Global FX Trader

Inflating Fears

Our thoughts on USD, JPY, EM carry, EUR, EM FX, ZAR and Positioning

- **USD: Move fast and break things.** Last week, we argued that pricing 30bp for the next Fed meeting was not a stable equilibrium for markets. Now, after a considerably rocky few days, we are ending in a similar place—and with a similar conclusion (Exhibit 1). However, the equilibrium is arguably even *more* unstable now. But, we think the balance of risks looks likely to break in the Dollar's favor over the next fortnight. On the one hand, Chair Powell very explicitly said the Fed is willing to speed up the pace in response to hotter data and upward revisions to Q4 2022. This lends some credence to not only pricing a substantial probability of 50bp in March, but also helps justify the changing correlations to economic news over the last month. And, economic data this week continued to show an extremely tight labor market. Job openings have barely budged over the last few months (at least according to JOLTS), and the economy has added over 800k new jobs in the first two months of the year—hardly a sign of pending recession, and seemingly consistent with Powell's assertion that the picture they thought they saw in early February has changed. But, on the other hand, stresses in the domestic banking system are perhaps the first clear sign that policy has become more restrictive, if not disruptive, which has put markets back into limbo. But, we think most paths to resolution should support the Dollar over coming weeks. On the one hand, if the FOMC holds fire because of financial stability concerns, that should ultimately lead to a safe-haven bid for the Dollar. As a corollary, we do not subscribe to the view that the Dollar's depreciation on Friday is a sign that the safe-haven status is not holding; it looks much more consistent with the market treating this mostly as a potential limit on Fed hikes rather than actually pricing increased risk across the system. And on the other hand, if banking pressures improve, or at least do not worsen, over the next couple weeks, then they should have little impact on the FOMC's decision. The most plausible route to a more negative outcome for the Dollar, in our view, would be renewed confirmation that restrictive policy is slowing the economy and lowering inflation—and the banking system stress may be a sign of policy having finally reached clearly restrictive territory, but that may not be evident for some weeks yet.

Kamakshya Trivedi
+44(20)7051-4005 |
kamakshya.trivedi@gs.com
Goldman Sachs International

Danny Suwanapruti
+65-6889-1987 |
danny.suwanapruti@gs.com
Goldman Sachs (Singapore) Pte

Michael Cahill
+44(20)7552-8314 |
michael.e.cahill@gs.com
Goldman Sachs International

Davide Crosilla
+44(20)7774-5725 |
davide.crosilla@gs.com
Goldman Sachs International

Karen Reichgott Fishman
+1(212)855-6006 |
karen.fishman@gs.com
Goldman Sachs & Co. LLC

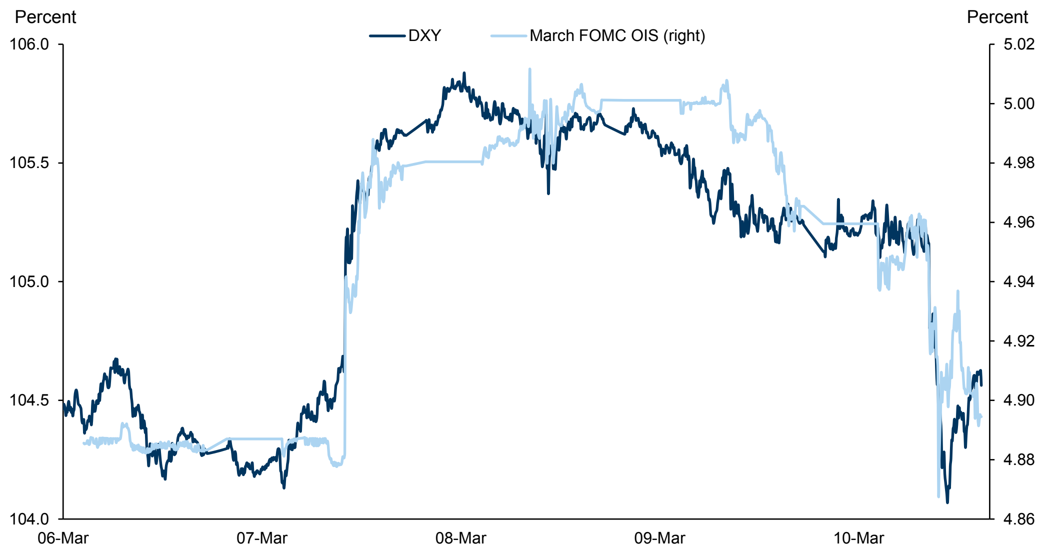
Ian Tomb
+44(20)7552-2901 | ian.tomb@gs.com
Goldman Sachs International

Teresa Alves
+44(20)7051-7566 |
teresa.alves@gs.com
Goldman Sachs International

Sid Bhushan
+44(20)7552-3779 |
sid.bhushan@gs.com
Goldman Sachs International

Isabella Rosenberg
+1(212)357-7628 |
isabella.rosenberg@gs.com
Goldman Sachs & Co. LLC

Exhibit 1: Dollar moves driven by Fed expectations this week



Source: Bloomberg

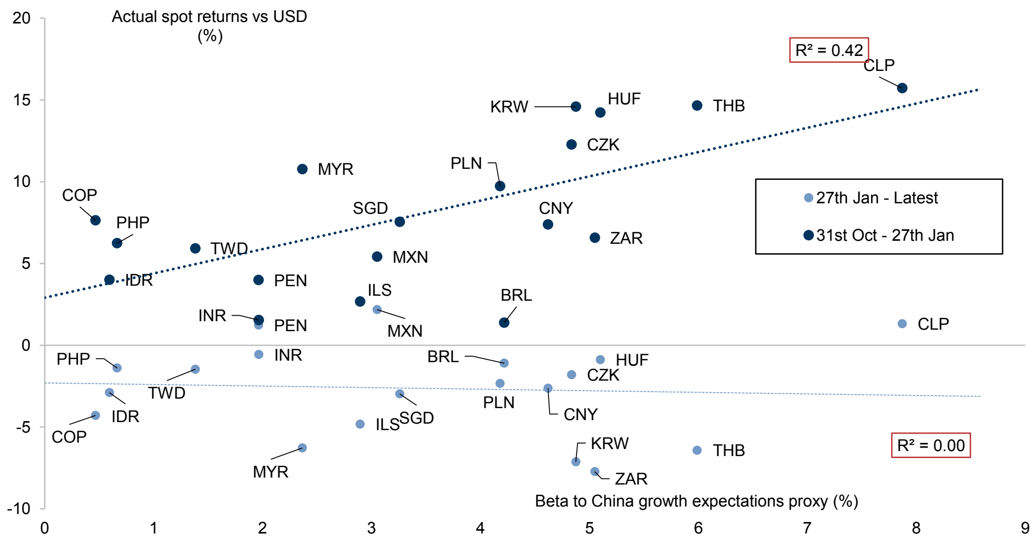
- **JPY: Arigato, next.** The Bank of Japan decided to keep policy on hold at Governor Kuroda's last meeting, as most had expected, seemingly giving the incoming leadership a "free hand" to reassess policy and plan a possible exit from extraordinarily easy policy on its own timeline. While USD/JPY moved up to just below 138 following comments from Fed Chair Powell that opened the door back up to 50bp rate hikes, the cross ended the week down less than a percent, being caught between some widening in the real rate differential and a more significant US equity sell-off of 4%. That said, market speculation of an upcoming shift in BoJ policy will likely increase going into the April meeting (though our economists currently think that a tweak in June looks more probable). This should continue to add some downside pressure to USD/JPY, especially if the initial results of the shunto wage negotiations that are due next week come in relatively strong, as our economists expect. But we have argued that the path of US real rates should matter most for USD/JPY performance, and with Kuroda's last BoJ meeting now in the rear-view mirror and the FOMC meeting on deck, we think that the cross can trade more freely with US growth and policy expectations in the coming weeks. After the volatility of recent sessions, we expect yields to drift higher again as the market re-focuses on the upcoming CPI report that is likely to be firm. That should create room for some renewed JPY weakness ahead of the March FOMC meeting—barring a significant further deterioration in broader risk sentiment.
- **EM carry: On a tight leash.** The ongoing increase in rate volatility means that EM FX will remain highly sensitive to the US data flow and market pricing for the next FOMC meeting. And, after a strong performance year-to-date, EM carry trades are particularly vulnerable, in our view, to a more indiscriminate selloff where market focus shifts to the risks of policy overtightening. In light of this volatile backdrop, we think the resilience of these trades can be increased by either (i) including more defensive currencies like INR, which would reduce the volatility of the portfolio or (ii)

choosing a funder with a similar US rate sensitivity (for example, our EM carry trade recommendation funded out of the Euro remained resilient to the broad USD move following Powell's testimony on Tuesday). Still, even with these considerations, we think EM carry trades that have performed well YTD should be kept on a tight leash over the next couple of weeks and so we have also been tightening stops for our preferred EM FX carry trade recommendations (long MXN, BRL & HUF vs EUR). To be sure, we think the key risk for a currency like MXN is not necessarily US rates moving higher (which the Peso has been able to digest for the most part), but rather a deterioration in broader risk sentiment emerging from signs of stress in the US economy, as we saw in June-July 2022. And after a period where the Mexican Peso has experienced 'too much love' as we argued last week, as long as sensitivity to activity and policy in core markets remains heightened, the more idiosyncratic behaviour of Brazilian local markets makes for a better long (and we continue to recommend that investors receive BRL Jan 29 DI, initiated earlier this week).

- **EUR: Setting the bar.** While the Fed is undecided over going back to 50bp, the ECB has been unequivocal—they are sticking to that pace at least for this meeting, and possibly for a while longer. And the Euro area stands out because, given more persistent inflation pressures and the elevated pace of nominal growth, the economy likely requires and can withstand faster hikes. There are not many other economies that can match the Fed's higher aim (and possibly faster pace) as well as the Euro area right now. For this reason, we think the Euro can still be somewhat resilient in a more indiscriminate period of Dollar appreciation, and EUR looks well-positioned to move higher on crosses in coming weeks (such as against SEK and GBP). Our 3m forecast for EUR/USD remains 1.02 but, now that the market has mostly corrected for an over-exuberant January, achieving this forecast will likely also require some disappointment on the EUR leg. While this looks unlikely to happen soon, we continue to see a number of "execution risks" for Europe in coming months, including our commodity teams' expectation that natural gas prices will start to rise and ultimately more than double from now through the summer.
- **EM FX: China Reopening vs US Rate Volatility.** Between November and January, EM currencies benefited from a better growth-inflation mix, where the earlier-than-expected China reopening was a key contributor to the improving cyclical picture and a key driver of cross EM FX performance (Exhibit 1). However, since then, with the Dollar moving stronger, the cross-section of EM currencies has increasingly reflected their sensitivity to US rates as policy hawkishness has re-emerged. Given our economists' above-consensus forecast for 2023 China growth and a continued recovery in high-frequency data, we think there is still upside in China-sensitive EM currencies. And our recent in-depth analysis suggests that KRW and THB are the clearest expressions of China-related optimism, whereas domestic growth risks make ZAR a less reliable proxy than in the past. Still, the prospect for US rates to stay "higher for longer" may require investors to keep an eye out for the sensitivity of EM currencies to US rate moves too: for instance, EM FX investors can pair China-sensitive EM FX longs with shorts in currencies with a similar US rate sensitivity (for example, CLP longs can become more US rate resilient with a GBP short in this simple framework). Alternatively, the Brazilian Real

stands out for featuring a combination of China growth exposure and US rate resiliency.

Exhibit 2: While FX sensitivities to China growth expectations explained a large part of the cross EM FX performance between November and January, this has not been the case since



X-axis displays the estimated beta of each currency to our market-based proxy of Chinese growth expectations, controlling for shifts in the S&P Index, oil prices and US 10-year real yields.

Source: Bloomberg, Goldman Sachs Global Investment Research

- **ZAR: A tough domestic backdrop.** In mid-February, we noted that the South African Rand had been trading more idiosyncratically and there was room for further underperformance relative to other EM currencies on the back of downside risks to domestic growth. And while USD/ZAR has traded lower in the last couple of sessions, potentially reflecting light positioning after a very challenging start to 2023, as well as the potential for the Rand to respond to an extension of China's reopening impulse, we think the domestic thesis for Rand underperformance remains. For one, the effects of power cuts are now starting to become visible as the sharper-than-expected contraction in 2022Q4 GDP suggests, with our economists now expecting 2023 GDP growth at only 0.2%. At the same time, the current account deficit widened sharply in Q4, driven by the goods trade balance (and weak export volumes specifically), which could offset the tailwind from increased Chinese commodity demand. And, more structurally, we think the ongoing changes in the portfolio flow picture imply there is an increasing role for more discretionary locally driven capital outflows. With South Africa heading into the winter months, the seasonal increase in electricity demand may lead to an intensification of power cuts, which would weigh on both economic growth and on locally driven capital flows. This would lead, in our view, to a weaker and a more idiosyncratic Rand over the near-term.

- **G10 Positioning: More balanced (probably).** Markets are pricing an unsteady equilibrium for the next Fed meeting, and given the packed calendar period, event risk is clearly elevated. In markets like these, positioning can play a crucial role.

While our typical measures of FX market positioning have been unavailable through the CFTC, we have been able to turn to price-based estimates, which suggest that Dollar positioning turned more balanced in February. USD built up a significant overweight into the end of 2022, after which optimism about US disinflation pushed Dollar positioning to a trough sometime early this year. In February however, the market narrative shifted and, since that shift, our price-based measures of USD positioning, including risk reversals and USD sensitivities to data surprises, suggest that positioning has turned more even against the G10. Depending on skew of the data over the coming weeks, more balanced positioning in the Dollar could suggest more symmetric sensitivities to data surprises.

Global FX Forecasts

	Current Spot	3-Month Horizon		6-Month Horizon		12-Month Horizon		Longer-term Forecasts (eop)		
		Forward	Forecast	Forward	Forecast	Forward	Forecast	2024	2025	2026
G10										
EUR/$	1.06	1.06	1.02	1.07	1.02	1.08	1.10	1.15	1.15	1.15
£/$	1.19	1.20	1.15	1.20	1.15	1.20	1.22	1.28	1.35	1.34
AUD/$	0.66	0.66	0.66	0.66	0.68	0.67	0.71	0.73	0.75	0.80
NZD/$	0.61	0.61	0.60	0.61	0.62	0.61	0.64	0.65	0.67	0.70
$/CAD	1.38	1.38	1.38	1.38	1.34	1.37	1.28	1.28	1.23	1.20
$/CHF	0.93	0.92	0.94	0.91	0.92	0.90	0.84	0.80	0.80	0.80
$/NOK	10.66	10.61	10.59	10.56	10.69	10.48	10.00	9.39	8.87	8.35
$/SEK	10.75	10.70	10.98	10.65	10.88	10.57	9.77	9.35	9.04	8.70
$/JPY	136	134	132	132	125	129	125	125	115	105
EMEA										
$/CZK	22.3	22.4	23.3	22.5	23.5	22.5	22.3	21.7	22.6	23.5
$/HUF	362	372	368	380	363	392	336	339	330	322
$/PLN	4.43	4.46	4.56	4.47	4.51	4.51	4.18	4.04	4.00	3.96
$/RON	4.64	4.66	4.85	4.67	4.85	4.70	4.55	4.39	4.43	4.48
$/RUB	78.74	78.74	75.00	81.64	80.00	86.61	85.00	85.00	85.00	85.00
$/UAH	36.9	39.8	36.6	43.0	42.0	45.9	50.0	52.5	55.0	57.5
$/TRY	18.81	19.88	19.00	21.28	21.00	24.16	22.00	20.00	20.00	20.00
$/ILS	3.61	3.59	3.50	3.57	3.50	3.54	3.40	3.35	3.30	3.30
$/ZAR	18.57	18.71	18.50	18.82	18.00	19.04	17.75	16.00	15.00	14.00
$/NGN	461	499	500	561	550	690	600	700	700	700
Americas										
$/ARS	200	243	230	299	260	434	340	500	700	900
$/BRL	5.17	5.25	4.90	5.33	4.85	5.46	4.80	4.85	4.75	4.60
$/MXN	18.36	18.67	18.75	18.99	18.50	19.60	18.25	19.00	19.00	19.00
$/CLP	796	806	775	815	775	826	770	800	775	750
$/PEN	3.78	3.80	3.90	3.82	3.90	3.85	3.80	3.75	3.65	3.55
$/COP	4778	4837	5000	4925	4900	5104	4600	4300	4000	3700
Asia										
$/CNY	6.97	6.92	6.80	6.88	6.70	6.79	6.50	6.70	6.50	6.40
$/HKD	7.85	7.83	7.80	7.81	7.80	7.78	7.80	7.80	7.80	7.80
$/INR	81.98	82.55	83.00	82.97	82.00	83.86	82.00	80.00	79.00	78.00
$/KRW	1322	1316	1250	1308	1230	1293	1220	1200	1180	1150
$/MYR	4.52	4.49	4.30	4.46	4.25	4.40	4.20	4.40	4.30	4.20
$/SGD	1.35	1.35	1.34	1.34	1.33	1.33	1.30	1.29	1.27	1.25
$/TWD	30.8	30.6	30.5	30.3	30.0	29.6	30.0	31.0	30.0	29.0
$/THB	35.05	34.76	33.50	34.43	32.50	33.78	32.00	34.00	34.00	34.00
$/IDR	15425	15500	15500	15530	15300	15590	15000	14500	14400	14200
$/PHP	55.24	55.37	56.00	55.46	55.50	55.69	55.00	55.00	58.00	58.00
Euro Crosses										
EUR/GBP	0.89	0.89	0.89	0.89	0.89	0.90	0.90	0.90	0.85	0.86
EUR/CHF	0.99	0.98	0.96	0.98	0.94	0.97	0.92	0.92	0.92	0.92
EUR/NOK	11.28	11.29	10.80	11.29	10.90	11.30	11.00	10.80	10.20	9.60
EUR/SEK	11.37	11.38	11.20	11.39	11.10	11.40	10.75	10.75	10.40	10.00
EUR/CZK	23.60	23.84	23.75	24.02	24.00	24.27	24.50	25.00	26.00	27.00
EUR/HUF	383	396	375	406	370	423	370	390	380	370
EUR/PLN	4.69	4.74	4.65	4.78	4.60	4.86	4.60	4.65	4.60	4.55
EUR/RON	4.91	4.96	4.95	4.99	4.95	5.07	5.00	5.05	5.10	5.15
EUR/RUB	83.3	83.8	76.5	87.3	81.6	93.4	93.5	93.5	97.8	97.8

Note: Spot values are as of Thursday's close.

See dynamic table here (or click image above): https://publishing.gs.com/content/themes/fx-forecasts.html

Source: Goldman Sachs Global Investment Research

Return Forecasts & Valuations

		Forecast: 12-Month Return (%)				GSDEER			GSFEER				
							Misalignment			Misalignment			
	Current Spot	Spot	Carry	Total	NEER	Estimate	Bilateral	Trade-Weighted	Estimate	Bilateral	Trade-Weighted	Average Estimate	PPP*
G10													
EUR/$	1.07	4.0	-1.9	2.0	-0.8	1.20	-11%	5%	1.23	-13%	1%	1.21	1.46
GBP/$	1.19	2.5	-0.8	1.6	-0.6	1.30	-8%	9%	1.31	-9%	7%	1.30	1.41
AUD/$	0.66	7.7	-1.5	6.2	2.0	0.90	-27%	-12%	0.82	-19%	-8%	0.87	0.67
NZD/$	0.61	4.9	0.1	5.1	-0.4	0.69	-11%	6%	0.77	-21%	-10%	0.72	0.69
$/CAD	1.38	8.0	-0.8	7.1	6.3	1.21	-13%	-8%	1.29	-6%	-1%	1.24	1.25
$/CHF	0.93	11.5	-3.6	7.5	8.7	0.94	1%	17%	0.85	-9%	3%	0.91	1.02
$/NOK	10.66	6.6	-1.7	4.8	2.6	5.60	-48%	-38%	7.22	-32%	-22%	6.25	10.79
$/SEK	10.75	10.0	-1.7	8.1	6.5	6.75	-37%	-24%	8.43	-22%	-4%	7.42	9.16
$/JPY	136	8.9	-5.6	2.8	4.4	97	-29%	-18%	117	-14%	-4%	105	88
EMEA													
$/CZK	22.2	0.1	0.9	1.0	-3.5	25.9	17%	35%	22.5	2%	16%	24.6	17.3
$/HUF	362	7.7	8.2	16.5	4.8	309	-15%	-1%	360	-1%	16%	330	215
$/PLN	4.43	6.0	1.7	7.8	3.4	3.63	-18%	-5%	4.0	-10%	5%	3.77	2.86
$/RON	4.64	2.2	1.3	3.5	--	--	--	--	--	--	--	--	--
$/RUB	78.74	-7.4	10.0	1.9	-10.6	65.67	-17%	3%	54.87	-30%	-15%	61.35	52.07
$/UAH	36.9	-26.1	24.3	-1.8	--	--	--	--	--	--	--	--	--
$/TRY	18.81	-14.5	28.4	9.8	-16.7	9.16	-51%	-45%	16.15	-14%	5%	11.95	8.88
$/ILS	3.61	6.1	-1.9	4.0	3.6	3.54	-2%	13%	2.93	-19%	-10%	3.30	4.26
$/ZAR	18.57	4.6	2.5	7.3	4.9	10.73	-42%	-35%	15.4	-17%	0%	12.60	15.93
$/NGN	461	-23.2	49.8	26.6	--	--	--	--	--	--	--	--	--
Americas													
$/ARS	200.4	-41.1	116.9	75.8	-31.6	--	--	--	--	--	--	--	--
$/BRL	5.17	7.6	5.7	13.7	5.4	3.84	-26%	-13%	5.21	1%	13%	4.39	5.57
$/MXN	18.36	0.6	6.8	7.4	-1.5	19.22	5%	11%	19.78	8%	12%	19.44	18.77
$/CLP	796	3.3	3.8	7.3	0.1	640	-20%	-5%	856	8%	13%	726	805
$/PEN	3.78	-0.4	1.8	1.3	-3.3	3.06	-19%	-7%	4.40	16%	24%	3.60	4.14
$/COP	4778	3.9	6.8	11.0	1.5	2774	-42%	-33%	4495	-6%	3%	3462	2980
Asia													
$/CNY	6.97	7.2	-2.5	4.4	3.1	5.17	-26%	-15%	6.38	-8%	5%	5.65	7.56
$/HKD	7.85	0.6	-0.8	-0.2	-4.9	7.35	-6%	15%	8.06	3%	12%	7.64	5.53
$/INR	81.98	0.0	2.3	2.3	-3.5	75.07	-8%	4%	78.80	-4%	14%	76.56	73.78
$/KRW	1322	8.4	-2.2	6.0	3.9	1237	-6%	13%	1270	-4%	9%	1250	950
$/MYR	4.52	7.6	-2.7	4.7	2.4	3.23	-29%	-16%	4.25	-6%	4%	3.64	2.31
$/SGD	1.35	4.1	-1.7	2.3	-0.8	1.37	1%	18%	1.42	5%	17%	1.39	0.61
$/TWD	30.8	2.7	-4.0	-1.4	-2.6	27.0	-12%	6%	27.9	-10%	0%	27.4	14.8
$/THB	35.05	9.5	-3.6	5.6	4.3	33.27	-5%	13%	35.45	1%	14%	34.14	21.82
$/IDR	15425	2.8	1.1	3.9	-2.3	14256	-8%	9%	13456	-13%	-3%	13936	11074
$/PHP	55.24	0.4	0.8	1.3	-4.6	57.21	4%	22%	68.38	24%	29%	61.68	51.90
Euro Crosses													
EUR/GBP	0.89	-1.4	1.1	-0.3	-0.6	0.93	4%	9%	0.94	6%	7%	0.93	1.03
EUR/CHF	0.99	7.3	-1.7	5.6	8.7	1.14	15%	17%	1.04	6%	3%	1.10	1.48
EUR/NOK	11.28	2.6	0.2	2.7	2.6	6.74	-40%	-38%	8.87	-21%	-22%	7.59	15.73
EUR/SEK	11.37	5.8	0.2	6.0	6.5	8.13	-29%	-24%	10.35	-9%	-4%	9.02	13.36
EUR/CZK	23.60	-3.7	10.1	6.4	-3.5	31.20	32%	35%	27.68	17%	16%	29.79	25.30
EUR/HUF	383	3.6	10.1	13.7	4.8	373	-3%	-1%	442	15%	16%	401	313
EUR/PLN	4.69	2.0	3.6	5.5	3.4	4.37	-7%	-5%	4.9	4%	5%	4.58	4.18
EUR/RON	4.91	-1.7	3.2	1.4	--	--	--	--	--	--	--	--	--
EUR/RUB	83.3	-10.9	11.9	1.0	-10.6	79.1	-5%	3%	67.4	-19%	-15%	74.4	--
Addendum													
USD	--	-4.0	-1.4	-5.2	-5.0	--	--	17%	--	--	9%	--	--

Note: USD returns average of all other currencies (except ARS, NGN and UAH) with opposite sign; *EM estimates adjusted for per capita income. Spot values as of Thursday.

See dynamic table here (or click image above): https://publishing.gs.com/content/themes/table.html?criteriaKey=1k2HGqqS2h

Source: Goldman Sachs Global Investment Research

Disclosure Appendix

Reg AC

We, Kamakshya Trivedi, Danny Suwanapruti, Michael Cahill, Davide Crosilla, Karen Reichgott Fishman, Ian Tomb, Teresa Alves, Sid Bhushan and Isabella Rosenberg, hereby certify that all of the views expressed in this report accurately reflect our personal views, which have not been influenced by considerations of the firm's business or client relationships.

Unless otherwise stated, the individuals listed on the cover page of this report are analysts in Goldman Sachs' Global Investment Research division.

Disclosures

Regulatory disclosures

Disclosures required by United States laws and regulations

See company-specific regulatory disclosures above for any of the following disclosures required as to companies referred to in this report: manager or co-manager in a pending transaction; 1% or other ownership; compensation for certain services; types of client relationships; managed/co-managed public offerings in prior periods; directorships; for equity securities, market making and/or specialist role. Goldman Sachs trades or may trade as a principal in debt securities (or in related derivatives) of issuers discussed in this report.

The following are additional required disclosures: **Ownership and material conflicts of interest:** Goldman Sachs policy prohibits its analysts, professionals reporting to analysts and members of their households from owning securities of any company in the analyst's area of coverage. **Analyst compensation:** Analysts are paid in part based on the profitability of Goldman Sachs, which includes investment banking revenues. **Analyst as officer or director:** Goldman Sachs policy generally prohibits its analysts, persons reporting to analysts or members of their households from serving as an officer, director or advisor of any company in the analyst's area of coverage. **Non-U.S. Analysts:** Non-U.S. analysts may not be associated persons of Goldman Sachs & Co. LLC and therefore may not be subject to FINRA Rule 2241 or FINRA Rule 2242 restrictions on communications with subject company, public appearances and trading securities held by the analysts.

Additional disclosures required under the laws and regulations of jurisdictions other than the United States

The following disclosures are those required by the jurisdiction indicated, except to the extent already made above pursuant to United States laws and regulations. **Australia:** Goldman Sachs Australia Pty Ltd and its affiliates are not authorised deposit-taking institutions (as that term is defined in the Banking Act 1959 (Cth)) in Australia and do not provide banking services, nor carry on a banking business, in Australia. This research, and any access to it, is intended only for "wholesale clients" within the meaning of the Australian Corporations Act, unless otherwise agreed by Goldman Sachs. In producing research reports, members of Global Investment Research of Goldman Sachs Australia may attend site visits and other meetings hosted by the companies and other entities which are the subject of its research reports. In some instances the costs of such site visits or meetings may be met in part or in whole by the issuers concerned if Goldman Sachs Australia considers it is appropriate and reasonable in the specific circumstances relating to the site visit or meeting. To the extent that the contents of this document contains any financial product advice, it is general advice only and has been prepared by Goldman Sachs without taking into account a client's objectives, financial situation or needs. A client should, before acting on any such advice, consider the appropriateness of the advice having regard to the client's own objectives, financial situation and needs. A copy of certain Goldman Sachs Australia and New Zealand disclosure of interests and a copy of Goldman Sachs' Australian Sell-Side Research Independence Policy Statement are available at: https://www.goldmansachs.com/disclosures/australia-new-zealand/index.html. **Brazil:** Disclosure information in relation to CVM Resolution n. 20 is available at https://www.gs.com/worldwide/brazil/area/gir/index.html. Where applicable, the Brazil-registered analyst primarily responsible for the content of this research report, as defined in Article 20 of CVM Resolution n. 20, is the first author named at the beginning of this report, unless indicated otherwise at the end of the text. **Canada:** This information is being provided to you for information purposes only and is not, and under no circumstances should be construed as, an advertisement, offering or solicitation by Goldman Sachs & Co. LLC for purchasers of securities in Canada to trade in any Canadian security. Goldman Sachs & Co. LLC is not registered as a dealer in any jurisdiction in Canada under applicable Canadian securities laws and generally is not permitted to trade in Canadian securities and may be prohibited from selling certain securities and products in certain jurisdictions in Canada. If you wish to trade in any Canadian securities or other products in Canada please contact Goldman Sachs Canada Inc., an affiliate of The Goldman Sachs Group Inc., or another registered Canadian dealer. **Hong Kong:** Further information on the securities of covered companies referred to in this research may be obtained on request from Goldman Sachs (Asia) L.L.C. **India:** Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (India) Securities Private Limited, Research Analyst - SEBI Registration Number INH000001493, 951-A, Rational House, Appasaheb Marathe Marg, Prabhadevi, Mumbai 400 025, India, Corporate Identity Number U74140MH2006FTC160634, Phone +91 22 6616 9000, Fax +91 22 6616 9001. Goldman Sachs may beneficially own 1% or more of the securities (as such term is defined in clause 2 (h) the Indian Securities Contracts (Regulation) Act, 1956) of the subject company or companies referred to in this research report. **Japan:** See below. **Korea:** This research, and any access to it, is intended only for "professional investors" within the meaning of the Financial Services and Capital Markets Act, unless otherwise agreed by Goldman Sachs. Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (Asia) L.L.C., Seoul Branch. **New Zealand:** Goldman Sachs New Zealand Limited and its affiliates are neither "registered banks" nor "deposit takers" (as defined in the Reserve Bank of New Zealand Act 1989) in New Zealand. This research, and any access to it, is intended for "wholesale clients" (as defined in the Financial Advisers Act 2008) unless otherwise agreed by Goldman Sachs. A copy of certain Goldman Sachs Australia and New Zealand disclosure of interests is available at: https://www.goldmansachs.com/disclosures/australia-new-zealand/index.html. **Russia:** Research reports distributed in the Russian Federation are not advertising as defined in the Russian legislation, but are information and analysis not having product promotion as their main purpose and do not provide appraisal within the meaning of the Russian legislation on appraisal activity. Research reports do not constitute a personalized investment recommendation as defined in Russian laws and regulations, are not addressed to a specific client, and are prepared without analyzing the financial circumstances, investment profiles or risk profiles of clients. Goldman Sachs assumes no responsibility for any investment decisions that may be taken by a client or any other person based on this research report. **Singapore:** Goldman Sachs (Singapore) Pte. (Company Number: 198602165W), which is regulated by the Monetary Authority of Singapore, accepts legal responsibility for this research, and should be contacted with respect to any matters arising from, or in connection with, this research. **Taiwan:** This material is for reference only and must not be reprinted without permission. Investors should carefully consider their own investment risk. Investment results are the responsibility of the individual investor. **United Kingdom:** Persons who would be categorized as retail clients in the United Kingdom, as such term is defined in the rules of the Financial Conduct Authority, should read this research in conjunction with prior Goldman Sachs research on the covered companies referred to herein and should refer to the risk warnings that have been sent to them by Goldman Sachs International. A copy of these risks warnings, and a glossary of certain financial terms used in this report, are available from Goldman Sachs International on request.

European Union and United Kingdom: Disclosure information in relation to Article 6 (2) of the European Commission Delegated Regulation (EU) (2016/958) supplementing Regulation (EU) No 596/2014 of the European Parliament and of the Council (including as that Delegated Regulation is implemented into United Kingdom domestic law and regulation following the United Kingdom's departure from the European Union and the European Economic Area) with regard to regulatory technical standards for the technical arrangements for objective presentation of investment recommendations or other information recommending or suggesting an investment strategy and for disclosure of particular interests or indications of conflicts of interest is available at https://www.gs.com/disclosures/europeanpolicy.html which states the European Policy for Managing Conflicts of Interest in Connection with Investment Research.

Japan: Goldman Sachs Japan Co., Ltd. is a Financial Instrument Dealer registered with the Kanto Financial Bureau under registration number Kinsho 69, and a member of Japan Securities Dealers Association, Financial Futures Association of Japan Type II Financial Instruments Firms Association, The Investment Trusts Association, Japan, and Japan Investment Advisers Association. Sales and purchase of equities are subject to commission pre-determined with clients plus consumption tax. See company-specific disclosures as to any applicable disclosures required by Japanese stock exchanges, the Japanese Securities Dealers Association or the Japanese Securities Finance Company.

Global product; distributing entities

Goldman Sachs Global Investment Research produces and distributes research products for clients of Goldman Sachs on a global basis. Analysts based in Goldman Sachs offices around the world produce research on industries and companies, and research on macroeconomics, currencies, commodities and portfolio strategy. This research is disseminated in Australia by Goldman Sachs Australia Pty Ltd (ABN 21 006 797 897); in Brazil by Goldman Sachs do Brasil Corretora de Títulos e Valores Mobiliários S.A.; Public Communication Channel Goldman Sachs Brazil: 0800 727 5764 and / or contatogoldmanbrasil@gs.com. Available Weekdays (except holidays), from 9am to 6pm. Canal de Comunicação com o Público Goldman Sachs Brasil: 0800 727 5764 e/ou contatogoldmanbrasil@gs.com. Horário de funcionamento: segunda-feira à sexta-feira (exceto feriados), das 9h às 18h; in Canada by Goldman Sachs & Co. LLC; in Hong Kong by Goldman Sachs (Asia) L.L.C.; in India by Goldman Sachs (India) Securities Private Ltd.; in Japan by Goldman Sachs Japan Co., Ltd.; in the Republic of Korea by Goldman Sachs (Asia) L.L.C., Seoul Branch; in New Zealand by Goldman Sachs New Zealand Limited; in Russia by OOO Goldman Sachs; in Singapore by Goldman Sachs (Singapore) Pte. (Company Number: 198602165W); and in the United States of America by Goldman Sachs & Co. LLC. Goldman Sachs International has approved this research in connection with its distribution in the United Kingdom.

Goldman Sachs International ("GSI"), authorised by the Prudential Regulation Authority ("PRA") and regulated by the Financial Conduct Authority ("FCA") and the PRA, has approved this research in connection with its distribution in the United Kingdom.

European Economic Area: GSI, authorised by the PRA and regulated by the FCA and the PRA, disseminates research in the following jurisdictions within the European Economic Area: the Grand Duchy of Luxembourg, Italy, the Kingdom of Belgium, the Kingdom of Denmark, the Kingdom of Norway, the Republic of Finland and the Republic of Ireland; GSI - Succursale de Paris (Paris branch) which is authorised by the French Autorité de contrôle prudentiel et de resolution ("ACPR") and regulated by the Autorité de contrôle prudentiel et de resolution and the Autorité des marches financiers ("AMF") disseminates research in France; GSI - Sucursal en España (Madrid branch) authorized in Spain by the Comisión Nacional del Mercado de Valores disseminates research in the Kingdom of Spain; GSI - Sweden Bankfilial (Stockholm branch) is authorized by the SFSA as a "third country branch" in accordance with Chapter 4, Section 4 of the Swedish Securities and Market Act (Sw. lag (2007:528) om värdepappersmarknaden) disseminates research in the Kingdom of Sweden; Goldman Sachs Bank Europe SE ("GSBE") is a credit institution incorporated in Germany and, within the Single Supervisory Mechanism, subject to direct prudential supervision by the European Central Bank and in other respects supervised by German Federal Financial Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, BaFin) and Deutsche Bundesbank and disseminates research in the Federal Republic of Germany and those jurisdictions within the European Economic Area where GSI is not authorised to disseminate research and additionally, GSBE, Copenhagen Branch filial af GSBE, Tyskland, supervised by the Danish Financial Authority disseminates research in the Kingdom of Denmark; GSBE - Sucursal en España (Madrid branch) subject (to a limited extent) to local supervision by the Bank of Spain disseminates research in the Kingdom of Spain; GSBE - Succursale Italia (Milan branch) to the relevant applicable extent, subject to local supervision by the Bank of Italy (Banca d'Italia) and the Italian Companies and Exchange Commission (Commissione Nazionale per le Società e la Borsa "Consob") disseminates research in Italy; GSBE - Succursale de Paris (Paris branch), supervised by the AMF and by the ACPR disseminates research in France; and GSBE - Sweden Bankfilial (Stockholm branch), to a limited extent, subject to local supervision by the Swedish Financial Supervisory Authority (Finansinpektionen) disseminates research in the Kingdom of Sweden.

General disclosures

This research is for our clients only. Other than disclosures relating to Goldman Sachs, this research is based on current public information that we consider reliable, but we do not represent it is accurate or complete, and it should not be relied on as such. The information, opinions, estimates and forecasts contained herein are as of the date hereof and are subject to change without prior notification. We seek to update our research as appropriate, but various regulations may prevent us from doing so. Other than certain industry reports published on a periodic basis, the large majority of reports are published at irregular intervals as appropriate in the analyst's judgment.

Goldman Sachs conducts a global full-service, integrated investment banking, investment management, and brokerage business. We have investment banking and other business relationships with a substantial percentage of the companies covered by Global Investment Research. Goldman Sachs & Co. LLC, the United States broker dealer, is a member of SIPC (https://www.sipc.org).

Our salespeople, traders, and other professionals may provide oral or written market commentary or trading strategies to our clients and principal trading desks that reflect opinions that are contrary to the opinions expressed in this research. Our asset management area, principal trading desks and investing businesses may make investment decisions that are inconsistent with the recommendations or views expressed in this research.

We and our affiliates, officers, directors, and employees will from time to time have long or short positions in, act as principal in, and buy or sell, the securities or derivatives, if any, referred to in this research, unless otherwise prohibited by regulation or Goldman Sachs policy.

The views attributed to third party presenters at Goldman Sachs arranged conferences, including individuals from other parts of Goldman Sachs, do not necessarily reflect those of Global Investment Research and are not an official view of Goldman Sachs.

Any third party referenced herein, including any salespeople, traders and other professionals or members of their household, may have positions in the products mentioned that are inconsistent with the views expressed by analysts named in this report.

This research is focused on investment themes across markets, industries and sectors. It does not attempt to distinguish between the prospects or performance of, or provide analysis of, individual companies within any industry or sector we describe.

Any trading recommendation in this research relating to an equity or credit security or securities within an industry or sector is reflective of the investment theme being discussed and is not a recommendation of any such security in isolation.

This research is not an offer to sell or the solicitation of an offer to buy any security in any jurisdiction where such an offer or solicitation would be illegal. It does not constitute a personal recommendation or take into account the particular investment objectives, financial situations, or needs of individual clients. Clients should consider whether any advice or recommendation in this research is suitable for their particular circumstances and, if appropriate, seek professional advice, including tax advice. The price and value of investments referred to in this research and the income from them may fluctuate. Past performance is not a guide to future performance, future returns are not guaranteed, and a loss of original capital may occur. Fluctuations in exchange rates could have adverse effects on the value or price of, or income derived from, certain investments.

Certain transactions, including those involving futures, options, and other derivatives, give rise to substantial risk and are not suitable for all investors.

Investors should review current options and futures disclosure documents which are available from Goldman Sachs sales representatives or at https://www.theocc.com/about/publications/character-risks.jsp and https://www.fiadocumentation.org/fia/regulatory-disclosures_1/fia-uniform-futures-and-options-on-futures-risk-disclosures-booklet-pdf-version-2018. Transaction costs may be significant in option strategies calling for multiple purchase and sales of options such as spreads. Supporting documentation will be supplied upon request.

Differing Levels of Service provided by Global Investment Research: The level and types of services provided to you by Goldman Sachs Global Investment Research may vary as compared to that provided to internal and other external clients of GS, depending on various factors including your individual preferences as to the frequency and manner of receiving communication, your risk profile and investment focus and perspective (e.g., marketwide, sector specific, long term, short term), the size and scope of your overall client relationship with GS, and legal and regulatory constraints. As an example, certain clients may request to receive notifications when research on specific securities is published, and certain clients may request that specific data underlying analysts' fundamental analysis available on our internal client websites be delivered to them electronically through data feeds or otherwise. No change to an analyst's fundamental research views (e.g., ratings, price targets, or material changes to earnings estimates for equity securities), will be communicated to any client prior to inclusion of such information in a research report broadly disseminated through electronic publication to our internal client websites or through other means, as necessary, to all clients who are entitled to receive such reports.

All research reports are disseminated and available to all clients simultaneously through electronic publication to our internal client websites. Not all research content is redistributed to our clients or available to third-party aggregators, nor is Goldman Sachs responsible for the redistribution of our research by third party aggregators. For research, models or other data related to one or more securities, markets or asset classes (including related services) that may be available to you, please contact your GS representative or go to https://research.gs.com.

Disclosure information is also available at https://www.gs.com/research/hedge.html or from Research Compliance, 200 West Street, New York, NY 10282.