BofA SECURITIES

Systematic Flows Monitor

Crude Oil could see further upside from CTA short covering

Introducing an upgrade to our CTA model

This past Monday we published More CTA Models = Better Impact Estimates, which motivated an expansion of our CTA model to include multiple trend lookback windows and varying stop-loss calibrations. The key takeaway from our work is that the models used by actual CTA strategies can vary but when a greater number of trend-following models are in consensus, the potential for their flows to have larger market impact increases. This week's flows monitor incorporates our updated CTA model.

Trend followers hold on to Gold longs and Oil shorts

Looking to next week, the greater risk from CTA flows could come from short covering in Oil. Medium to long-term trend followers are short Crude Oil (CL) in size, with long-term models stretched even more so. Our model expects covering to accelerate from 64.9 to 71.4 on the front CL future. In other commodities, CTAs remain long Gold, Soybean Oil, and short Soybean Meal in size. Soybean Oil longs could see unwind pressure in the 46.1 to 43.9 range.

USD shorts still large vs EUR, GBP, and MXN

Our model shows CTAs near max long EUR, GBP, and MXN versus USD. Positions are not near unwind triggers now and only would be at risk should USD see a sharp rally higher. JPY and CAD longs are less stretched while AUD is mixed.

Less consensus on CTA equity & bond positioning

Trend followers could be long European equities but positioning is varied based on trend speed. Short to medium-term trend followers could have turned long the S&P 500 and NASDAQ-100 but long-term models remain short. Russell 2000, on the other hand, is likely short from medium and long-term models. In fixed income, CTAs are likely short 10Y US Treasury futures but not in large size. On the other hand, the 30Y future does have a larger short but there's little near-term risk of covering.

SPX gamma is long & small suggesting low market impact

As of Thursday's close, SPX gamma was long $1.7bn (37th 1y %ile) continuing the positive but low magnitude gamma regime we have discussed in prior reports. Additionally, the inflows into long VIX ETPs we noted in our 23 May 2025 report seem to have continued (e.g., the AUM in levered long VIX products is at nearly the highest level since 2022) helping to drive the overall end-user VIX delta exposure higher (95th 1y %ile). The dealer VIX gamma has also seen some modest growth, though is not extreme (59th 1y %ile). See our option positioning daily for details.

Timestamp: 06 June 2025 07:29PM EDT

06 June 2025

Equity Derivatives
Global

BofA Data Analytics

Table of Contents

Global Equity Derivatives Rsch
BofAS

Chintan Kotecha
Equity-Linked Analyst
BofAS
chintan.kotecha@bofa.com

Nitin Saksena
Equity-Linked Analyst
BofAS
nitin.saksena@bofa.com

Nicholas Dunne
Equity-Linked Analyst
BofAS
nicholas.dunne@bofa.com

Matthew Welty
Equity-Linked Analyst
BofAS
matthew.welty@bofa.com

Benjamin Bowler
Equity-Linked Analyst
BofAS
benjamin.bowler@bofa.com

Abhinandan Deb >>
Equity-Linked Analyst
MLI (UK)
abhinandan.deb@bofa.com

Lars Naeckter >>
Equity-Linked Analyst
Merrill Lynch (DIFC)
lars.naeckter@bofa.com

See Team Page for List of Analysts

A list of abbreviations used is available at the end of this report.

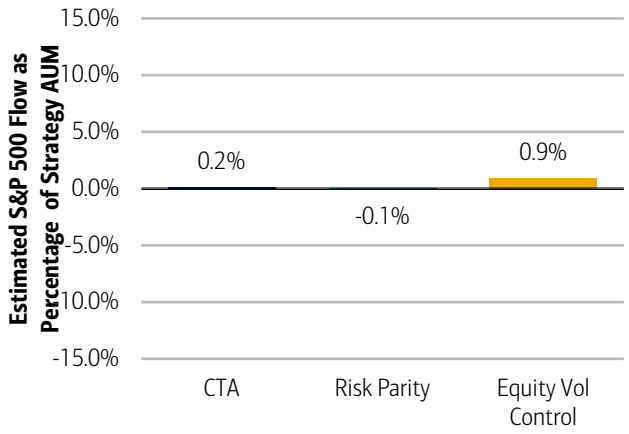
Current S&P 500 1-Day Systematic Flows

On Monday, 9-Jun-2025 we could see S&P 500 buying from equity vol control.

As of Thursday's close, SPX gamma was long $1.7bn (37th 1y %ile) continuing the positive but low magnitude gamma regime we have discussed in prior reports.

For those interested in more regular updates, contact us to be added to the distribution list for our Option Positioning Daily Update report.

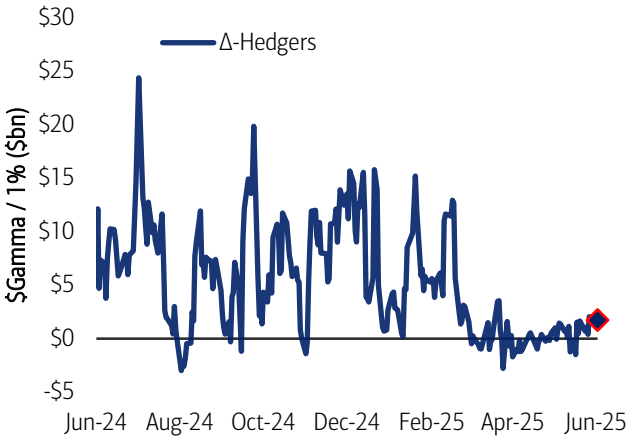
Exhibit 1: Estimated 1-day S&P 500 Flow from CTAs, Risk Parity, and Equity Vol Control
Estimates are for Monday, 9-Jun-2025 and subject to change each day. Next week could see buying from vol control.



Source: BofA Global Research. Data as of 6-Jun-2025.

BofA GLOBAL RESEARCH

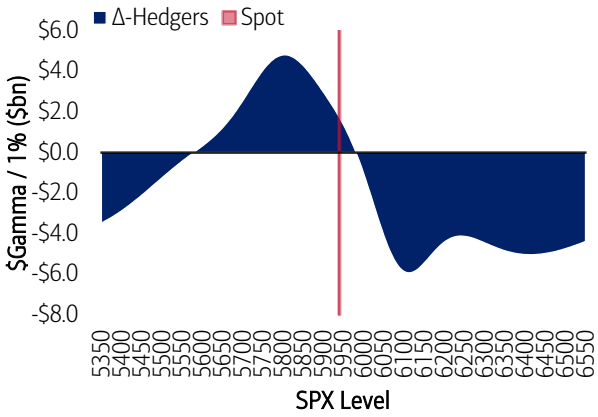
Exhibit 2: End-of-day SPX option gamma for delta-hedgers
EOD SPX gamma for Δ-Hedgers



Source: BofA Global Research, CBOE. Data through 05-Jun-25.

BofA GLOBAL RESEARCH

Exhibit 3: Current SPX gamma for delta-hedgers across spot levels
Current EOD SPX gamma for Δ-Hedgers after a hypothetical move in spot



Source: BofA Global Research, CBOE. Data for 05-Jun-25. Gamma is recomputed after each hypothetical move in spot holding fixed strike vols and option positions constant.

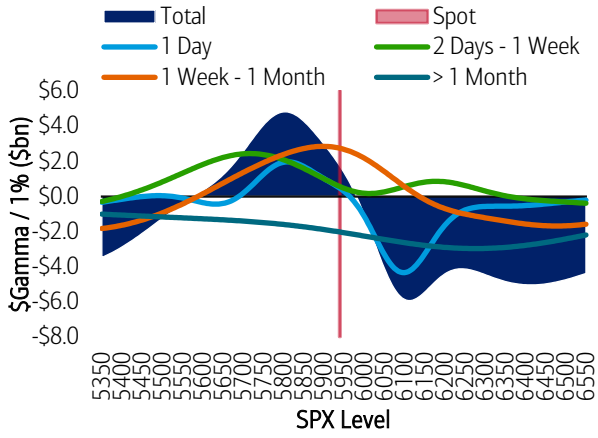
BofA GLOBAL RESEARCH

SPX Option Gamma Positioning

Using our SPX gamma levels (as shown in Exhibit 2), we then infer the likely impact of delta-hedging on the underlying equity market. Specifically, Exhibit 5 highlights our estimate for the impact of gamma (via delta-hedging with futures) on S&P 500 e-mini 1-month realized volatility if delta-hedging occurred only in the last hour, last 30-minutes, or last 15-minutes of the trading session. See the appendix for additional details on how the market impact analysis was conducted.

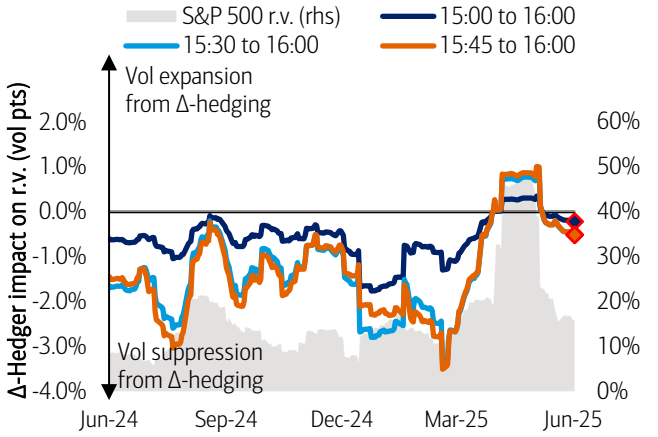
As an example, Exhibit 5 indicates that if delta-hedging was confined to the last 15-minutes of the trading day (15:45 to 16:00), then SPX gamma may have been responsible for a 0.5pt (3%) decrease in S&P 500 e-mini realized vol over the past 1-month.

Exhibit 4: SPX gamma for delta-hedgers across spot levels & tenors
SPX gamma contribution of various tenors at different underlying levels



Source: BofA Global Research, CBOE. Data as of 05-Jun-25. Tenors are given in business days.
BofA GLOBAL RESEARCH

Exhibit 5: Estimated impact of Δ-hedging on S&P 500 realized vol
Estimated impact of EOD SPX gamma on S&P 500 e-mini 1-month realized volatility via delta-hedging, with hedging confined to different time windows near the close (=market observed realized vol – estimated vol w/o Δ-hedgers)



Source: BofA Global Research, CBOE. Data as of 05-Jun-25.
BofA GLOBAL RESEARCH

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 6 summarizes our model applied to 23 common CTA underlyings within equities, fixed income, commodities and FX using three different windows to measure trend strength and four different stop loss triggers. Further details on this model can be found in More CTA Models = Better Impact Estimates.

To illustrate how to interpret Exhibit 6, using the first row as an example, the takeaways are: (1) Our CTA model's S&P 500 futures position is mixed, (2) The current trend signal is +23% using short term trends, +5% using medium term trends, and -61% using long term trends 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 increase on median to bullish paths and decrease on bearish paths for short and medium-term models and increase on all paths for long term models, and (4) unwinds (buy trigger) of remaining short positions could come around the 6120 futures level while unwinds (sell trigger) of long positions could come at 5662.

Exhibit 6: 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

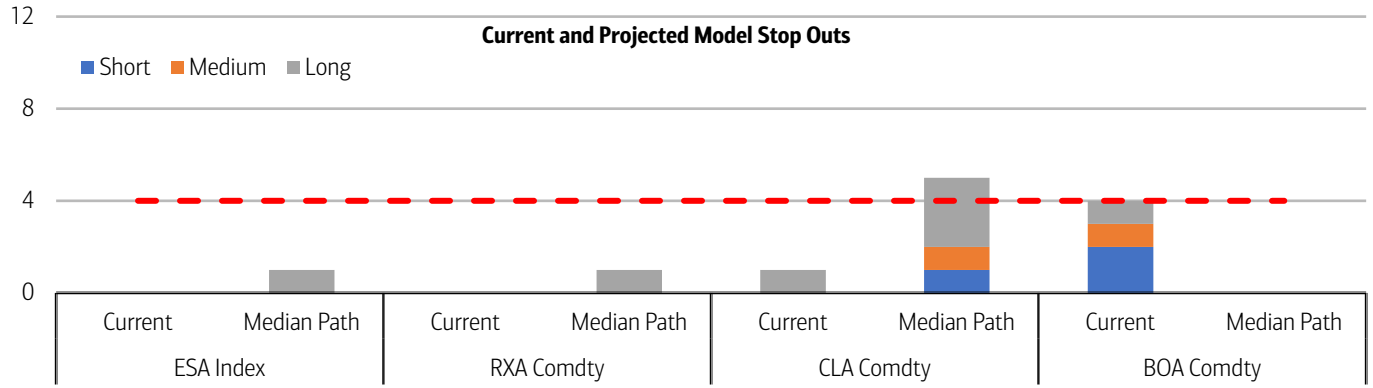
			5-day Trend Projection				5-day Trend Projection				5-day Trend Projection				Sell Trigger Range		Buy Trigger Range	
Asset Class	Underlying	Short Term Trend Strength	Bearish	Median	Bullish	Medium Term Trend Strength	Bearish	Median	Bullish	Long Term Trend Strength	Bearish	Median	Bullish	Current Price	Low	High	Low	High
Equities	S&P 500 (ES)	49%	38%	58%	63%	23%	13%	28%	37%	-60%	-46%	-48%	-36%	6010	5662	5662	6120	6120
	NASDAQ-100 (NQ)	69%	30%	77%	69%	42%	15%	47%	44%	-48%	-21%	-31%	-22%	21811	20957	21118	22384	22384
	Russell 2000 (RTY)	18%	2%	19%	30%	-33%	-50%	-38%	-23%	-100%	-100%	-100%	-100%	2135	--	--	2157	2228
	SX5E (VG)	63%	41%	59%	63%	95%	72%	92%	90%	28%	30%	38%	37%	5427	5216	5216	--	--
	NIKKEI (NK)	33%	17%	29%	35%	11%	-5%	4%	11%	-58%	-47%	-49%	-42%	37770	--	--	38724	38724
Bonds	10yr Tsy Futures (TY)	-18%	-39%	-30%	-18%	-29%	-43%	-35%	-25%	-6%	-22%	-18%	-14%	109.95	--	--	--	--
	30yr Tsy Futures (US)	-67%	-75%	-80%	-64%	-87%	-90%	-97%	-81%	-75%	-88%	-96%	-87%	112.13	--	--	113.69	114.68
	Bund Futures (RX)	5%	-1%	18%	21%	-55%	-42%	-36%	-36%	-61%	-44%	-48%	-51%	130.37	--	--	131.53	131.74
	China 10yr Bond Futures (TFT)	-3%	-7%	-3%	5%	63%	31%	63%	54%	100%	85%	100%	100%	108.90	107.88	107.98	--	--
Commodities	Gold (GC)	66%	56%	70%	73%	100%	100%	100%	100%	100%	100%	100%	100%	3333	3184	3184	--	--
	Oil (CL)	-40%	-34%	-20%	-6%	-57%	-50%	-42%	-28%	-100%	-86%	-95%	-85%	64.7	--	--	64.9	71.4
	Aluminum (LA)	-51%	-62%	-55%	-43%	-53%	-73%	-67%	-55%	-100%	-100%	-100%	-100%	2472	--	--	2558	2558
	Copper (BCOM, HG)	-12%	-15%	-6%	1%	27%	23%	33%	33%	39%	30%	35%	31%	483	--	--	--	--
	Copper (GSCI, LP)	25%	17%	28%	33%	32%	22%	34%	38%	-9%	-8%	-5%	-1%	9820	--	--	--	--
	Soybeans (S)	21%	7%	19%	29%	12%	0%	11%	21%	-9%	-1%	4%	8%	1058	1022	1022	--	--
	Soybean Oil (BO)	55%	13%	25%	36%	74%	38%	52%	61%	92%	82%	94%	94%	47.4	43.9	46.1	--	--
	Soybean Meal (SM)	-64%	-57%	-47%	-15%	-100%	-100%	-100%	-68%	-100%	-100%	-100%	-100%	296	--	--	303	319
FX	EUR/USD	84%	76%	100%	89%	93%	90%	100%	100%	100%	100%	100%	100%	1.1393	1.1066	1.1161	--	--
	GBP/USD	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	1.3525	1.3244	1.3245	--	--
	AUD/USD	43%	36%	50%	56%	7%	4%	15%	21%	-30%	-20%	-17%	-14%	0.6494	--	--	0.6599	0.6599
	USD/JPY	-26%	-45%	-37%	-18%	-29%	-49%	-41%	-23%	-57%	-64%	-58%	-49%	144.9	--	--	--	--
	USD/MXN	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	19.1	--	--	19.5	19.7
	USD/CAD	-78%	-100%	-100%	-69%	-33%	-65%	-59%	-35%	-23%	-47%	-46%	-32%	1.3699	--	--	1.4001	1.4001

Source: BofA Global Research. Data as of 06-Jun-2025.

Markets currently at stop-outs and projections for next week

Based on our work in More CTA Models = Better Impact Estimates, when at least 4 of our 12 models stop out, historically we have seen larger market impact. In Exhibit 7 below we should those markets which CTAs could have model stop outs in the next week in just a median price path.

Exhibit 7: Summary of BofA Trend Following (CTA) Model Stopped Out Positions
We run our model 12 times using four stop loss sensitivities and three trend windows and show the number of current and median path stop outs to gauge crowding

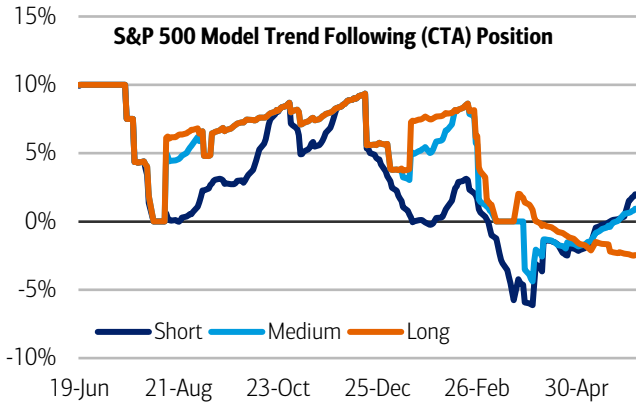


Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Equities

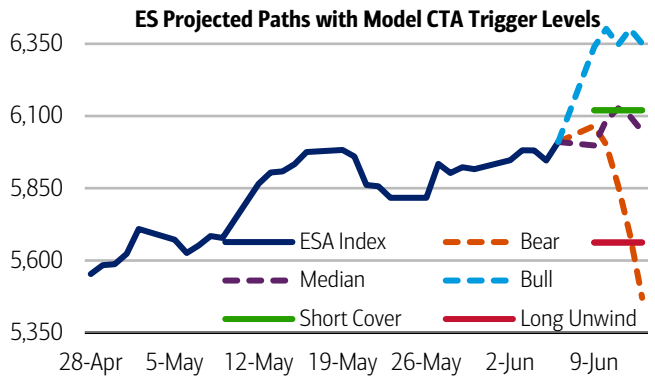
Exhibit 8: BofA Model Trend Following (CTA) S&P 500 Futures Unwind Levels & Projected Paths
Model weights using short-, medium-, and long-term trends.



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

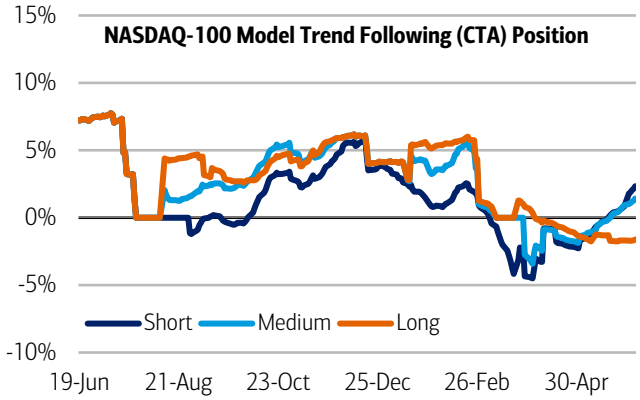
Exhibit 9: BofA Model Trend Following (CTA) S&P 500 Futures Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

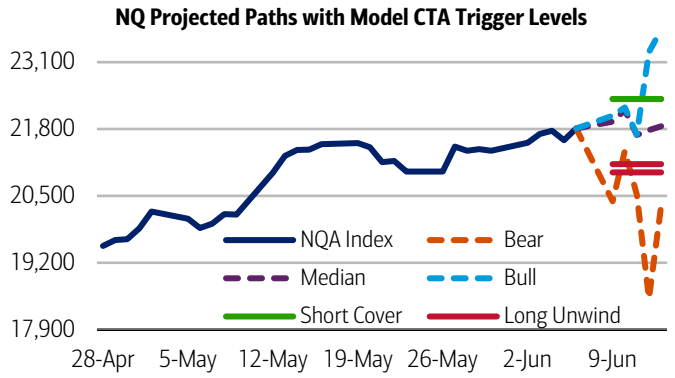
Exhibit 10: BofA Model Trend Following (CTA) NASDAQ-100 Position
Model weights using short-, medium-, and long-term trends.



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

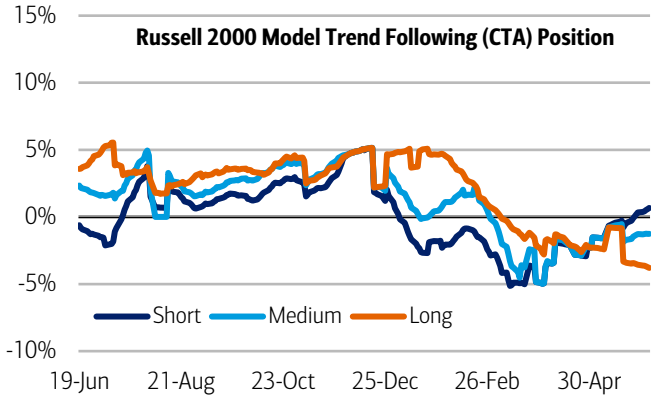
Exhibit 11: BofA Model Trend Following (CTA) NASDAQ-100 Futures Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

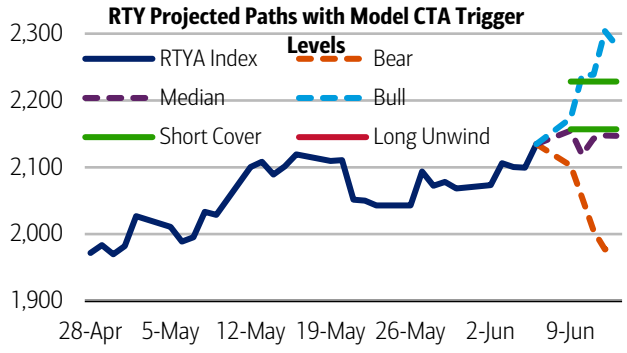
Exhibit 12: BofA Model Trend Following (CTA) Russell 2000 Position
Model weights using short-, medium-, and long-term trends.



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Exhibit 13: BofA Model Trend Following (CTA) Russell 2000 Futures Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers

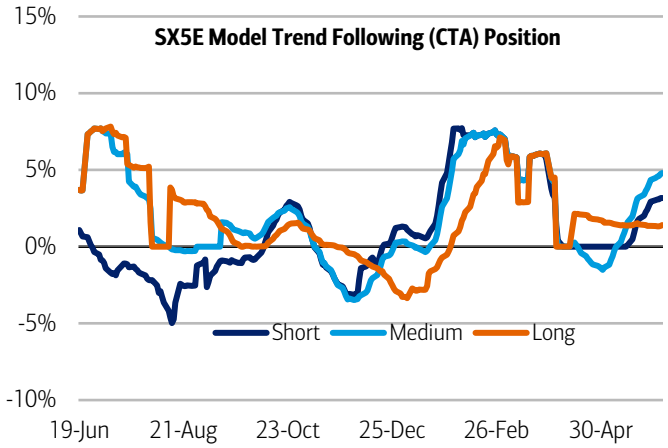


Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Equities (continued)

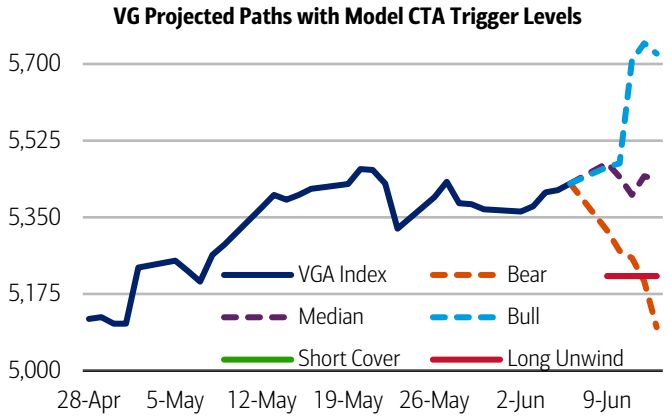
Exhibit 14: BofA Model Trend Following (CTA) ESTX50 Position
Model weights using short-, medium-, and long-term trends.



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

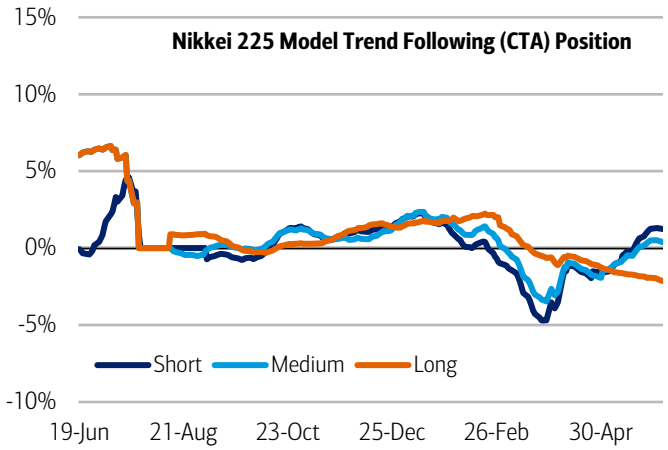
Exhibit 15: BofA Model Trend Following (CTA) ESTX50 Futures Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

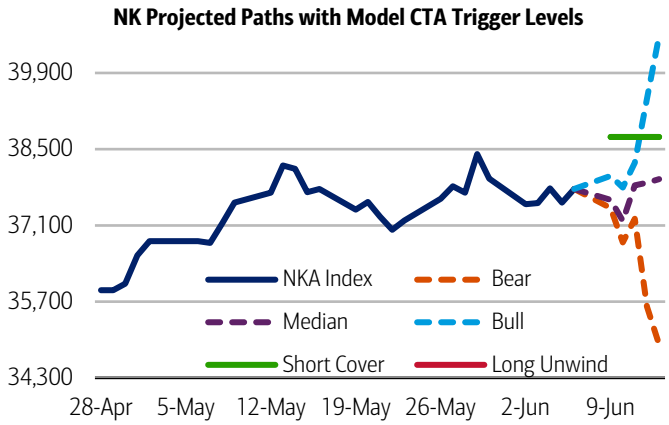
Exhibit 16: BofA Model Trend Following (CTA) Nikkei 225 Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Exhibit 17: BofA Model Trend Following (CTA) Nikkei 225 Futures Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers

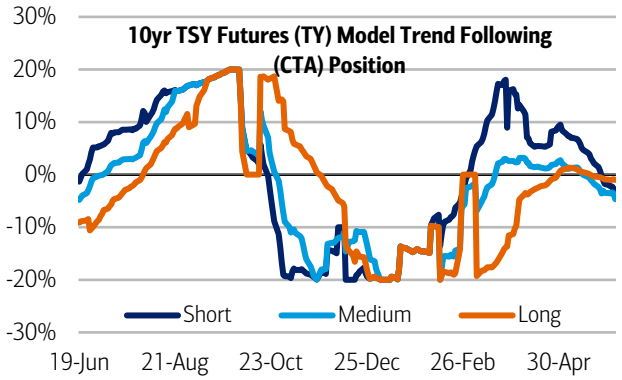


Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Fixed Income

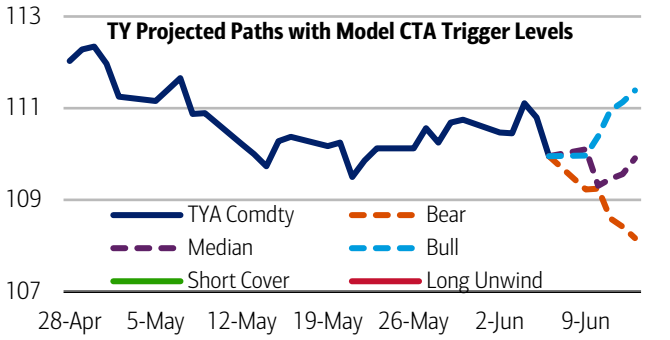
Exhibit 18: BofA Model Trend Following (CTA) TY Futures Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

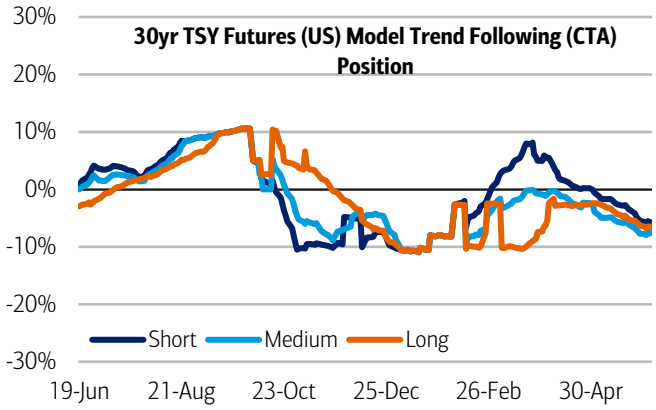
Exhibit 19: BofA Model Trend Following (CTA) TY Futures Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

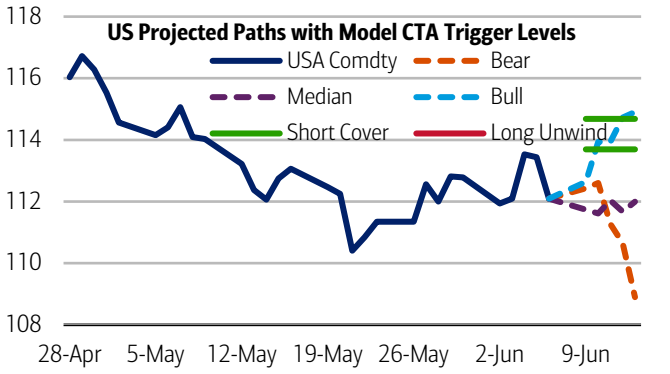
Exhibit 20: BofA Model Trend Following (CTA) US Futures Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

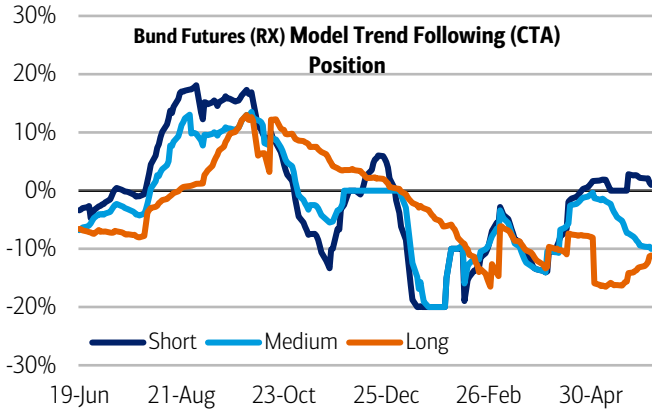
Exhibit 21: BofA Model Trend Following (CTA) US Futures Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

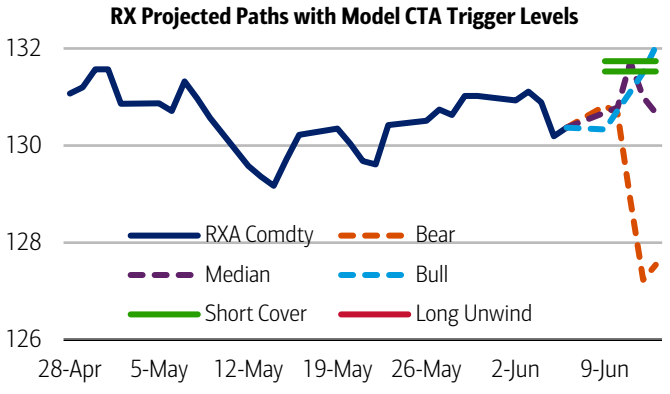
Exhibit 22: BofA Model Trend Following (CTA) Bund Futures Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Exhibit 23: BofA Model Trend Following (CTA) RX Futures Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers

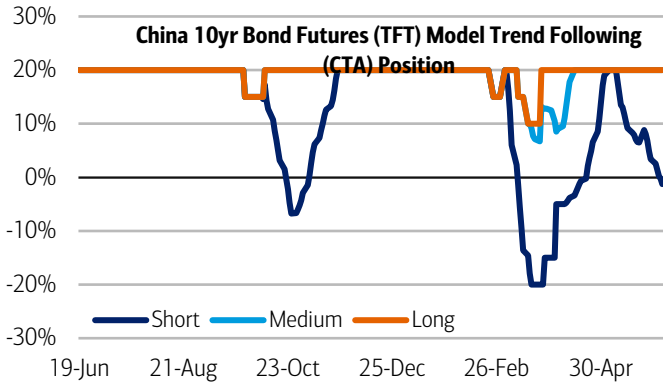


Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Fixed Income (continued)

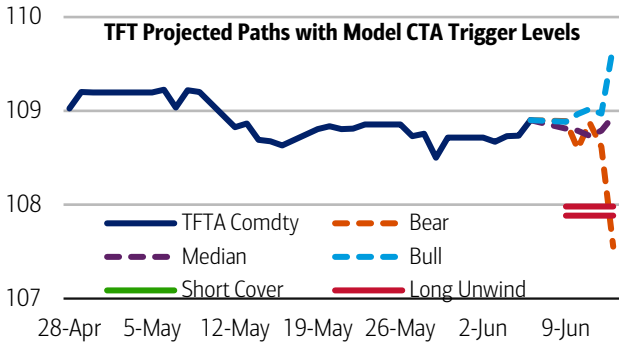
Exhibit 24: BofA Model Trend Following (CTA) China 10yr Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Exhibit 25: BofA Model BofA Model Trend Following (CTA) CGB Futures Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers

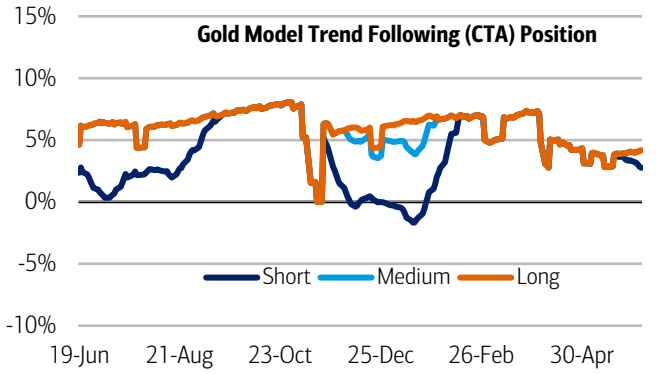


Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Commodities

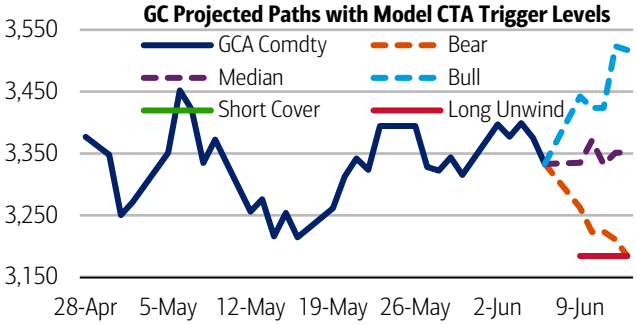
Exhibit 26: BofA Model Trend Following (CTA) Gold Futures Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

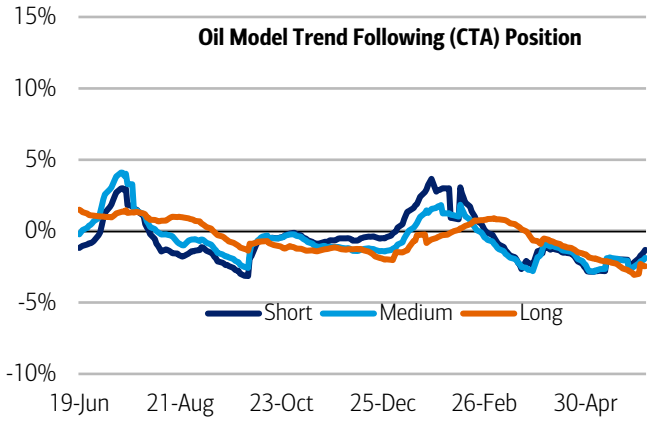
Exhibit 27: BofA Model Trend Following (CTA) Gold Futures Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

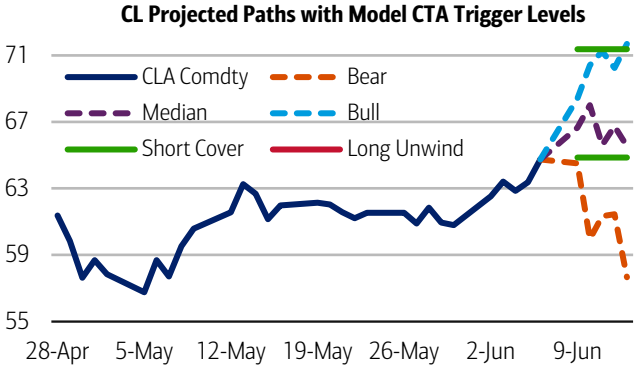
Exhibit 28: BofA Model Trend Following (CTA) Oil Futures Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Exhibit 29: BofA Model Trend Following (CTA) Oil Futures Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers

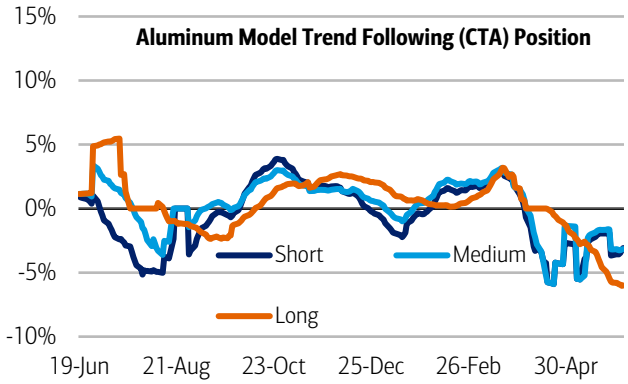


Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Commodities (continued)

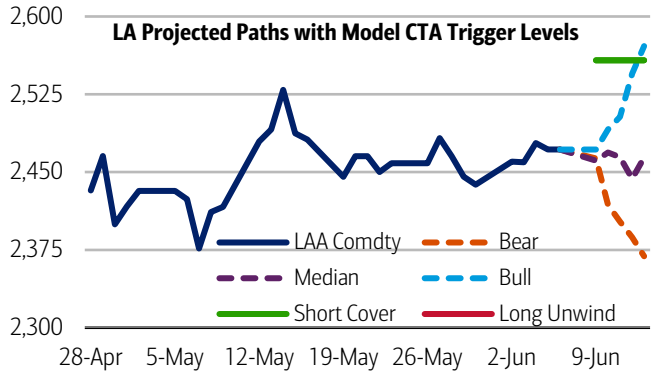
Exhibit 30: BofA Model Trend Following (CTA) Aluminum Futures Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

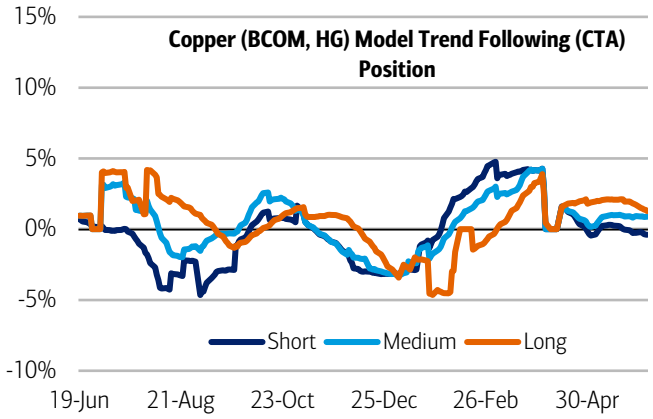
Exhibit 31: BofA Model Trend Following (CTA) Aluminum Futures Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

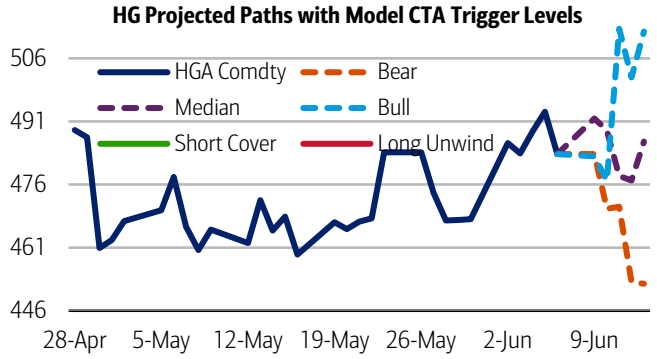
Exhibit 32: BofA Model Trend Following (CTA) Copper (HG) Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

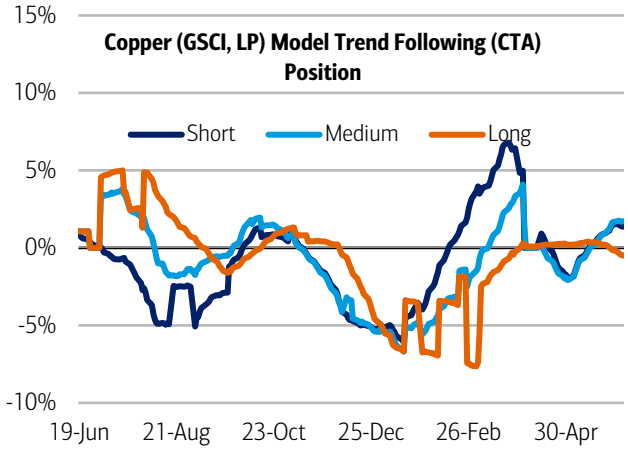
Exhibit 33: BofA Model Trend Following (CTA) Copper Futures (BCOM) Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

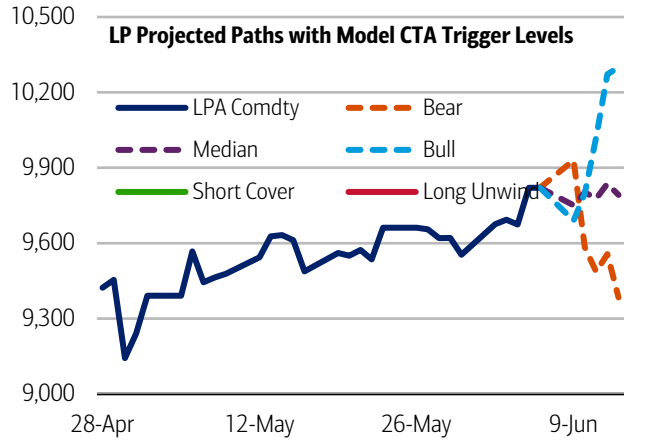
Exhibit 34: BofA Model Trend Following (CTA) Copper (LP) Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Exhibit 35: BofA Model Trend Following (CTA) Copper Futures (GSCI) Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers

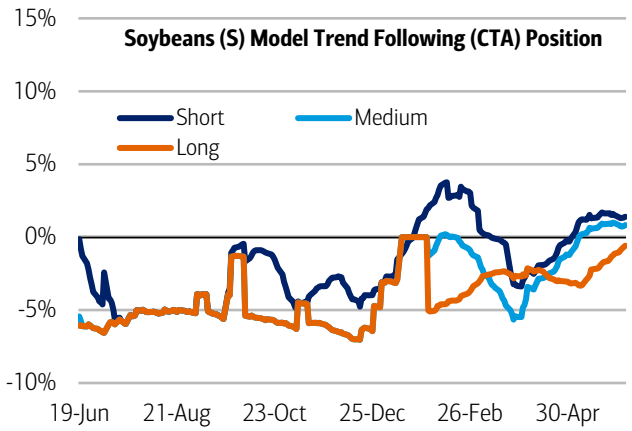


Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Commodities (continued)

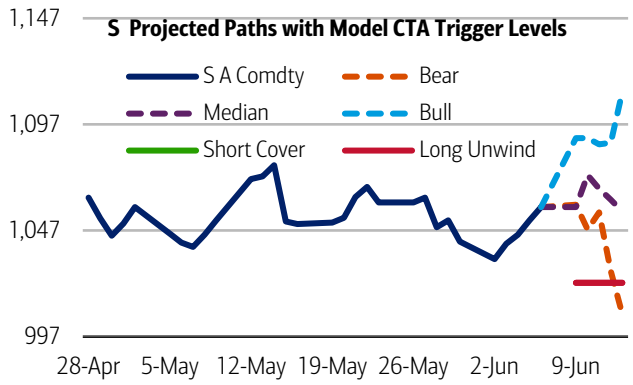
Exhibit 36: BofA Model Trend Following (CTA) Soybeans Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

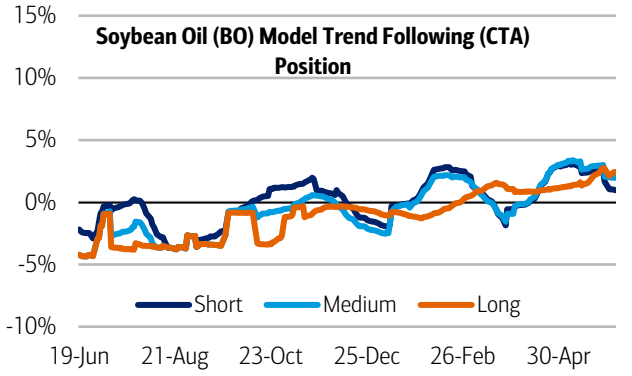
Exhibit 37: BofA Model Trend Following (CTA) Soybean Futures Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

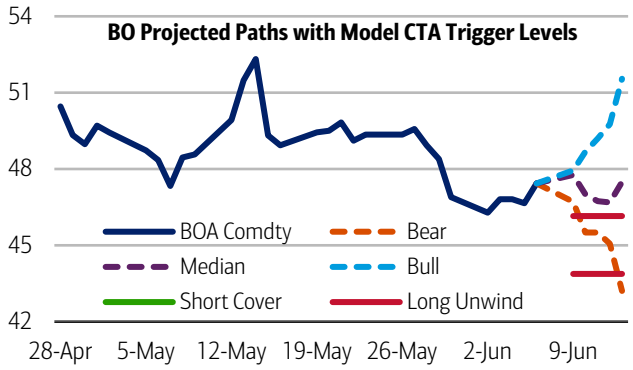
Exhibit 38: BofA Model Trend Following (CTA) Soybean Oil Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

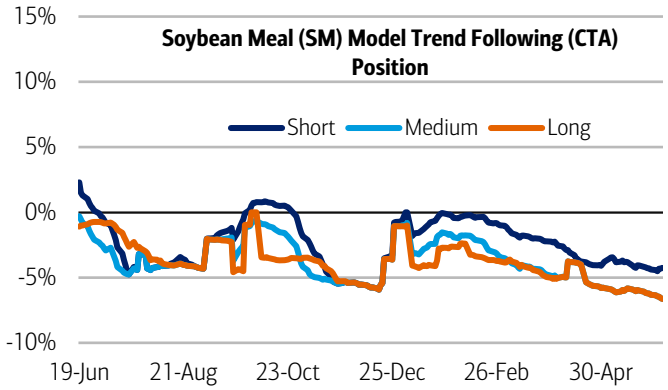
BofA GLOBAL RESEARCH

Exhibit 39: BofA Model Trend Following (CTA) Soybean Oil Futures Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers



BofA GLOBAL RESEARCH

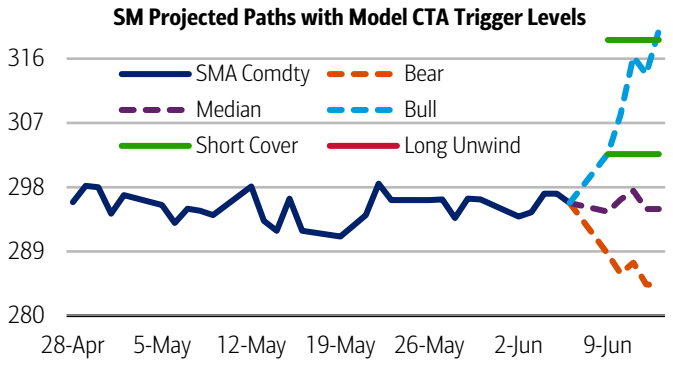
Exhibit 40: BofA Model Trend Following (CTA) Soybean Meal Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Exhibit 41: BofA Model Trend Following (CTA) Soybean Meal Futures Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers

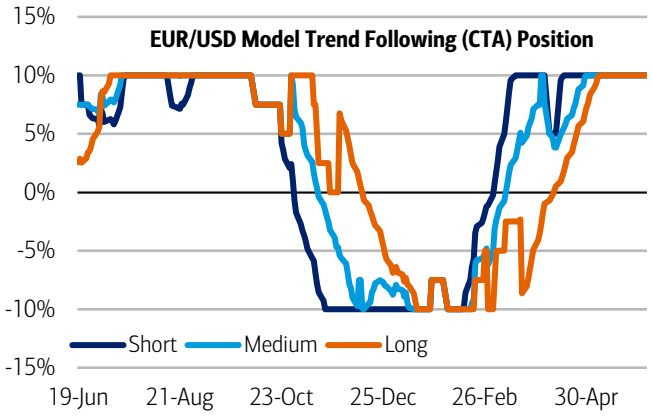


Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Foreign Exchange (FX)

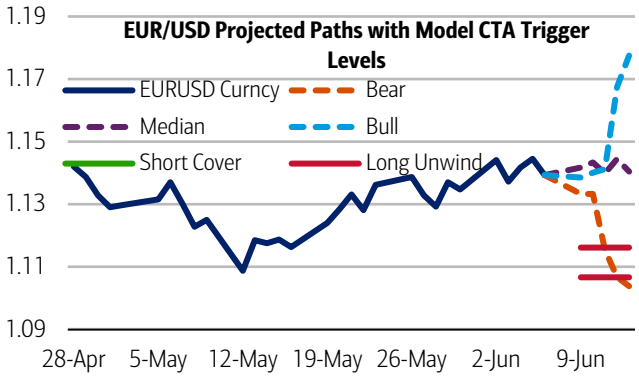
Exhibit 42: BofA Model Trend Following (CTA) EUR/USD Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

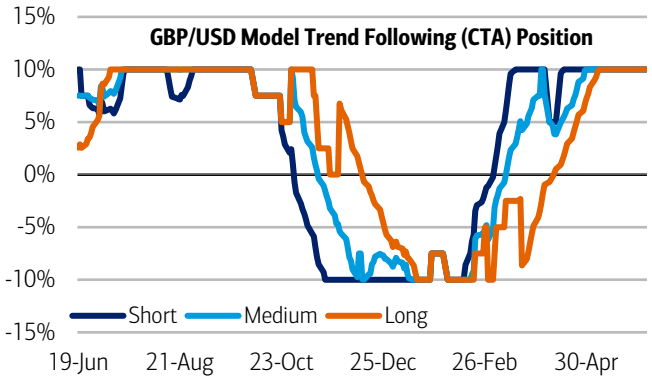
Exhibit 43: BofA Model Trend Following (CTA) EUR/USD Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

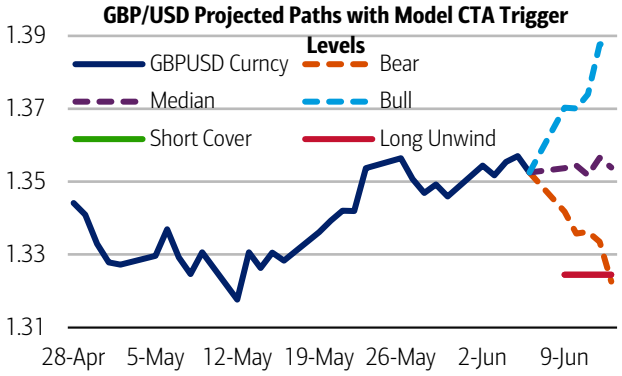
Exhibit 44: BofA Model Trend Following (CTA) GBP/USD Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

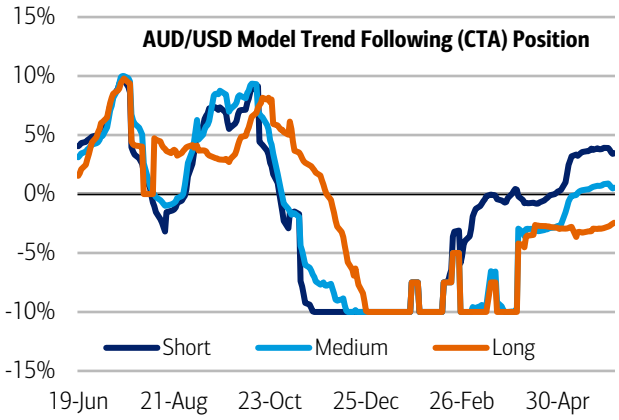
Exhibit 45: BofA Model Trend Following (CTA) GBP/USD Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

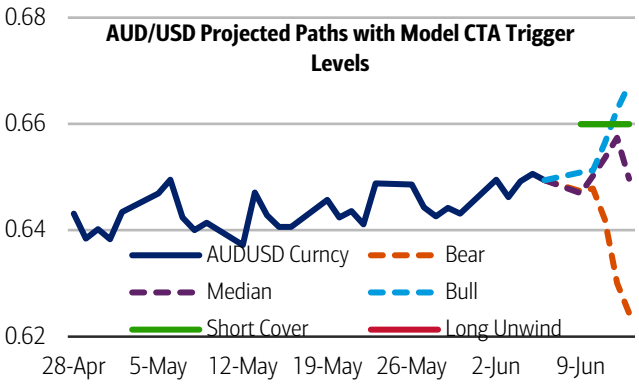
Exhibit 46: BofA Model Trend Following (CTA) AUD/USD Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Exhibit 47: BofA Model Trend Following (CTA) AUD/USD Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers

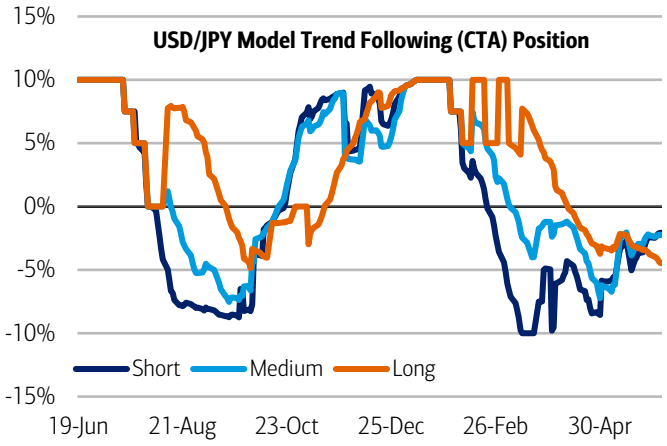


Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

FX (Continued)

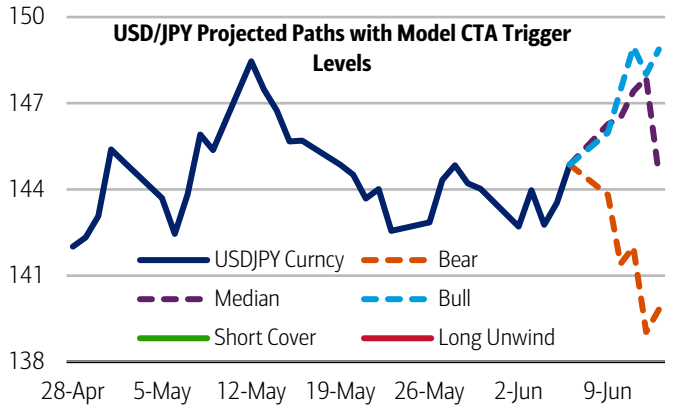
Exhibit 48: BofA Model Trend Following (CTA) USD/JPY Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

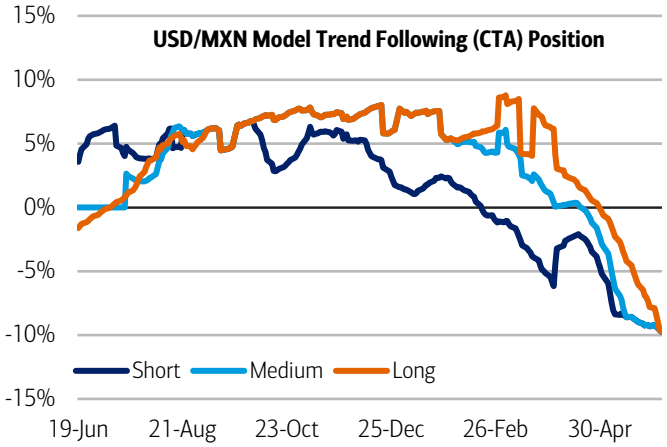
Exhibit 49: BofA Model Trend Following (CTA) USD/JPY Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

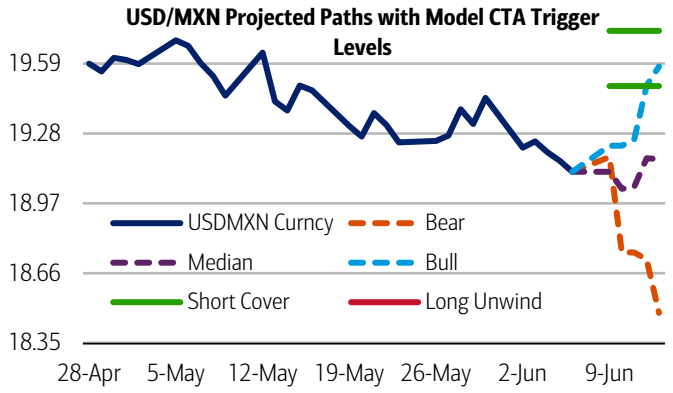
Exhibit 50: BofA Model Trend Following (CTA) USD/MXN Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

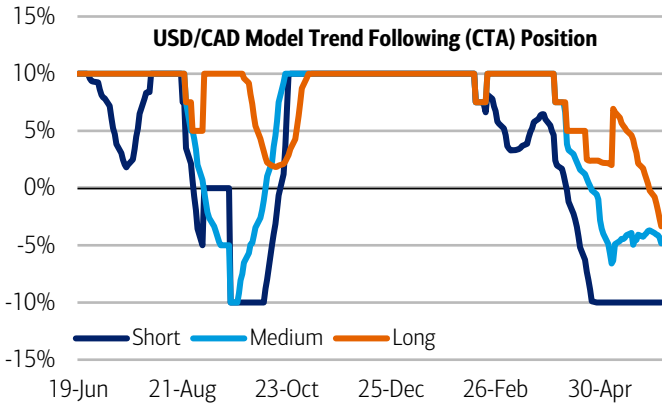
Exhibit 51: BofA Model Trend Following (CTA) USD/MXN Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

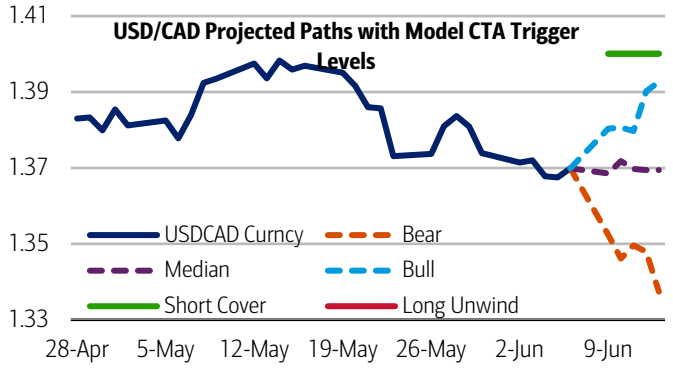
Exhibit 52: BofA Model Trend Following (CTA) USD/CAD Position
Model weights using short-, medium-, and long-term trends



Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Exhibit 53: BofA Model Trend Following (CTA) USD/CAD Unwind Levels & Projected Paths
Please see the appendix for more details on paths and unwind triggers



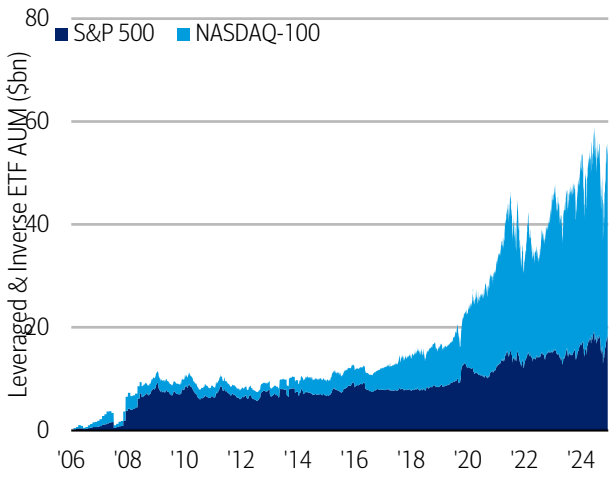
Source: BofA Global Research. Data as of 06-Jun-2025.

BofA GLOBAL RESEARCH

Leveraged and Inverse ETFs

Our analysis indicates that US based ETFs currently could be responsible for approximately $865mn and $2.1bn in S&P 500 and NASDAQ-100 buying (selling), respectively, per 1% move up (down) in the underlying index. This would equate to 4% and 33% of the average notional S&P 500 (ES) and NASDAQ-100 (NQ) futures traded from 3:55 PM to 4:00 PM over the last month. Notably, the amount of NASDAQ-100 futures that leveraged & inverse ETFs would theoretically need to trade for each 1% move increased with spot last week.

Exhibit 54: S&P 500 and NASDAQ-100 leveraged & inverse ETF AUM
Total AUM in S&P 500 and NASDAQ-100 leveraged & inverse ETFs are approximately $18bn and $37bn, respectively



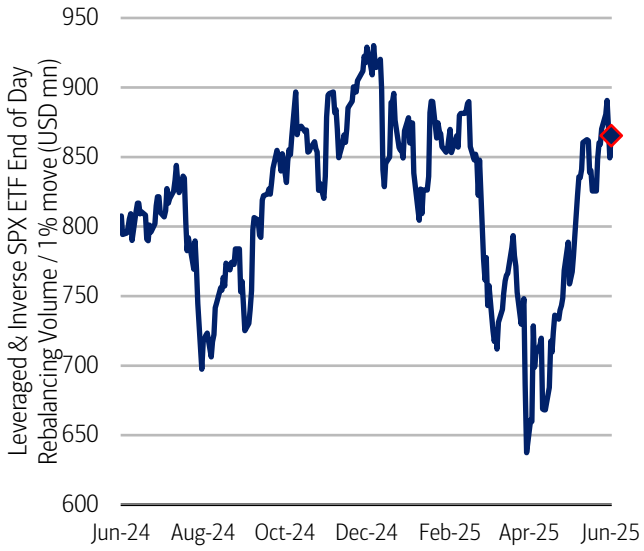
Source: BofA Global Research. Data as of 5-Jun-2025.

BofA GLOBAL RESEARCH

There is now approximately $55bn outstanding AUM in US domiciled S&P 500 and NASDAQ-100 leveraged and inverse ETFs, equating to over $100bn notional for these two indices. These vehicles aim to provide investors with a daily return proportional to the return of their underlying index. For example, a 2x leveraged ETF targets a 2% increase for each 1% gain in its underlying index while a 2x inverse ETF targets a 2% decline for each 1% increase in the underlying.

Leveraged and inverse ETFs must systematically rebalance at the end of each trading day to achieve their daily leverage target. In fact, in these rebalances both leveraged and inverse ETFs will buy in a rising market and sell in a falling market (see example in the Appendix). Therefore, the rebalance has the potential to accelerate index gains or losses into the close if a significant amount of the underlying futures need to be bought or sold. Notably, our analysis cannot account for the creation or redemption of ETF shares on T and must rely on prior day AUM.

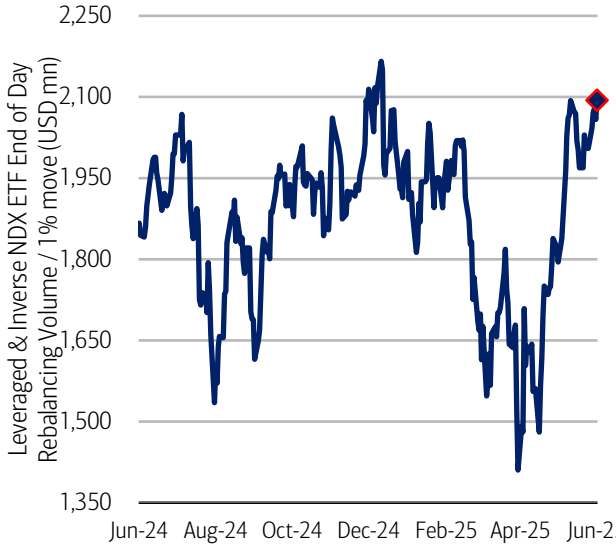
Exhibit 55: S&P 500 flow from leveraged & inverse ETFs per 1% move
Leveraged & inverse ETFs need to trade approximately $865mn for every 1% the index moves. This is approximately $5mn less than last week.



Source: BofA Global Research. This analysis only includes leveraged and inverse ETFs traded on US exchanges. Data as of 6-Jun-2025.

BofA GLOBAL RESEARCH

Exhibit 56: NASDAQ-100 leveraged & inverse ETF flow per 1% move
Leveraged & inverse ETFs need to trade approximately $2.1bn for every 1% the index moves. This is approximately $89 more than last week.

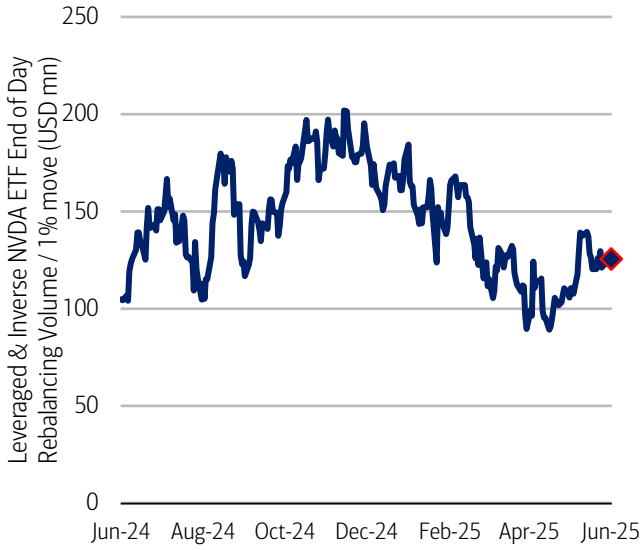


Source: BofA Global Research. This analysis only includes leveraged and inverse ETFs traded on US exchanges. Data as of 6-Jun-2025.

BofA GLOBAL RESEARCH

The rebalance of leveraged and inverse ETFs may also amplify moves into the close at the single stock level. NVIDIA and Tesla currently top single stock leveraged and inverse ETF AUM with approximately $5.6bn and $6.0bn outstanding, respectively. Our analysis indicates that ETFs could be responsible for approximately $126mn and $158mn in NVDA and TSLA buying (selling), respectively, per 1% move up (down) in the underlying stock. This would equate to 5.0% and 7.8% of the average notional volume traded from 3:55 PM to 4:00 PM over the last month. The amount of TSLA that leveraged and inverse ETF providers need to buy per 1% move significantly decreased this week.

Exhibit 57: NVIDIA flow from leveraged & inverse ETFs per 1% move
Leveraged & inverse ETFs need to trade approximately $126mn for every 1% that NVDA moves. This is approximately $4mn more than last week.



Source: BofA Global Research. Data as of 6-Jun-2025.

BofA GLOBAL RESEARCH

Exhibit 58: Tesla flow from leveraged & inverse ETFs per 1% move
Leveraged & inverse ETFs need to trade approximately $158mn for every 1% that TSLA moves. This is approximately $45mn less than last week.

Source: BofA Global Research. Data as of 6-Jun-2025.

BofA GLOBAL RESEARCH

Beyond NVDA and TSLA, leveraged and inverse ETFs have proliferated in other single stocks which we summarize in the table below. While most ETF providers achieve their stated return targets via swaps, some have recently begun employing short-dated, deep in the money calls and puts. Options can impact a fund's ability to achieve its stated leverage target, and although the delta hedge for these options will move in the same direction as the rebalance for the position on swap, it will not be of the same magnitude.

Exhibit 59: Single stock with over $100mn in leveraged & inverse ETFs
TSLA L&I ETF AUM significantly declined as the stock fell this week

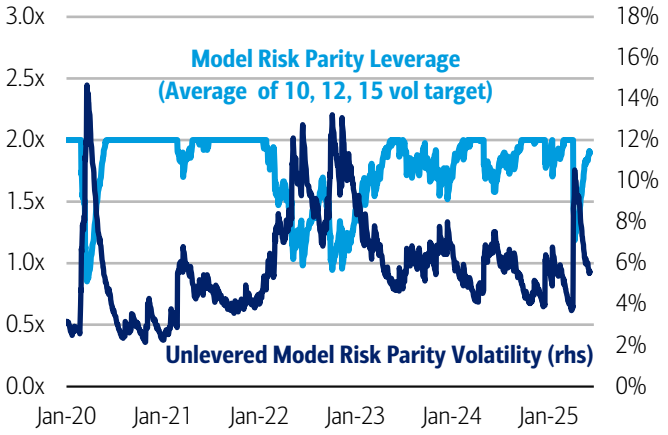
	AUM ($mn)	1w AUM chg ($mn)	Rebalance*/1% move ($mn)	1yr %ile of Rebalance Amount	Rebalance Amount/Last 5 min notional (%)
TSLA	6,016	-2159	157.5	77	7.8
NVDA	5,572	219	125.9	31	5.0
MSTR	3,090	-23	73.1	62	15.5
PLTR	1,071	-62	23.0	97	4.1
COIN	843	25	18.9	65	3.4
SMCI	387	19	7.7	92	6.0
GOOGL	360	-1	8.0	98	1.0
AMD	337	14	7.3	97	1.8
META	329	39	7.6	95	0.9
AMZN	318	24	7.0	99	0.6
AAPL	296	10	6.5	99	0.4
MSFT	200	7	4.8	77	0.2
AVGO	174	3	3.5	96	0.4
TSM	153	10	3.3	95	3.3

Source: BofA Global Research. *Theoretical rebalance amount assumes that leverage is achieved without options. This is a screen and not a recommended list either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances / objectives before making any investment decisions. Data as of 6-Jun-2025.

BofA GLOBAL RESEARCH

Risk Parity Model

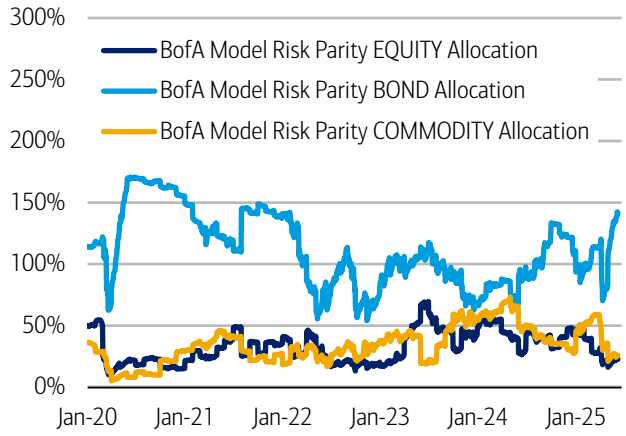
Exhibit 60: BofA Model Risk Parity Realized Volatility & Leverage
Our model risk parity leverage is a function of the prevailing volatility and below we show the average for three popular risk targets. Leverage is back near max levels.



Source: BofA Global Research. Data as of 6-Jun-2025.

BofA GLOBAL RESEARCH

Exhibit 61: BofA Model Risk Parity Asset Class Allocations
Allocations are inversely proportional to an asset's volatility, that is, lower volatility assets have higher allocation. Risk parity bond allocations increased at the last monthly rebalance taking weight from equity and commodity.

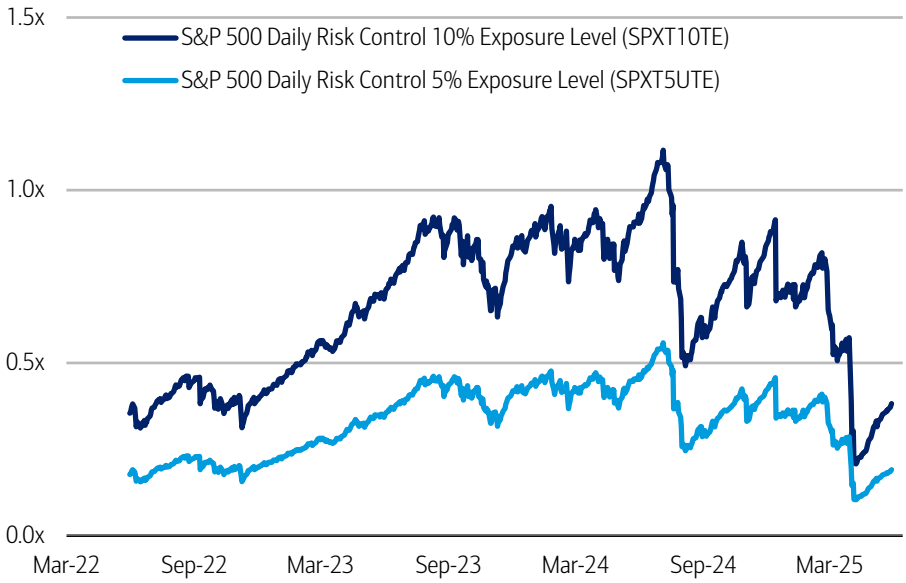


Source: BofA Global Research. Data as of 6-Jun-2025.

BofA GLOBAL RESEARCH

S&P 500 Equity Vol Control

Exhibit 62: 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%). Leverage has been on a steady rise as realized vol declines. There is room for continued rise.



Source: BofA Global Research. Data as of 6-Jun-2025.

BofA GLOBAL RESEARCH

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 2024-Q4 stood at $339.4bn***.

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

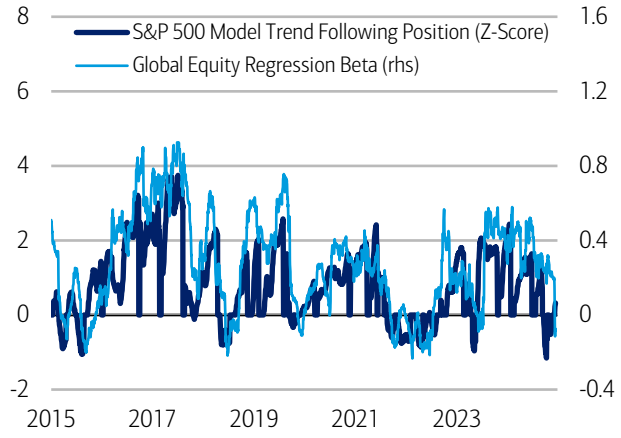
Despite the inclusion of fundamental, discretionary trading strategies and/or a focus on a subset of asset classes, our analysis suggests CTA performance can largely be explained by:

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 63 and Exhibit 64 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.

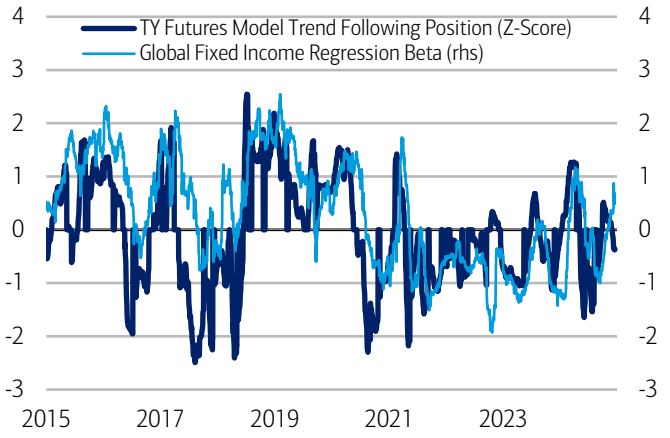
Exhibit 63: BofA bottom-up model CTA allocation in the S&P 500 alongside a top-down regression beta of global equities on the SG CTA Index (a popular benchmark CTA index)
Our bottom-up model is in-line with a top-down regression



Source: BofA Global Research. Data as of 6-Jun-2025.

BofA GLOBAL RESEARCH

Exhibit 64: 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



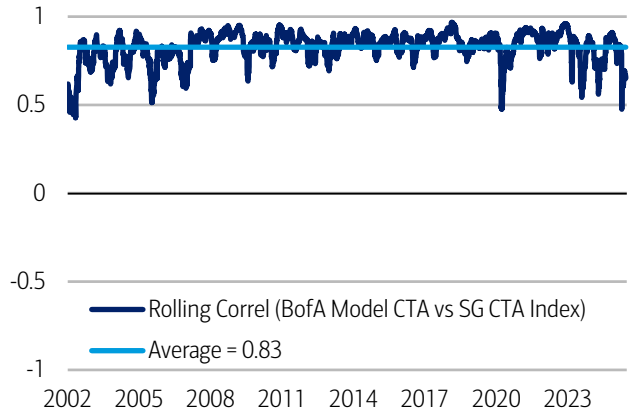
Source: BofA Global Research. Data as of 6-Jun-2025.

BofA GLOBAL RESEARCH

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 Exhibit 65 and Exhibit 66 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.

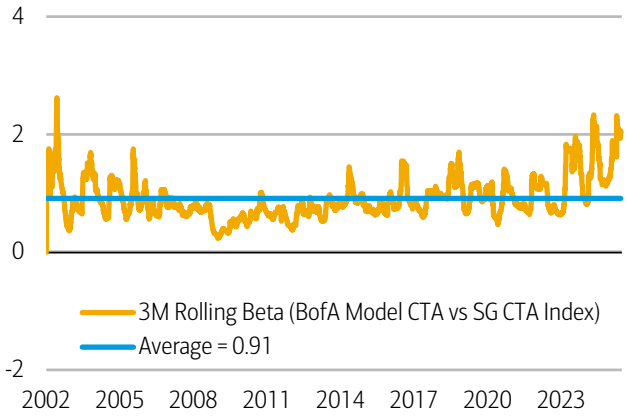
Exhibit 65: Rolling correl. of daily returns of BofA bottom-up model CTA strategy and the SG CTA Index (a popular benchmark CTA index)
Our bottom-up CTA model sized using trend/vol ratios, equal risk across asset classes, and with rules governing stop loss and re-initiation of positions tracks the benchmark CTA index well through time.



Source: BofA Global Research. Data as of 6-Jun-2025.

BofA GLOBAL RESEARCH

Exhibit 66: 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 6-Jun-2025.

BofA GLOBAL RESEARCH

Background on risk parity strategies

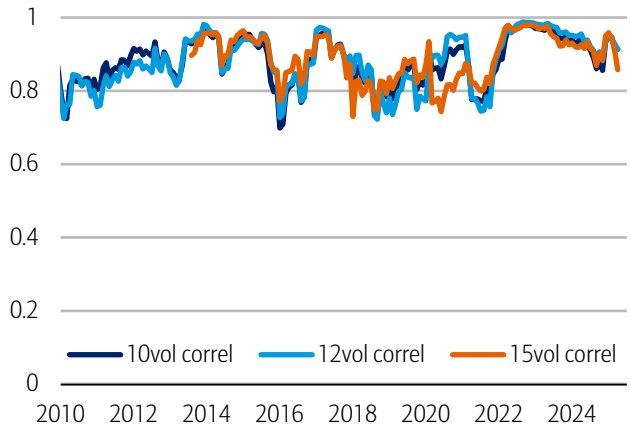
Similar to CTAs, our analysis indicates that risk parity strategies may allocate across the major asset classes and also size their positions as a function of prevailing volatility. However, risk parity strategies are agnostic to price trend and remain fully long each asset class. Risk parity strategies 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 Exhibit 68 through Exhibit 70 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 67 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 67: 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.

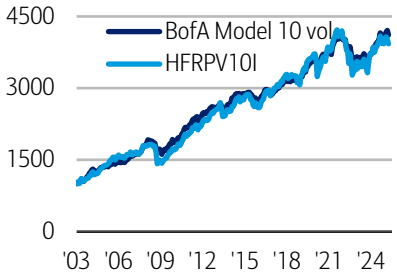


Source: BofA Global Research. Monthly data from Jan-2010. HFR institutional risk parity indices are used.

BofA GLOBAL RESEARCH

Exhibit 68: BofA Model Risk Parity (10% vol target, 1.5x max leverage)

BofA model risk parity tracks the benchmark HFR risk parity index

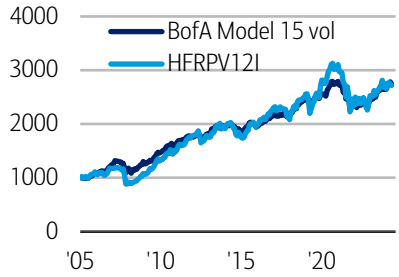


Source: BofA Global Research. Data as of 30-Apr-2025.

BofA GLOBAL RESEARCH

Exhibit 69: BofA Model Risk Parity (12% vol target, 1.5x max leverage)

BofA model risk parity tracks the benchmark HFR risk parity index

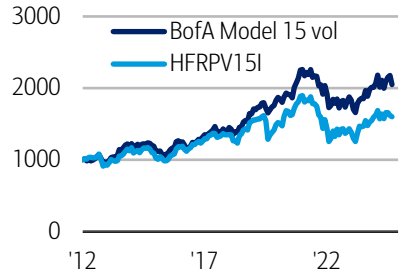


Source: BofA Global Research. Data as of 30-Apr-2025.

BofA GLOBAL RESEARCH

Exhibit 70: 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 30-Apr-2025.

BofA GLOBAL RESEARCH

Background on equity vol control strategies

Equity vol control is a simpler 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-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.

Background on leveraged & inverse ETFs

Leveraged & inverse ETFs target a daily return equal to a positive or negative multiple of their underlying index. For both the S&P 500 and NASDAQ-100, the 3x long ETF is currently the most popular by AUM. Since their introduction in 2006, the total AUM in US based S&P 500 & NASDAQ-100 leveraged & inverse ETFs has grown to about ***$55bn***.

Leveraged & inverse ETFs rebalance daily to be able to achieve their desired daily return multiple on the following trading day. An example of this rebalancing is shown below and demonstrates that leveraged and inverse funds buy and sell on the same days.

Exhibit 71: Leveraged and inverse ETFs both buy in up markets and sell in down markets
Stylized example of leveraged and inverse ETF rebalancing flows for 2x long and 2x short ETFs

	Benchmark	2x Long ETF		2x Short ETF	
	Price	Price	Share Exposure & Rehedge	Price	Share Exposure & Rehedge
Day 1	$100.00	$100.00	Long 2 * 100/100 = 2.00 Shares	$100.00	Short 2 * 100/100 = 2.00 Shares
	↓	↓		↓	
Return	+10%	+20%		-20%	
	↓	↓		↓	
Day 2	$110.00	$120.00	Long 2 * 120 / 110 = 2.18 Shares	$80.00	Short 2 * 80 / 110 = 1.45 Shares
	↓	↓	Buy 0.18 Shares at $110	↓	Buy 0.55 Shares at $110
Return	-10%	-20%		+20%	
	↓	↓		↓	
Day 3	$99.00	$96.00	Long 2 * 96 / 99 = 1.94 Shares	$96.00	Short 2 * 96 / 99 = 1.94 Shares
			Sell 0.24 Shares at $99		Sell 0.49 Shares at $99

Source: BofA Global Research.

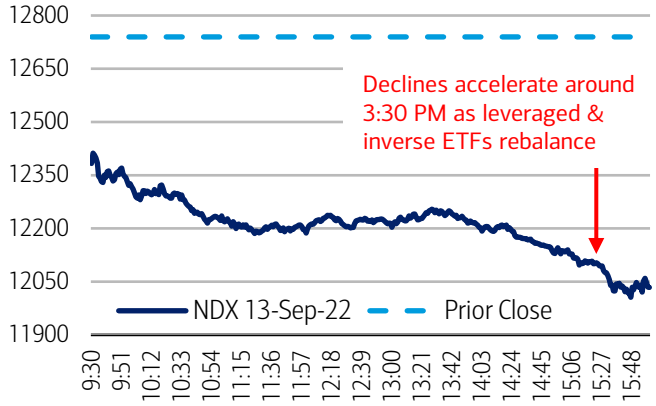
BofA GLOBAL RESEARCH

Note in the example above that although both the 2x long and short ETFs achieved their desired daily return, the return over the two trading days is not equivalent to +/- 2x the return of the benchmark over two days due to the effect of daily compounding. Investors using these vehicles should recognize that *returns over longer horizons will not be equal to the product of the return of the benchmark index and the ETF's leverage factor*.

Leveraged & inverse ETF rebalance can amplify moves in the underlying asset

We point to the NASDAQ-100 on 13-Sep-22 for one example of systematic flows from the leveraged & inverse ETF complex potentially extending large index moves at the end of the trading day. The index opened 2.8% lower from its prior close and then declined another 2.5% from the open to 3:30 PM. At this point, our data indicated that the leveraged & inverse ETF rebalance required approximately $7.7bn notional NQ futures be sold into the close. This represented 60% of average notional NQ futures volume between 3:30 PM and 4:00PM over the prior month. As expected, futures volume into the close rose for the ETF rebalance with over $20bn notional traded between 3:30 PM and 4:00 PM. As this systematic selling went through, the index declined another 34bps in the final half hour of trading.

Exhibit 72: Leveraged & inverse ETF rebalancing may have extended NASDAQ-100 losses on 13 Sep 2022
NASDAQ-100 intraday price on 13-Sep-22. The index declined 5.5% from its previous close and saw a dip lower at the end of the trading day



Source: BofA Global Research.

BofA GLOBAL RESEARCH

Background on option positioning

Key highlights of our approach to option positioning include:

- Deriving gamma estimates based on signed volume data from the exchange rather than using models that risk mis-classifying option buys/sells
- Quantifying the impact of this gamma on S&P realized volatility by estimating the market impact of delta-hedging flows
- Including SPX 0DTE gamma in the picture by accounting for gamma arising from both expiring & non-expiring options

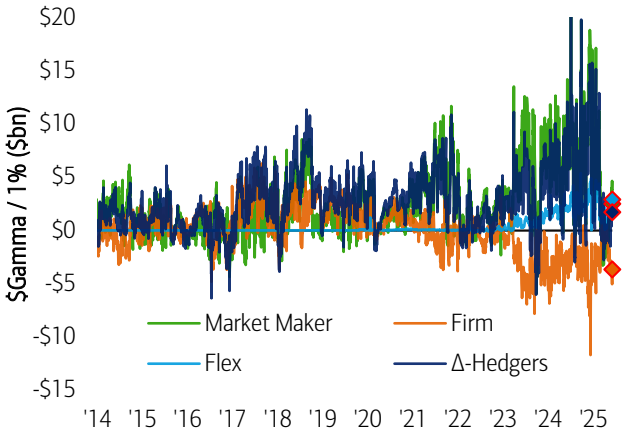
Many market participants have long sought an accurate measure of option positioning to assess the impact that options and their subsequent hedging may have on both the underlying and derivative markets. Our aim here is to provide such estimates for the size and impact of the net gamma of delta-hedgers (often colloquially referred to as "dealer gamma") for SPX options specifically.

At its core any approach to estimating option positioning tends to boil down to one key step: how do you determine if end-users are long or short a particular option? Market participants have addressed this question in a variety of ways historically. To give a few concrete examples (some with more merit than others) you could: (i) naively assume end-users buy all puts and sell all calls, (ii) categorize option trades based on their distance from the bid and ask, or (iii) use a local volatility surface to impute a buy or sell signal from changes in the volatility.

Instead of the aforementioned ideas, our position estimates are grounded in data directly from the exchange which classifies option trades as a buy or sell according to the exchange's own records for 5 types of market participants: customers, pro-customers, broker-dealers, market makers, and firms. By way of example, customers (both regular and professionals) include a mix of retail and sophisticated players like hedge funds, market makers are the usual suspects, while broker-dealers and firms often (though not necessarily exclusively) capture a portion of the trading activities at banks.

Our gamma estimates combine the footprint of market makers and firms (as highlighted in Exhibit 73) under the assumption that market makers delta-hedge both regular and flex options (labelled as "Market Maker" & "Flex" respectively) while firms hedge only regular options. For clarity, a flex option is similar to a traditional (or regular) listed option, however, with a flex option the user may choose the expiration and strike (among other parameters) to be an expiry or strike that is not otherwise available in traditional options. We find that historically delta-hedgers as we've defined them tend to be skewed net long gamma from SPX options and in the +$0-10bn range. For comparison Exhibit 74 shows the SPX gamma implied by the naïve assumption that end-users buy all puts and sell all calls which is often appreciably larger in magnitude than our estimate of SPX gamma for delta-hedgers.

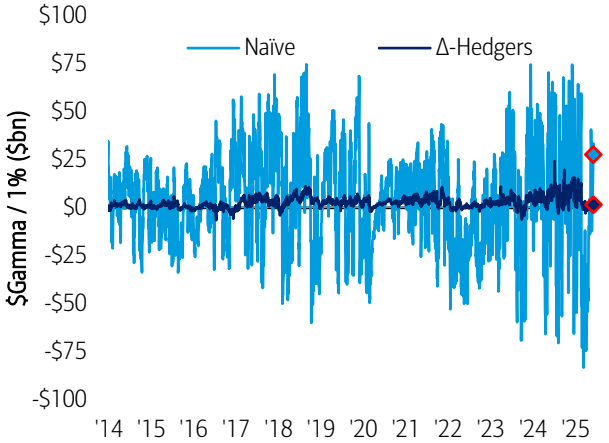
Exhibit 73: Historical SPX gamma for Firms, MMs, Flex and Δ-Hedgers
Our estimates for Δ-Hedger (= firm + mm + flex) gamma assume that firms delta-hedge only regular options while market makers hedge regular & flex



Source: BofA Global Research, CBOE. Data as of 05-Jun-25.

BofA GLOBAL RESEARCH

Exhibit 74: Comparison of gamma for Δ-Hedgers with a naïve estimate
A naïve estimate of gamma which assumes end-users buy all puts and sell all calls tends to be larger in magnitude than our gamma level for Δ-Hedgers



Source: BofA Global Research, CBOE. Data as of 05-Jun-25 for the Δ-Hedger gamma level and as of 04-Jun-25 for the naïve gamma estimate.

BofA GLOBAL RESEARCH

Quantifying the impact of gamma on realized volatility

To infer the impact of SPX option gamma on S&P 500 e-mini realized volatility (as presented in Exhibit 5) we perform the following steps: (i) Use the gamma level from the prior day's close and the subsequent realized equity move to estimate the delta that hedgers need to buy or sell. (ii) Quantify the market impact of trading the required delta in the S&P 500 e-mini futures market with trading confined to the last 1-hour, 30-minutes, or 15-minutes of the trading session. (iii) Calculate new hypothetical daily market returns after removing the impact from trading the delta. These new returns are then used to estimate the realized volatility in the absence of delta-hedgers.

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.

Exhibit 75: List of abbreviations
Abbreviations used in this report

0DTE: zero-days-to-expiration
AUD: Australian dollar
CTA: Commodity Trading Advisor
CGB: China Government Bond
FV: 5-Year US Treasury Note Futures
JPY: Japanese Yen
KTB: Korean Treasury Bond
MXN: Mexican Peso
RTY: Russell 2000 Index
SG: Soc Gen
SPX: S&P 500 Index
TSY: Treasury
TU: 2-Year US Treasury Note Futures
US: U.S. Treasury Bond Futures
USDJPY: United States Dollar/ Japanese Yen Cross
UST: US Treasury
UXY: Ultra 10-Year US Treasury Note Futures
WN: CME Ultra Long Term U.S. Treasury Bond Future

Source: BofA Global Research

BofA GLOBAL RESEARCH

Options Risk Statement

Potential Risk at Expiry & Options Limited Duration Risk

Unlike owning or shorting a stock, employing any listed options strategy is by definition governed by a finite duration. The most severe risks associated with general options trading are total loss of capital invested and delivery/assignment risk... all of which can occur in a short period.

Investor suitability

The use of standardized options and other related derivatives instruments are considered unsuitable for many investors. Investors considering such strategies are encouraged to become familiar with the "Characteristics and Risks of Standardized Options" (an OCC authored white paper on options risks). U.S. investors should consult with a FINRA Registered Options Principal.

For detailed information regarding the risks involved with investing in listed options, see the Options Clearing Corporation's Characteristics and Risks of Standardized Options website.

Analyst Certification

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

Disclosures

Important Disclosures

One or more analysts contributing to this report owns stock of the covered issuer: NVIDIA, Tesla Motors
One or more analysts contributing to this report owns options on the financial instrument: NVIDIA, Tesla Motors
BofAS or one of its affiliates acts as a market maker for the equity securities recommended in the report: NVIDIA, Tesla.
The issuer is or was, within the last 12 months, an investment banking client of BofAS and/or one or more of its affiliates: NVIDIA, Tesla Motors.
BofAS or an affiliate has received compensation from the issuer for non-investment banking services or products within the past 12 months: NVIDIA, Tesla Motors.
The issuer is or was, within the last 12 months, a non-securities business client of BofAS and/or one or more of its affiliates: NVIDIA, Tesla Motors.
BofAS or an affiliate has received compensation for investment banking services from this issuer within the past 12 months: NVIDIA.
BofAS or an affiliate expects to receive or intends to seek compensation for investment banking services from this issuer or an affiliate of the issuer within the next three months: Tesla Motors.
BofAS together with its affiliates beneficially owns one percent or more of the common stock of this issuer. If this report was issued on or after the 9th day of the month, it reflects the ownership position on the last day of the previous month. Reports issued before the 9th day of a month reflect the ownership position at the end of the second month preceding the date of the report: NVIDIA, Tesla Motors.
BofAS or one of its affiliates is willing to sell to, or buy from, clients the common equity of the issuer on a principal basis: NVIDIA, Tesla.
The issuer is or was, within the last 12 months, a securities business client (non-investment banking) of BofAS and/or one or more of its affiliates: NVIDIA, Tesla Motors.
Due to the nature of the market for derivative securities, the issuers or securities recommended or discussed in this report are not continuously followed. Accordingly, investors must regard this report as providing stand-alone analysis and should not expect continuing analysis or additional reports relating to such issuers and/or securities.
Due to the nature of quantitative analysis, the issuers or securities recommended or discussed in this report are not continuously followed. Accordingly, investors must regard this report as providing stand-alone analysis and should not expect continuing analysis or additional reports relating to such issuers and/or securities.
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.

Other Important Disclosures

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

Recipients who are not institutional investors or market professionals should seek the advice of their independent financial advisor before considering information in this report in connection with any investment decision, or for a necessary explanation of its contents.
Officers of BofAS or one or more of its affiliates (other than research analysts) may have a financial interest in securities of the issuer(s) or in related investments.
Refer to BofA Global Research policies relating to conflicts of interest.
"BofA Securities" includes BofA Securities, Inc. ("BofAS") and its affiliates. Investors should contact their BofA Securities representative or Merrill Global Wealth Management financial advisor if they have questions concerning this report or concerning the appropriateness of any investment idea described herein for such investor. "BofA Securities" is a global brand for BofA Global Research.
Information relating to Non-US affiliates of BofA Securities and Distribution of Affiliate Research Reports:
BofAS and/or Merrill Lynch, Pierce, Fenner & Smith Incorporated ("MLPF&S") may in the future distribute, information of the following non-US affiliates in the US (short name: legal name, regulator): Merrill Lynch (South Africa): Merrill Lynch South Africa (Pty) Ltd., regulated by the Financial Sector Conduct Authority; 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 Canadian Investment Regulatory Organization; Merrill Lynch (Mexico): Merrill Lynch Mexico, SA de CV, Casa de Bolsa, regulated by the Comisión Nacional Bancaria y 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.

This report may contain a short-term trading idea or recommendation, which highlights a specific near-term catalyst or event impacting the issuer or the market that is anticipated to have a short-term price impact on the equity securities of the issuer. Short-term trading ideas and recommendations are different from and do not affect a stock's fundamental equity rating, which reflects both a longer term total return expectation and attractiveness for investment relative to other stocks within its Coverage Cluster. Short-term trading ideas and recommendations may be more or less positive than a stock's fundamental equity rating.

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

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

Foreign currency rates of exchange may adversely affect the value, price or income of any security or financial instrument mentioned herein. Investors in such securities and instruments, including ADRs, 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 sustainability in this material is limited as discussed herein and is not intended to provide a comprehensive view on any sustainability claim with respect to any issuer or security.

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

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

All opinions, projections and estimates constitute the judgment of the author as of the date of publication and are subject to change without notice. Prices also are subject to change without

notice. BofA Securities is under no obligation to update this information and BofA Securities ability to publish information on the subject issuer(s) in the future is subject to applicable quiet periods. You should therefore assume that BofA Securities will not update any fact, circumstance or opinion contained herein.
Certain outstanding reports or investment opinions relating to securities, financial instruments and/or issuers may no longer be current. Always refer to the most recent research report relating to an issuer prior to making an investment decision.
In some cases, an issuer may be classified as Restricted or may be Under Review or Extended Review. In each case, investors should consider any investment opinion relating to such issuer (or its security and/or financial instruments) to be suspended or withdrawn and should not rely on the analyses and investment opinion(s) pertaining to such issuer (or its securities and/or financial instruments) nor should the analyses or opinion(s) be considered a solicitation of any kind. Sales persons and financial advisors affiliated with BofAS or any of its affiliates may not solicit purchases of securities or financial instruments that are Restricted or Under Review and may only solicit securities under Extended Review in accordance with firm policies.
Neither BofA Securities nor any officer or employee of BofA Securities accepts any liability whatsoever for any direct, indirect or consequential damages or losses arising from any use of this information.

Research Analysts

Global

Benjamin Bowler
Equity-Linked Analyst
BofAS
benjamin.bowler@bofa.com

Americas

Nitin Saksena
Equity-Linked Analyst
BofAS
nitin.saksena@bofa.com

Chintan Kotecha
Equity-Linked Analyst
BofAS
chintan.kotecha@bofa.com

Nicholas Dunne
Equity-Linked Analyst
BofAS
nicholas.dunne@bofa.com

Matthew Welty
Equity-Linked Analyst
BofAS
matthew.welty@bofa.com

EMEA

Abhinandan Deb >>
Equity-Linked Analyst
MLI (UK)
abhinandan.deb@bofa.com

Asia-Pac

Lars Naeckter >>
Equity-Linked Analyst
Merrill Lynch (DIFC)
lars.naeckter@bofa.com

Trading ideas and investment strategies discussed herein may give rise to significant risk and are not suitable for all investors. Investors should have experience in relevant markets and the financial resources to absorb any losses arising from applying these ideas or strategies.
>> Employed by a non-US affiliate of BofAS and is not registered/qualified as a research analyst under the FINRA rules. Refer to "Other Important Disclosures" for information on certain BofA Securities entities that take responsibility for the information herein in particular jurisdictions.