Global Rates and FX Primer

FX Quant Insight primer - 2024

15 July 2024

G10 FX Strategy
Global

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Key takeaways

- This is an overview of the FX Quant Insight report that we publish on Monday. We also review signal performance.
- The FX Quant Insight report proposes an FX View of the Week to express our high-conviction short-term FX views.
- The report discusses option flows, key positioning levels, cross-asset signals, and interactive time-zone plots.

The FX Quant Insight framework

In the long-run, exchange rates should converge toward the equilibrium rate. In the medium-term, relative monetary and fiscal policies play a major role in driving exchange rate fluctuations. For the short-term, we see trends and flows as key drivers and synthesize four quantitative components every Monday to form "FX View of the Week":

1. **Option Flow Signals**: we use weekly shifts of the FX vol curves and SDR (Swap Data Repository) data to get signals for the coming week from options.
2. **Technical Matrix**: we use BofA FX positioning analysis, ADX, Bollinger bands, support and resistance levels to derive a signal by quantifying FX trends.
3. **CARS Signals**: the BofA CARS model uses cross-asset factors to makes weekly predictions for G10 FX in a systematic fashion.
4. **Interactive Time Zone**: investors can examine historical cumulative returns at different hours of the day and variable lookback periods for G10 FX.

CARS (model): Cross-Asset Regime Switching

SDR: Swap Data Repository

MAA: Moving Average Aggregator

UD: Up/Down volatility

RS: Residual Skew

ADX: Average Directional Movement Index

DMI: Directional Movement Index

Exhibit 1: Sample quant signals from July 1 showed bullish AUD/CHF RV signal
Top signals from quant models

Section	Insight	Rationale
Option Flow	EUR calls CHF puts	Demand for EUR calls and CHF puts recover as French election risk premium unwinds.
Technical Matrix	Bullish AUD	Trend continuation signals favor higher AUD vs USD and on the crosses.
CARS	Rates regime	Bullish AUD and JPY vs CHF and SEK on rates divergence.
Time Zone	Asia-hour USD demand	USD demand from Asia trading hours persisted last week.
EM FX	Higher USDKRW	Positioning uptrend continuation favors higher USDKRW.

Source: BofA Global Research. This is a sample view of the front-page table for the FX Quant Insight publication and does not indicate any current Research views. Snapshot as of 07/1/2024.

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These four components cover different aspects of the FX market, and the weekly FX Quant Insight publication would summarize key takeaways from each component as shown by the Exhibit 1 example to form a short-term FX view for the coming week. Based on readers' suggestions, we also started to include a short summary of top EM FX signals on the front page this year.

Refer to important disclosures on page 15 to 16.
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Timestamp: 15 July 2024 12:15AM EDT

Option Flow Signals

Our options flow signals combine SDR (Swap Data Repository) flows data (FX Viewpoint: SDR: What do FX options flows tell us? 01 February 2021) with Event analysis framework (FX Viewpoint: Vol-guided decisions 18 March 2021) to gauge bullish and bearish sentiments.

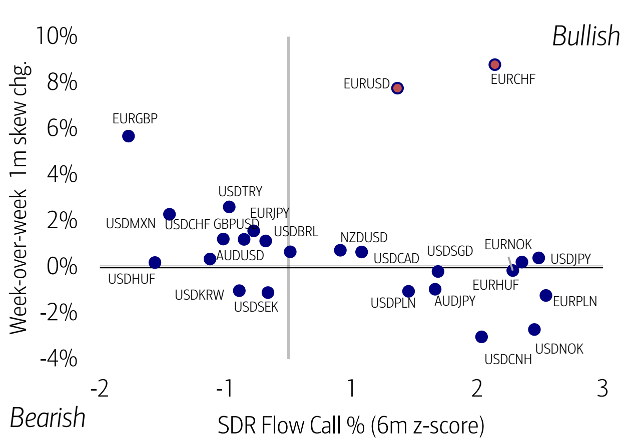
SDR (swap data repository) option flow

Option flow offers preview of future spot moves

As FX options expire in the future, we can effectively use option flows in the recent past as a proxy for investors' expectation of future spot movements and gauge directional risks. Exhibit 2 plots the 6m z-score of call percentage (% of aggregated call option notional vs total notional) for the FX options transactions in the previous week with 3m or less tenors as reported by the SDR along the x-axis. Along the y-axis, it plots the week-over-week 1m skew (25-delta risk reversal divided by atm vol) change. Option flows show bullish spot signals for FX pairs that fall in the top-right quadrant, as demand has been in favor of out-of-money (OTM) calls for these pairs. By contrast, option flows have been bearish for pairs that fall in the bottom-left quadrant. In this example (July 1 2024), we find option flow and skew moving for EUR calls (Exhibit 2) as French election risk premium started to fade away after the initial risk-off market moves.

Exhibit 2: Demand for EUR calls recovered vs USD and CHF

1m skew change vs call percentage z-score as of July 1 2024



Source: BofA Global Research, DTCC. Note: CNH flows are proxied by "CNY" flows in SDR. Snapshot as of July 1 2024. SDR data is collected for transactions in the previous week for <3m tenor options.

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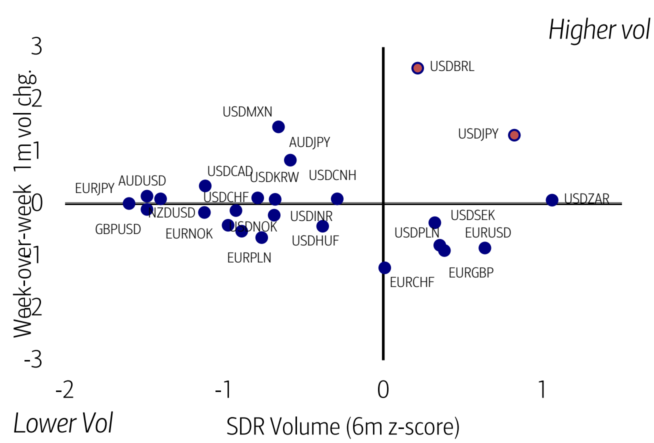
Exhibit 3: Implied vols increased with higher volume for BRL and JPY

1m implied vol change vs volume z-score as of July 1 2024



Source: BofA Global Research, DTCC. Note: CNH flows are proxied by "CNY" flows in SDR. Snapshot as of July 1 2024. SDR data is collected for transactions in the previous week for <3m tenor options.

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Option flow also pinpoints focal point of the market

Similarly, we can plot the previous week's SDR volume z-score vs week-over-week 1m vol change to gauge which pairs have caught the market's attention. We measure rising options demand by rising SDR flow volumes coinciding with a pick-up in implied vol. Exhibit 3 shows increased options trading volume and rising implied vol levels for BRL and JPY(as of July 1 2024).

How well does option flow work?

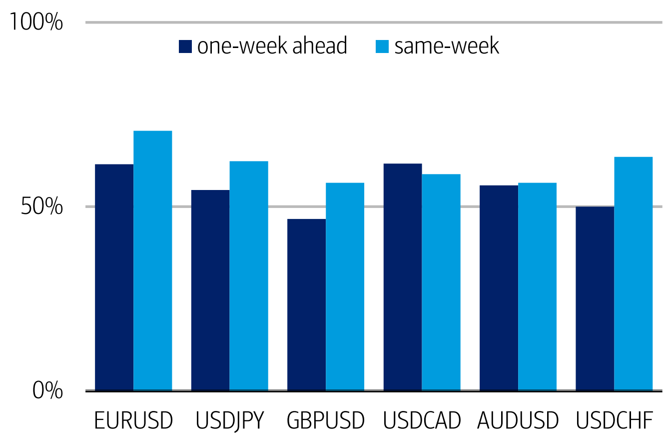
To evaluate options flow signals, we first considered the weekly SDR call percentage signal by itself (naively bullish an FX pair in spot if options call percentage is above 50%). We then find that signals have more predictive power by considering z-score thresholds of weekly call percentages. Exhibit 4 shows for major and liquid USD/G10 pairs, since October 2022 weekly option flows have broadly had a hit ratio of above 50% when compared to spot move in the same week. Typically spot move and option flow would be in tandem; in aggregate option flow across all 6 FX pairs have had a hit ratio of 61% for the same-week spot move since October 2022. With the exception of GBPUSD,

Exhibit 4 also shows current week's option flow direction having above 50% hit ratio for next week's spot direction. While this hit ratio is not high, it still suggests SDR options data could provide forward-looking insights for spot market.

The hit ratio would improve with the magnitude of option flow. Exhibit 5 shows for EURUSD, the direction of current week's option flow has had hit ratios of respectively 71% and 62% for same-week and one-week ahead spot moves since Oct 2022. But once the option flow is translated to a 6m z-score and thresholds are applied to isolate weeks of outsized option flow, the signal can improve monotonically. At above +/-1.5 z-score cutoff, EURUSD option flow would have 100% hit ratio with respect to same-period spot move (sample size of 14 weeks with z>1.5 since Oct 2022). At the same time, the hit ratio for next week's spot move also improved to 90%. Weeks of outsize option flow are typically associated with pivotal moments in the market. As a result, the spot trend is more likely to break out and continue in the same direction for the coming week.

Exhibit 4: Option flow for current week tends to lead to spot move in the same direction for next week

Option flow's same-week and one-week ahead hit ratio on spot move



Source: BofA Global Research, Bloomberg, DTCC. The light blue bar shows the percent of times that option flow and spot move were in the same direction within the same week since Oct 2022. The dark blue bar shows the percent of times that option flow and next week's spot move were in the same direction.

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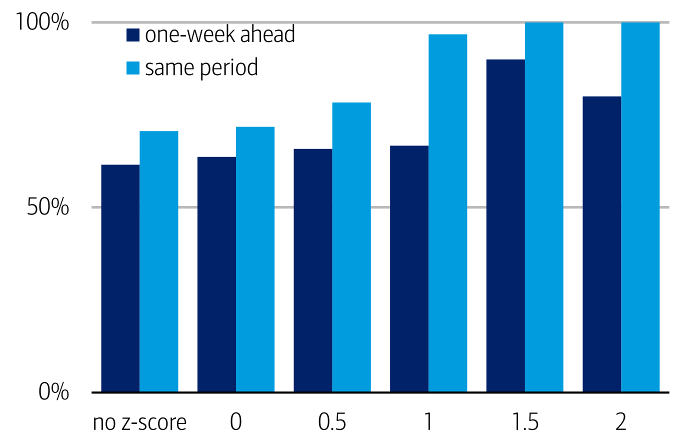
Exhibit 5: More extreme option flow can serve as a better predictor of future spot move

EURUSD option flow's hit ratio on spot move at various z-score cutoffs



Source: BofA Global Research, Bloomberg, DTCC.

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Event analysis: vol-guided decisions

Following a significant currency move (a rally or a sell-off), investors often face the dilemma of either chasing the move or fading it. We believe the FX options market can provide valuable information about positioning and sentiment, so we have also developed a framework called the Event analysis that uses the level of volatility, skew and term structure to help with such decisions (FX Viewpoint: Vol-guided decisions 18 March 2021).

Given the current spot trend could be rising or falling and the overall option signal could be bullish or bearish as well, we derive four strategies through historical scenario analysis:

- Bearish Continuation: sell a currency whose depreciation is accompanied by a parallel shift higher across the vol curve and a rise in put skew.
- Bearish Contrarian: sell a currency whose appreciation is accompanied by an increase in put skew.
- Bullish Continuation: buy a currency whose appreciation is accompanied by a relative inversion of the vol curve and a decline in put skew.
- Bullish Contrarian: buy a currency whose depreciation is accompanied by a fall in 1m vol and a decline in put skew.

Exhibit 6 summarizes spot and vol moves for major currency pairs over the past week (as of July 1). Since the Event analysis may not produce a signal every week, we highlight bullish or bearish conditions that have been partially satisfied by green and red shading, respectively. In this example, the Event analysis was moderately bullish EURUSD, 1m EURUSD implied vol declined by more than 0.2 with skew also rising by more than 1% for EUR calls. The full Bullish Contrarian signal did not form as EURUSD spot for the previous week hovered around 0%. In the same week, Event analysis was moderately bearish JPY vs the USD. Three of the four Bearish Continuation signal conditions were satisfied for the JPY as 1m vol rose by more than 0.5, 1y vol change was positive, and spot return was beyond -1% for JPY.

To learn more about FX volatility and options please refer to our FX Volatility Dashboard as well as the FX Vol Dashboard Primer (Global Rates and FX Primer: FX Volatility Dashboard Primer – 2024 02 April 2024).

Exhibit 6: G10 FX risk premiums broadly eased except for JPY; event analysis is moderately bearish JPY on widening put skew and rising vol
Event analysis signals for July 1 2024

Pair	Old spot	New spot	1m vol	1m vol chg	1y vol	1y vol chg	1y - 1m chg	Currency	Return vs USD	1m skew % chg vs USD	Signals
EURUSD	1.0733	1.0750	5.89	-0.85	6.62	-0.23	0.62	EUR	0.16%	5.19	EUR No Signal
USDJPY	159.62	161.37	10.08	1.31	9.96	0.26	-1.05	JPY	-1.09%	-1.29	JPY No Signal
GBPUSD	1.2686	1.2663	6.04	-0.11	7.30	-0.16	-0.05	GBP	-0.18%	1.01	GBP No Signal
USDCHF	0.8930	0.9024	5.79	-0.17	6.91	0.00	0.16	CHF	-1.05%	-1.03	CHF No Signal
AUDUSD	0.6657	0.6664	8.39	0.15	9.40	-0.03	-0.18	AUD	0.11%	1.28	AUD No Signal
USDCAD	1.3657	1.3704	5.01	0.34	5.66	0.02	-0.33	CAD	-0.34%	-0.14	CAD No Signal
USDSEK	10.4759	10.5856	9.67	-0.37	10.74	-0.07	0.30	SEK	-1.04%	0.69	SEK No Signal
USDNOK	10.5385	10.6384	9.77	-0.53	11.17	-0.21	0.32	NOK	-0.94%	2.05	NOK No Signal
NZDUSD	0.6125	0.6085	8.57	0.09	9.46	-0.07	-0.17	NZD	-0.66%	0.82	NZD No Signal
USDSGD	1.3528	1.3566	3.90	-0.13	4.58	-0.04	0.09	SGD	-0.28%	0.09	SGD No Signal
USDKRW	1389.1	1382.4	7.55	0.11	8.79	0.02	-0.09	KRW	0.49%	1.12	KRW No Signal
USDMXN	17.9549	18.3493	14.88	1.47	13.72	0.54	-0.93	MXN	-2.17%	0.08	MXN No Signal
USDTRY	32.9235	32.6760	13.13	-1.57	24.36	0.50	2.07	TRY	0.75%	-7.15	TRY No Signal
USDZAR	18.1041	18.2071	13.75	0.07	14.38	0.01	-0.06	ZAR	-0.57%	-0.28	ZAR No Signal
USDHUF	368.2	367.0	10.25	-0.43	10.97	-0.12	0.31	HUF	0.31%	-0.93	HUF No Signal
USDPLN	4.0009	4.0053	9.21	-0.80	10.26	-0.31	0.48	PLN	-0.11%	-0.61	PLN No Signal

Source: BofA Global Research, Bloomberg. Snapshot as of July 1 2024.
The table shows the 1-year percentile and 1-week change in 1m and 1y implied vol, the 1y-1m spread, and the 1m 25 delta risk reversal as a percentage of the ATM. For a currency with a put skew, the rules for generating the signal column are the following:
[1] Bearish Continuation: Spot change < -1%, 1m vol change > 0.5%, 1y vol change > 0%, 1m skew chg. < -2; [2] Bearish Contrarian: Spot change > 1%, 1m skew change < -2;
[3] Bullish Continuation: Spot change > 2%, 1y-1m change < -0.1%, 1m skew change > 2; [4] Bullish Contrarian Spot change < -1%, 1m vol change < -0.2%, 1m skew chg. > 1.
Parameters that triggered a bearish condition are colored in red; parameters that triggered a bullish condition are colored in green.

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How well does event analysis work

Exhibit 7 shows the aggregated hit ratio and number of signals for each of the four strategies since 2008 and since 2020 across all the currencies from Exhibit 6. We previously looked at the historical performance in FX Viewpoint: Vol-guided decisions 18 March 2021, and now extend the result to 2024. Over the long run since 2008, all four strategies showed hit ratios that ranged from 54% to 58%. In more recent years, three strategies continued to maintain similar hit ratios, but the Bullish Continuation strategy has underperformed. The underperformance of Bullish Continuation event analysis strategy for global currencies vs the USD in recent history is largely driven by the persistently resilient USD, in our view. After rallying to a decades-high in 2022, the USD has yet to retrace all of its appreciation in this cycle and remains broadly overvalued against global currencies.

Exhibit 7: Bullish continuation signals for global currencies have underperformed in recent years amid persistently strong USD
Event analysis signal hit ratio and # of signals

	Hit ratio since 2008	# of signals since 2008	Hit ratio since 2020	# of signals since 2020
Bearish Continuation	58%	531	54%	183
Bearish Contrarian	54%	156	55%	40

Exhibit 7: Bullish continuation signals for global currencies have underperformed in recent years amid persistently strong USD
Event analysis signal hit ratio and # of signals

	Hit ratio since 2008	# of signals since 2008	Hit ratio since 2020	# of signals since 2020
Bullish Continuation	54%	175	33%	43
Bullish Contrarian	56%	115	67%	24

Source: BofA Global Research, Bloomberg

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Option Flow was bullish EURUSD as election risk premium from June receded

Overall, option flow signals from the July 1 FX Quant Insight publication would suggest fading French election risk premium and increased demand for EUR calls. At the same time, increased implied vol amid narrowing USDJPY skew suggested the JPY was still under pressure.

Technical Matrix

The Technical Matrix is a table of technical indicators (Technicals Explained: In 2024, get to know technical strategy 05 January 2024) and BofA positioning analysis (Global Rates and FX Primer: 01 October 2018) that look at trend following and reversal signals.

The BofA G10 FX positioning analysis model with MAA, UD and RS

Our positioning analysis model gauges positioning using three proprietary indicators: Moving Average Aggregator (MAA), Up/Down volatility (UD) and Residual Skew (RS).

The daily MAA is the average of the 28 binary conditions given by comparing various short and long simple moving average pairs (SMA), such as whether the 50d SMA is above or below the 200d SMA (See Exhibit 8 footer for full list of SMAs). For many investors, a conventional bullish signal for a currency pair occurs when: the short-dated moving average is crossing above the long-dated moving average. The MAA reaches 100% when 28 moving average pairs are bullish, while it reaches 0% when 28 pairs are bearish. Similarly, the MAA is at 50% when 14 out of 28 pairs are bullish and 14 other pairs are bearish. A high (low) percentage of buy signals suggests long (short) positioning in the pair is quite heavy.

We construct Up/Down vol indicator as a spread of realized volatility between up and down days over the past month. Higher volatility in direction of the trend is bullish, while significant volatility against the trend is bearish. For the Technical Matrix, we normalize UD such that a high (low) value corresponds with greater down (up) vol, so that low values of UD may be interpreted as low positioning.

Following the intuition of the Event analysis, we construct Residual put Skew indicator as a residual of a regression of weekly changes in 1m 25d risk reversals (% atm) on weekly changes in spot over 6 month rolling window. Using a normalized cumulative sum of these residuals over the previous month, we get a measure of contrarian and trend-following signals from skew. We then take the 1-year percentile to normalize the RS indicator. Low RS values reflect light positioning and excess demand for calls, while high values reflect excess demand for puts and relatively stretched long positioning.

Trend continuation and reversals with positioning analysis

We consider a pair to be in uptrend if the MAA is above 60%, and in downtrend if the MAA is below 40%. The positioning analysis shows uptrend reversal signal if MAA, UD and RS are all above 80 and uptrend continuation signal if MAA is above 60 while UD and RS are below 50. The model shows downtrend reversal signal if MAA, UD, and RS are all below 20 and downtrend continuation signal if MAA is below 40 while UD and RS are above 50.

Exhibit 8 shows the trend determined by MAA in the Positioning Trend column. The Bullish/Bearish column indicates the signals from MAA, UD, and RS. It shows “Bullish” (in green) if positioning analysis has uptrend continuation or downtrend reversal signals for the pair, and "Bearish" (in red) if positioning analysis has downtrend continuation or uptrend reversal signals for the pair. The column shows "Slightly Bullish" or "Slightly Bearish" (in yellow) if only one of UD or RS indicators supports the signal. In the example as of July 1 2024 (Exhibit 8), the Technical Matrix showed bullish continuation signals for AUD uptrends vs both the USD and on the cross vs NZD. AUD spot looked to break higher from the upside AU inflation surprise in the previous week (Australia Watch: 26 June 2024); our model expects trend-followers to ride the bullish AUD wave further. In contrary to the option flow signals, spot trend analysis would suggest the EUR was still under pressure as of July 1.

Exhibit 8: Existing trend is bullish AUD against both the USD and on the crosses
Technical matrix with positioning analysis and key levels to watch

		Spot	Positioning Trend	Bullish / Bearish	ADX Trend	Bollinger Bands	Next Support	Next Resistance
	EURUSD	1.0755	↓	Bearish	Range	None	1.0448	1.0764
	USDJPY	161.35	↑	No Signal	Transition	None	156.86	161.40
	GBPUSD	1.2671	↑	No Signal	Range	None	1.2653	1.2720
	AUDUSD	0.6669	↑	Bullish	Range	None	0.6656	0.6895
USD	USDCHF	0.9025	↑	No Signal	Downtrend	None	0.8981	0.9032
	USDCAD	1.37	↑	Bullish	Range	None	1.3686	1.3899
	NZDUSD	0.6087	↑	No Signal	Range	None	0.6082	0.6093
	USDSEK	10.5749	↓	No Signal	Range	None	10.4268	10.5865
	USDNOK	10.6319	↓	No Signal	Range	None	10.6000	10.6959
	EURGBP	0.8487	↓	Bearish	Downtrend	None	0.8397	0.8518
	EURJPY	173.53	↑	No Signal	Transition	Upper	169.04	173.55
	EURAUD	1.6127	↓	No Signal	Downtrend	None	1.5998	1.6279
EUR	EURCHF	0.97065	↔	No Signal	Uptrend	None	0.9693	0.9734
	EURCAD	1.4734	↔	No Signal	Transition	None	1.4710	1.4750
	EURNZD	1.7668	↓	No Signal	Uptrend	None	1.7383	1.7725
	EURSEK	11.3728	↓	Bearish	Uptrend	None	11.0030	11.3821
	EURNOK	11.4342	↓	Bearish	Range	None	11.0965	11.4440
	AUDJPY	107.603	↑	No Signal	Uptrend	None	103.85	107.66
	AUDNZD	1.0956	↑	Bullish	Uptrend	None	1.0887	1.1031
	AUDCAD	0.9136	↑	No Signal	Range	None	0.9060	0.9179
G10 Cross	NOKSEK	0.9947	↑	No Signal	Range	None	0.9947	0.9997
	CADJPY	117.777	↑	Slightly Bearish	Uptrend	None	114.61	117.87
	GBPJPY	204.45	↑	Slightly Bearish	Uptrend	Upper	198.48	204.47
	NZDJPY	98.22	↑	No Signal	Transition	None	95.38	98.32
	GBPCHF	1.1436	↑	No Signal	Transition	None	1.1428	1.1678
	USDMXN	18.3504	↑	Slightly Bearish	Uptrend	None	17.9495	18.9929
	USDBRL	5.5875	↑	No Signal	Uptrend	None	5.2572	5.6038
	USDZAR	18.1882	↓	Bearish	Range	None	17.4193	18.2676
EM	EURPLN	4.3049	↔	No Signal	Range	None	4.3049	4.3540
	EURHUF	394.32	↑	Slightly Bearish	Transition	None	391.91	399.75
	USDKRW	1382.40	↑	Bullish	Range	None	1373.65	1400.00
	USDINR	83.4463	↑	No Signal	Range	None	83.43	83.50
	USDCNH	7.3006	↑	No Signal	Range	None	7.2610	7.3682

Data as of 07/01/24. **Source:** BofA Global Research, Bloomberg.

Positioning uptrend has MAA > 60, downtrend MAA < 40. Positioning uptrend reversal likely if MAA/UD/RS > 80, continuation likely if UD, RS < 50. Positioning downtrend reversal likely if MAA/UD/RS < 20, and continuation likely if UD, RS > 50. UD and RS are 1y percentile and MAA is in %.

Positioning is bullish (green) if matrix shows downtrend reversal or uptrend continuation; Positioning is bearish (red) if matrix shows uptrend reversal or downtrend continuation.

Positioning is slightly bullish or slightly bearish (yellow) if only one of UD or RS supports the signal.

ADX downtrend if ADX>=25 and DMI+ is below DMI-. ADX uptrend if ADX>=25 and DMI+ is above DMI-. ADX shows Transition if ADX is between 20 and 25, and Range if ADX<20. Cells in the ADX Trend column are colored with more intensity if the ADX trend signal matches the positioning signal. 14-day lookback is used for the ADX indicators.

The Bollinger Bands column shows 'Upper' if spot is above the +2 std bollinger band, and 'Lower' if spot is below the -2 std band. 20-day SMA is used for Bollinger indicators.

Cells in Next Support and Next Resistance columns are colored if spot is within 0.5% of the support or resistance level.

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How well do trend-following and reversal signals perform over time

The positioning analysis is by no means a systematic strategy. However, many trend-following CTAs operate under a similar mindset – chasing after trends as they form and exit positions as trend become too stretched or flips to the opposite side. In FX, trend-following strategies tend to perform better when the USD exhibits strong trending behaviors. Exhibit 9 shows over the past decade, FX trend factor has had the best performance in 2014 and 2022. Both are years where the USD saw prolonged uptrends as investors looked to own the USD ahead of a new Fed hiking cycle. To the contrary, trend-following strategies underperformed in 2023 as the USD spent more time trading sideways with MAA hovering between 40 and 60 (i.e. neutral trend in positioning analysis, Exhibit 10).

Exhibit 9: Trend-followers performed best in 2014 and 2022 over the past decade
Trend factor performance by year

	return	vol	Sharpe
2014	7.1%	3.0%	2.4
2015	2.7%	4.9%	0.6
2016	-2.6%	2.7%	-1.0
2017	0.5%	2.8%	0.2
2018	0.2%	4.6%	0.0
2019	-1.0%	2.7%	-0.4
2020	1.4%	4.7%	0.3
2021	-3.9%	3.5%	-1.1
2022	4.5%	4.6%	1.0
2023	-1.6%	2.1%	-0.8

Source: BofA Global Research, Bloomberg

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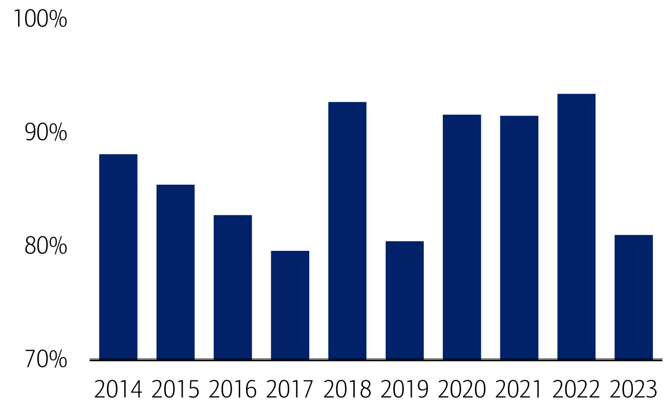
Exhibit 10: 2023 was one of the least trending years in FX over the past decade
% of times USD MAA showed prominent uptrend or downtrend by year



Source: BofA Global Research, Bloomberg. Chart shows % of times in each year that MAA was outside of the 40-60 range for the DXY index.

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Trending and mean-reversion technical signals

In addition to MAA, UD, and RS, the technical analysts in the industry have also derived other indicators that we could use to support the positioning analysis signals. For the Technical Matrix, we employ the ADX (Average Directional Movement) and Bollinger Bands indicators. To learn more about a variety of technical strategies, please see Technicals Explained primer (Technicals Explained: In 2024, get to know technical strategy 05 January 2024), as well as our Quantifying Technicals publications for the ADX (Quantifying Technicals: 25 April 2022) and Bollinger indicators (Quantifying Technicals: 24 January 2022).

Use ADX Trend in addition to the positioning trend

The ADX is determined by a secondary indicator called DMI (Directional Movement Index). The DMI consists of two lines: DMI Plus and DMI Minus. The DMI Plus line tends to move higher on rising prices, while the DMI Minus line tends to move higher on falling prices. When the DMI Plus crosses above the DMI Minus, the start of a new uptrend is formed. In contrary, when the DMI Minus crosses above the DMI Plus, the start of a new downtrend is formed.

The ADX is a combination of the DMI lines and is used to define the path of prices as range bound or trending. Rising ADX indicates the current trend is gaining strength, while falling ADX indicates the current trend is weakening. When the ADX is below 20, the Technical Matrix ADX column would show “Range”, suggesting the pair does not have prominent trend. When the ADX is between 20 and 25, the Technical Matrix shows “Transition” (in grey), suggesting the pair may be transitioning between up and down trends. When the ADX is above 25, the Technical Matrix shows either “Uptrend” (in green) or “Downtrend” (in red) depending on whether DMI Plus is above or below DMI Minus. The “Uptrend” and “Downtrend” cells in this column would have more intense coloring if the ADX trend is in the same direction as the MAA trend (Positioning Trend column). As the ADX and DMI indicators in the Technical Matrix are calculated using 14-day open-high-low-close (OHLC) spot prices, the ADX trend may appear to be different at times with the trend determined by the longer-dated MAA, as the MAA positioning trend is determined by moving average crossings (through 200d SMA).

Use Bollinger Bands as another directional signal

The Bollinger Band consists of three lines: a moving average of price, two standard deviations above the moving average and two standard deviations below. For the Technical Matrix, we calculate Bollinger bands with a 20-day simple moving average. The bands often serve as an estimate of support and resistance levels. When markets are range bound, prices tend to trade between the bands. But when spot is edging close to the bands or breaks out of the Bollinger range, a more significant trend would form. As a result, the Bollinger Bands column in the Technical Matrix shows “Lower” (in red) when the spot price is below the lower band and “Upper” (in green) when the spot price is above the upper band. It should also be noted that when the bands are narrow relative to the past and prices break out through a band then a new trend and trade in the direction of the breakout is signaled. We would examine the Bollinger band in conjunction with the Bullish/Bearish signals from positioning analysis.

Key levels to watch: Next Support and Next Resistance

Finally, the Technical Matrix uses 50d SMA, 100d SMA, 200d SMA, 1y high and low, 2y high and low, 1y 38.2%, 50%, and 61.8% Fibonacci retracement levels to determine the next support and resistance levels that investors should consider. Cells in these columns are colored in grey if the displayed spot price is within 0.5% from the next support and resistance levels.

Technical Matrix signals were bullish USD/CNH

Overall, for the sample data as of July 1, the highest conviction signal from the Technical matrix would be bullish AUD. The bearish EUR signals from Technical Matrix offsetted with the bullish EUR signals from Option Flow for this week.

CARS Signals

In 2022, we released the CARS (Cross-Asset Regime Switching) model (FX Viewpoint: CARS model: weekly FX cross-asset drivers 22 June 2022). It is a systematic model that makes weekly buy/sell decisions for G10 currencies based on cross-asset: equity, rates, and commodity factors (Exhibit 11).

Identify macro shock periods to weather volatility

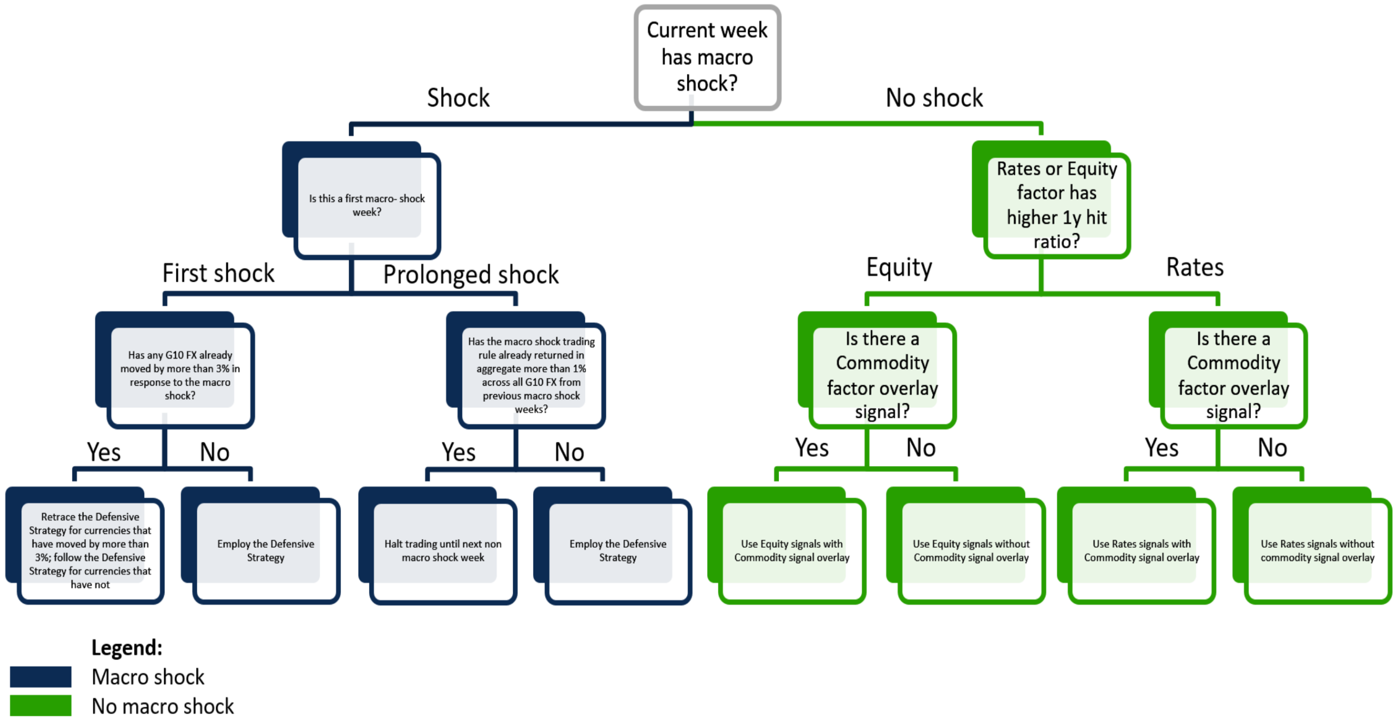
The CARS model classifies each week as either normal or one with a "macro shock". The model defines a "macro shock" as sharp declines in at least one of the following cross asset factors: equity returns, global yields or commodity prices. Conceptually, if the market expects an economic slowdown ahead, the equities fall as growth slows, yields fall as monetary policy becomes more dovish and commodity falls amid slower demand. The model assumes G10 FX behaves differently when there are macro shocks. The market is typically trend-following and accumulates long positions in normal times (also known as "risk-on"), which may be quickly unwound during a flight to quality or a "risk-off" episode during a macro shock.

Our macro-shock component not only gains from the "flight-to-quality" behavior exhibited during periods of systematic shocks, but also helps the model reduce the potential loss from retracement and volatility that tends to occur with systematic shocks as well.

Performance-based cross-asset factor selection for normal weeks

In normal weeks, ie, without a macro shock, the CARS model is designed to determine whether to prioritize the equity risk factor or the rates risk factor to trade G10 FX based on the 1y rolling performance of each. In addition, we introduce a commodity factor overlay to the equity vs rates factor selection process. The "normal week" cross-asset component improves upon our existing models by considering commodities as a driver for FX and assuming a dynamic relationship between FX and other asset classes over time.

Exhibit 11: The CARS model uses weekly trading rules based on different regimes
Graphic representation of the macro-shock and the cross-asset components for the CARS model



Defensive Strategy: for the CARS model, we define the defensive strategy as the act of buying JPY and CHF vs the USD, and selling rest of G10 FX vs the USD.

Source: BofA Global Research, Bloomberg

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CARS model since the initial 2022 release

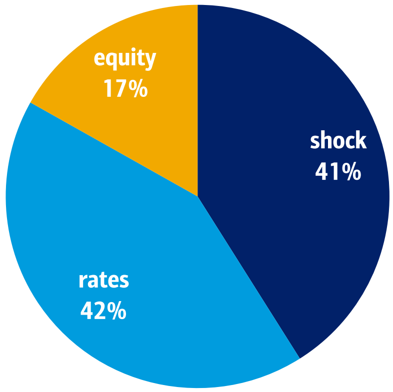
In a recent viewpoint (FX Viewpoint: 06 June 2024), we looked at how the model has fared since the initial release in 2022. From July 2022 to April 2024, the model has spent the most time under the rates regime where weekly bullish/bearish FX signals are derived by a combination of G10 yield levels and yield changes (Exhibit 12). The model has also determined a substantial amount of weeks to fall under a shock regime. Under the shock regime, the model would turn bearish on the so-called “high-beta” currencies against USD, JPY and CHF.

The model had an overall hit ratio of 53% since the release in June 2022. This is above 50% but lower than the previously backtested 60% hit ratio from 2007 to 2021 as we had noted in the initial publication. Breaking down the overall hit ratio by regime, we found the model has had a 62% hit ratio for the shock regime and 53% hit ratio for the rates regime since inception (Exhibit 13), maintaining similar performance to that of the historical period.

The model hit ratio has underperformed during its time in an equity regime. However, the silver lining is the model only spent 17% of the time in an equity regime. The model was devised to choose between rates and equity regime based on rolling hit ratios of each factor and has benefitted from this construction by underutilizing signals from equity factor.

Finally, the commodity factor overlay, which generates additional weekly FX signals on top of the signals produced by the prevailing regime between rates and equity, has occurred 15% of the time with a weekly hit ratio of 55%. The commodity factor overlay only produces signals during weeks of sharp commodity price rallies.

Exhibit 12: Rates regime has been the most prevalent followed by shock regime
Breakdown of cross-asset regime since release of the model



Source: BofA Global Research, Bloomberg. Chart reports the breakdown of weekly regime from July 2022 to April 2024.

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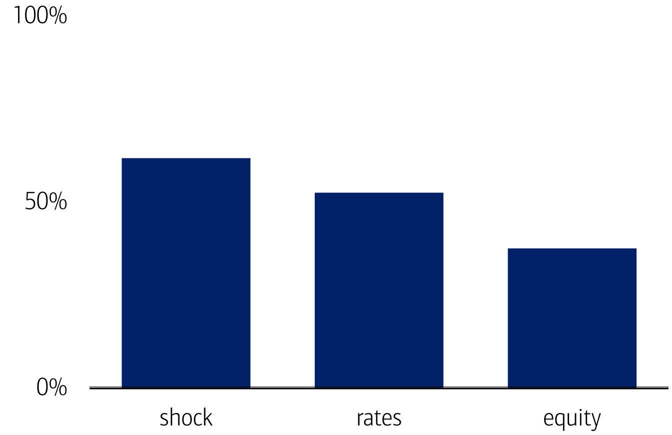
Exhibit 13: Both shock and rates factors had hit ratios above 50%
Hit ratio of model signals under each regime since release of the model



Source: BofA Global Research, Bloomberg. Chart reports the hit ratio for each regime from July 2022 to April 2024.

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Normal weeks: FX signals depend on cross-asset drivers

Every week, the CARS model produces a dashboard showing the latest bullish/bearish signals for G10 FX and the cross-asset stylized statistics. Exhibit 14 shows an example of how the dashboard would look for a no-macro shock week. The week of July 1, 2024 was a normal week with the rates factor having a greater 1y rolling hit ratio than the equity factor hit ratio. As a result, CARS was bullish AUD and JPY vs the CHF and SEK as the AU and JP yields increased the most in the previous week in terms of 5y z-scores. To the contrary, rates factor ranked CHF and SEK at the bottom in G10 as SZ yield fell in the previous week and SW yield was largely unchanged.

Exhibit 14: CARS was bullish AUD and JPY vs bearish SEK and CHF on rates factor
CARS signals for rates regime week as of July 1 2024

Currency	Bullish/Bearish	Equity	Rates	Commodity
EUR		7	4	4
JPY	Bullish	1	1	9
GBP		10	7	7
AUD	Bullish	4	2	2
CAD		5	6	1
CHF	Bearish	9	10	8
NZD		2	8	6
SEK	Bearish	8	9	5
NOK		3	3	3

Global regime	Values
Commodity z-score	-1.1
Performing factor	Rates
USD Equity	6
USD Rates	5

Source: BofA Global Research, Bloomberg. The Equity ranking is ordered by 5y z-score of 1-week equity return. The Rates ranking is ordered by 5y z-score of 1-week rate change and level of 2y swap rate. The Commodity ranking is ordered by 52-week FX correlation with BCOM. The Commodity z-score is the 1y z-score of 1-week BCOM Index return.

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Macro-shock weeks: model would trades G10 FX in a risk-off fashion

As macro-shock and normal weeks are mutually exclusive, a different dashboard shows signals for normal weeks. Exhibit 15 shows an example of how the dashboard would look for a macro-shock week. The week of June 8, 2024, CARS model moved to the macro shock regime since in the previous week, US yield declined by more than 1 z-score on the back of softening ISM PMIs and US payrolls data. For the subsequent week, the model looked to stay bullish USD vs the cyclically-sensitive G10 currencies as it would expect the USD to retrace some of the previous week's loss.

Exhibit 15: In this macro-shock week on July 8 2024, CARS was bullish USD as US yield fell by more than 1 z-score from the previous week

CARS signals for a macro-shock week

Currency	Bullish/Bearish	Equity Shock	Rates Shock
EUR	Bearish	-0.3	-0.7
JPY	Bullish	0.6	-0.9
GBP	Bearish	-0.4	-0.8
AUD	Bearish	-0.1	-0.7
CAD	Bearish	-0.3	-0.5
CHF	Bullish	0.4	-0.3
NZD	Bearish	0.1	-1.0
SEK	Bearish	-0.6	-0.2
NOK	Bearish	-0.4	0.0

Global regime	z-score
Commodity Shock	0.4
S&P 500	0.6
US Treasury	-1.1

Source: BofA Global Research, Bloomberg. This "macro shock" example is from July 8 2024.

The chart shows bull/bear signals for G10 FX versus the USD based on cross-asset shocks. Factor cells are colored in red if equity/rates z-scores are below -1 and commodity z-score is below -2.

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Interactive Time Zone

Breaking down currency performance by time zones can help investors better understand the sources of key flows. For example, private cross-border portfolio investment flows or reserve rebalancing related flows at any given time can be important drivers of FX movement. In addition, as FX is traded around the clock, understanding price action by currency and time zone can be useful for investors considering strategic hedges or expressing a directional view.

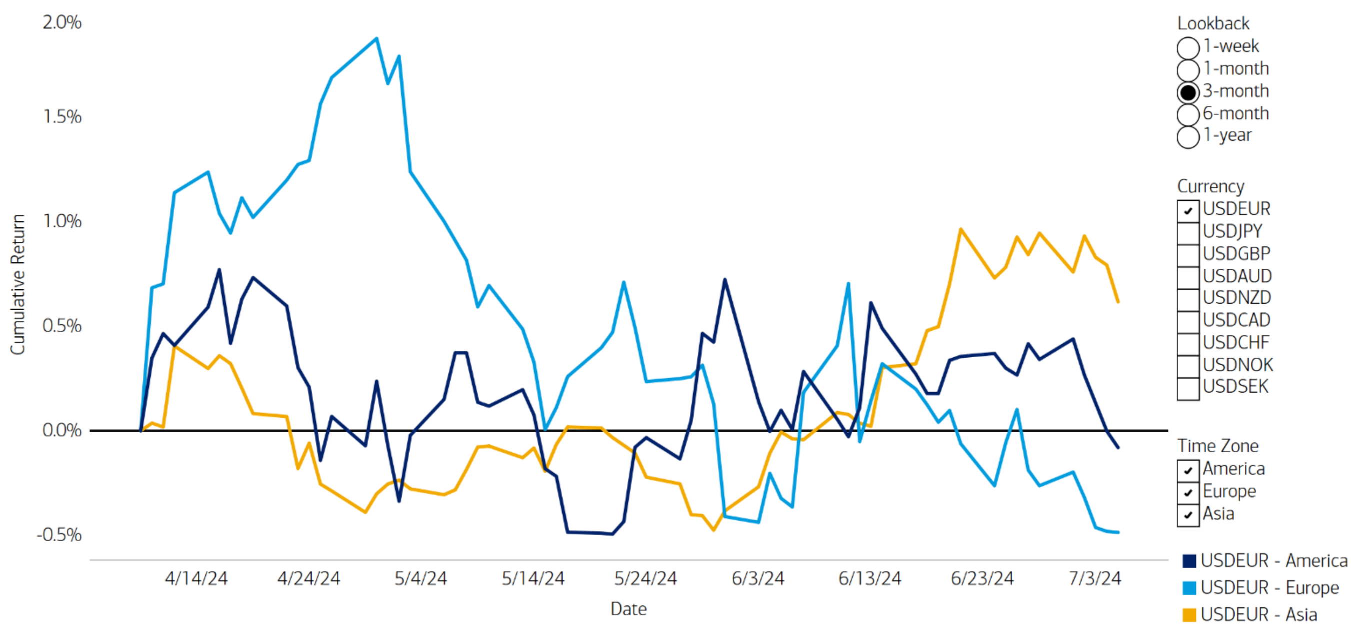
Split a 24-hour day to regional America, Europe, and Asia time zones

In our weekly FX Quant Insight report, we present an interactive Tableau dashboard that allows investors to examine currency cumulative returns vs the USD at different lookback periods, currency groupings, and time zones. Hours are shown in Coordinated Universal Time (UTC). We define America time zone as 1pm-12am UTC (9am-8pm EDT), Europe time zone as between 8am-1pm UTC (4am-9am EDT), and Asia time zone as between 12am to 8am UTC (8pm-4am EDT).

In this example as of Jul 8 2024 (Exhibit 16), the time zone interactive plot shows throughout June, Asia-based investors were the largest buyers of USD. But into the first week of July, investors across all three time zones sold the USD on the back of weak US economic data.

Expanding exhibits in the HTML view shows cumulative FX returns at different lookback periods, currency groupings, and time zones.

Exhibit 16: Time zone chart shows in the first week of July, investors across all time zones sold the USD
Interactive time zone plot as of July 8 2024. *For readers of the web-formatted version of this report, access interactive features of the visualization by clicking on the image. Use the Google Chrome or Microsoft Edge browser for the best experience*



We denote America time zone as between 1pm to 12am UTC, Europe time zone as between 8am to 1pm UTC, and Asia time zone as between 12am to 8am UTC.

Source: BofA Global Research

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A more granular breakdown splits a day into eight 3-hour ranges

We also present a heatmap that further breaks down a 24-hour day into eight 3-hour intervals (Exhibit 17). Using the heatmap for the sample week of July 8, we can pinpoint more detailed price actions at different time of the day. The heatmap table would suggest USD supply in the first week of July was concentrated around 11am-2pm and 11pm-2am UTC. The 11am-2pm period coincided with the 10am and 8:30am ET US data releases that triggered the USD selloffs in the previous week. As Asia-based investors accumulated the most long USD positions from June, we also find another period of USD supply around the Asia trading hours of 11pm-2am UTC.

Exhibit 17: More granular time zone heat map table shows USD supply in the first week of July was concentrated around 11am-2pm and 11pm-2am UTC

Cumulative price change by currency in granular 3-hour increments as of July 8 2024. *For readers of the web-formatted version of this report, access interactive features of the visualization by clicking on the image. Use the Google Chrome or Microsoft Edge browser for the best experience*

	8am-11am	11am-2pm	2pm-5pm	5pm-8pm	8pm-11pm	11pm-2am	2am-5am	5am-8am
USDEUR	0.1%	-0.5%	0.1%	-0.2%	0.0%	-0.8%	0.0%	-0.2%
USDJPY	0.0%	0.2%	-0.2%	0.0%	-0.1%	-0.1%	0.0%	-0.1%
USDGBP	-0.3%	-0.8%	0.2%	-0.1%	0.0%	-1.0%	0.0%	-0.2%
USDAUD	0.0%	-0.5%	0.0%	-0.3%	0.0%	-1.0%	0.2%	-0.4%
USDNZD	0.0%	-0.6%	-0.1%	-0.2%	0.1%	-0.5%	0.3%	-0.1%
USDCAD	0.1%	-0.3%	0.1%	-0.1%	0.1%	-0.5%	0.1%	-0.3%
USDCHF	0.0%	-0.1%	0.0%	-0.2%	0.0%	-0.1%	0.0%	0.0%
USDNOK	0.3%	-0.5%	-0.1%	-0.2%	-0.1%	-1.0%	0.1%	-0.6%
USDSEK	0.1%	-0.5%	-0.2%	-0.1%	-0.2%	-0.8%	0.1%	0.1%

Lookback
- 1-week
- 1-month
- 3-month
- 6-month
- 1-year

Hours are as of UTC. Currency pairs with greater loss over the lookback period are colored in darker red. Currency pairs with greater gain over the lookback period are colored in darker green. We denote America time zone as between 1pm to 12am UTC, Europe time zone as between 8am to 1pm UTC, and Asia time zone as between 12am to 8am UTC.

Source: BofA Global Research

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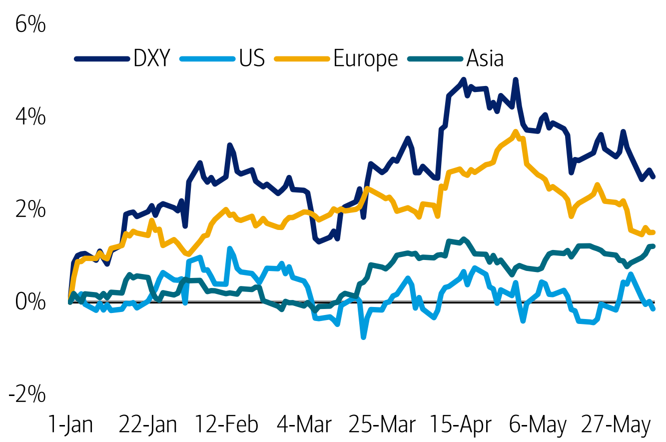
USD spot rally in 2024 has been driven by demand in foreign hours

Breaking down the 2024 USD rally across US, Europe, and Asia time zones, we find the USD was largely unchanged in US trading hours (Exhibit 18). Using DXY as a proxy for the broad USD price action, Exhibit 19 shows the overall USD move has had the highest correlation to European-hour moves followed by Asia-hour moves in 2024. Historically, the US-hour flow has had a much stronger correlation to overall DXY price actions and local US hours were the main driver of the overall USD move since 2020.

Improved carry, growth divergence in favor of the US, plus portfolio flows drove the increased foreign demand for USD. While the recent low correlation between the DXY index and US-hour return is unlikely to sustain at this level, more European-hour USD supply is likely needed for the USD to materially weaken later this year.

Exhibit 18: US-based investors had little influence on USD price actions in 2024

DXY year-to-date price action broken down by time zone



Source: BofA Global Research. We define US time zone as 1pm-12am UTC (9am-8pm EDT), Europe time zone as between 8am-1pm UTC (4am-9am EDT), and Asia time zone as between 12am to 8am UTC (8pm-4am EDT).

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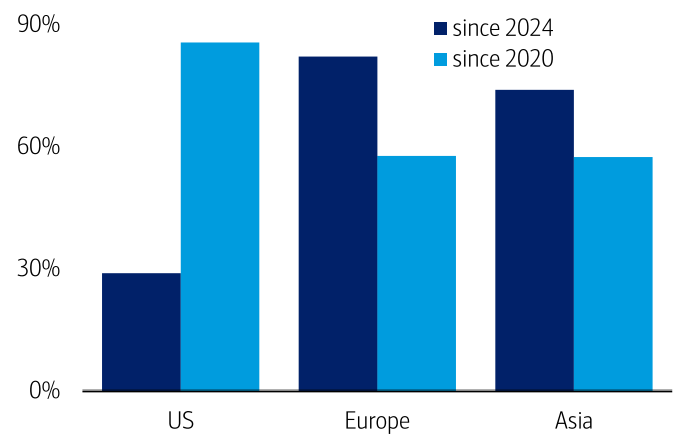
Exhibit 19: US-hour price action's correlation to overall DXY price move sharply declined in 2024

DXY correlation to USD cumulative return in different time zones



Source: BofA Global Research. We define US time zone as 1pm-12am UTC (9am-8pm EDT), Europe time zone as between 8am-1pm UTC (4am-9am EDT), and Asia time zone as between 12am to 8am UTC (8pm-4am EDT).

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