4449	--	--	--	--
	SX7E	Neutral	68%	49%	61%	66%	118	--	--	--	--
	NIKKEI 225	Long	71%	73%	84%	84%	35963	--	--	--	--
Bonds	10yr Tsy Futures (TY)	Long	43%	13%	28%	28%	111.25	108.85	-2.2%	--	--
	Bund Futures (RX)	Neutral	82%	51%	57%	60%	134.00	--	--	--	--
	Korea Treasury Bond (KAA)	Long	83%	61%	72%	74%	113.02	112.58	-0.4%	--	--
Commodities	Gold	Long	38%	15%	28%	31%	2031.4	1930.2	-5.0%	--	--
	Oil	Short	-36%	-39%	-37%	-20%	73.8	--	--	--	--
	Aluminum	Short	-1%	-29%	-21%	-12%	2138.2	--	--	--	--
	Copper (BCOM, HG)	Long	3%	-28%	-15%	-3%	379.0	--	--	--	--
	Copper (GSCI, LP)	Short	-43%	-52%	-52%	-33%	8261.8	--	--	8600	4.1%
	Soybeans	Short	-89%	-94%	-95%	-83%	1214.0	--	--	1264	4.1%
	Soybean Oil	Short	-73%	-78%	-75%	-71%	46.9	--	--	--	--
	Soybean Meal	Short	-73%	-72%	-89%	-74%	356.4	--	--	--	--
FX	EUR/USD	Long	55%	24%	38%	46%	1.0894	1.0714	-1.6%	--	--
	GBP/USD	Long	58%	42%	56%	61%	1.2703	1.2414	-2.3%	--	--
	AUD/USD	Neutral	65%	21%	40%	43%	0.6598	--	--	--	--
	USD/JPY	Short	-12%	11%	22%	35%	148.1	--	--	--	--
	USD/MXN	Short	-59%	-59%	-52%	-39%	17.0894	--	--	17.5344	2.6%
	USD/CAD	Neutral	-71%	-49%	-43%	-30%	1.3431	--	--	--	--

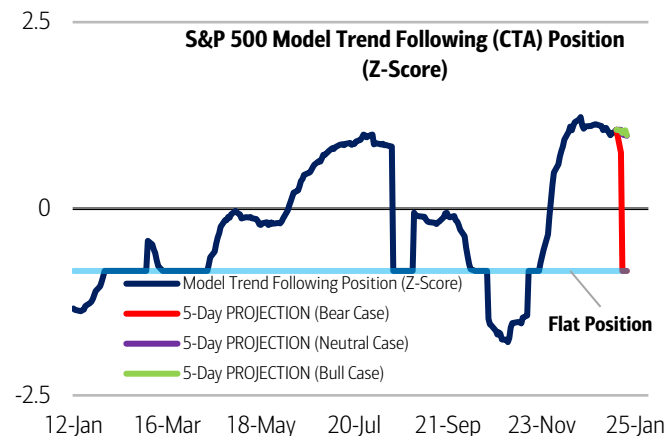
Source: BofA Global Research. Data as of 19-Jan-2024.

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## Equities

### Exhibit 2: BofA Model Trend Following (CTA) S&P 500 Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios

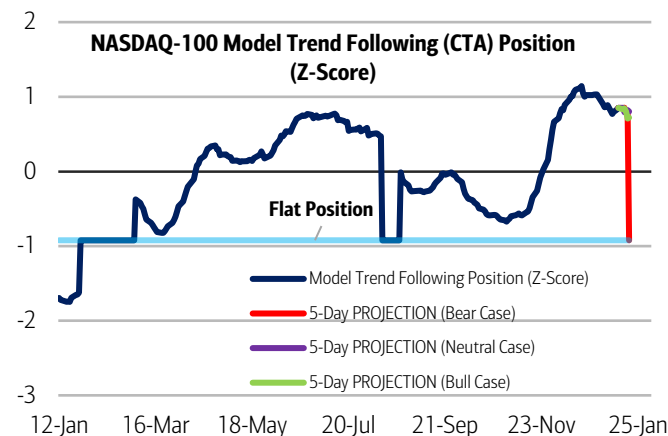


Source: BofA Global Research. Data as of 19-Jan-2024.

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### Exhibit 3: BofA Model Trend Following (CTA) NASDAQ-100 Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios

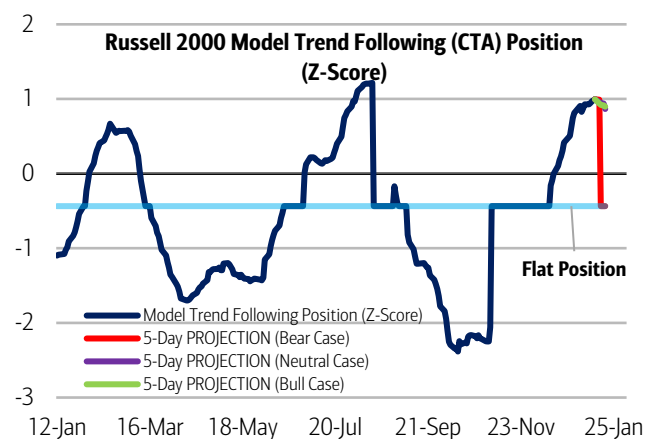


Source: BofA Global Research. Data as of 19-Jan-2024.

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### Exhibit 4: BofA Model Trend Following (CTA) Russell 2000 Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios

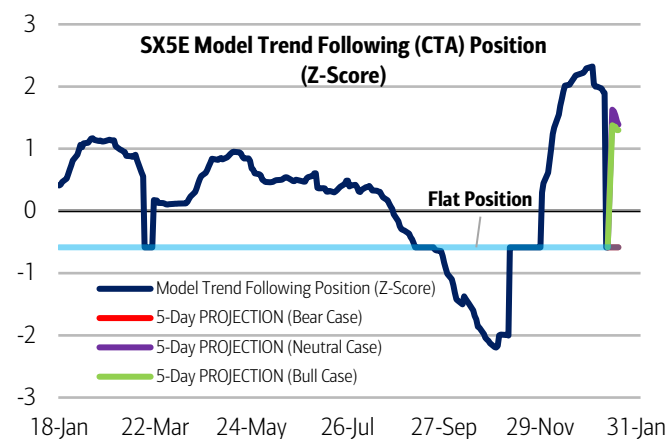


Source: BofA Global Research. Data as of 19-Jan-2024.

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### Exhibit 5: BofA Model Trend Following (CTA) ESTX50 Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios



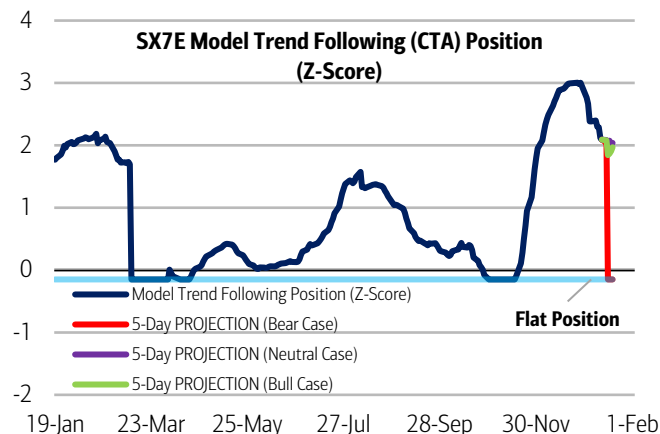
Source: BofA Global Research. Data as of 19-Jan-2024.

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## Equities (continued)

### Exhibit 6: BofA Model CTA EURO STOXX Banks Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios

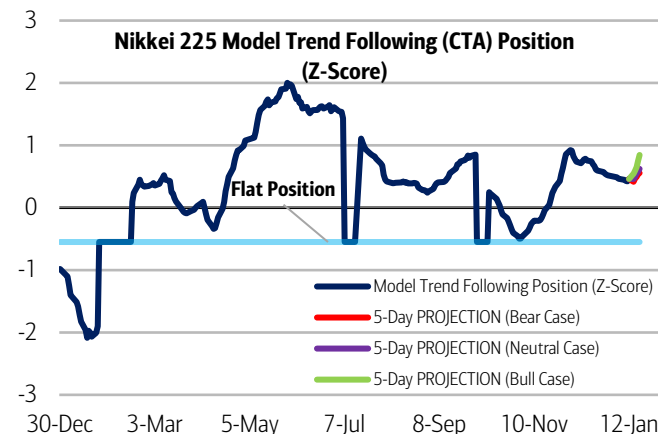


Source: BofA Global Research. Data as of 19-Jan-2024.

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### Exhibit 7: BofA Model Trend Following (CTA) NIKKEI 225 Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios



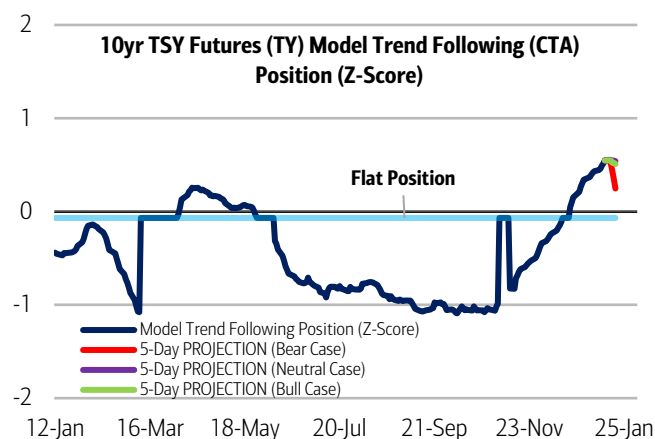
Source: BofA Global Research. Data as of 19-Jan-2024.

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## Fixed Income

### Exhibit 8: BofA Model Trend Following (CTA) TY Futures Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios

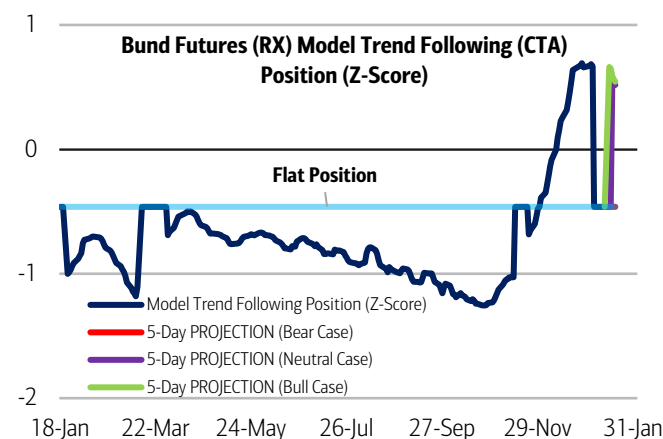


Source: BofA Global Research. Data as of 19-Jan-2024.

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### Exhibit 9: BofA Model Trend Following (CTA) Bund Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios



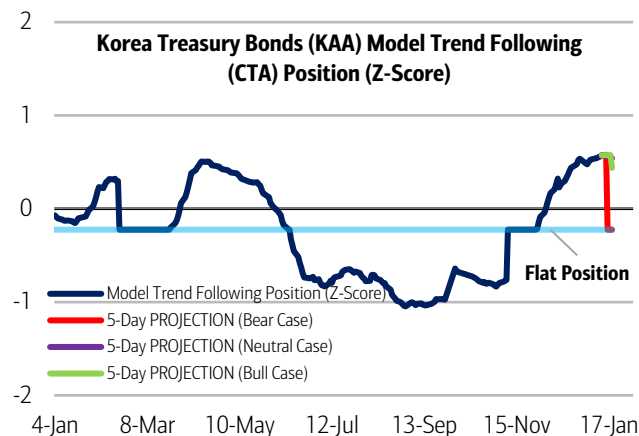
Source: BofA Global Research. Data as of 19-Jan-2024.

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## Fixed Income (continued)

### Exhibit 10: BofA Model Trend Following (CTA) KTB Futures Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios



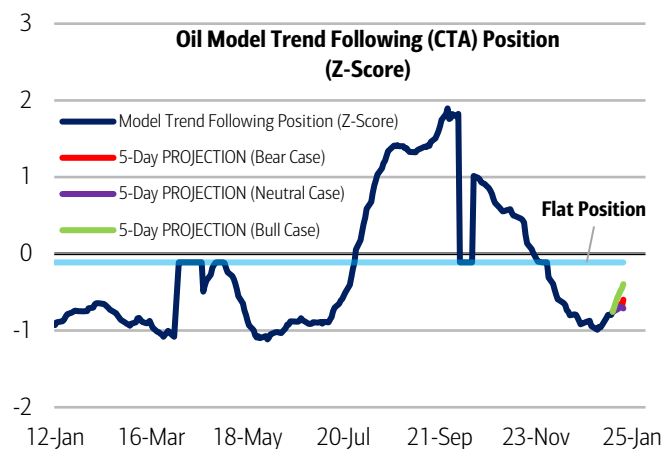
Source: BofA Global Research. Data as of 19-Jan-2024.

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## Commodities

### Exhibit 11: BofA Model Trend Following (CTA) Oil Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios

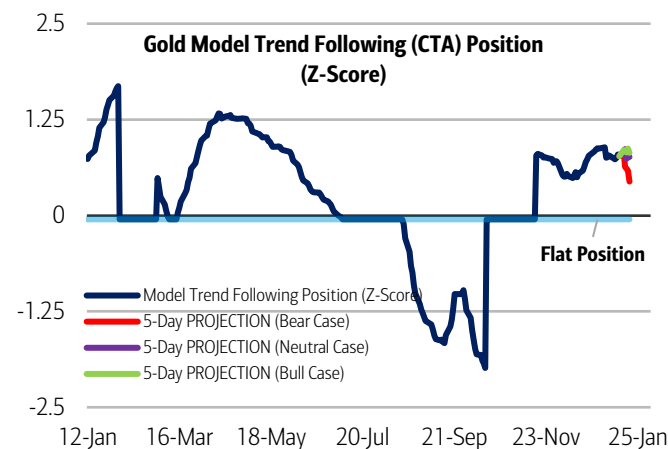


Source: BofA Global Research. Data as of 19-Jan-2024.

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### Exhibit 12: BofA Model Trend Following (CTA) Gold Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios



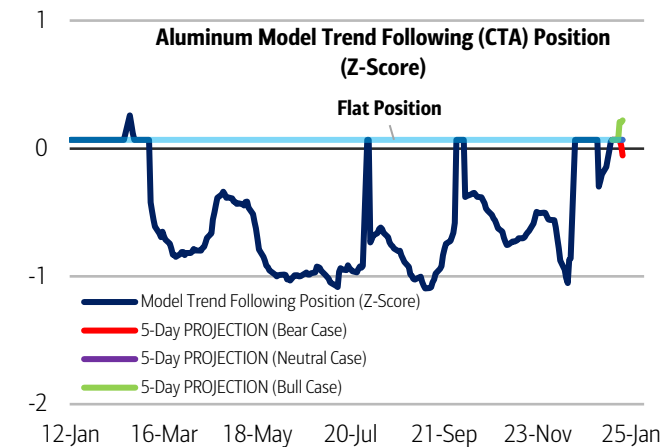
Source: BofA Global Research. Data as of 19-Jan-2024.

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## Commodities (continued)

### Exhibit 13: BofA Model Trend Following (CTA) Aluminum Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios

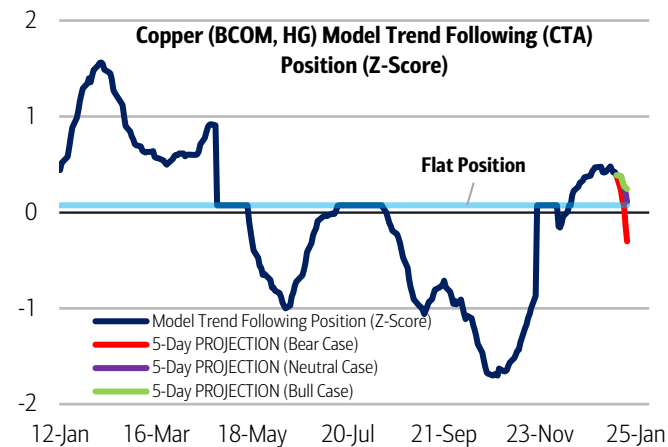


Source: BofA Global Research. Data as of 19-Jan-2024.

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### Exhibit 14: BofA Model Trend Following (CTA) Copper (HG) Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios

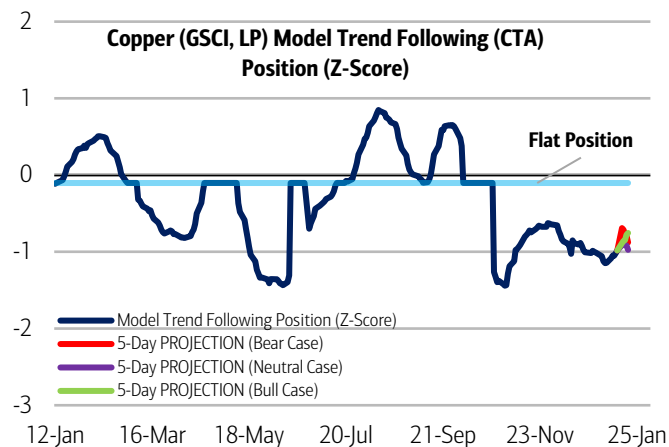


Source: BofA Global Research. Data as of 19-Jan-2024.

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### Exhibit 15: BofA Model Trend Following (CTA) Copper (LP) Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios

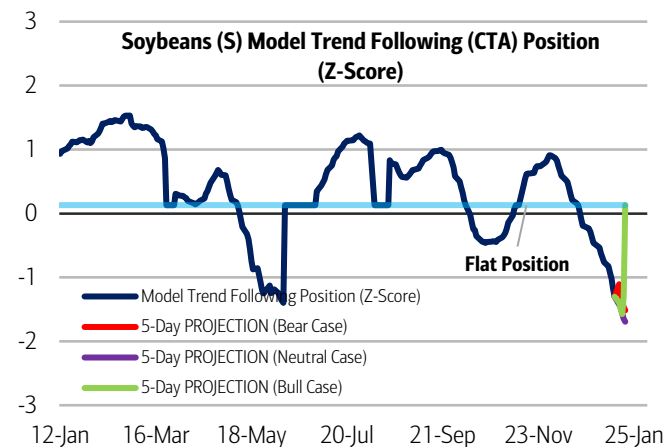


Source: BofA Global Research. Data as of 19-Jan-2024.

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### Exhibit 16: BofA Model Trend Following (CTA) Soybean (S) Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios



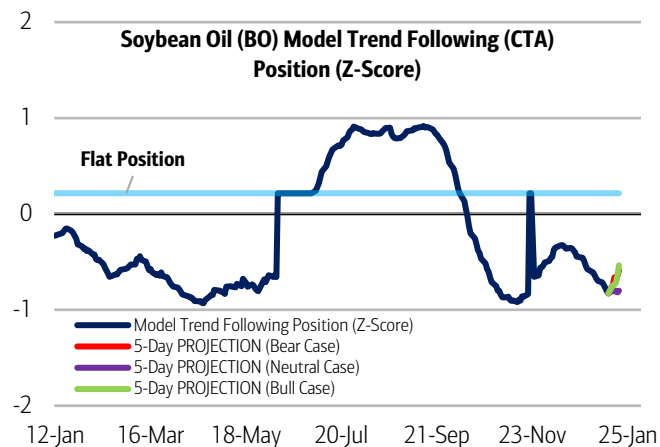
Source: BofA Global Research. Data as of 19-Jan-2024.

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## Commodities (continued)

### Exhibit 17: BofA Model Trend Following (CTA) Soybean Oil Position

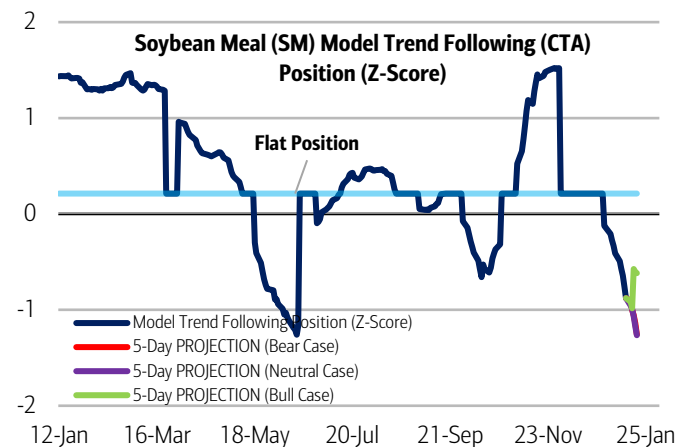
Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios



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### Exhibit 18: BofA Model Trend Following (CTA) Soybean Meal Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios

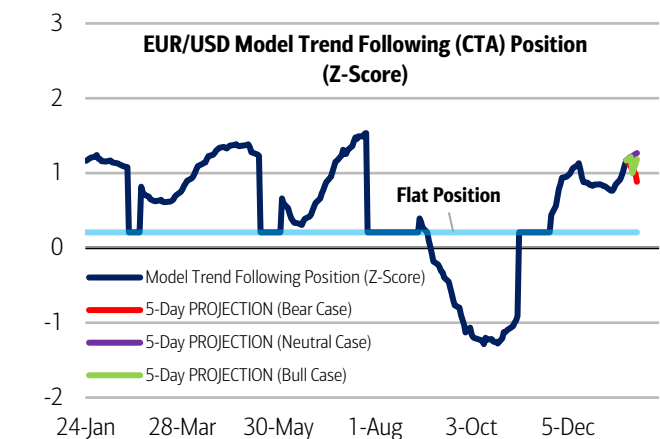


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## Foreign Exchange (FX)

### Exhibit 19: BofA Model Trend Following (CTA) EUR/USD Position

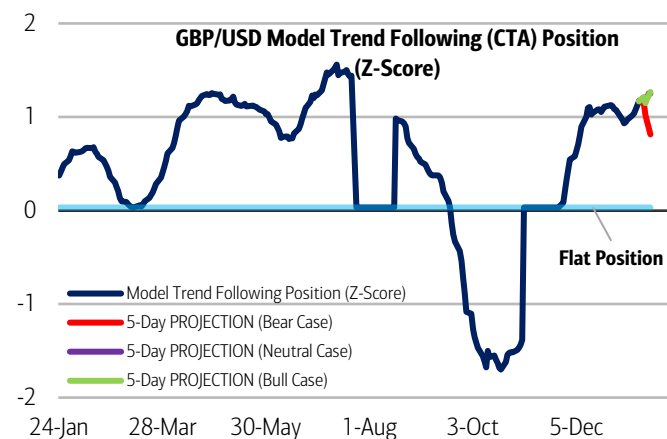
Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios



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### Exhibit 20: BofA Model Trend Following (CTA) GBP/USD Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios

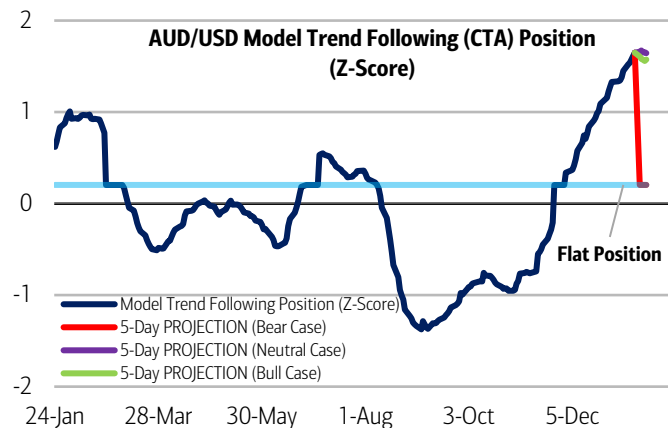


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## FX (continued)

### Exhibit 21: BofA Model Trend Following (CTA) AUD/USD Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios

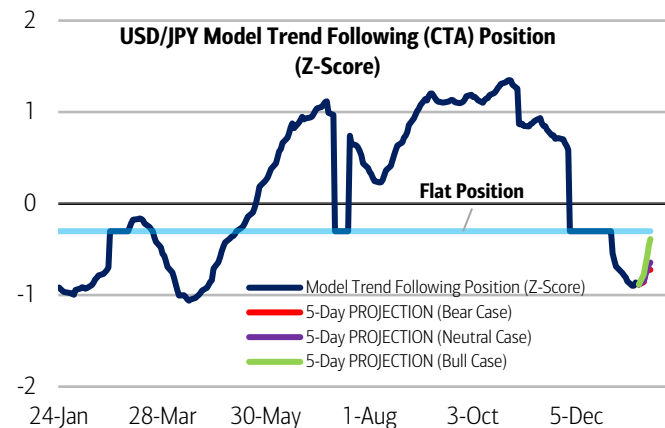


Source: BofA Global Research. Data as of 19-Jan-2024.

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### Exhibit 22: BofA Model Trend Following (CTA) USD/JPY Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios

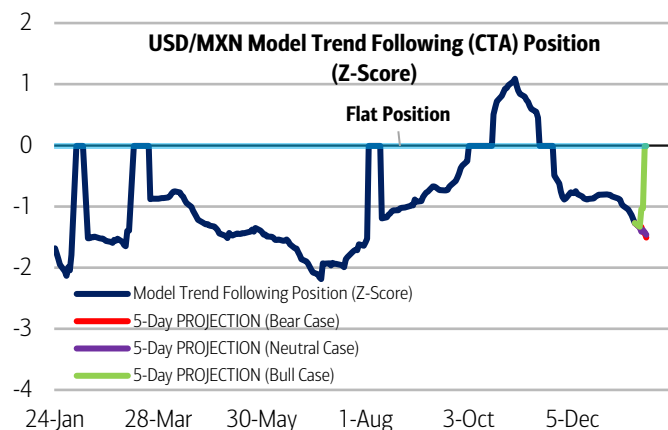


Source: BofA Global Research. Data as of 19-Jan-2024.

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### Exhibit 23: BofA Model Trend Following (CTA) MXN/USD Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios

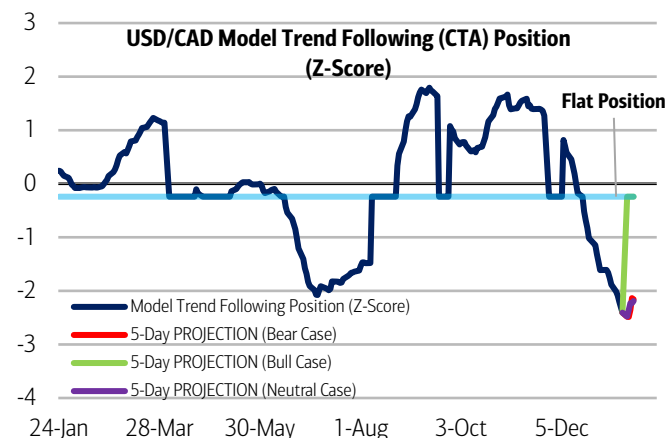


Source: BofA Global Research. Data as of 19-Jan-2024.

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### Exhibit 24: BofA Model Trend Following (CTA) CAD/USD Position

Z-score of position shown below along with projection of how the position could evolve over the next 5 trading sessions based on bullish, neutral, and bearish scenarios



Source: BofA Global Research. Data as of 19-Jan-2024.

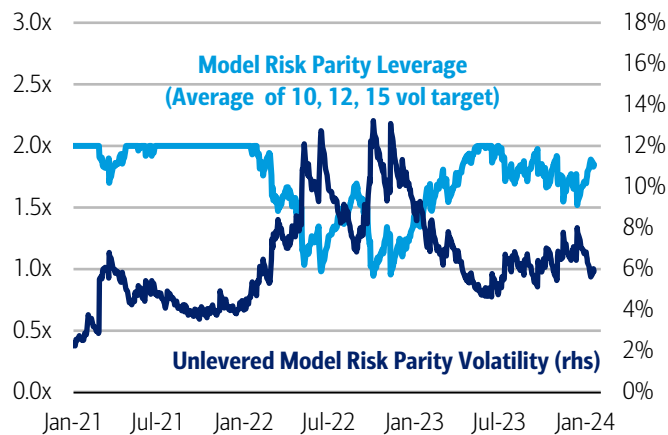
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# Risk Parity Model

## Exhibit 25: BofA Model Risk Parity Realized Volatility & Leverage

Our model risk parity leverage is a function of the prevailing volatility and below we show the average for three popular risk targets

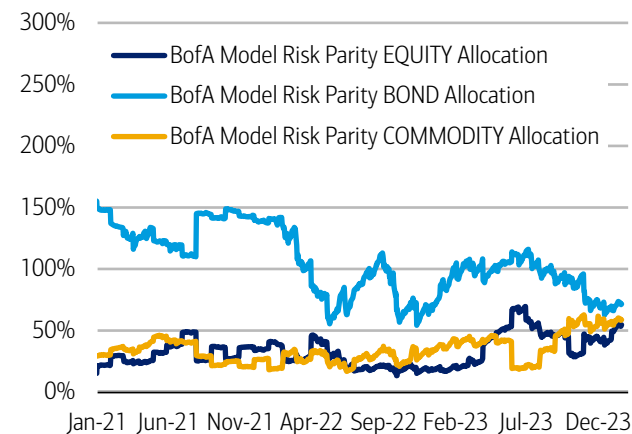


Source: BofA Global Research. Data as of 19-Jan-2024.

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## Exhibit 26: BofA Model Risk Parity Asset Class Allocations

Allocations are inversely proportional to an asset's volatility, that is, lower volatility assets have higher allocation



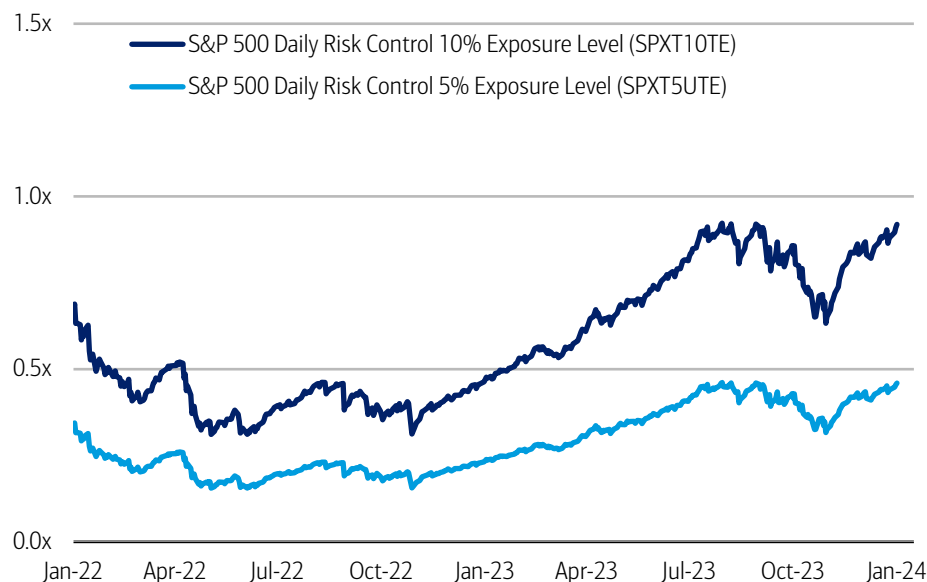
Source: BofA Global Research. Data as of 19-Jan-2024.

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# S&P 500 Equity Vol Control

## Exhibit 27: S&P 500 Daily Risk Control (10% and 5%) Exposure Level

To model equity vol control, we show the exposure for the S&P Daily Risk Control Index (both 10% and 5%)



Source: BofA Global Research. Data as of 19-Jan-2024.

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## Recent price action around CTA model trigger points

### Exhibit 28: Ultra Long Term Tsy Futures (WN) trigger on 18-Jan-2024

WN futures featured in our daily update, please email us to be subscribed



Source: BoFA Global Research, Bloomberg

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### Exhibit 29: RTY stop loss triggered week of 19-Jan-24

Increased selling at our model's trigger point



Source: BoFA Global Research, Bloomberg

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### Exhibit 30: KOSPI2 stop loss triggered week of 19-Jan-24

KOSPI2 is featured in our daily update, please email us to be subscribed



Source: BoFA Global Research, Bloomberg

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### Exhibit 31: CHF/USD stop loss triggered week of 19-Jan-24

CHF is included in our daily update, please email us to be subscribed



Source: BoFA Global Research, Bloomberg

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## CTA model trigger points (continued)

### Exhibit 32: AUD/USD stop loss triggered week of 19-Jan-24

Increased selling at our model's trigger point



Source: BofA Global Research, Bloomberg

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### Exhibit 33: EURO STOXX 50 trigger in week ending 10-Nov-2023

Accelerated covering through our model's trigger



Source: BofA Global Research, Bloomberg

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### Exhibit 34: Russell 2000 trigger in week ending 3-Nov-2023

Accelerated covering through our model's trigger



Source: BofA Global Research, Bloomberg

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### Exhibit 35: EUR/USD stop loss triggered week ending 3-Nov-2023

Accelerated covering through our model's trigger



Source: BofA Global Research, Bloomberg

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## CTA model trigger points (continued)

### Exhibit 36: 10yr Tsy Futures (TY) trigger in week ending 3-Nov-2023

Accelerated covering through our model's trigger



Source: BofA Global Research, Bloomberg

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### Exhibit 37: Ultra Long Term Tsy Futures (WN) trigger on 3-Nov-2023

WN futures featured in our daily update, please email us to be subscribed



Source: BofA Global Research, Bloomberg

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### Exhibit 38: Soybean Meal trigger in week ending 27-Oct-2023

Accelerated covering through our model's trigger



Source: BofA Global Research, Bloomberg

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### Exhibit 39: Gold stop loss triggered week ending 13-Oct-2023

Accelerated covering through our model's trigger



Source: BofA Global Research, Bloomberg

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## CTA model trigger points (continued)

### Exhibit 40: Oil stop loss triggered week ending 6-Oct-2023

Increased selling at our model's trigger point

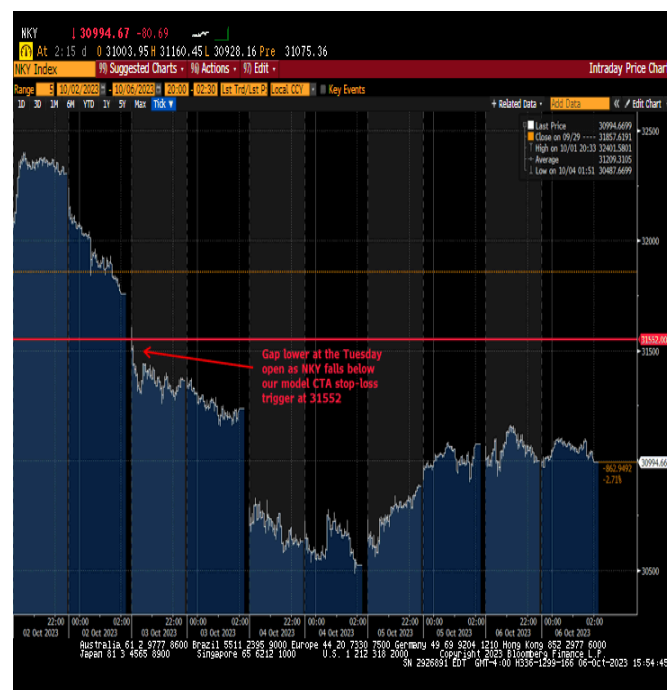


Source: BofA Global Research, Bloomberg

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### Exhibit 41: Nikkei stop loss triggered week ending 6-Oct-2023

Increased selling at our model's trigger point



Source: BofA Global Research, Bloomberg

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### Exhibit 42: CAD/USD stop loss triggered week ending 22-Sep-2023

Acceleration upward post our model's buy to cover trigger



Source: BofA Global Research, Bloomberg

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### Exhibit 43: SPX stop loss triggered week ending 18-Aug-22

Persistent downside following a sell trigger on 15-Aug consistent with CTAs fully exiting a stretched long SPX position



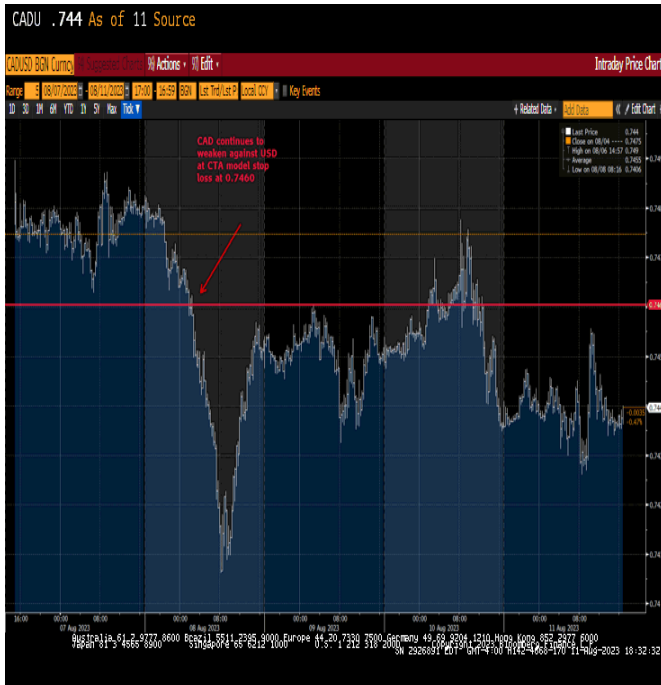
Source: BofA Global Research, Bloomberg

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## CTA model trigger points (continued)

**Exhibit 44: CAD/USD stop loss triggered week ending 11-Aug-23**  
Increased selling at our model's trigger point



Source: BofA Global Research, Bloomberg

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**Exhibit 45: MXN/USD stop loss triggered week ending 4-Aug-23**  
Increased selling at our model's trigger point



Source: BofA Global Research, Bloomberg

BoFA GLOBAL RESEARCH

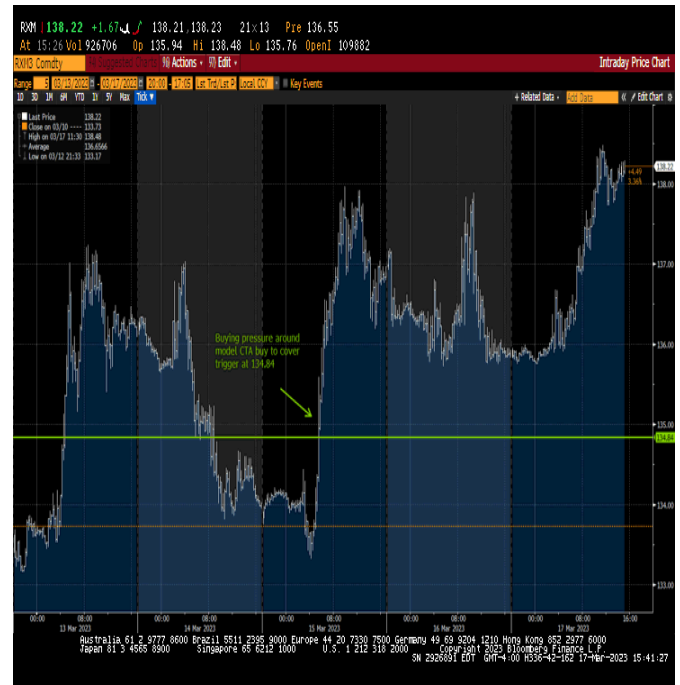
**Exhibit 46: MXN/USD stop loss triggered week of 17-Mar-23**  
Accelerated selling through our model's trigger



Source: BofA Global Research, Bloomberg

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**Exhibit 47: RX stop loss triggered week of 17-Mar-23**  
Accelerated covering through our model's trigger



Source: BofA Global Research, Bloomberg

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## CTA model trigger points (continued)

### Exhibit 48: TY stop loss triggered week of 17-Mar-23

Accelerated upside through our model's trigger



Source: BofA Global Research, Bloomberg

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### Exhibit 49: SXSE stop loss triggered week of 17-Mar-23

After testing, SXSE accelerated declines through model trigger



Source: BofA Global Research, Bloomberg

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### Exhibit 50: Russell 2000 stop loss triggered week of 10-Mar-23

Our model's stop loss coincided with a significant drop in RTY



Source: BofA Global Research, Bloomberg

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### Exhibit 51: AUD/USD stop loss triggered week of 24-Feb-23

Ceiling at our model's exit level and as well further downside



Source: BofA Global Research, Bloomberg

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## CTA model trigger points (continued)

### Exhibit 52: JPY/USD stop loss triggered week of 24-Feb-23

Acceleration in downside post our model's trigger



Source: BofA Global Research, Bloomberg

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### Exhibit 53: EUR/USD stop loss triggered week of 24-Feb-23

EUR/USD saw a ceiling post our sell trigger and as well continued downside



Source: BofA Global Research, Bloomberg

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### Exhibit 54: TY futures expected to see large shorts week of 24-Feb-23

Persistent downside post a sell trigger early in the week



Source: BofA Global Research, Bloomberg

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### Exhibit 55: KTB futures stop loss triggered week of 17-Feb-23

Downside continued through our model's long unwind trigger



Source: BofA Global Research, Bloomberg

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## CTA model trigger points (continued)

### Exhibit 56: MXN/USD stop loss triggered week of 10-Feb-23

While the move did accelerate around our model stop loss, Mexican central bank actions later in the week propelled the peso higher



Source: BofA Global Research, Bloomberg

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### Exhibit 57: RTY outperformance vs SPX week of 3-Feb-23

In the week prior our model forecasted outsized buying pressure in the Russell 2000 relative to the S&P 500



Source: BofA Global Research, Bloomberg

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### Exhibit 58: Nikkei-225 stop loss triggered week of 23-Jan-23

After hitting our CTA model's stop loss, the index showed support for the remainder of the week



Source: BofA Global Research, Bloomberg

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### Exhibit 59: NASDAQ-100 stop loss triggered on 27-Jan-23

The index saw upward price action which is consistent with CTA short covering



Source: BofA Global Research, Bloomberg

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# Appendix

## Background on trend following strategies (CTAs)

Trend following strategies have their roots in the commodity asset class as some of the earliest known applications were applied to futures within that asset class.

Correspondingly, these trend following strategies were referred to as CTAs which is short for Commodity Trading Advisor. Today, however, global futures markets also comprise stock index, interest rate, currency, and commodity futures. To leverage the benefits of diversification that exists across these asset classes, trend following strategies have broadened their investment universe but are often still referred to as CTAs. Assets in trend following strategies are tracked in a database maintained by BarclayHedge and **as of 2023-Q2 stood at \$352.2bn.**

### CTAs can be trend followers but also can be fundamental discretionary

CTA managers often implement rules-based systematic trend following strategies but also can make investment decisions based on fundamental analysis and market views. Those that are systematic could be allocating to futures across multiple asset classes as a function of both trend and volatility. Discretionary CTAs, on the other hand, may also allocate in some part or fully based on fundamentals and economic factors. This class of CTAs may become more concentrated in a given asset class based on outlook and may not be as broadly allocated across markets at any given period.

### Benchmark CTA explained by x-asset, risk controlled, trend following

Despite the inclusion of fundamental, discretionary trading strategies and/or a focus on a subset of asset classes, our analysis suggests CTA performance can largely be explained by:

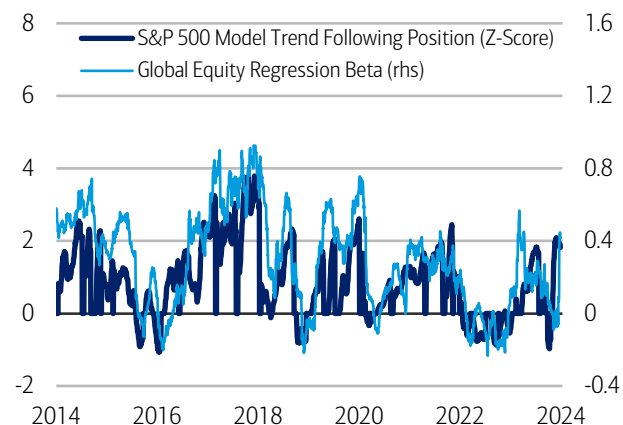
1. Investments across multiple asset classes (i.e., equity, interest rates, commodities, and currencies)
2. The use of trend following signals to determine long or short allocations
3. Risk control mechanisms to determine sizing and increase diversification.

To this effect, we built a top-down multi-factor regression model to explain the performance of a representative benchmark CTA index using a set of cross-asset investments. The CTA benchmark we reference is the SG CTA Index which is comprised of approximately 20 of the largest CTAs by assets, reconstituted yearly with members held in equal weight, and published with daily data. Then, specifically, the multi-factor regression is of global equities, global bonds, commodities, and currency daily returns on the SG CTA index's daily returns. For more details on the top-down multi-factor regression and a discussion on CTA benchmarks, please see our report titled *Quantitative Investment Strategies Panorama*, "Trends aren't going out of fashion", pages 14-19 published in Mar-2017.

In Exhibit 48 and 49 we show the regression beta of both global equities and bonds on the SG CTA Index alongside the z-score of our bottom-up estimate of CTA model sizing (the data displayed in the CTA section earlier) within the S&P 500 and TY futures respectively. Our bottom-up estimate of the position size is estimated by the ratio of component trend to its prevailing volatility. Importantly, our simple bottom-up estimate calculation closely tracks the respective regression betas over time.

### Exhibit 60: BofA bottom-up model CTA allocation in the S&P 500 alongside a top-down regression beta of global equities on the SG CTA Index (a popular benchmark CTA index)

Our bottom-up model is in-line with a top-down regression



Source: BofA Global Research. Data as of 19-Jan-2024.

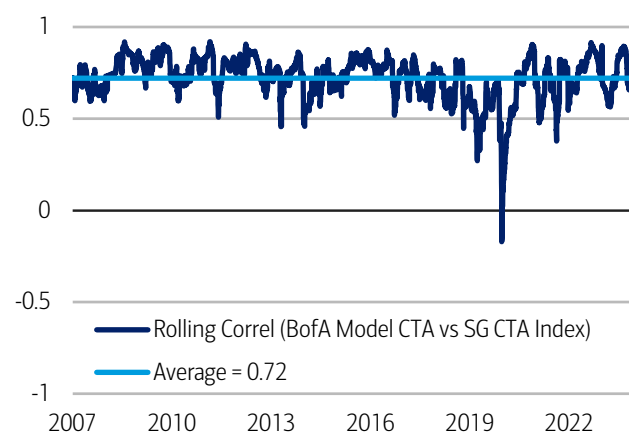
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### BofA model CTA strategy tracks the benchmark index well

We also constructed a bottom-up CTA strategy using a wide range of futures investments across multiple asset classes. To do so, for each underlying we started with the trend/vol ratio, then assumed equal risk across asset classes and layered on top both rules for stop losses & subsequent re-initiation of positions. In Exhibits 50 and 51 are the rolling correlation and beta of returns for our bottom-up CTA strategy and the SG CTA benchmark index. Correlation of daily returns averages around 0.7 with beta close to 1.

### Exhibit 62: Rolling correl. of daily returns of BofA bottom-up model CTA strategy and the SG CTA Index (a popular benchmark CTA index)

Our bottom-up CTA model sized using trend/vol ratios, equal risk across asset classes, and with rules governing stop loss and re-initiation of positions tracks the benchmark CTA index well through time.

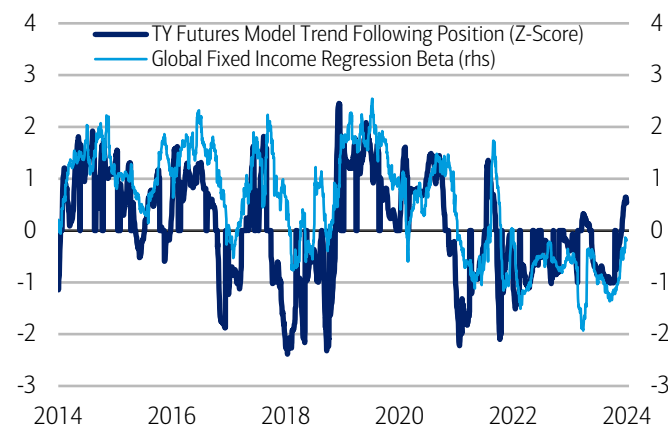


Source: BofA Global Research. Data as of 19-Jan-2024.

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### Exhibit 61: BofA bottom-up model CTA allocation in TY futures alongside a top-down regression beta of global bonds on the SG CTA Index (a popular benchmark CTA index)

Our bottom-up model is in-line with a top-down regression

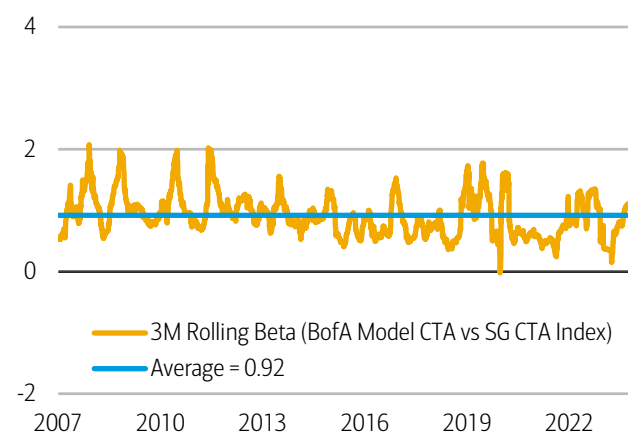


Source: BofA Global Research. Data as of 19-Jan-2024.

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### Exhibit 63: Rolling 3M beta of daily returns of BofA bottom-up model CTA strategy and the SG CTA Index (a popular benchmark CTA index)

Our bottom-up CTA model sized using trend/vol ratios, equal risk across asset classes, and with rules governing stop loss and re-initiation of positions tracks the benchmark CTA index well through time.



Source: BofA Global Research. Data as of 19-Jan-2024.

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## Background on risk parity strategies

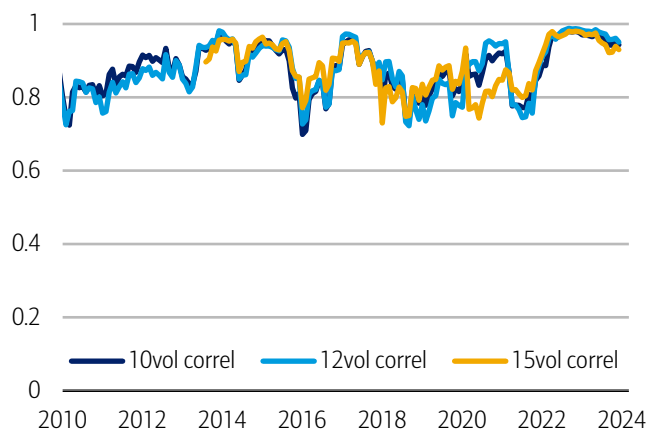
Similar to CTAs, our analysis indicates that risk parity strategies may allocate across the major asset classes and also size their positions as a function of prevailing volatility. However, risk parity strategies are agnostic to price trend and remain fully long each asset class. Risk parity strategies are popular for their ability to target diversification and have a strong track record of positive performance. In 2017, HFR (Hedge Fund Research) launched a suite of benchmark risk parity indices that are comprised of some of the largest risk parity funds. These benchmark indices are published monthly.

The BofA risk parity model is a simple risk parity application applied to equities (S&P 500), bonds (10Y Treasury Futures Total Return), and commodities (S&P GSCI index) rebalanced monthly using the prior three months of data to determine volatility and correlation forecasts. In Exhibits 53 through 55 we show applications of the BofA risk parity model with risk targets of 10, 12, and 15 and in each case compare to the respective HFR risk parity benchmark over monthly periods. Then in Exhibit 52 is the rolling one-year correlation of prior twelve monthly returns for each HFR index and BofA model pair. Correlation tends to be high ( $> 0.8$ ). As well, the betas are close to 1 with each model strategy closely fitting the respective HFR benchmark.

Unlike for CTAs, there is no database of risk parity funds from which we could gather an estimate of assets tracking the strategy. However, **commonly used estimates have ranged from \$200bn to \$750bn.**

### Exhibit 64: Rolling 1-year correlation of HFR risk parity and BofA model risk parity monthly returns

HFR risk parity indices with 10, 12, and 15 vol are highly correlated to the respective BofA model risk parity strategies with similar vol targets.

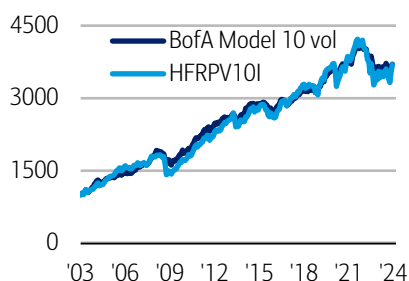


Source: BofA Global Research. Monthly data from Jan-2010. HFR institutional risk parity indices are used.

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### Exhibit 65: BofA Model Risk Parity (10% vol target, 1.5x max leverage)

BofA model risk parity tracks the benchmark HFR risk parity index

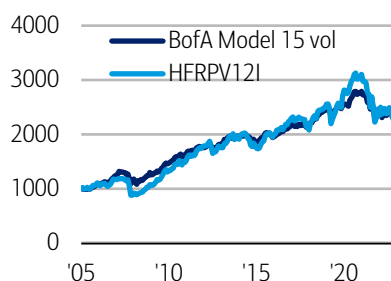


Source: BofA Global Research. Data as of 31-Dec-2023.

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### Exhibit 66: BofA Model Risk Parity (12% vol target, 1.5x max leverage)

BofA model risk parity tracks the benchmark HFR risk parity index

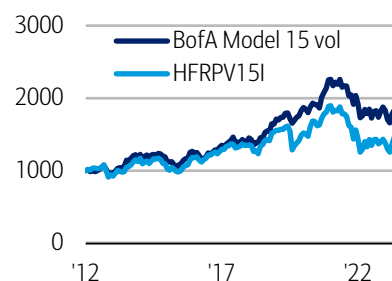


Source: BofA Global Research. Data as of 31-Dec-2023.

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### Exhibit 67: BofA Model Risk Parity (15% vol target, 3.0x max leverage)

BofA model risk parity tracks the benchmark HFR risk parity index



Source: BofA Global Research. Data as of 31-Dec-2023.

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## Background on equity vol control strategies

Equity vol control is a more simple quantitative strategy relative to CTAs and risk parity. This class of quant dynamically adjusts leverage to target a predefined level of risk based on prevailing equity volatility. For example, if the prevailing level of S&P 500 volatility was 20%, then an S&P 500 10% vol controlled strategy would set leverage to 0.5x, or 50% of total AUM. If on the other hand prevailing volatility was 5%, then leverage would be set to 2x, or 200% of total AUM. Equity vol control strategies are often applied to equity indices with the largest market cap and volumes in order to improve tradability. Risk targets tend to range from 5% to 15%. Versus CTAs and risk parity, assets in equity vol control are the least publicized **but estimates of \$300bn can be reasoned.**

## CTA model parameters and outputs explained

### Trend strength is calculated using a collection of moving average crosses

Our model trend following strategy requires the measurement of an asset's price trend and we do so using a collection of moving average crosses. The key parts of the calculation are the use of both near and far moving average crosses, weighted equally. A simple example of this would be to measure the 1-month, 3-month, and 10-month moving averages for an asset. Then we compare the 1-month to each the 3-month and 10-month where if it is higher we score it +1 and lower then -1. The two scores are then averaged such that if the 1-month was higher than both the 3- and 10-month the trend strength would be +1 (max long) and if the 1-month was lower than both the 3- and 10-month the trend strength would be -1 (max short). Our actual calculation uses a greater number of crosses and also prorates the crosses based on component volatility in order to make trend strength more continuous over time. Importantly, we do not use the spot price in any cross as our analysis leads us to conclude that actual trend following strategies do not as well.

### Bearish/median/bullish price paths are determined using historical data

For each underlying that we apply our trend following model on we also show a projection of how the model position can evolve over the next five trading days. We do this by applying our CTA model on bearish, median, and bullish price paths over the next week. These price paths are determined using historical data for each underlying. Price paths are in part a function of the prevailing volatility of an asset so when determining the various paths we sample only those historical data where volatility is similar to current. Then from this subset of data we can determine low (bear), neutral (median), and high (high) price paths to apply one week ahead.

### Rules governing buy and sell triggers in our CTA model

At any given point in time our bottom-up trend following model applied on an underlying asset can be either in a position (long or short) or flat. If in a position, then should a price trend strongly to reverse, our model could potentially hit a stop loss. We assume the stop loss is set such that in an extreme event where every component hits a stop loss simultaneously in the overall model, the loss to the portfolio is approximately 10%. For an underlying asset which our trend following model is currently flat, we assume re-entry occurs under two conditions. If the asset's price hits a local high and its trend strength is positive, a long is initiated. Vice-a-versa, if an asset hits a local low and its trend strength is negative, a short is initiated. The local high/low level can range from lookbacks over the prior five to ten days.

## Timescale of leverage changes

CTAs, risk parity, and equity vol control strategies monitor and adjust leverage daily. However, the lag between a model prescribed change in leverage and the actual adjustment varies. Our models and analysis indicate that CTAs are the fastest to respond to model changes, potentially even intraday. Risk parity and equity vol control, however, tend to move slower with adjustments to leverage occurring in the one to two subsequent trading sessions.



## A comment on model diversity and market impact

It is important to note that the analysis in this report on trend following and risk parity is based on one implementation of each class of strategy that attempts to track a respective benchmark for each. Actual trend following and risk parity strategies that compose the benchmark indices could vary in their rules-based implementations. This is an important consideration with regards to market impact from this class of strategies. That is, to the extent the models have more diversity, the potentially less impact they can have on the market as trading may not occur at the same levels and/or at the same time. This is a crucial point that is commonly not discussed surrounding this type of analysis.



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# Research Analysts

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## Global

### Benjamin Bowler

Equity-Linked Analyst  
BofAS  
[benjamin.bowler@bofa.com](mailto:benjamin.bowler@bofa.com)

## Americas

### Nitin Saxena

Equity-Linked Analyst  
BofAS  
[nitin.saxena@bofa.com](mailto:nitin.saxena@bofa.com)

### Chintan Kotecha

Equity-Linked Analyst  
BofAS  
[chintan.kotecha@bofa.com](mailto:chintan.kotecha@bofa.com)

### Nicholas Dunne

Equity-Linked Analyst  
BofAS  
[nicholas.dunne@bofa.com](mailto:nicholas.dunne@bofa.com)

## EMEA

### Abhinandan Deb >>

Equity-Linked Analyst  
MLI (UK)  
[abhinandan.deb@bofa.com](mailto:abhinandan.deb@bofa.com)

## Asia-Pac

### Lars Naeckter >>

Equity-Linked Analyst  
Merrill Lynch (DIFC)  
[lars.naeckter@bofa.com](mailto:lars.naeckter@bofa.com)

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