

## GOAL Kickstart

## Lower gas prices and China re-opening support European assets

Macro data in the US have been mixed the past week, with a softer than expected ISM, especially on the Services side and manufacturing new orders component, but solid payroll growth. In the Euro Area, headline flash HICP inflation came in below expectations mainly driven by lower energy costs. In fact, energy prices have collapsed since the second half of December - TTF is down ca. 20% and oil ca. 8% - in part as mild temperatures in Europe have driven down demand.

The fall in gas prices has been a significant positive for European assets which have outperformed their US counterparts since December. Risk premia across European assets have reset materially lower vs. the US suggesting investors' have been reassessing Europe related risks quite sharply (Exhibit 1): equity risk premia have narrowed much more in Europe and credit spreads in both the IG and HY space have tightened relative to the US (Exhibit 2). Similarly, European cyclicals have started to outperform the US after lagging for most of last year (Exhibit 3). China's re-opening should also provide an additional boost to both the European economy and assets - our strategists have upgraded their STOXX 600 price target to 420/440/465 over 3/6/12m and expect a more modest hit to earnings (-5% EPS in 2023 vs. -8% previously). Although we still expect returns to be mild,

the two tailwinds of lower energy prices (which can reduce recession risks) and China re-opening make European risky assets more attractive: we upgrade European equities to N over 3m, OW over 12m from UW/N prior in our asset allocation. With the dollar likely peaking, European assets might also become more interesting for US based investors.

European equity volatility has also come down and looks low vs. the US, creating opportunities in the options space. Volatility for both the EUROSTOXX 50 and DAX has fallen to one of the lowest levels on record relative to the S&P 500 (Exhibit 4) - call switches on DAX vs. S&P 500 appear attractive particularly given the exposure of DAX to lower energy costs and better China growth. On the flipside, European rates vol continues to be elevated both relative to domestic equities and to US rates vol (Exhibit 5) - selling EUR rates receivers can still be attractive near-term with a continuation of the ECB hiking cycle and risks around a further bullish repricing of growth. In the FX space, CHF vol still looks relatively cheap vs. cyclical FX (Exhibit 6) as a hedge against a potential deterioration of the growth/inflation mix in either direction. Our FX strategists remain structurally bullish on the Swiss Franc, especially

**Cecilia Mariotti**  
+44(20)7552-0450 |  
cecilia.mariotti@gs.com  
Goldman Sachs International

**Christian Mueller-Glissmann, CFA**  
+44(20)7774-1714 | christian.mueller-glissmann@gs.com  
Goldman Sachs International

**Andrea Ferrario**  
+44(20)7552-4353 |  
andrea.ferrario@gs.com  
Goldman Sachs International

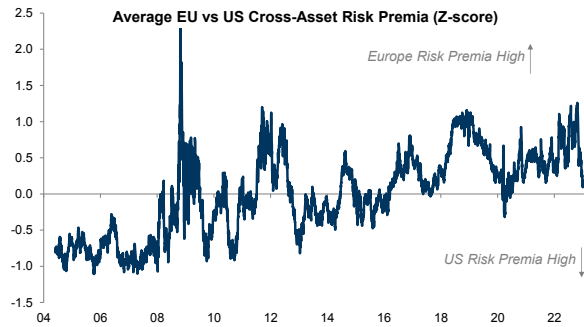
**Peter Oppenheimer**  
+44(20)7552-5782 |  
peter.oppenheimer@gs.com  
Goldman Sachs International

against GBP.

## Lower gas prices and China re-opening support European assets

### Exhibit 1: Risk premia across European assets have reset materially lower vs. the US

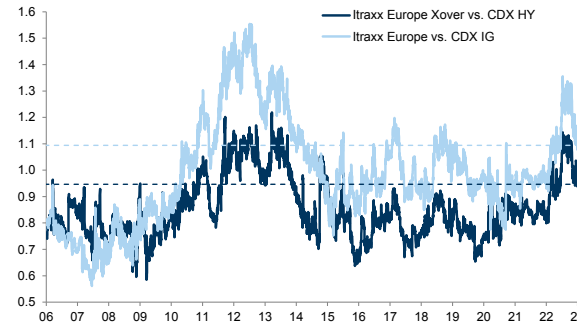
Aggregate includes: ERP, EY, Cycl. vs. def EY, credit spreads, 5y inflation



Source: Datastream, Haver Analytics, Goldman Sachs Global Investment Research

### Exhibit 2: European credit spreads have tightened relative to the US

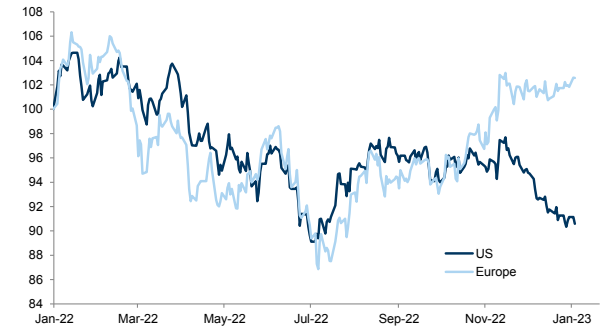
Shyntetic 5-year



Source: Haver Analytics, Goldman Sachs Global Investment Research

### Exhibit 3: European cyclicals have started to outperform US cyclicals

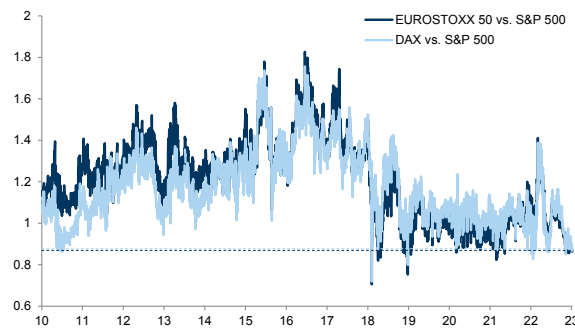
Cyclicals vs. Defensives



Source: Datastream, Goldman Sachs Global Investment Research

### Exhibit 4: European equity vol has fallen to one of the lowest levels on record vs. the S&P 500

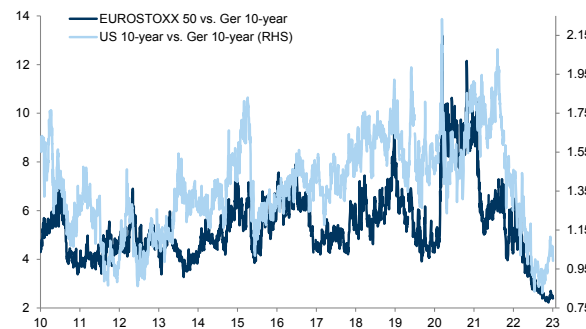
3-month ATM volatility



Source: Datastream, Goldman Sachs Global Investment Research

### Exhibit 5: European rates vol continues to be elevated both relative to domestic equities and to US rates vol

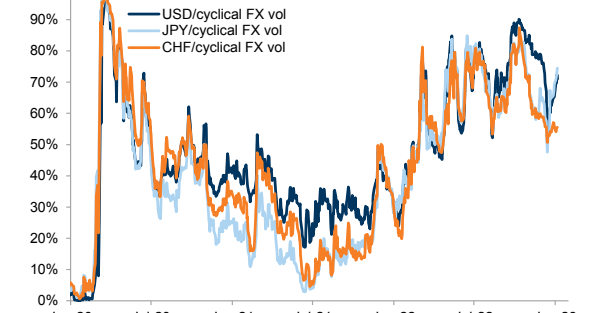
3-month ATM volatility



Source: Datastream, Goldman Sachs Global Investment Research

### Exhibit 6: CHF vol still looks relatively cheap vs. procyclical FX

Percentile since 2007 of 3m 25D risk-off implied vol



Source: Datastream, Goldman Sachs Global Investment Research

## Cross-asset: Forecasts

Exhibit 7: GOAL asset allocation recommendations and GS cross-asset forecasts

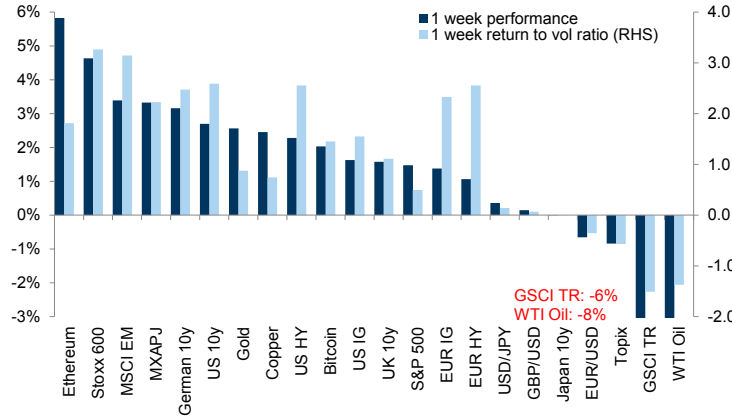
	Allocation Weighting		Current Level	Forecasts			Forecast Upside/Downside (%)		
	3m	12m		3m	6m	12 m	3m	6m	12 m
<b>Equities</b>	<b>UW</b>	<b>N</b>			<b>Index level</b>			<b>Total Return</b>	
S&P 500 (\$)	UW	UW	3895	3600	3900	4000	-7.1	1.0	4.5
Stoxx Europe 600 (€)	N	OW	444	420	440	465	-4.6	0.8	8.2
MSCI Asia-Pacific Ex-Japan (\$)	OW	OW	522	510	525	550	-1.4	1.4	6.8
Topix (¥)	OW	OW	1876	2000	2050	2200	6.8	9.7	18.1
<b>10 Year Government Bonds</b>	<b>UW</b>	<b>N</b>			<b>Yield (%)</b>			<b>Total Return</b>	
US	N	OW	3.57	3.68	4.11	4.19	-0.3	-2.9	-1.7
Germany	N	UW	2.21	2.75	2.75	2.74	-4.1	-3.5	-2.3
Japan	N	UW	0.50	0.50	0.50	0.50	0.4	0.5	0.8
UK	-	-	3.48	4.00	4.00	3.99	-3.3	-2.4	-0.6
<b>Corporate Bonds</b>	<b>OW</b>	<b>N</b>			<b>Spread</b>			<b>Total Return</b>	
Bloomberg Barclays US IG	OW	N	133	179	169	150	-3.2	-4.4	-1.5
Bloomberg Barclays US HY	UW	N	448	598	573	500	-4.7	-4.0	0.8
iBoxx EUR IG	OW	N	182	239	224	210	-4.6	-3.5	-1.9
BAML EUR HY	UW	N	485	657	612	550	-5.8	-3.7	0.0
JP Morgan EMBI Div.	UW	N	469	477	485	500	-0.1	-2.1	-0.6
<b>Commodities</b>	<b>N</b>	<b>OW</b>			<b>Spot price</b>			<b>Spot Return</b>	
WTI (\$/bbl)	-	-	74	89.4	94.5	99.1	21.2	28.1	34.3
Brent (\$/bbl)	-	-	79	95	100	105	20.8	27.1	33.5
Copper (\$/mt)	-	-	8,570	9,500	10,000	11,000	10.9	16.7	28.4
Gold (\$/troy oz)	-	-	1,862	1,850	1,950	1,950	-0.7	4.7	4.7
<b>FX</b>					<b>Spot rate</b>			<b>Spot Return</b>	
EUR/USD	-	-	1.06	1.02	1.02	1.10	-3.8	-3.8	3.7
USD/JPY	-	-	132.4	136.0	136.0	126.0	2.7	2.7	-4.8
GBP/USD	-	-	1.20	1.15	1.15	1.22	-4.5	-4.5	1.3
AUD/USD	-	-	0.68	0.66	0.68	0.71	-3.5	-0.6	3.8
USD/BRL	-	-	5.25	5.20	5.20	5.00	-1.0	-1.0	-4.8
USD/INR	-	-	82.7	83.0	82.0	82.0	0.3	-0.9	-0.9
USD/CNY	-	-	6.86	6.80	6.70	6.50	-0.9	-2.3	-5.2
<b>Cash</b>	<b>OW</b>	<b>N</b>			<b>Spot rate</b>			<b>Total Return</b>	
US 3-month Tbill	-	-	-	-	-	-	1.16	2.42	4.71
Germany 3-month Bubills	-	-	-	-	-	-	0.53	1.22	2.76

Source: Bloomberg, Datastream, Bloomberg-Barclays, ICE-BAML, iBoxx, Goldman Sachs Global Investment Research

# Cross-asset: Weekly and YTD performance, absolute and risk-adjusted

**Exhibit 8: Local currency total returns and return to vol ratios over the past week**

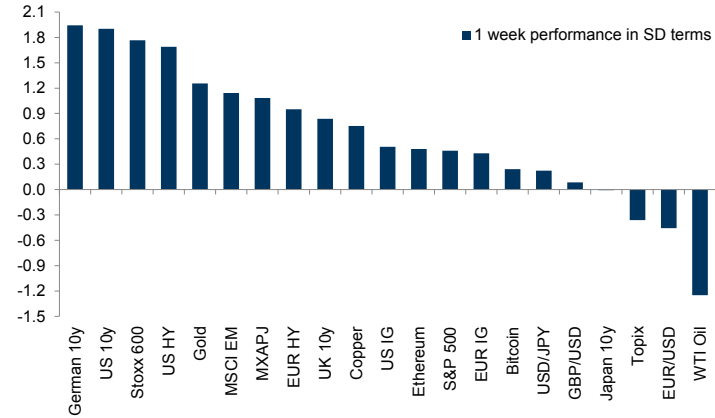
Weekly returns, return to vol ratios based on weekly volatility



Source: Datastream, iBoxx, Goldman Sachs Global Investment Research

**Exhibit 9: Local currency total returns in standard deviation terms**

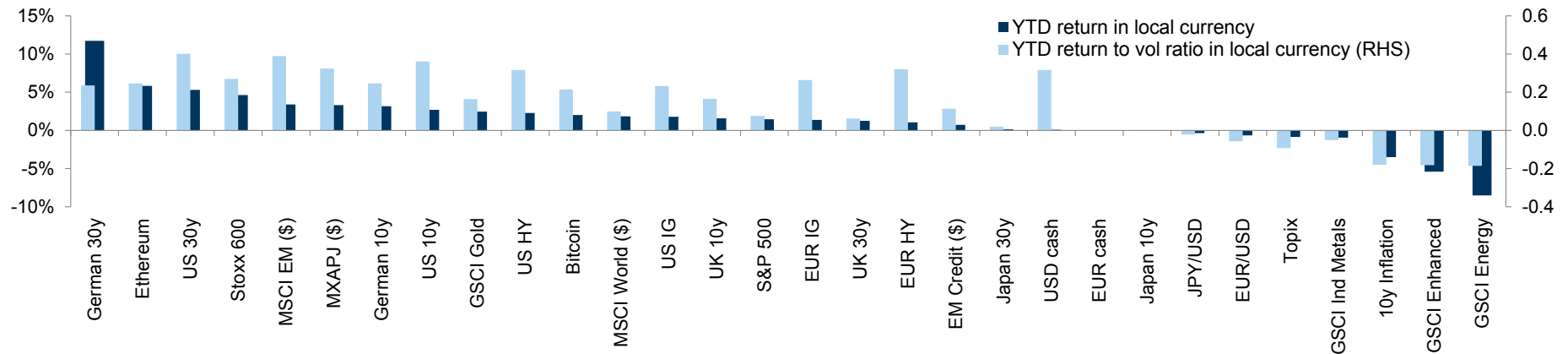
1-week performance in rolling 12m standard deviation terms



Source: Datastream, iBoxx, Goldman Sachs Global Investment Research

**Exhibit 10: Local currency returns and return to vol ratios**

YTD returns



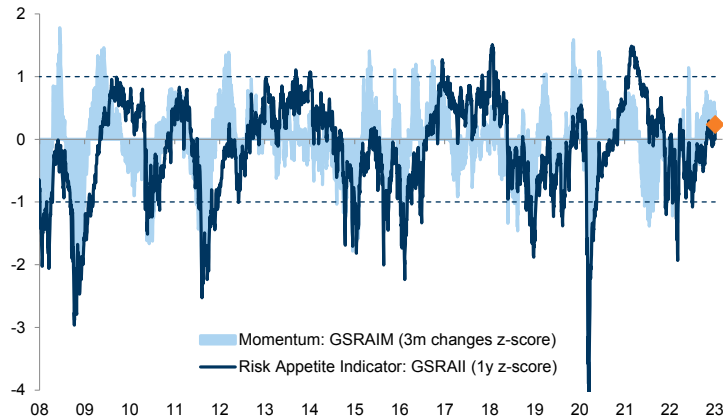
Source: Datastream, iBoxx, Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

# Cross-asset: Risk appetite indicator

**Exhibit 11: Risk appetite indicator level and momentum factors**

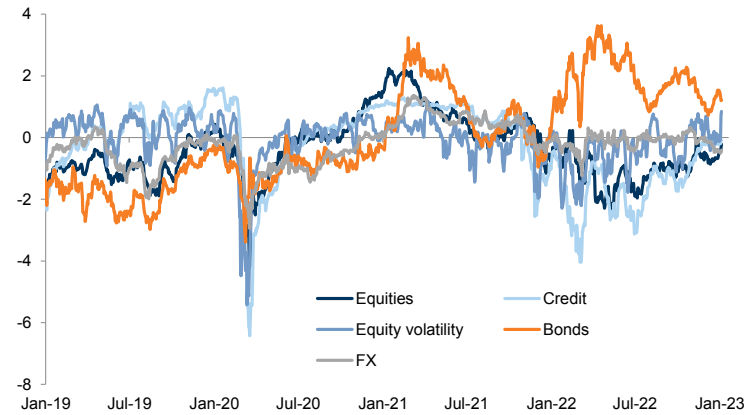
See July 2016 GOAL for construction details



Source: Goldman Sachs Global Investment Research

**Exhibit 12: Risk appetite indicators for different asset classes**

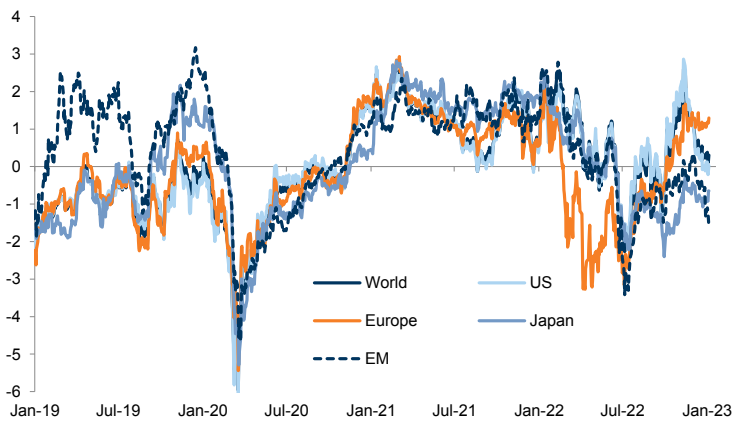
See July 2016 GOAL for construction details



Source: Goldman Sachs Global Investment Research

**Exhibit 13: Cyclical vs. defensives 1-year rolling z-score across regions**

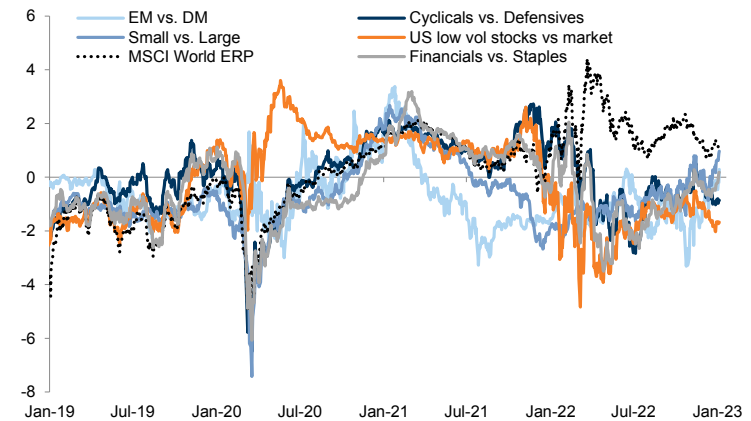
See July 2016 GOAL for construction details



Source: Goldman Sachs Global Investment Research

**Exhibit 14: Sub-components of equity risk appetite indicator**

See July 2016 GOAL for construction details



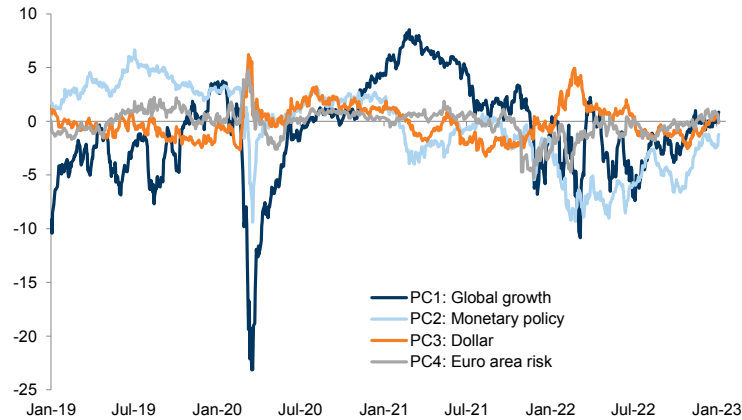
Source: Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

# Cross-asset: Risk appetite principal component analysis

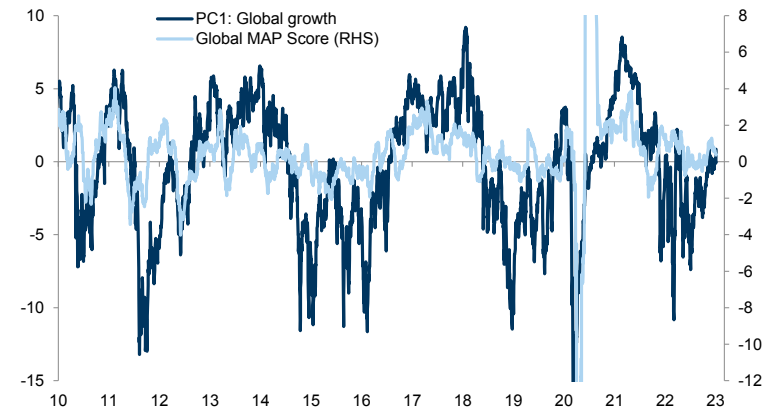
**Exhibit 15: GS RAI principal component**

See April 2019 GOAL for construction details



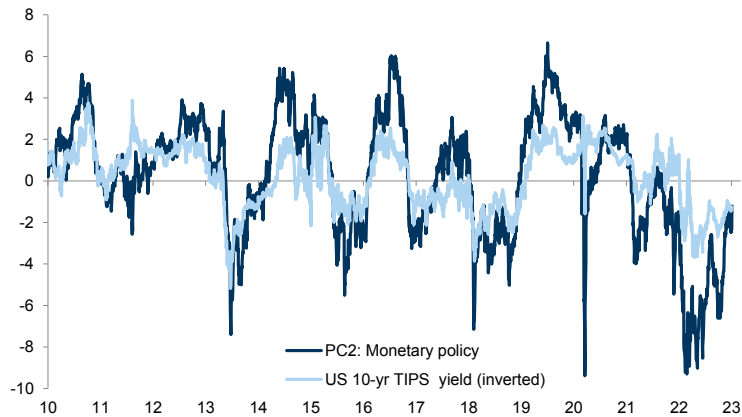
Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 16: PC1: Global growth factor vs. Global MAP Score**



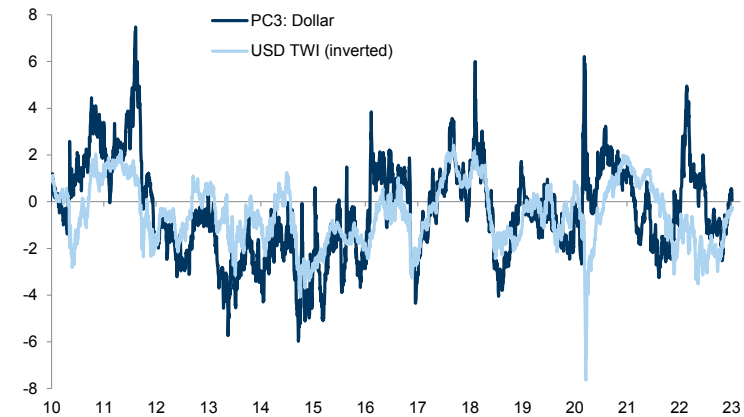
Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 17: PC2: Monetary policy factor vs. US 10-year TIPS yield**



Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 18: PC3: Dollar factor vs. USD TWI**

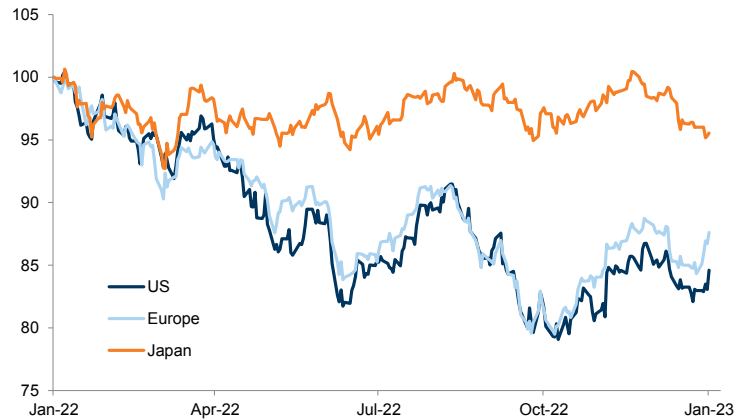


Source: Datastream, Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

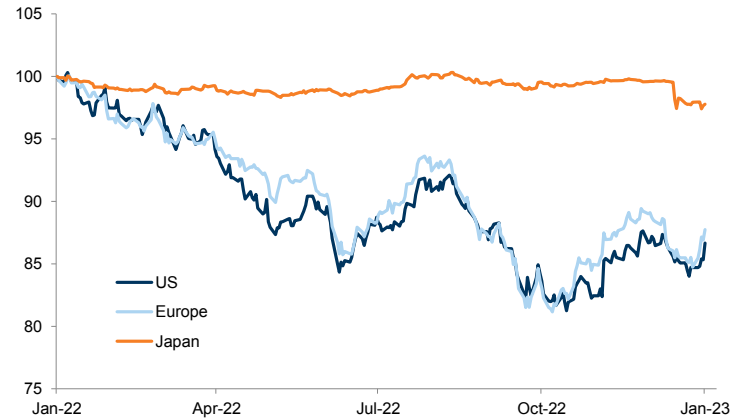
# Cross-asset: Balanced portfolios and dynamic allocation strategies performance

**Exhibit 19: 60/40 equity/bond portfolio performance across regions last 12m**  
Relative total return performance indexed to 100 12m ago (data since 2010)



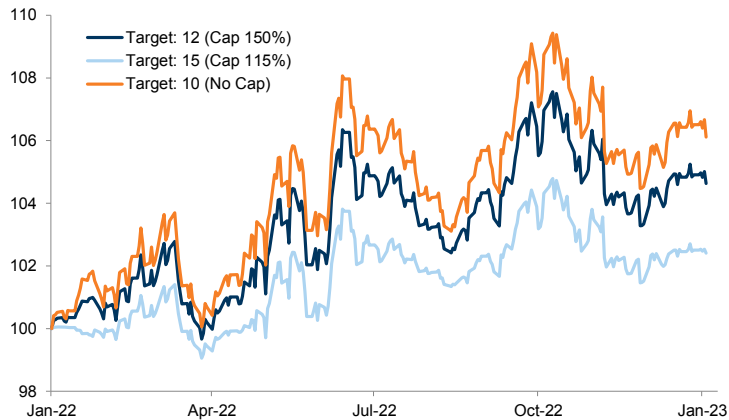
Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 20: Risk parity portfolio performance across regions last 12m**  
Weighted inversely by 3m realised volatility of equity and 10y bonds



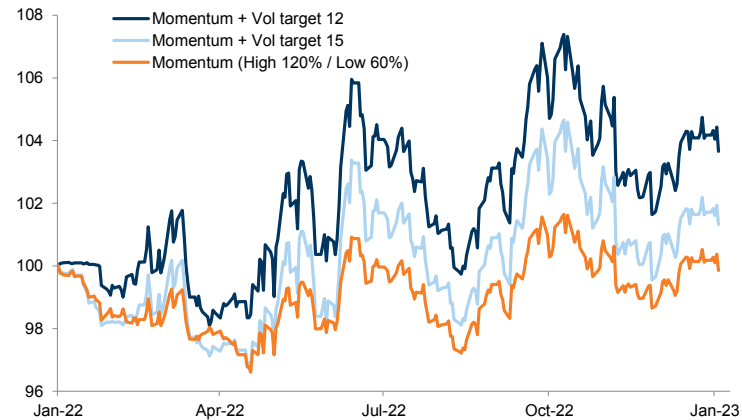
Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 21: 60/40 portfolio with volatility target strategies overlay vs. US 60/40 portfolio**  
60% S&P 500, 40% US 10y bond; based on 1m realised S&P 500 volatility



Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 22: 60/40 portfolio with volatility target strategies and momentum overlay vs. US 60/40**  
60% S&P 500, 40% US 10y bond; Strategy methodology see: GOAL: The Balanced Bear - Part 2

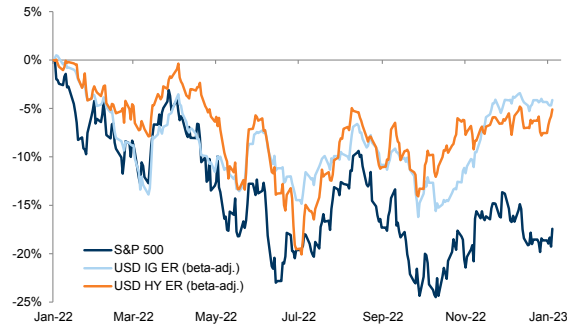


Source: Datastream, Goldman Sachs Global Investment Research

# Cross-asset: Equity vs. credit monitor

**Exhibit 23: USD cash credit vs. US equity**

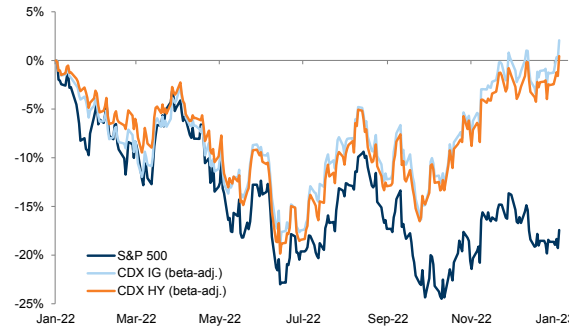
Cash credit excess returns (beta-adjusted) vs. S&P 500 total returns



Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 24: USD synthetic credit vs. US equity**

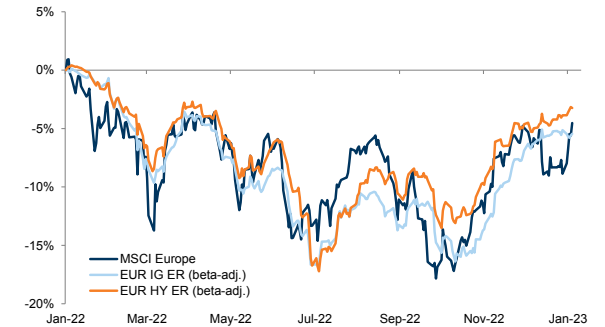
Synthetic credit excess returns (beta-adjusted) vs. S&P 500 total returns



Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 25: EUR cash credit vs. European equity**

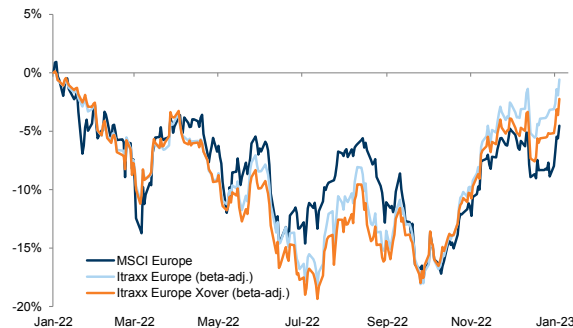
Cash credit excess returns (beta-adjusted) vs. MSCI Europe total returns



Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 26: EUR synthetic credit vs. European equity**

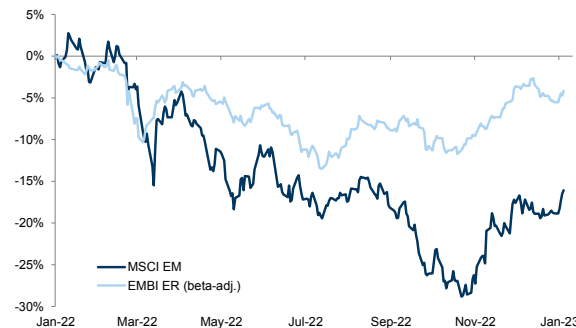
Synthetic credit excess returns (beta-adjusted) vs. MSCI Europe total returns



Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 27: EM cash credit vs. EM equity**

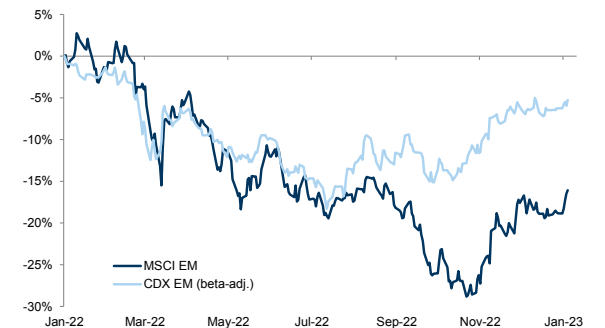
Cash credit excess returns (beta-adjusted) vs. MSCI EM total returns



Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 28: EM synthetic credit vs. EM equity**

Synthetic credit excess returns (beta-adjusted) vs. MSCI EM total returns



Source: Datastream, Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT



# Cross-asset: Valuation and risk premia

## Exhibit 29: Cross-asset valuation table

A higher percentile means more expensive relative to 10y history

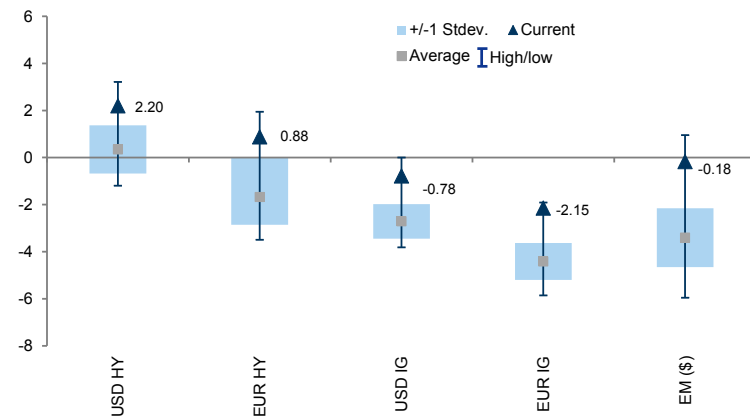
	Equity					Government bonds				Credit					FX	
	S&P 500	Stoxx 600	MXAPJ	Topix	MSCI EM	US 10y	German 10y	Japan 10y	UK 10y	US IG	US HY	EUR IG	EUR HY	EM (\$)	EUR/USD	USD/JPY
<b>Valuation metric</b>	<b>12m forward P/E ratio</b>					<b>Yield</b>				<b>Spread</b>					<b>Actual - GS fair value</b>	
<b>Current:</b>	17.2x	12.4x	13.2x	11.8x	11.8x	3.6%	2.2%	0.4%	3.5%	149bp	458bp	182bp	483bp	469bp	-0.11 €//\$	36.3 \$/¥
<b>Expensiveness (last 10y percentile):</b>	<b>60%</b>	<b>12%</b>	<b>58%</b>	<b>2%</b>	<b>53%</b>	<b>3%</b>	<b>1%</b>	<b>22%</b>	<b>2%</b>	<b>38%</b>	<b>38%</b>	<b>9%</b>	<b>22%</b>	<b>9%</b>	<b>61%</b>	<b>5%</b>
<b>3M change:</b>	1.6x	1.7x	1.6x	-0.1x	1.3x	-0.3%	0.0%	0.2%	-0.8%	-29bp	-44bp	-54bp	-117bp	-77bp	0.09 €//\$	-11.6 \$/¥
<b>Average:</b>	17.4x	14.4x	13.1x	13.9x	11.9x	2.2%	0.4%	0.2%	1.5%	145bp	448bp	133bp	406bp	-22bp	-0.10 €//\$	14.6 \$/¥
<b>95th:</b>	22.1x	17.4x	16.2x	17.3x	14.8x	3.1%	1.8%	0.7%	2.9%	192bp	693bp	202bp	583bp	508bp	0.12 €//\$	35.6 \$/¥
<b>5th:</b>	14.1x	11.9x	11.4x	12.0x	10.1x	0.7%	-0.5%	-0.1%	0.3%	102bp	324bp	96bp	279bp	275bp	-0.21 €//\$	-1.2 \$/¥

*Note: GSDEER is our fair value macro model for exchange rates. US IG spread is from iBoxx. EM (\$) is JPM EMBI.*

Source: Datastream, I/B/E/S, iBoxx, Goldman Sachs Global Investment Research

## Exhibit 30: Credit spread minus equity risk premium estimates across markets

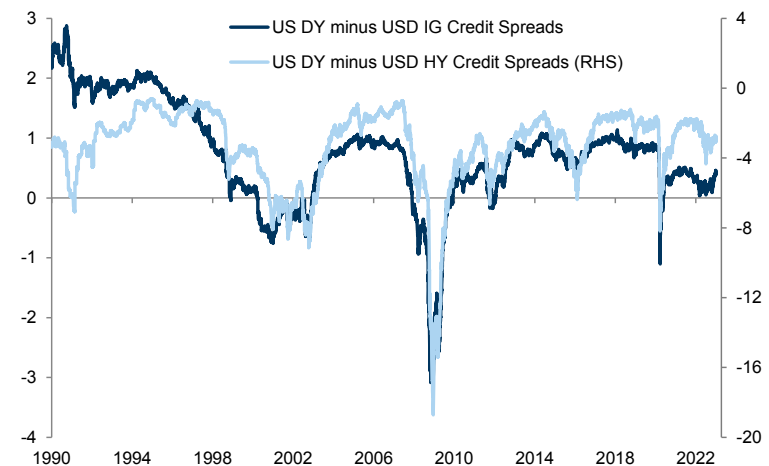
Equity risk premia based on 1-stage DDM using local 10-year yields and LT GDP consensus estimates. Using past 10 years of data.



Source: Datastream, iBoxx, Goldman Sachs Global Investment Research

## Exhibit 31: Equity vs. credit relative valuation

US Dividend Yield minus Credit spreads



Source: Datastream, Goldman Sachs Global Investment Research

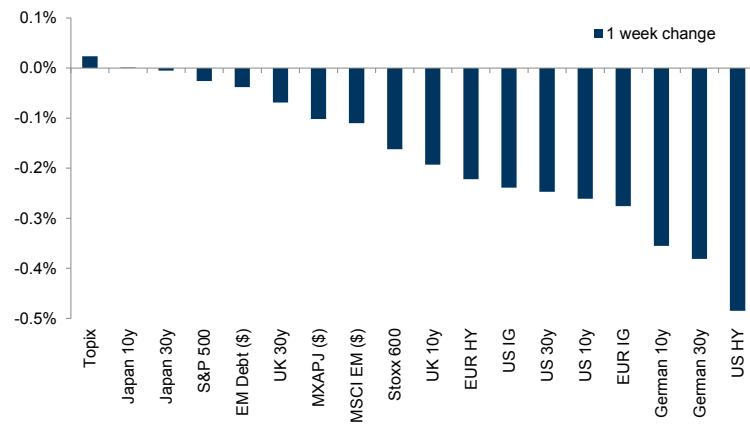
# Cross-asset: Yields

Exhibit 32: Current yields across assets and their percentile to the past 10 years

Valuation metric	Equity					Government bonds				Credit				
	S&P 500	Stoxx 600	MXAPJ (\$)	Topix	MSCI EM (\$)	US 10y	German 10y	Japan 10y	UK 10y	US IG	EUR IG	US HY	EUR HY	EM Debt (\$)
<b>Current:</b>	1.8%	3.5%	3.1%	2.8%	3.3%	3.6%	2.2%	0.4%	3.5%	5.1%	4.1%	8.5%	7.4%	8.4%
<b>Percentile (-10y):</b>	<b>21%</b>	<b>32%</b>	<b>35%</b>	<b>98%</b>	<b>84%</b>	<b>98%</b>	<b>99%</b>	<b>78%</b>	<b>98%</b>	<b>98%</b>	<b>98%</b>	<b>92%</b>	<b>98%</b>	<b>98%</b>
<b>Average:</b>	2.0%	3.6%	3.1%	2.3%	3.0%	2.2%	0.5%	0.2%	1.5%	2.7%	1.2%	6.6%	4.4%	5.8%
<b>95th:</b>	2.3%	4.0%	3.5%	2.7%	3.4%	3.2%	1.8%	0.7%	2.9%	4.6%	3.1%	8.8%	6.9%	7.9%
<b>5th:</b>	1.5%	3.0%	2.4%	1.9%	2.5%	0.7%	-0.5%	-0.1%	0.3%	1.2%	0.3%	4.8%	2.9%	4.7%
<b>3m real. ret. vol:</b>	24.7%	14.7%	14.0%	23.4%	21.2%	10.5%	11.4%	4.0%	13.0%	9.7%	5.5%	7.6%	4.8%	8.6%
<b>Percentile (-10y):</b>	<b>91%</b>	<b>57%</b>	<b>25%</b>	<b>94%</b>	<b>89%</b>	<b>92%</b>	<b>95%</b>	<b>93%</b>	<b>97%</b>	<b>95%</b>	<b>92%</b>	<b>89%</b>	<b>86%</b>	<b>85%</b>
<b>Yield/vol ratio</b>	0.07	0.24	0.22	0.12	0.15	0.34	0.19	0.10	0.27	0.53	0.75	1.11	1.55	0.98

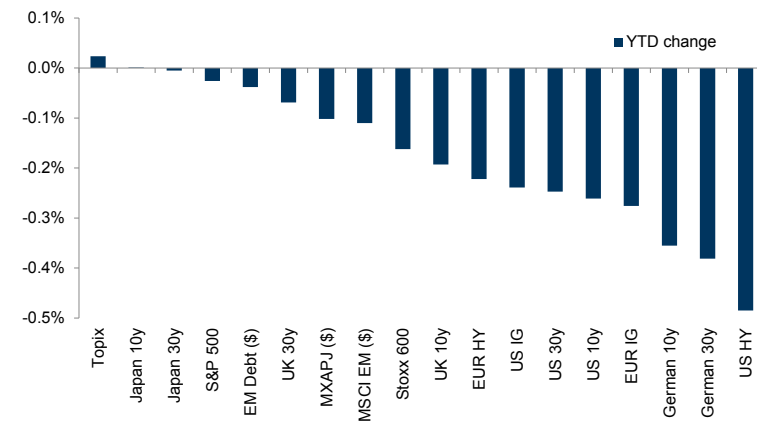
Source: Datastream, iBoxx, Goldman Sachs Global Investment Research

Exhibit 33: Past week change in yields across assets



Source: Datastream, iBoxx, Goldman Sachs Global Investment Research

Exhibit 34: YTD change in yields across assets

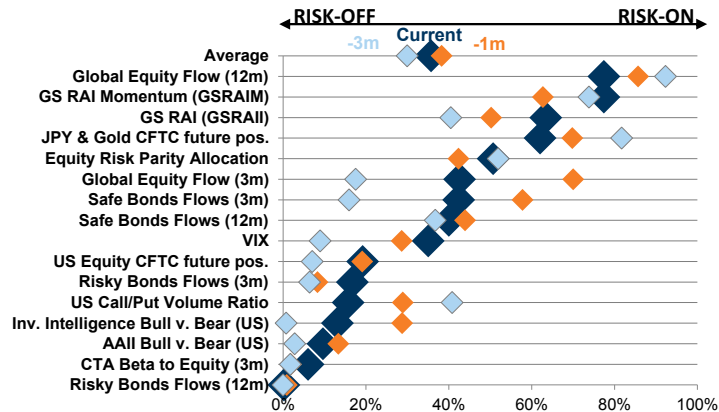


Source: Datastream, iBoxx, Goldman Sachs Global Investment Research

# Cross-asset: Sentiment and Positioning

**Exhibit 35: Percentile of sentiment indicators**

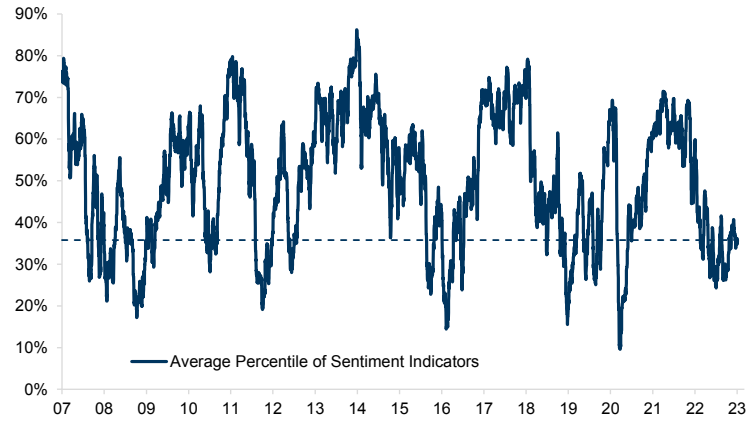
Data since 2007



Source: Datastream, Haver Analytics, EPFR, Goldman Sachs Global Investment Research

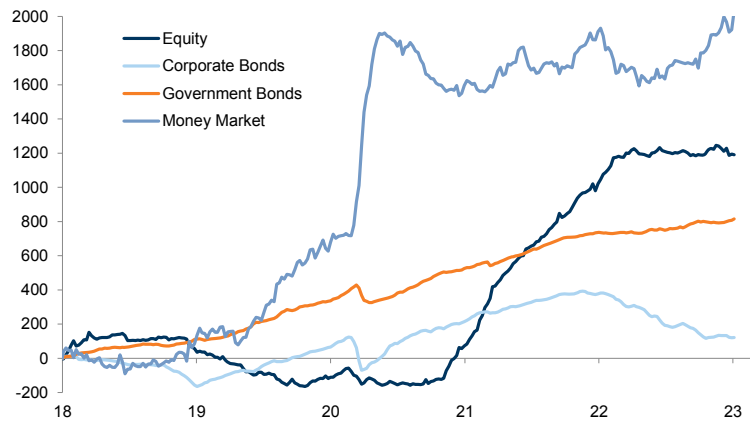
**Exhibit 36: Average percentile of sentiment indicators**

Data since 2007



Source: Datastream, Haver Analytics, EPFR, Goldman Sachs Global Investment Research

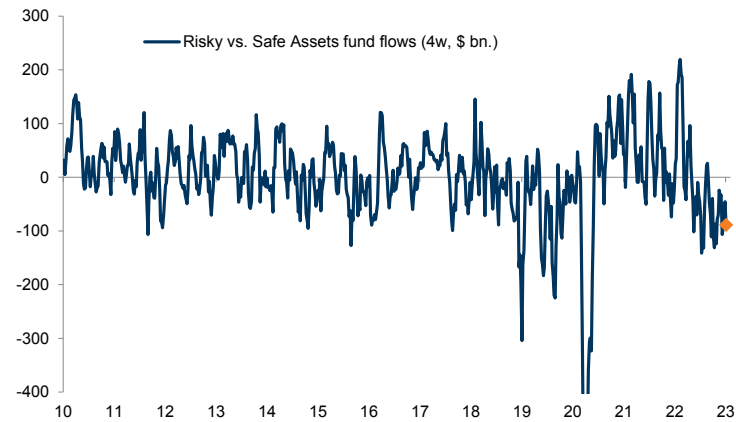
**Exhibit 37: Cumulative fund flows across assets**



Source: Datastream, Haver Analytics, EPFR, Goldman Sachs Global Investment Research

**Exhibit 38: Risky vs. safe assets fund flows**

4 weeks rolling flows, USD bn



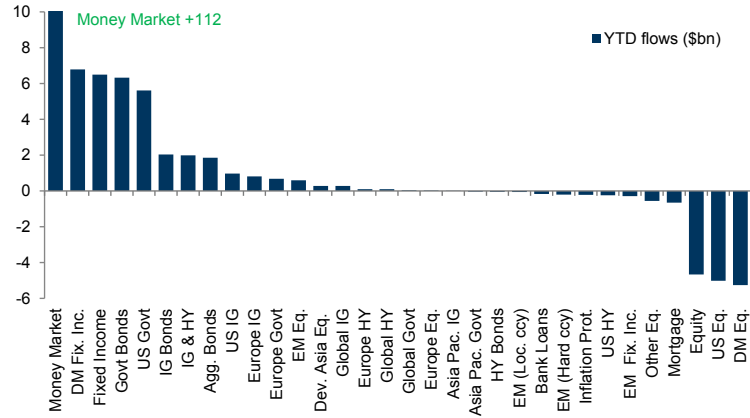
Source: Datastream, Haver Analytics, EPFR, Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

# Cross-asset: Global Funds Flows

**Exhibit 39: YTD cross-asset global fund flows**

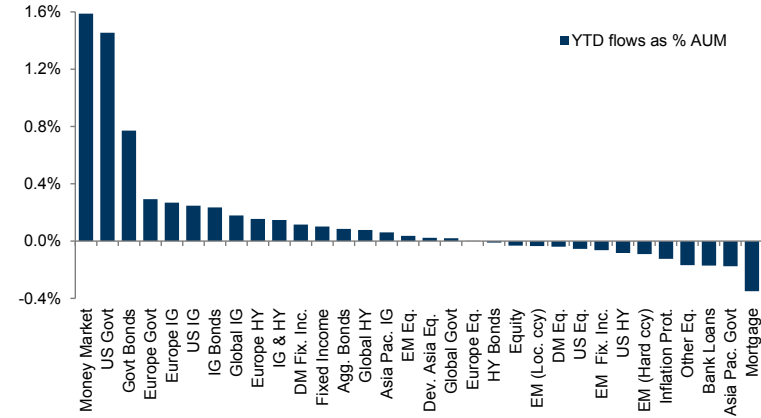
All reporting funds. \$ Bn



Source: EPFR, Goldman Sachs Global Investment Research

**Exhibit 40: YTD cross-asset global fund flows**

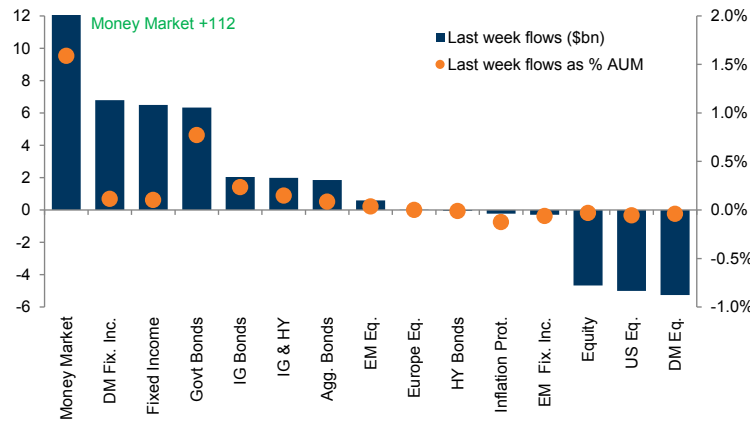
All reporting funds. % of AUM



Source: EPFR, Goldman Sachs Global Investment Research

**Exhibit 41: 1-week cross-asset global fund flows**

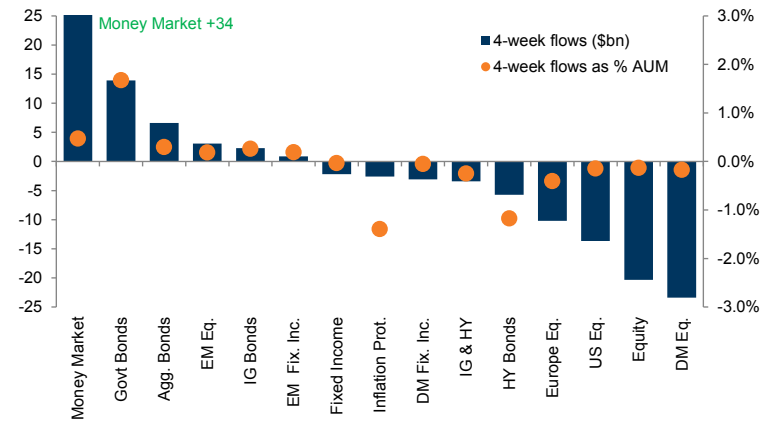
All reporting funds



Source: EPFR, Goldman Sachs Global Investment Research

**Exhibit 42: 4-week cross-asset global fund flows**

All reporting funds



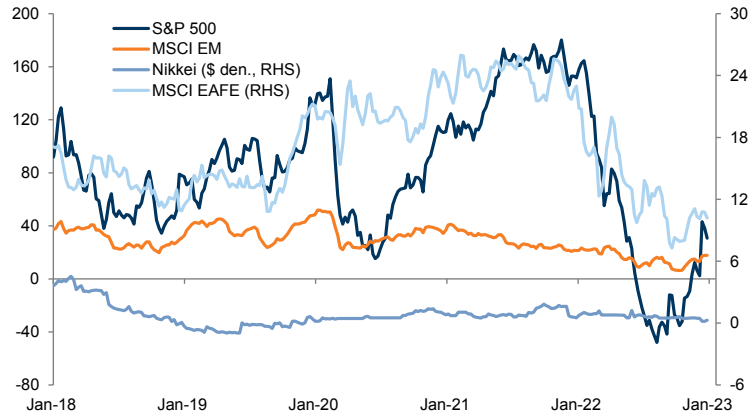
Source: EPFR, Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

# Cross-asset: CFTC positioning

**Exhibit 43: Equity net long positioning**

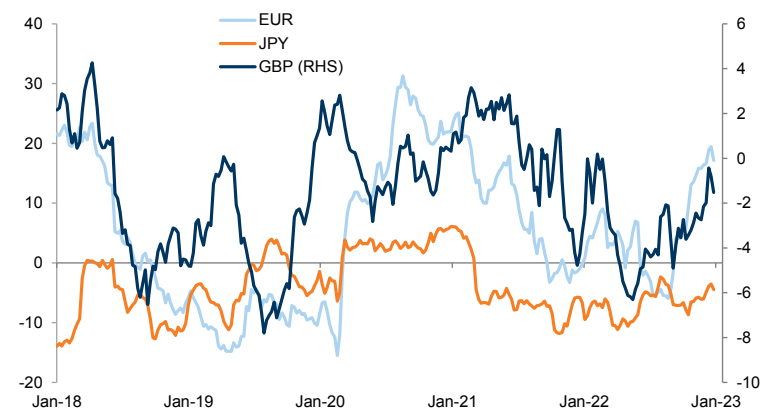
Leveraged funds and asset managers net future positions (\$ bn)



Source: Bloomberg, CFTC, Goldman Sachs Global Investment Research

**Exhibit 44: Currency net long positioning**

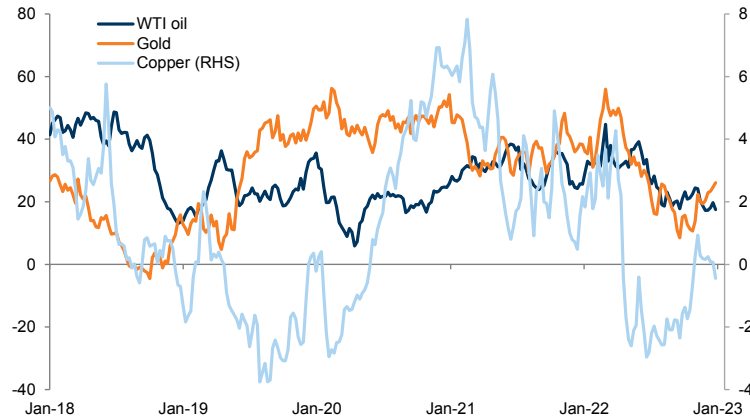
Net non-commercial positions (\$ bn)



Source: Bloomberg, CFTC, Goldman Sachs Global Investment Research

**Exhibit 45: Commodity net long positioning**

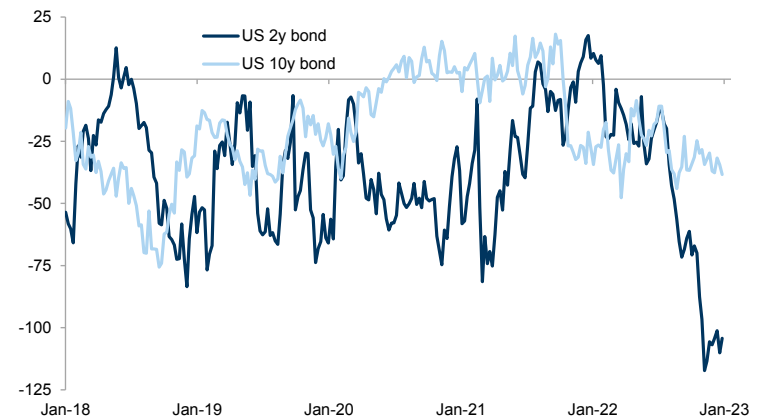
Net non-commercial positions (\$ bn)



Source: Bloomberg, CFTC, Goldman Sachs Global Investment Research

**Exhibit 46: US Treasury net long positioning**

Net non-commercial positions (\$ bn)

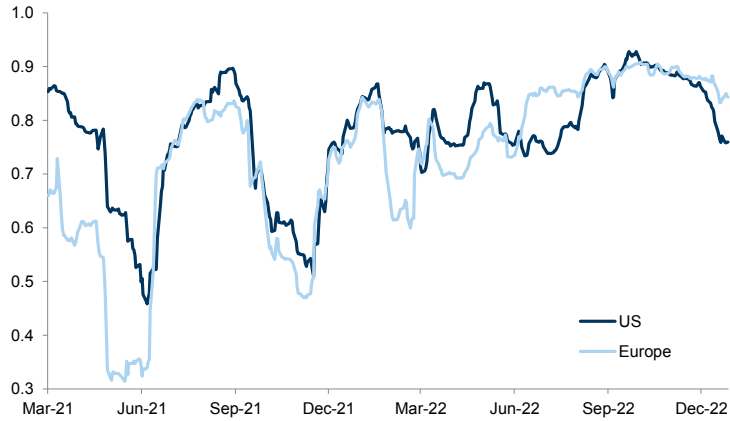


Source: Bloomberg, CFTC, Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

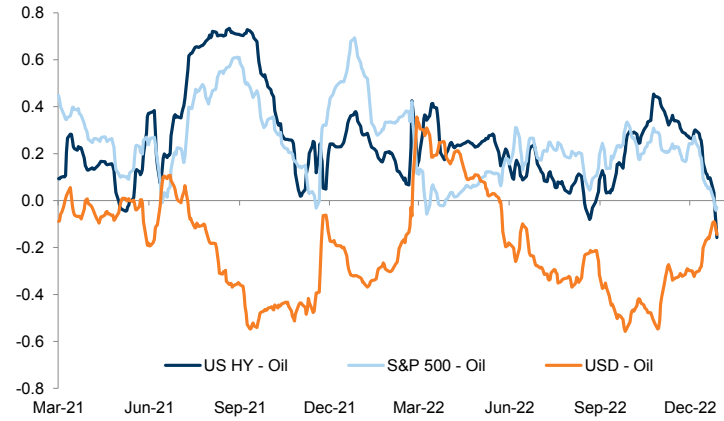
# Cross-asset: Correlations: Equity vol/CDS, commodity prices/credit & FX, equity/bond, equity/FX

**Exhibit 47: 3m rolling equity vol/CDS correlation of weekly level changes**  
 CDX HY for the US, iTraxx Xover for Europe; ATM implied vol for S&P 500 and Euro Stoxx 50



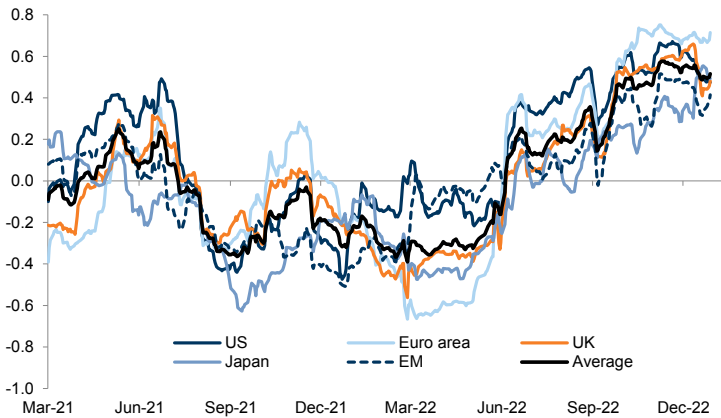
Source: Datastream, Goldman Sachs, Goldman Sachs Global Investment Research

**Exhibit 48: 3m rolling commodity price correlations of weekly % changes with different assets**



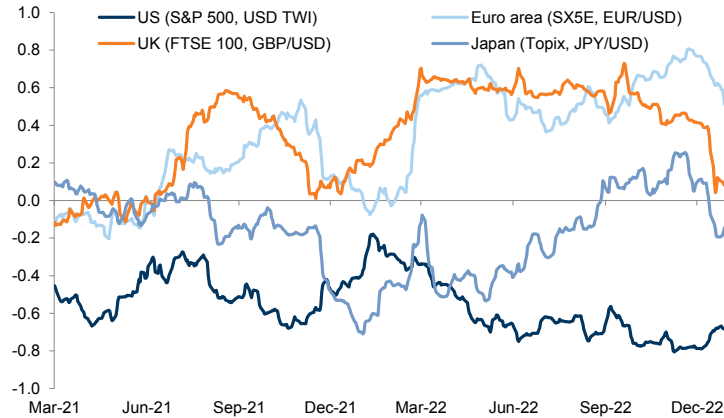
Source: Datastream, Goldman Sachs, Goldman Sachs Global Investment Research

**Exhibit 49: 3m rolling equity/bond correlation of weekly returns**



Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 50: 3m rolling equity/FX correlation of weekly returns**



Source: Datastream, Goldman Sachs Global Investment Research

# Cross-asset: Correlation matrix

## Exhibit 51: Cross-asset correlation matrix

Upper half of matrix: current 1-year correlation (black shading = more/less than 0.50/-0.50); lower half of matrix: percentile since 2001 (dark grey shading indicates above 75th percentile, orange shading indicates below 25th percentile); correlations are calculated on weekly, local currency returns.

	S&P 500	STOXX 600	MXAPJ	TOPIX	MSCI EM	US 10 yr	Germany 10 yr	Japan 10 yr	UK 10 yr	EUR/USD	USD/JPY	AUD/USD	iBoxx US IG	iBoxx EUR IG	BAML US HY	BAML EUR HY	EM Credit (\$)	WTI Crude Oil	Copper	Gold	VIX
<b>Current 1y correlation of weekly returns</b>																					
<b>S&amp;P 500</b>		0.68	0.45	0.53	0.44	0.24	0.33	0.03	0.41	0.48	-0.33	0.59	0.50	0.52	0.78	0.62	0.61	0.12	0.20	0.18	-0.74
<b>STOXX 600</b>	0.08		0.57	0.45	0.55	0.20	0.25	-0.08	0.31	0.45	-0.25	0.47	0.45	0.49	0.65	0.70	0.68	-0.20	0.19	0.12	-0.52
<b>MXAPJ</b>	0.13	0.29		0.60	0.98	0.32	0.18	0.06	0.18	0.51	-0.45	0.67	0.53	0.45	0.51	0.62	0.61	0.04	0.52	0.51	-0.28
<b>TOPIX</b>	0.41	0.10	0.41		0.57	-0.04	-0.07	0.00	0.02	0.35	0.04	0.46	0.28	0.21	0.44	0.52	0.38	0.09	0.15	0.05	-0.40
<b>MSCI EM</b>	0.09	0.16	0.83	0.37		0.28	0.16	0.03	0.17	0.47	-0.43	0.64	0.49	0.42	0.50	0.60	0.59	0.07	0.54	0.48	-0.27
<b>US 10 yr</b>	1.00	1.00	0.98	0.99	0.98		0.84	0.52	0.71	0.20	-0.56	0.26	0.86	0.75	0.46	0.37	0.50	0.01	0.22	0.28	-0.06
<b>Germany 10 yr</b>	1.00	1.00	1.00	0.89	0.99	0.92		0.47	0.83	0.03	-0.47	0.23	0.73	0.89	0.48	0.40	0.39	0.05	0.11	0.19	-0.09
<b>Japan 10 yr</b>	0.83	0.69	0.77	0.87	0.71	0.59	0.35		0.39	-0.13	-0.06	0.04	0.43	0.39	0.26	0.16	0.16	-0.11	0.12	0.12	0.16
<b>UK 10 yr</b>	1.00	1.00	0.99	0.99	0.99	0.21	0.42	0.27		0.19	-0.41	0.29	0.67	0.75	0.44	0.40	0.42	0.09	0.12	0.13	-0.22
<b>EUR/USD</b>	0.91	0.97	0.84	0.83	0.68	0.64	0.63	0.18	0.70		-0.46	0.58	0.38	0.17	0.42	0.39	0.58	-0.11	0.24	0.38	-0.39
<b>USD/JPY</b>	0.03	0.00	0.08	0.24	0.06	0.39	0.36	0.81	0.56	0.36		-0.53	-0.58	-0.55	-0.41	-0.45	-0.55	-0.22	-0.41	-0.52	0.16
<b>AUD/USD</b>	0.74	0.68	0.59	0.70	0.59	0.91	0.92	0.67	0.96	0.52	0.11		0.48	0.44	0.63	0.59	0.50	0.23	0.47	0.61	-0.34
<b>iBoxx US IG</b>	0.95	0.95	0.95	0.94	0.95	0.55	0.74	0.49	0.54	0.84	0.12	0.95		0.81	0.72	0.64	0.76	-0.06	0.21	0.21	-0.28
<b>iBoxx EUR IG</b>	0.95	0.95	0.90	0.72	0.89	0.91	0.78	0.63	0.75	0.74	0.04	0.92	0.80		0.68	0.70	0.62	0.06	0.25	0.25	-0.24
<b>BAML US HY</b>	0.93	0.70	0.32	0.52	0.28	0.96	1.00	0.88	0.99	0.86	0.03	0.82	0.95	0.92		0.78	0.74	0.06	0.28	0.29	-0.47
<b>BAML EUR HY</b>	0.88	0.90	0.64	0.54	0.65	0.99	1.00	0.84	1.00	0.86	0.01	0.81	0.95	0.91	0.41		0.75	-0.04	0.36	0.27	-0.38
<b>EM Credit (\$)</b>	0.83	0.86	0.63	0.69	0.51	0.77	0.78	0.45	0.83	0.94	0.02	0.63	0.90	0.84	0.89	0.92		-0.15	0.26	0.27	-0.42
<b>WTI Crude Oil</b>	0.37	0.09	0.10	0.29	0.12	0.71	0.81	0.38	0.88	0.05	0.11	0.45	0.38	0.60	0.24	0.22	0.06		0.39	0.37	-0.02
<b>Copper</b>	0.24	0.24	0.66	0.20	0.69	1.00	0.96	0.89	0.95	0.39	0.00	0.54	0.93	0.91	0.50	0.73	0.59	0.70		0.58	-0.01
<b>Gold</b>	0.78	0.71	0.92	0.68	0.88	0.65	0.60	0.47	0.40	0.33	0.27	0.85	0.48	0.72	0.79	0.87	0.55	0.82	0.93		-0.02
<b>VIX</b>	0.77	0.94	0.92	0.80	0.96	0.00	0.00	0.61	0.00	0.05	0.97	0.47	0.05	0.13	0.37	0.58	0.32	0.72	0.98	0.43	
<b>Current correlation's percentile since 2001</b>																					

Source: Datastream, iBoxx, Goldman Sachs Global Investment Research

# Cross-asset: Implied and realised vol, call and put skew

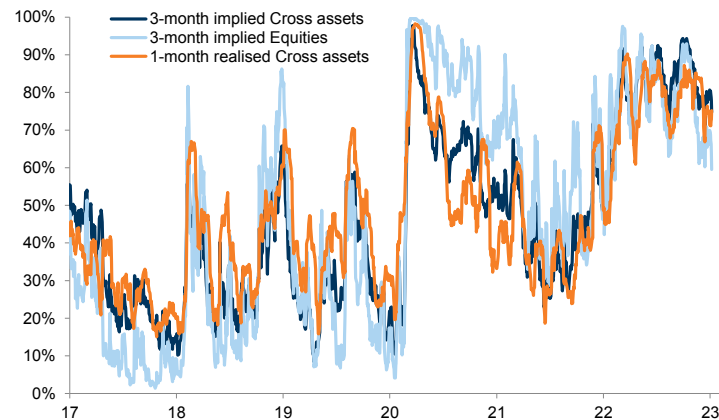
**Exhibit 52: Cross-asset volatility, current and historical percentiles, implied 3m and realised 1m**

	Equities						Rates				Credit			Commodities			Currencies		
	S&P 500	EURO STOXX 50	Nikkei 225	FTSE 100	MSCI EM	MSCI EAFE	USD 2-year	USD 10-year	EUR 2-year	EUR 10-year	CDX IG	CDX HY	iTraxx Europe	WTI	Gold	Copper	EUR/USD	JPY/USD	GBP/USD
<b>Implied (3-month ATM, %)</b>																			
<b>Current:</b>	20.3	17.6	18.3	12.6	22.1	18.3	7.8	7.3	6.8	7.3	52.4	51.5	55.4	46.2	15.2	29.9	8.7	13.1	10.9
<b>Percentile:</b>	<b>82%</b>	<b>50%</b>	<b>39%</b>	<b>33%</b>	<b>74%</b>	<b>79%</b>	<b>92%</b>	<b>93%</b>	<b>93%</b>	<b>95%</b>	<b>68%</b>	<b>73%</b>	<b>60%</b>	<b>84%</b>	<b>57%</b>	<b>96%</b>	<b>72%</b>	<b>97%</b>	<b>84%</b>
<b>1M change:</b>	-1.5	-1.4	-0.1	-1.6	-0.7	-1.7	-1.5	-1.0	-1.0	-0.3	-2.1	-2.9	-2.3	-3.2	0.3	-0.1	-0.6	0.5	-0.2
<b>Average:</b>	15.8	18.4	19.7	15.0	20.0	15.6	3.5	4.8	2.1	3.6	50.1	45.7	53.6	34.4	14.8	21.4	7.8	8.8	8.8
<b>95th:</b>	25.2	26.1	26.7	22.6	26.7	22.6	8.7	7.7	7.9	7.5	69.7	65.7	70.0	54.5	20.4	29.7	11.3	12.8	13.0
<b>5th:</b>	10.0	12.3	13.8	10.3	15.2	10.4	1.3	3.5	0.9	2.2	38.5	30.7	38.7	17.1	9.7	15.2	5.1	5.6	6.1
<b>Realised (%)</b>																			
<b>1-month:</b>	19.5	21.8	15.0	12.0	12.5	17.3	7.5	7.3	6.5	8.3	48.3	46.3	55.4	39.1	15.1	19.6	8.7	20.3	11.4
<b>Percentile:</b>	<b>78%</b>	<b>79%</b>	<b>32%</b>	<b>48%</b>	<b>43%</b>	<b>81%</b>	<b>93%</b>	<b>92%</b>	<b>95%</b>	<b>98%</b>	<b>79%</b>	<b>85%</b>	<b>84%</b>	<b>66%</b>	<b>63%</b>	<b>54%</b>	<b>73%</b>	<b>99%</b>	<b>87%</b>
<b>Average:</b>	14.8	17.7	19.8	14.3	14.5	13.0	3.2	4.6	1.6	3.3	39.8	34.0	42.7	37.8	14.4	19.9	7.7	8.5	8.8

Source: Goldman Sachs, Goldman Sachs Global Investment Research

**Exhibit 53: 10y percentile for cross-asset average volatility**

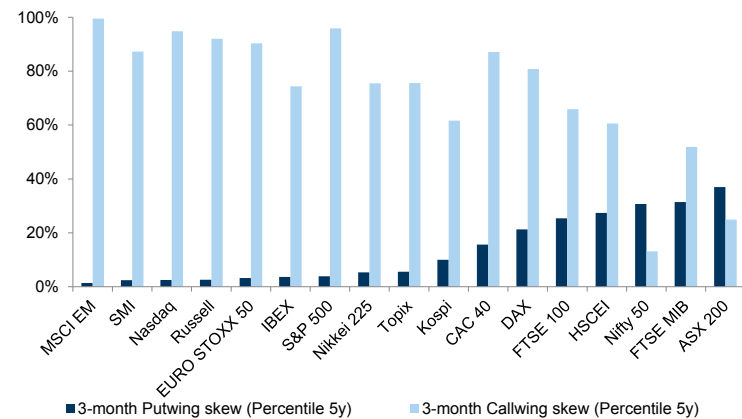
Using 16 assets across equity, government bonds, credit, commodities and FX



Source: Goldman Sachs, Goldman Sachs Global Investment Research

**Exhibit 54: Putwing and Callwing normalised skew 5y percentile**

Normalised skew = (impl. vol 25 delta put/call minus implied vol 50 delta call)/50 delta call



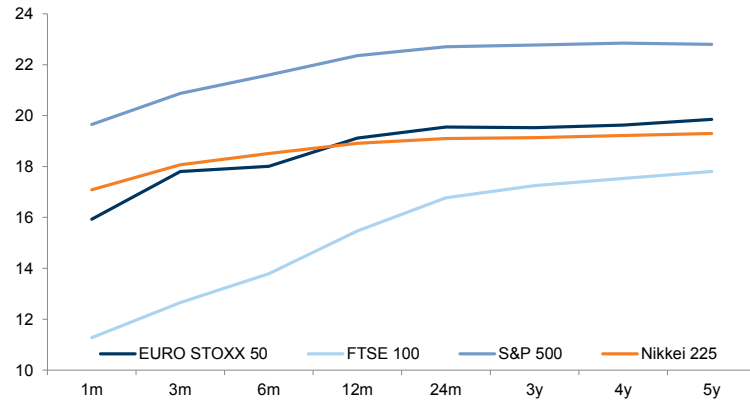
Source: Goldman Sachs, Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT



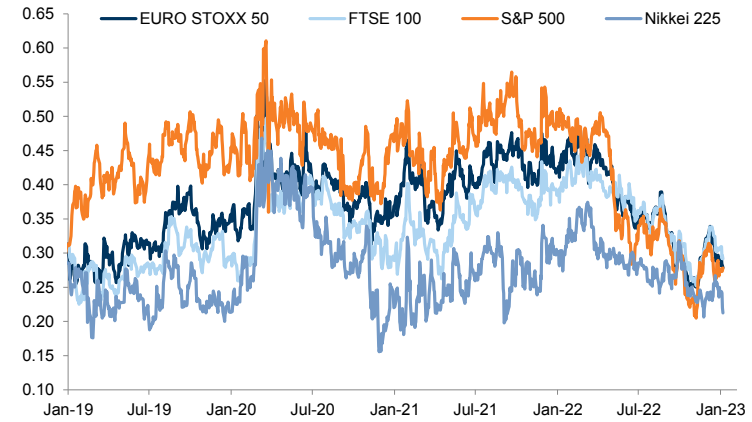
# Cross-asset: Volatility, skew, CDS with equity vol, rate vol

**Exhibit 55: ATM implied volatility term structure for equity indices**



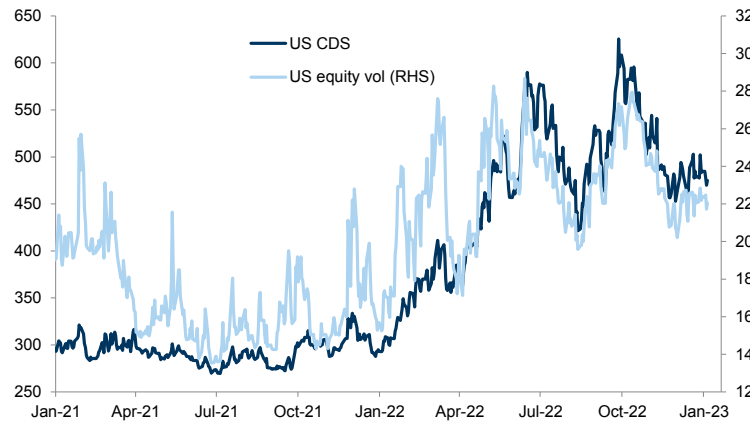
Source: Goldman Sachs, Goldman Sachs Global Investment Research

**Exhibit 56: Normalised implied volatility skew across regions**  
3m 25 delta put vol minus 25 delta call vol scaled by ATM implied vol



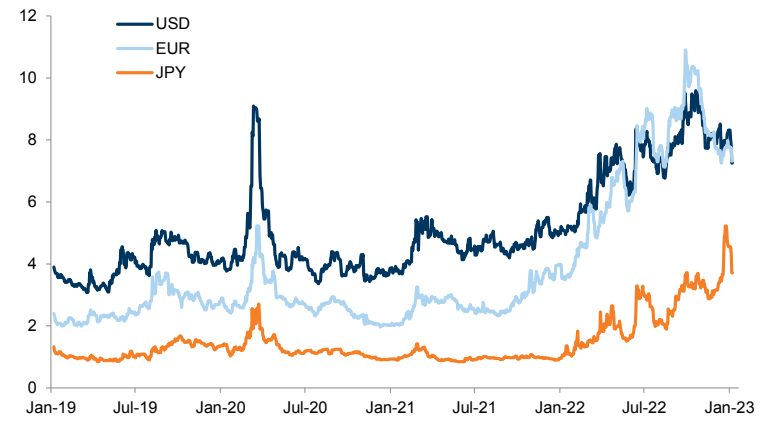
Source: Goldman Sachs, Goldman Sachs Global Investment Research

**Exhibit 57: CDS and equity vol levels in the US**  
CDX HY, 3m ATM S&P 500 implied vol



Source: Goldman Sachs, Goldman Sachs Global Investment Research

**Exhibit 58: 3m ATM implied rate volatility across regions**  
3-month implied volatility of 10-year rates (bp/day)



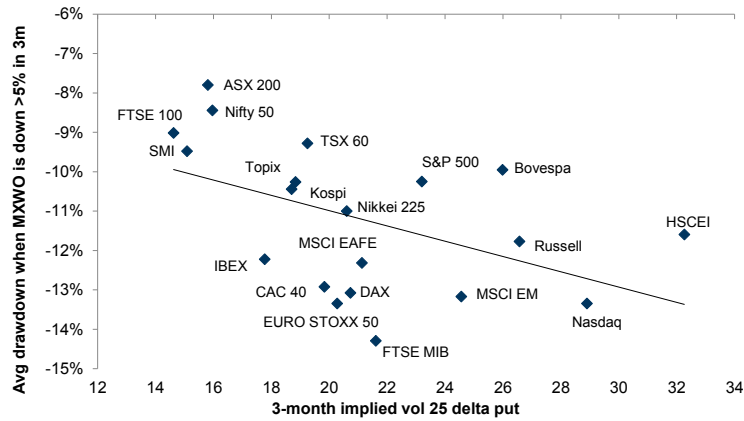
Source: Goldman Sachs, Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

# Cross-asset: Alternatives and option strategies

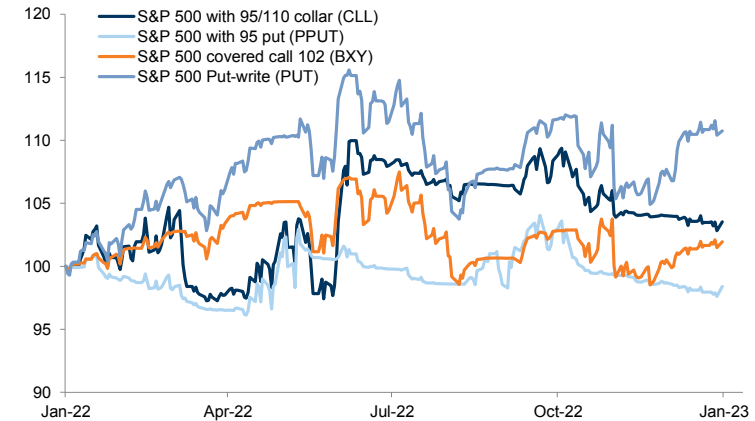
**Exhibit 59: Implied volatility (3-month 25 delta put) vs. average drawdown during MXWO corrections**

3m put 25 delta put option implied vol vs. average performance during a 5% MXWO drawdown



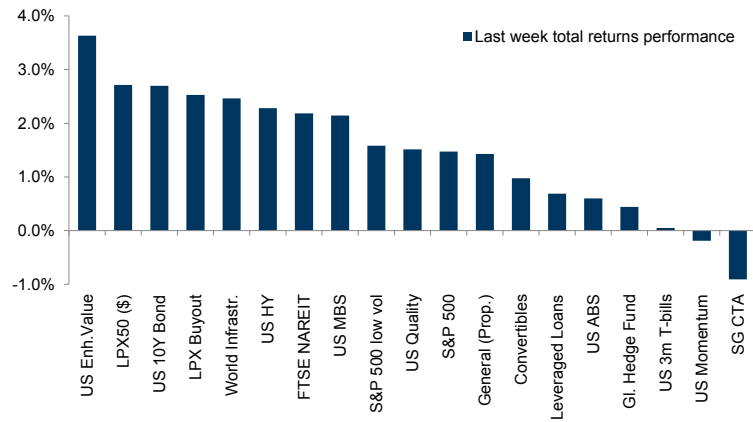
Source: Goldman Sachs Global Investment Research

**Exhibit 60: Systematic option strategies vs. S&P 500 performance**  
CBOE Strategies vs. S&P 500 performance



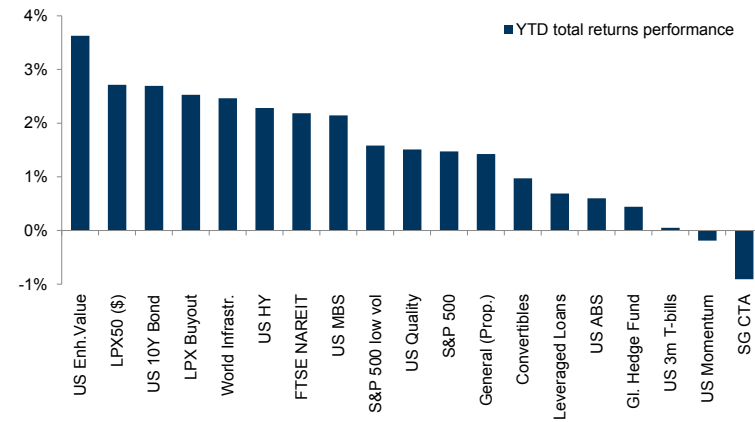
Source: Bloomberg, Goldman Sachs Global Investment Research

**Exhibit 61: Last week performance of alternative assets or strategies**



Source: Bloomberg, Datastream, Goldman Sachs Global Investment Research

**Exhibit 62: YTD performance of alternative assets or strategies**



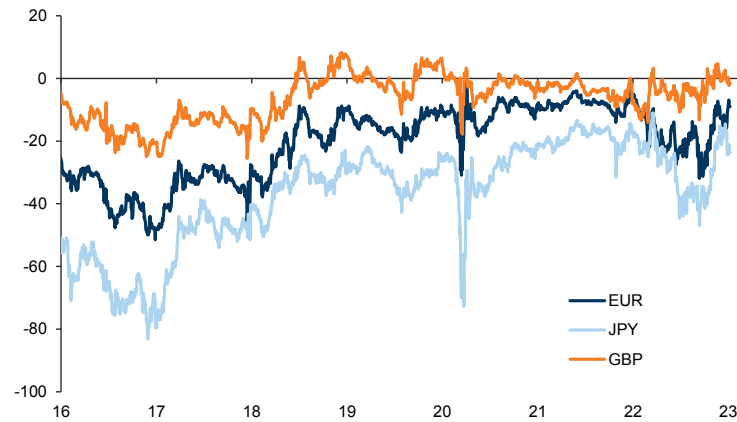
Source: Bloomberg, Datastream, Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

# Cross-asset: Liquidity indicators

**Exhibit 63: 1-year cross-currency basis**

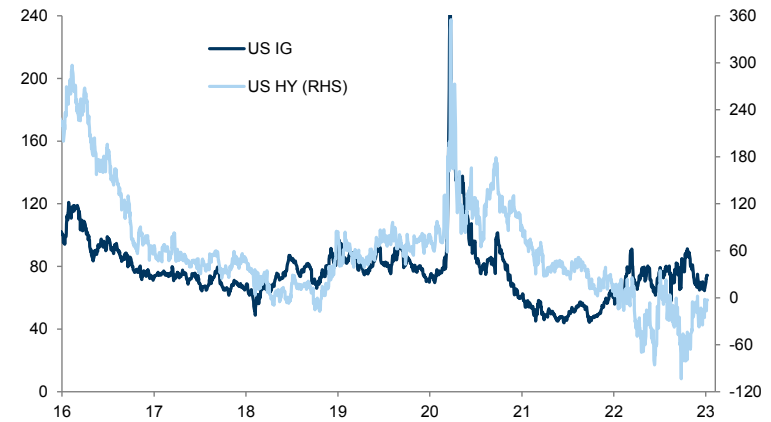
Basis points



Source: Goldman Sachs Group Inc., Goldman Sachs Global Investment Research

**Exhibit 64: Cash credit versus CDS spread**

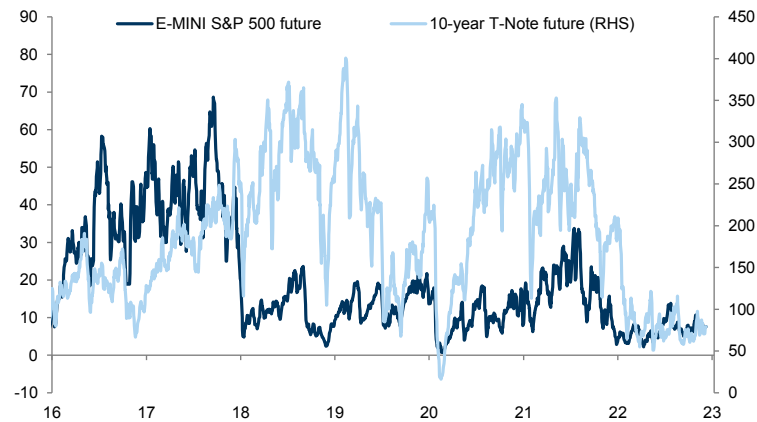
Basis points



Source: Goldman Sachs Group Inc., Haver Analytics, Goldman Sachs Global Investment Research

**Exhibit 65: Top-of-book depth**

5-day average, \$ mln

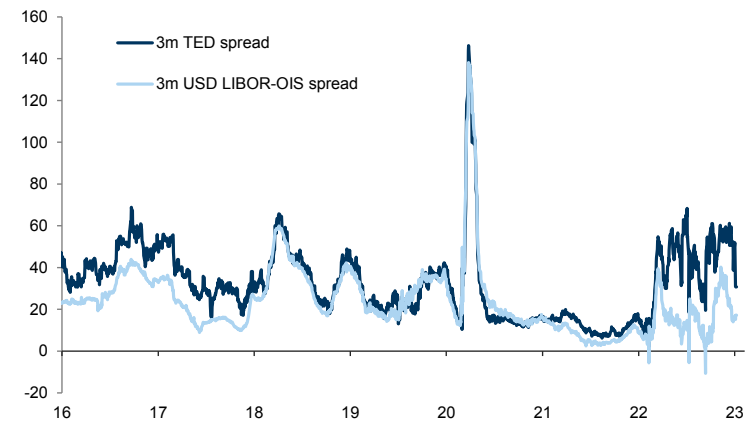


E-MINI S&P 500 = 5d avg. # of contracts \* S&P 500 price \* \$50. 10-year T-note = 5d avg. # of contracts \* \$100,000

Source: Goldman Sachs Group Inc., Bloomberg, Goldman Sachs Global Investment Research

**Exhibit 66: Interbank spread**

Basis points



TED spread = 3m USD LIBOR rate - 3m T-bill rate

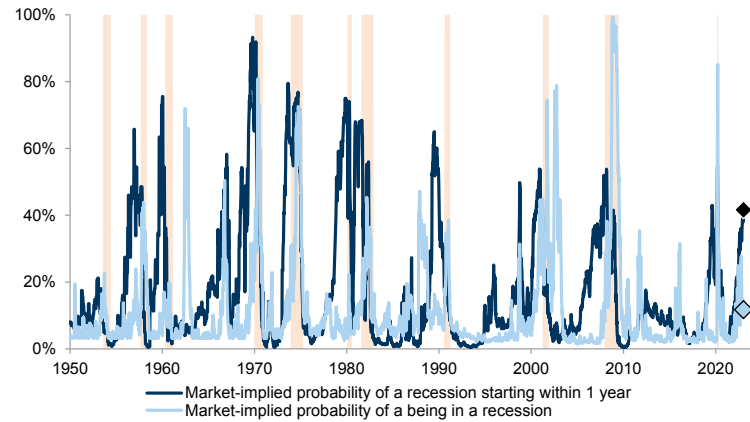
Source: Bloomberg, Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

# Cross-asset: Market pricing of US recession risk

**Exhibit 67: Market-implied US recession probability**

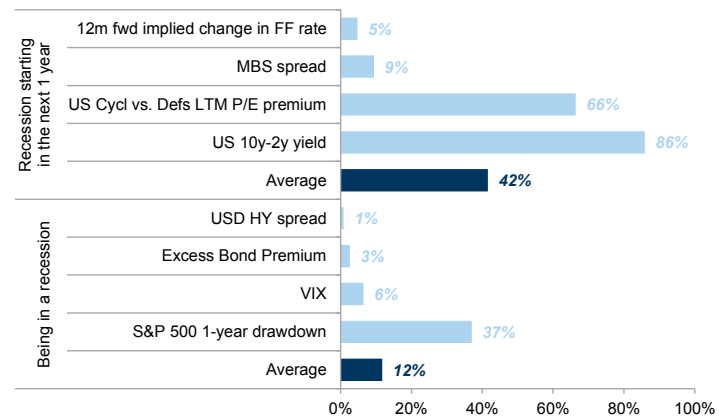
Average of univariate logit models on the right. Orange shade: NBER recession



Source: Haver Analytics, Datastream, Worldscope, Goldman Sachs Global Investment Research

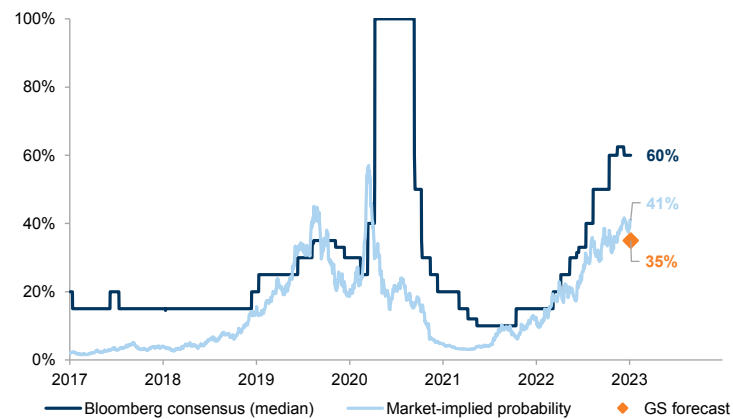
**Exhibit 68: Market-implied US recession probability by indicator**

Univariate logit models. Maximum history since 1950



Source: Haver Analytics, Datastream, Worldscope, Goldman Sachs Global Investment Research

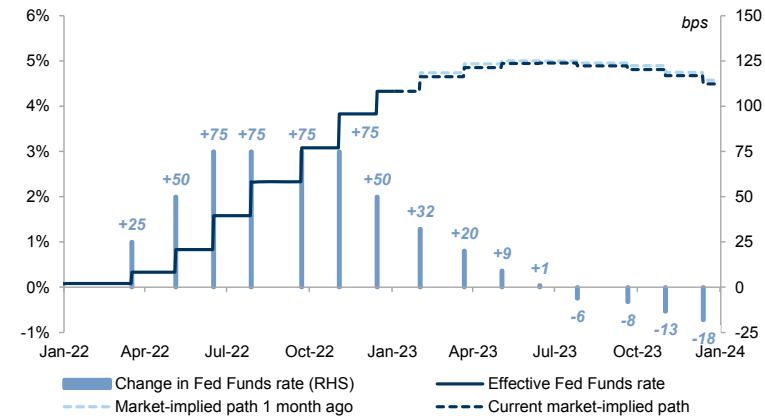
**Exhibit 69: Probability of a US recession in the next 1 year**



Source: Haver Analytics, Datastream, Worldscope, Bloomberg, Goldman Sachs Global Investment Research

**Exhibit 70: Market-implied path of the Fed Funds rate**

Based on 30-day Fed Funds futures

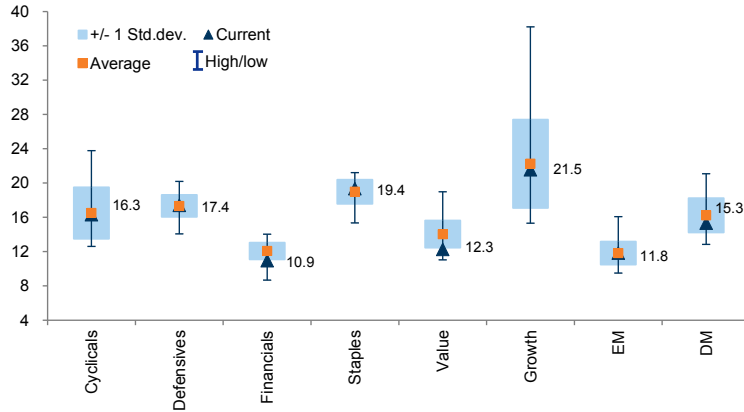


Source: Haver Analytics, Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

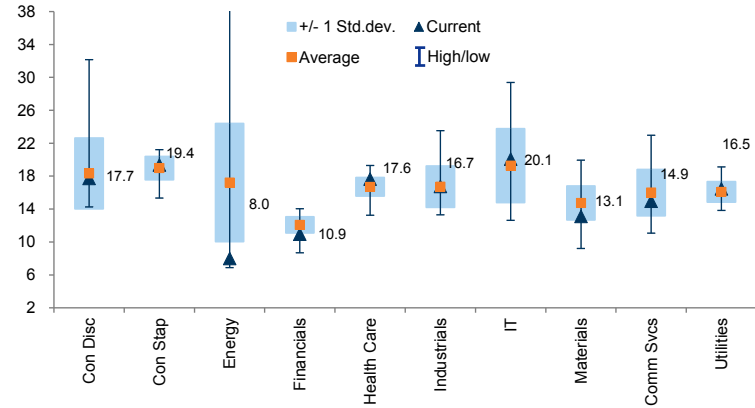
# Equity: Valuation and styles

**Exhibit 71: Valuation ranges of MSCI World styles indices**  
12-month forward P/Es relative to the last 10 years



Source: Datastream, I/B/E/S, Goldman Sachs Global Investment Research

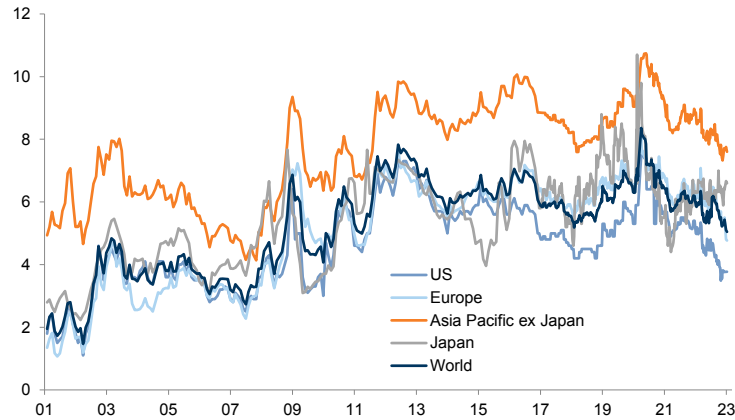
**Exhibit 72: MSCI World sector valuations**  
12-month forward P/Es relative to the last 10 years



Source: Datastream, I/B/E/S, Goldman Sachs Global Investment Research

**Exhibit 73: Global market implied ERPs (%)**

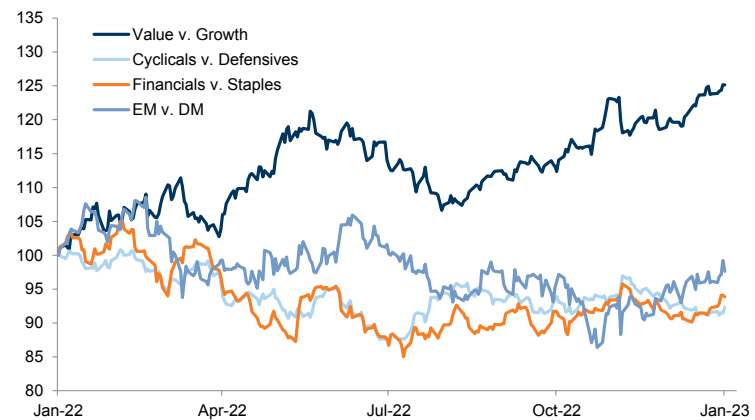
Implied ERPs are calculated by each regional strategy team. While specific assumptions differ between regions, all are calculated using similar frameworks



Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 74: MSCI World style index performance**

Performance indexed to 100 12m ago



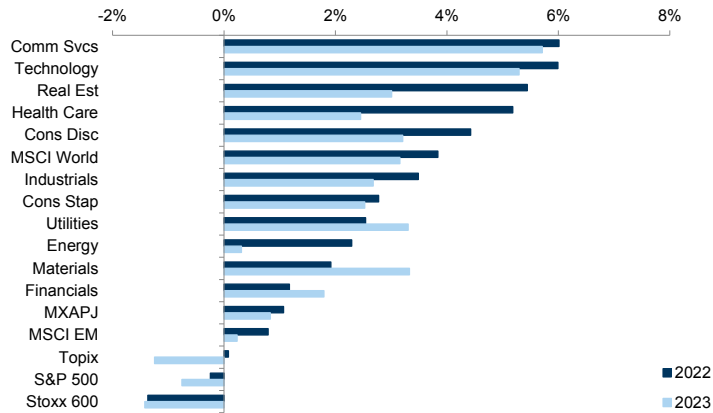
Source: Datastream, Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

# Equity: Earnings

**Exhibit 75: 1-month revision to I/B/E/S consensus earnings**

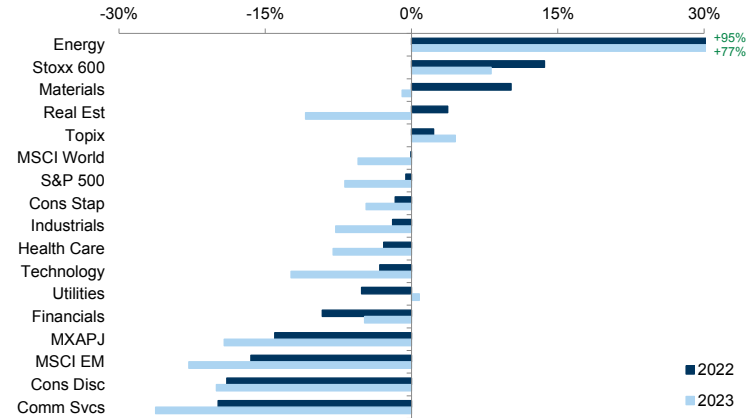
MSCI World sectors, other global equity index aggregates. TOPIX: FY 2022/2023



Source: Datastream, I/B/E/S, Goldman Sachs Global Investment Research

**Exhibit 76: 12-month revision to I/B/E/S consensus earnings**

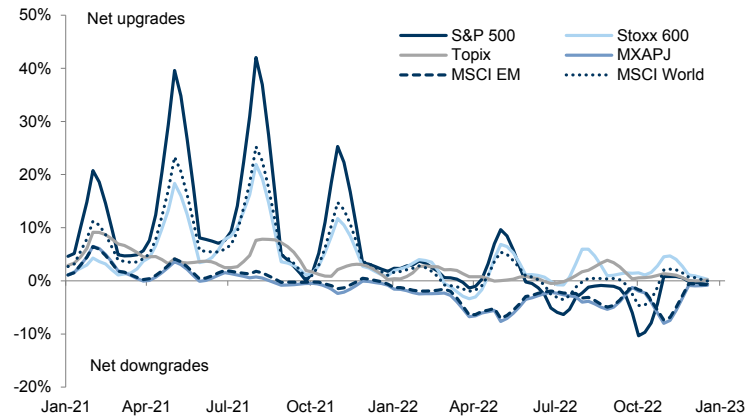
MSCI World sectors, other global equity index aggregates. TOPIX: FY 2022/2023



Source: Datastream, I/B/E/S, Goldman Sachs Global Investment Research

**Exhibit 77: Earnings sentiment: Analyst upgrades minus downgrades (scaled by total analysts) across markets**

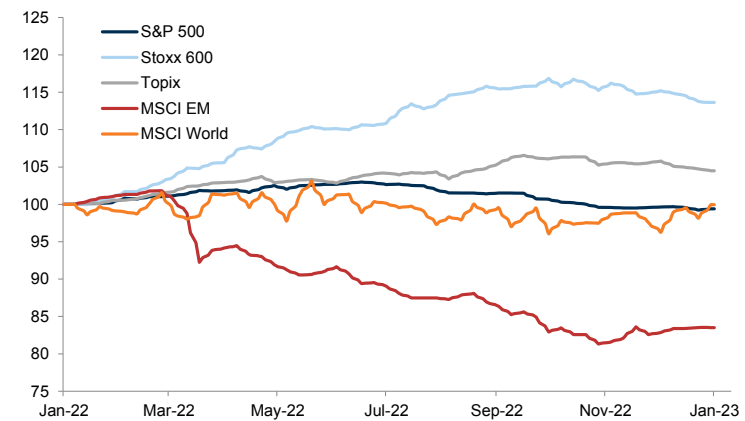
1-month moving average of net monthly upgrades



Source: Datastream, I/B/E/S, Goldman Sachs Global Investment Research

**Exhibit 78: 2022 consensus earnings expectations over the past 12 months**

Earnings indexed to 100 12 months ago. TOPIX: FY 2023



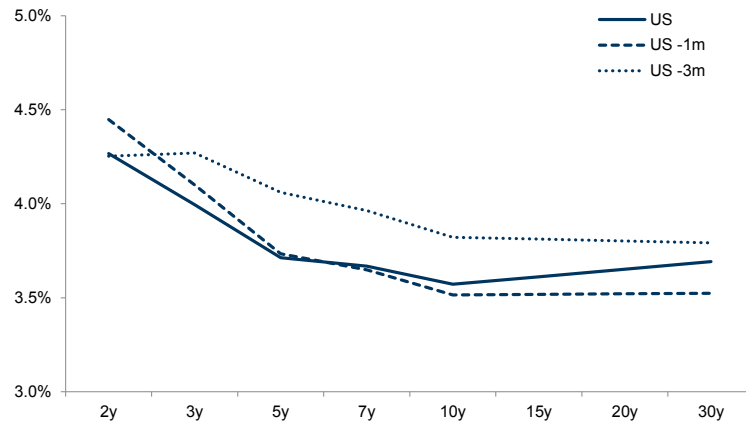
Source: Datastream, I/B/E/S, Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

# Government bonds: Yield curves

**Exhibit 79: US yield curve dynamics**

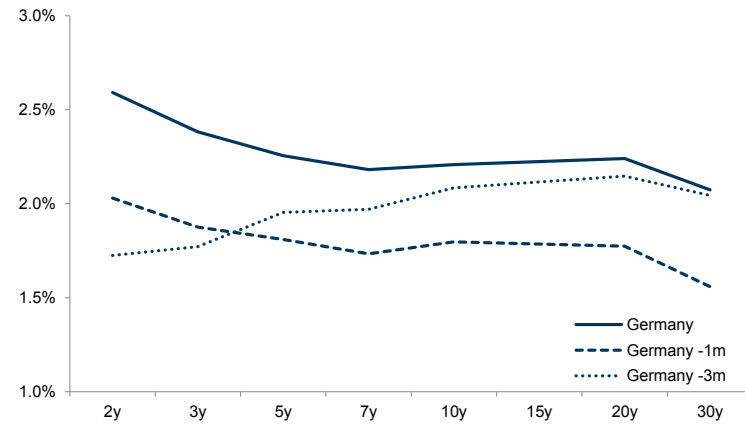
Current relative to 1 month and 3 months ago



Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 80: German yield curve dynamics**

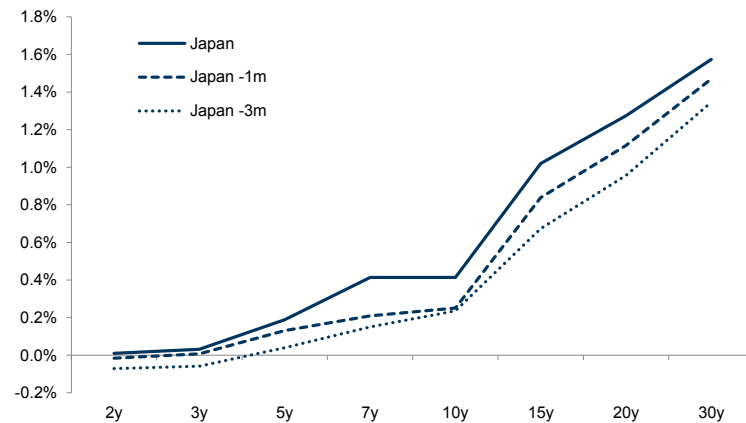
Current relative to 1 month and 3 months ago



Source: Datastream, Goldman Sachs Global Investment Research

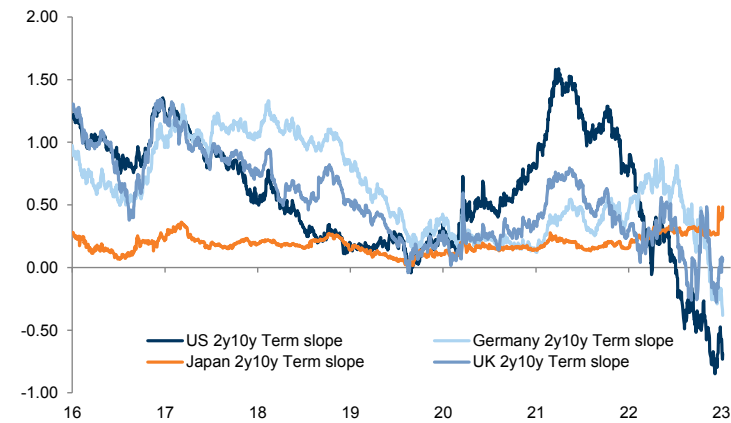
**Exhibit 81: Japan yield curve dynamics**

Current relative to 1 month and 3 months ago



Source: Goldman Sachs Global Investment Research

**Exhibit 82: Yield curve term slope across regions**



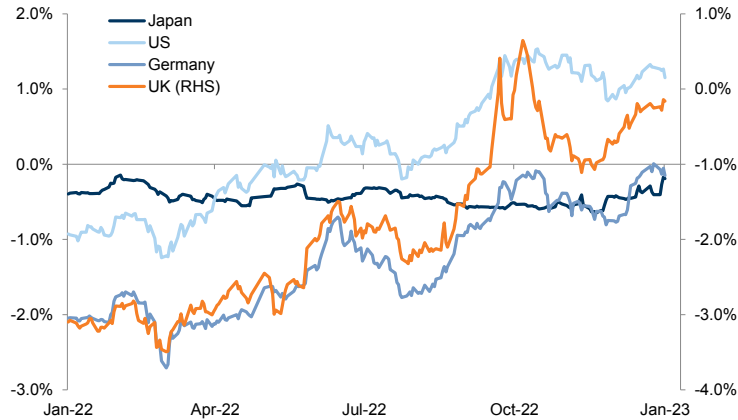
Source: Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

# Government bonds: Real yields, inflation, breakevens, 10y IR differentials

**Exhibit 83: 10y real yields across regions**

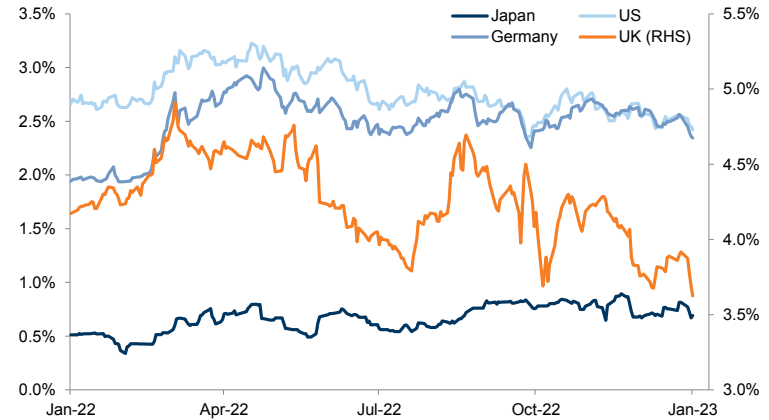
Nominal bond yield minus CPI inflation swap (RPI for the UK)



Source: Goldman Sachs, Goldman Sachs Global Investment Research

**Exhibit 84: 10y inflation swaps across regions**

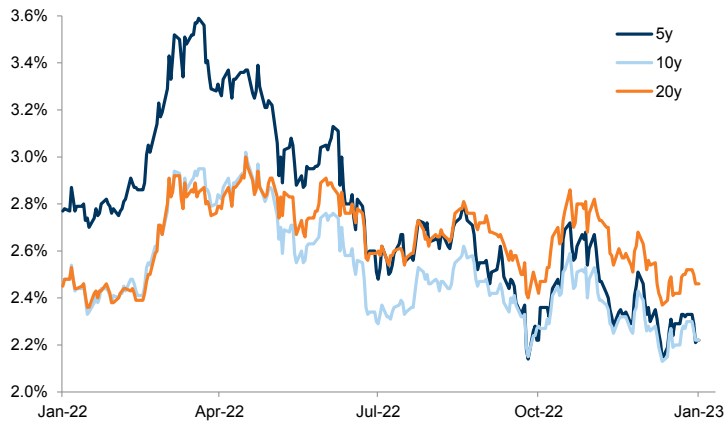
CPI inflation swap (RPI for the UK)



Source: Goldman Sachs, Goldman Sachs Global Investment Research

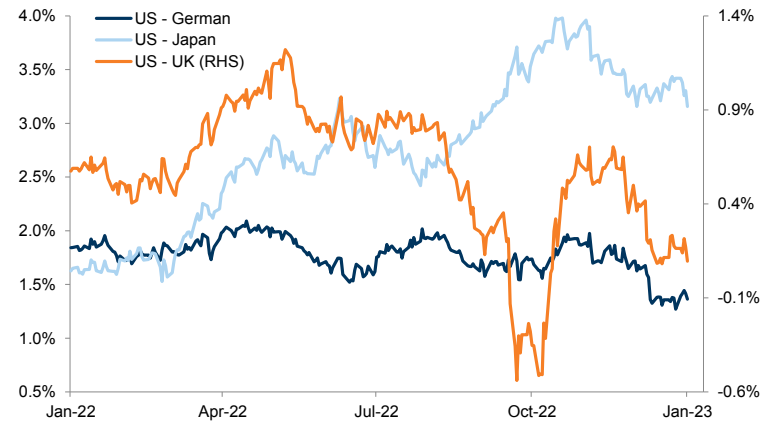
**Exhibit 85: US breakeven inflation**

Nominal yield minus TIPS yield



Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 86: 10y nominal bond yield differentials**



Source: Datastream, Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT



# Credit: Spreads - history and forecasts

## Exhibit 87: Credit spread forecasts

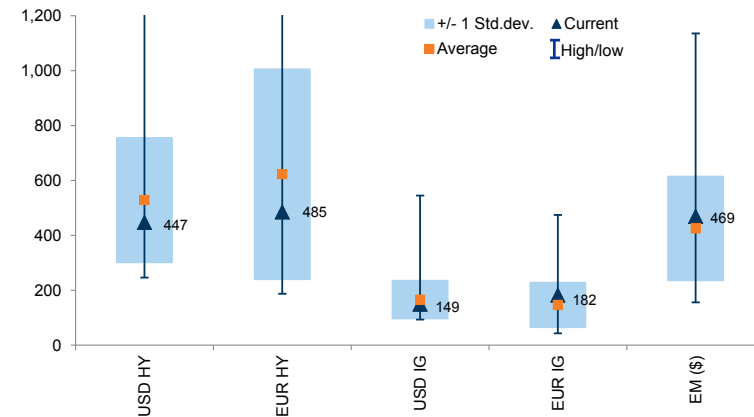
Yieldbook Citi US IG, iBoxx EUR IG, BAML US HY and EUR HY

Sector	Updated through Jan. 04, 2023				
	Current	2023Q1	2023Q2	2023Q3	2023Q4
<b>USD Spreads</b>					
IG	132	180	170	160	150
IG Fin	143	190	178	166	155
IG Non-Fin	127	170	165	155	148
High Yield	448	600	575	550	500
<b>EUR Spreads</b>					
IG	184	240	225	215	210
IG Fin	228	295	270	240	230
IG Non-Fin	157	200	190	185	180
High Yield	486	660	615	575	550

Source: Bloomberg-Barclays, ICE-BAML, iBoxx, Goldman Sachs Global Investment Research

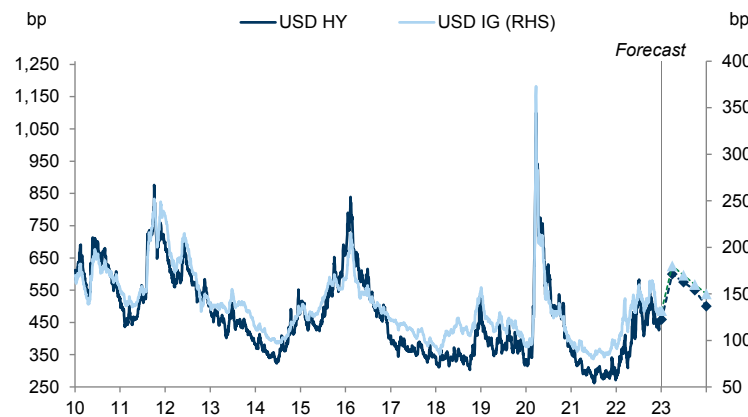
## Exhibit 88: Current credit spreads relative to their historical ranges

Credit spreads (US HY and IG since 1985, EUR IG since 1997, EUR HY and EM since 1998)



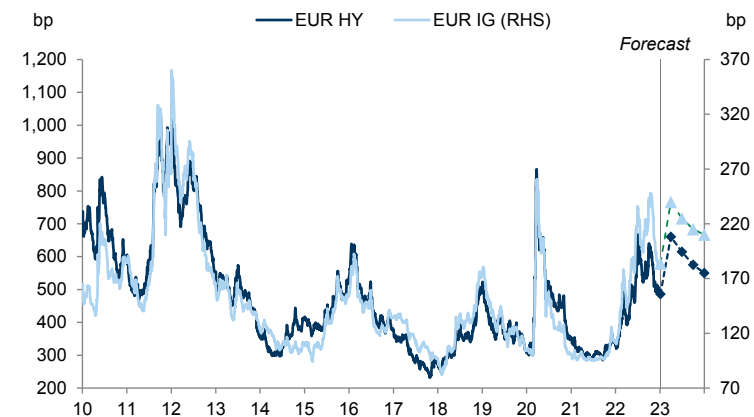
Source: Haver Analytics, iBoxx, Goldman Sachs Global Investment Research

## Exhibit 89: Our USD spread forecast for IG vs. HY



Source: Bloomberg-Barclays, Goldman Sachs Global Investment Research

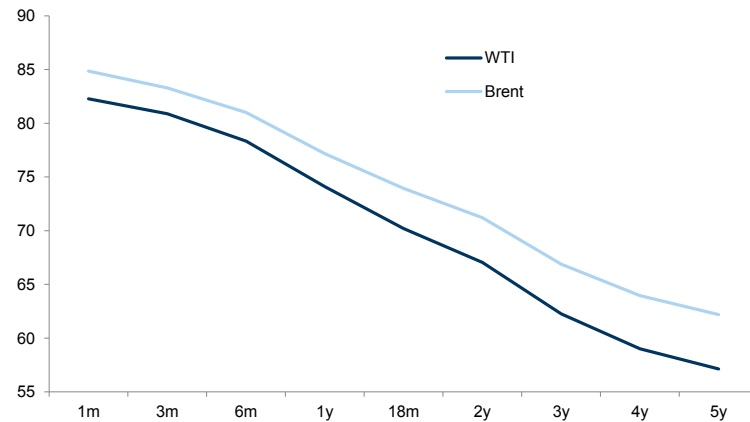
## Exhibit 90: Our EUR spread forecast for IG vs. HY



Source: ICE-BAML, iBoxx, Goldman Sachs Global Investment Research

# Commodities: Curve shapes and roll yields

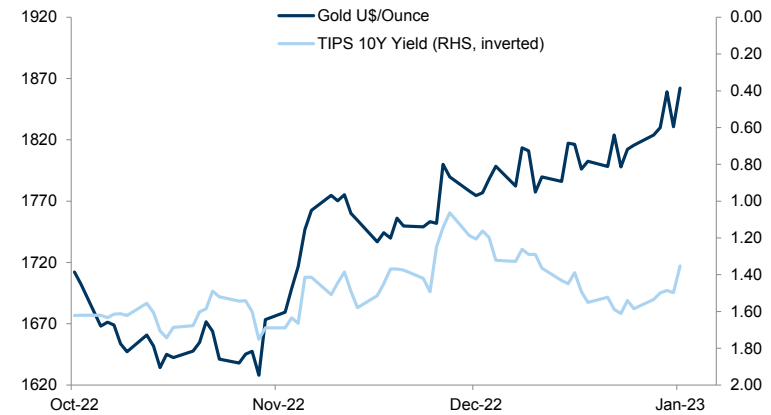
**Exhibit 91: WTI and Brent oil forward curves**



Source: Goldman Sachs, Goldman Sachs Global Investment Research

**Exhibit 92: Gold price and US real yields**

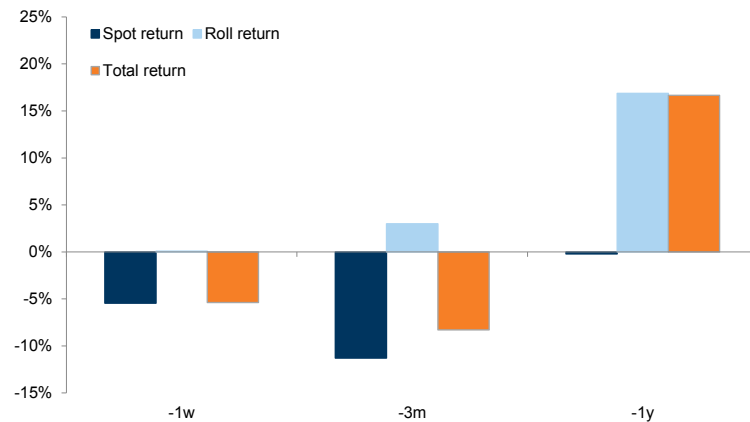
US 10-year TIPS yield, Gold US/ounce



Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 93: GSCI® Enhanced spot, roll and total returns**

Returns over the past 1 week, 3 months and 1 year



Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 94: Recent performance of GSCI® Enhanced sectors**

Weight signifies contribution to the GSCI® Enhanced index

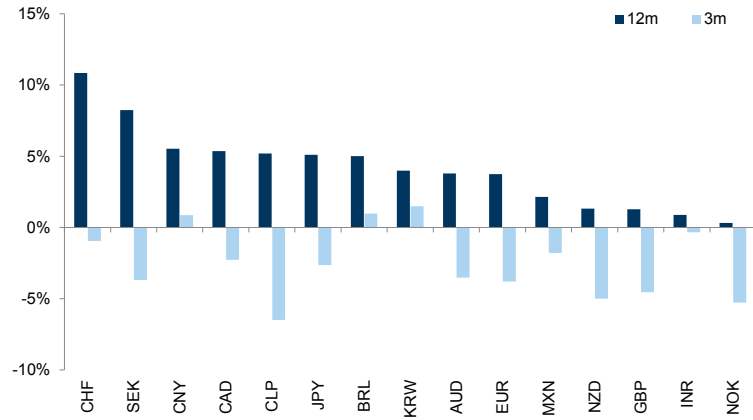
	Current Weight	Returns (%)		
	(%)	-1w	-1m	-1y
<b>S&amp;P GSCI Enhanced</b>	<b>100.0</b>	<b>-5.4</b>	<b>0.8</b>	<b>16.6</b>
Energy	57.9	-7.7	1.4	25.9
Industrial Metals	11.2	-0.9	-3.5	-8.9
Precious Metals	4.7	2.2	4.4	3.8
Agriculture	19.1	-3.6	0.7	8.0
Livestock	7.0	-2.0	0.7	4.7

Source: Goldman Sachs, Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

# FX: Forecasts and forwards, recent performance and positioning

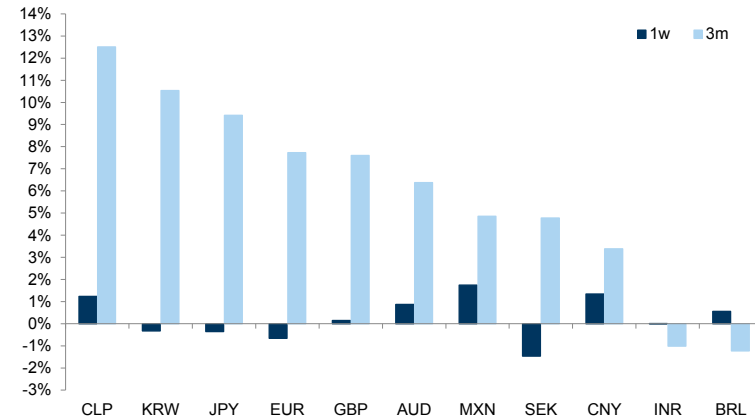
**Exhibit 95: Our 3- and 12-month forecasts for dollar crosses**



Source: Datastream, Goldman Sachs Global Investment Research

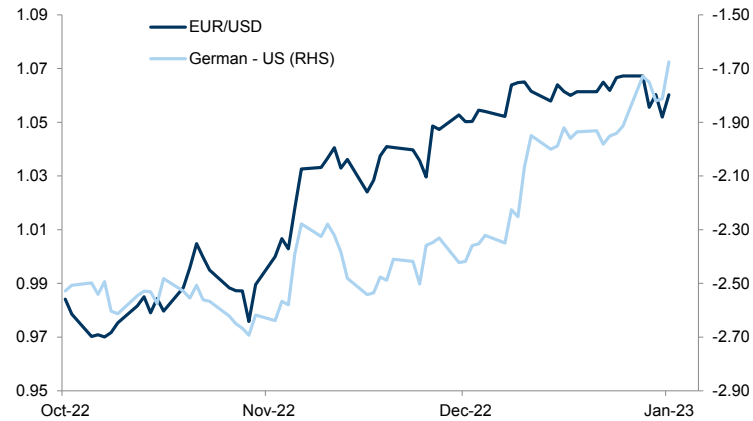
**Exhibit 96: Recent performance of dollar crosses**

Percentage change over past 1 week, 3 months



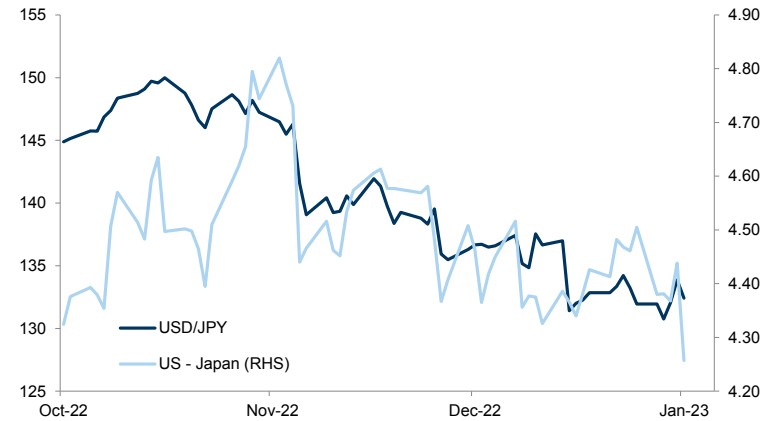
Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 97: EUR/USD against German - US 2y interest rate differentials past 3m**



Source: Datastream, Goldman Sachs Global Investment Research

**Exhibit 98: USD/JPY against US - Japan 2y interest rate differentials past 3m**



Source: Datastream, Goldman Sachs Global Investment Research

For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

# Disclosure Appendix

## Reg AC

We, Cecilia Mariotti, Christian Mueller-Glissmann, CFA, Andrea Ferrario and Peter Oppenheimer, 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

### Other Disclosures

MSCI disclosure. All MSCI data used in this report is the exclusive property of MSCI, Inc. (MSCI). Without prior written permission of MSCI, this information and any other MSCI intellectual property may not be reproduced or disseminated in any form and may not be used to create any financial instruments or products or any indices. This information is provided on an "as is" basis, and the user of this information assumes the entire risk of any use made of this information. Neither MSCI, any of its affiliates nor any third party involved in, or related to, computing or compiling the data makes any express or implied warranties or representations with respect to this information (or the results to be obtained by the use thereof), and MSCI, its affiliates and any such third party hereby expressly disclaim all warranties of originality, accuracy, completeness, merchantability or fitness for a particular purpose with respect to any of this information. Without limiting any of the foregoing, in no event shall MSCI, any of its affiliates or any third party involved in, or related to, computing or compiling the data have any liability for any direct, indirect, special, punitive, consequential or any other damages (including lost profits) even if notified of the possibility of such damages. MSCI and the MSCI indexes are service marks of MSCI and its affiliates. The Global Industry Classification Standard (GICS) were developed by and is the exclusive property of MSCI and Standard & Poor's. GICS is a service mark of MSCI and S&P and has been licensed for use by The Goldman Sachs Group, Inc.

Equity basket disclosure. The ability to trade the basket(s) discussed in this research will depend upon market conditions, including liquidity and borrow constraints at the time of trade.

## 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 the Global Investment Research Division 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 and Type II Financial Instruments Firms 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

The Global Investment Research Division of Goldman Sachs 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](mailto: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](mailto: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.

Effective from the date of the United Kingdom's departure from the European Union and the European Economic Area (“Brexit Day”) the following information with respect to distributing entities will apply:

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, the Republic of Cyprus and the Republic of Ireland; GS - Succursale de Paris (Paris branch) which, from Brexit Day, will be authorised by the French Autorité de contrôle prudentiel et de résolution (“ACPR”) and regulated by the Autorité de contrôle prudentiel et de résolution and the Autorité des marchés 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 (Finansinspektionen) 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 our Global Investment Research Division. 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](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 the Global Investment Research division of GS 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.

© 2023 Goldman Sachs.

**No part of this material may be (i) copied, photocopied or duplicated in any form by any means or (ii) redistributed without the prior written consent of The Goldman Sachs Group, Inc.**