Goldman Sachs | Economics Research

21 November 2022 | 1:17PM EST

2023 Global Rates Outlook

Chasing Neutral

- **Central bank pauses in sight:** Hiking cycles are likely to be paused across most G10 by 2Q23, though cycle extension risk appears underpriced and in some cases, easing shortly after the peak appears overpriced.
- **Global duration—trading the peak:** With the cycle peak for yields still ahead, extension risks and repricing of short-run neutral rates support a near-term bearish bias, but carry and "insurance" argue for a mild long bias beyond the pause. We expect benchmark 10y USTs and bunds to peak at 4.5% and 2.75% respectively in 1H23, though Treasury yields could end 2023 lower, at 4.3%.
- **From a flattening to a steepening bias:** Past peak inversion/bear flattening, but not yet time for sustained steepening, in our view. Material steepening may require clearer evidence of more imminent rate cuts.
- **European inflation set to exceed the US:** Markets appear too optimistic about inflation normalization in Europe, and not sufficiently concerned about skew of risks—particularly of sticky above-target inflation—in the US.
- **A lower rate vol regime:** We think a slower pace of normalization and eventual pause can allow for lower vols even as market microstructure remains impaired. Look to monetize vol premium opportunistically, particularly in the US, where vol moderation is likely to be more sustained.
- **Global QT implications:** Fed QT doesn't translate to duration impact, but should see tighter front end swap spreads. BoE and (potential) ECB QT also have similar implications for spreads, but could also mean modestly higher yields.
- **EMU sovereign spreads:** Currently too tight in our view, and will likely face widening pressure from higher core rates, ECB QT (if undertaken as we expect) and elevated supply on greater financing needs.
- **Money markets in 2023:** Significant liquidity drain across markets, but there should still be system-wide surpluses. Still, we expect short-term rates to be pressured higher; repo rates should underperform on a relative basis, both on account of lower liquidity and increased availability of collateral.

Praveen Korapaty
+1(212)357-0413 | praveen.korapaty@gs.com
Goldman Sachs & Co. LLC

George Cole
+44(20)7552-1214 | george.cole@gs.com
Goldman Sachs International

William Marshall
+1(646)446-1751 | william.c.marshall@gs.com
Goldman Sachs & Co. LLC

Simon Freycenet
+44(20)7774-5017 | simon.freycenet@gs.com
Goldman Sachs International

Ravi Raj
+1(212)934-8372 | ravi.raj@gs.com
Goldman Sachs India SPL

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

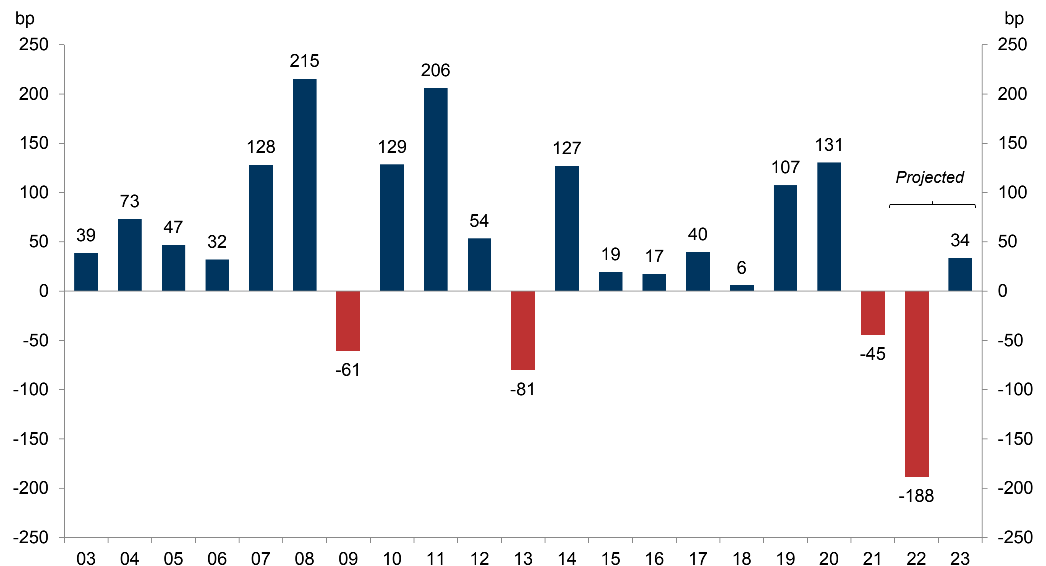
Investors should consider this report as only a single factor in making their investment decision. For Reg AC certification and other important disclosures, see the Disclosure Appendix, or go to www.gs.com/research/hedge.html.

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

After two years of negative returns, with the current year producing the largest losses in fixed income in the past few decades, we see the duration portion of investor portfolios producing flat-to-modestly positive returns in 2023. Exhibit 1 shows the yearly total returns from holding 10y UST Treasuries since 2003. As can be seen, for 2023, we expect positive returns of 34bp per unit of duration risk (versus -188bp this year). Indeed, we see positive returns across most of G10, led by New Zealand. Of note, we expect positive total returns despite projecting higher yields next year than current levels. This is because yields are sufficiently high that carry (income) should offset small losses from modest selloffs. While we expect total returns to turn positive next year for cash buyers, levered returns (i.e., returns for investors that require financing) are likely to remain mostly negative, albeit only modestly so. In our view, these return projections understate the value proposition of bonds. In the event of a recession, owning some low risk bonds (like US Treasuries) could serve as insurance to a broader risk asset portfolio. That said, for reasons we discuss in this report, the insurance value may not be as large as in the past few cycles, and we acknowledge that the opportunity cost of not owning fixed income isn't large outside of an imminent recession scenario—after all, cash yields are set to exceed longer duration yields in most advanced economies in the next few months, in our view.

Exhibit 1: We expect total returns from holding Treasuries to turn positive next year after significantly negative returns in 2022

Yearly total returns to holding 10y USTs, basis points running



Source: Goldman Sachs Global Investment Research

Although we are moderately constructive on fixed income over the course of the next year, we do not see an urgent case for duration longs in the near term. This is partly due the lack of an opportunity cost we highlighted above, but also because we retain a bearish bias on duration in the near term (through 1Q23). We had turned more neutral following the selloff in October, but we believe the recent decline in bonds yields, particularly after the US CPI miss, is overdone. Our projections are substantially above forwards over the next six months, and we are looking for higher peak rates than we

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

have witnessed thus far in this cycle. This is despite our expectation of a sizable moderation in inflation, largely because we think risks remain that central banks may hike to a terminal rate above what is currently priced in markets, and that they are unlikely to cut as aggressively as investors appear to be anticipating (there are exceptions like the UK, where central bank policy may be more dovish than market pricing, but in these cases, we would expect investors would require more risk premium). The higher peak rates view stems from a few underlying assumptions. First, we believe the economy is more resilient than investors fear, and will be able to withstand tightening and avoid a deep recession. Second, while as noted above, we are looking for a material decline in price pressures, there is an "easy" part of inflation coming down (from core good disinflation, for instance) and a "hard" part (tied to tightness in the labor market)—the latter will likely require central banks to remain restrictive for longer. Third, there remain some upside risks to our call for inflation moderation. As investors observe that the economies are better able to cope with higher policy rate settings, we expect they will update their current priors on the neutral rate for this cycle, which we think are still too low.

With this backdrop in mind, our themes for the coming year are as follows. **First**, although we expect central banks will largely pause (or end) their tightening campaigns next year, investors appear to be underappreciating the risk of hike cycle extension and overestimating the odds of rapid easing, both of which we think are inclined to fade. **Second**, we retain a mildly bearish duration bias going up to the point the pause becomes apparent, and then have a mildly bullish bias thereafter, as yields become attractive. **Third**, we believe we are close to an end to the large bear flattening trend we have witnessed this year, and expect yield curves will be sticky for a while before beginning to steepen materially—we would look to sell the tail featuring an extension of curve flattening. **Fourth**, inflation markets appear too sanguine on the prospects of "normalization," particularly in Europe, where the declines implied in HICP swaps are much more rapid than our economists' baseline. **Fifth**, as macro uncertainty narrows, we expect a transition to a lower rate volatility regime, particularly in the US, and look for various venues to monetize vol premium. This is despite market microstructure remaining impaired. **Sixth,** we anticipate a large increase in sovereign free float, which should result in tighter swap spreads, particularly in the front and belly in both the US and Europe. **Finally**, we believe next year will feature notable shrinkage in central bank balance sheets, contributing to increased supply to the public and a reduction in excess liquidity. This should put upward pressure on short term rates, with shifts in the relative setting of money market rates, though we do not expect the system to "break."

Our forecasts for G10 yields reflect many of the themes discussed above. Continued central bank normalization should take 10y UST and bund yields to peaks of 4.5% and 2.75% in 2Q23, before we see either a flat lining or modest decline by end-2023. Beyond our bearish bias in the early part of next year, we turn more constructive on fixed income, given the increased attractiveness both from a carry perspective and portfolio insurance value.

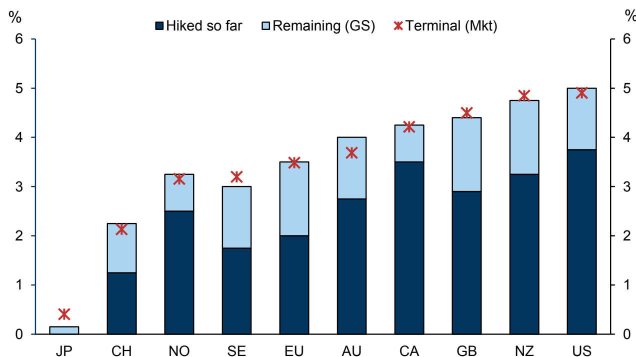
Central banks closer to the end (or a pause)

Following a year of aggressive central bank tightening, we expect growth rates across

G10 will be well below potential. In the Euro area and the UK, our economists expect an outright contraction in activity. Alongside this slow growth, there should be progress on two key fronts. The cumulative tightening of monetary policy thus far should create some slack in the labor market, and while inflation is still above most central banks' targets, it is likely to decline substantially from current elevated levels. Given the extent of tightening already seen thus far this cycle, policymakers appear to be looking for an off-ramp from the frenetic pace of hikes to a more measured approach. Indeed, smaller central banks—BoC, RBA, and Norges Bank—have already stepped down their pace of hiking, and we expect the Fed, ECB and BoE will soon follow suit. The main reason for this is that policymakers likely view their current policy rate settings as already exceeding "neutral" levels. Given the lags in observing the impact of changes in monetary policy on the economy, a slower pace would allow the central banks to better calibrate policy. From a risk management perspective, a more measured approach reduces the odds of substantial overtightening (and thereby a deeper recession). However, a step down is also likely to be accompanied by a higher terminal rate—the progress on inflation and labor markets that central bankers are looking for may not be as visible in the early part of the coming year. To be sure, markets are anticipating this to some extent, with terminal rate pricing modestly exceeding our economists' forecasts in certain regions (Exhibit 2).

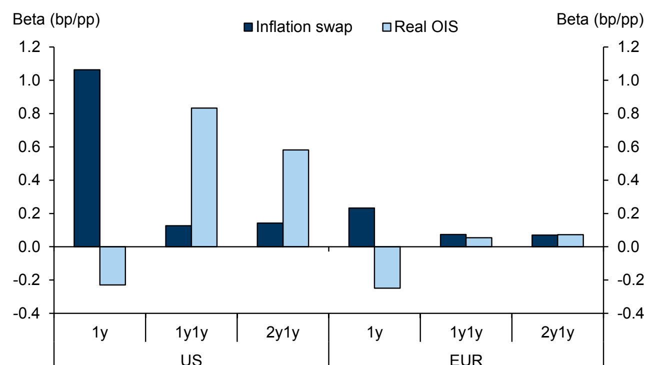
For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

Exhibit 2: Market terminal rate pricing is roughy in line with our economists' baseline projections
Cumulative hikes so far and remaing to GS policy rate peak vs peak market pricing



Source: Goldman Sachs Global Investment Research, Goldman Sachs

Exhibit 3: US real yields are more responsive to stronger-than-expected inflation data than those in the Euro area
Beta of change in US and EUR inflation and real OIS to inflation surprise on day of inflaiton release (US CPI and Germany HICP)



Source: Goldman Sachs Global Investment Research, Bloomberg

While we see cycle extension risks, we expect most G10 central banks will have at least have paused, if not ended, their hiking campaigns by the end of 1H23. The reasons why central banks may pause vary by region. In the US, the Fed may feel the need to pause given the extent of its tightening; markets are pricing a peak funds rate substantially above policymakers' neutral rate priors, and the Fed may conclude its policy stance is sufficiently restrictive to bring inflation down. That is, the Fed will likely shift to a more balanced risk management perspective, given the expected improvement in inflation. In the Euro area, a central bank pause may be influenced by concerns about debt sustainability in the periphery, and in the UK, this could be tied to the larger rate pass-through via mortgage rate resets. In both cases, and unlike for the Fed, considerations other than managing inflation risk may start to play a role.

Investors appear to be taking these different constraints and risk management considerations into account. Exhibit 3 shows the sensitivity of various forward yields to inflation surprises in the US and the Euro area this year. US real yields are more responsive to stronger-than-expected inflation data than those in the Euro area on both on a current year and a 1- and 2-year forward basis. Further, not only are US real yields more responsive than European real yields to a similar surprise, but at forward horizons, they have tended to increase by *more* than forward inflation rates (also Exhibit 3). This is not the case in Europe, where the response of both inflation and real components have been roughly similar. This suggests that investors believe that the Fed is less constrained in tightening policy to address inflation when compared to the ECB, both in terms of initial aggressiveness in tightening policy in real terms, but also in maintaining a higher real rate for longer. Looking across G10, markets where central banks are perceived as less constrained (or more hawkish), such as the Fed, the BoC, and the RBNZ, have more inversion in the forward curves than their peers. In terms of trades, we believe investors are underestimating terminal rates, and we are short March 2023 BoC OIS (see here). In the US, we think investors are simultaneously underpricing cycle extension risk as well as overestimating odds of cuts almost immediately after the peak, and therefore short SFRZ3 (December 2023 SOFR futures) contracts. On the latter trade, we note that the median time for the Fed to cut after a pause has been over seven months since the 1990s.

Global duration: Trading the peak

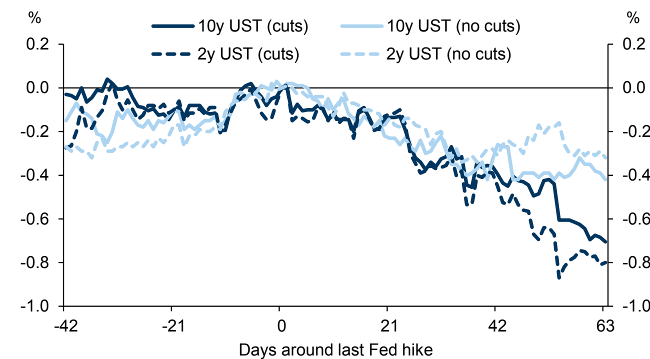
Longer maturity yields, including the benchmark 10y rates we forecast across G10, are likely to peak in the first half of 2023. Historically, interest rates have tended to hit their cycle (or local) highs when central banks have paused or ended their tightening campaign. Exhibit 4 shows the behavior of 10y UST yields around Fed pauses, which we define as the last policy rate increase not followed by further increases in the subsequent six months—this definition of pause also includes the end of a cycle. In cases where the pause was not followed by rate cuts in a short time period (this was the case for most pauses since the 1990s), the median decline in 10y yields in the following 3-month window was about 30-40bp. This is in contrast to pauses that were followed fairly quickly by Fed easing; in this case, the median decline was closer to 70bp. This difference in behavior is more clearly visible at shorter maturities—2y yields declined by roughly the same amount as 10y yields in the 'no immediate cuts' scenarios, whereas they decline 80-90bp when easing was more imminent.

The empirical observations above can be understood when looking at yields through the lens of an expectations and term premium components. We've documented previously that when the central bank is on hold, the expectation component contributes only marginally to the variation in interest rates. For yields to rise in such a scenario, term premium would have to reprice higher. Typically, however, term premium *declines* in the late stages of a cycle, both because of an increasing downside skew to risks around real rates, and falling inflation risk premium. We therefore would typically expect nominal yields to be biased lower following a central bank pause. However, we see reasons for caution in extrapolating these assumptions to this cycle. In particular, if central banks pause because of other constraints before it is clear inflation is firmly under control,

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

term premia may remain elevated, either because investors anticipate reasonable odds of a resumption in hikes, or because they may require more compensation for inflation risk. Of course, if the pause is the result of clear progress on inflation, we could see the more typical reaction, i.e., a decline in yields. There could be some differentiation between regions here. We think Euro area and UK yields could fall in the former category whereas the US may be closer to the latter, arguing for further compression of forward yield spreads between the regions. Specifically, because of ECB and BoE constraints—fragmentation risk for the former, and consumers' elevated interest rate sensitivity for the latter—may limit the rise in real yields, much of this compression is likely to be driven by the inflation component (discussed in a later section). This would also mean that European yields will likely decline at a slower pace than US yields following their respective central bank pauses.

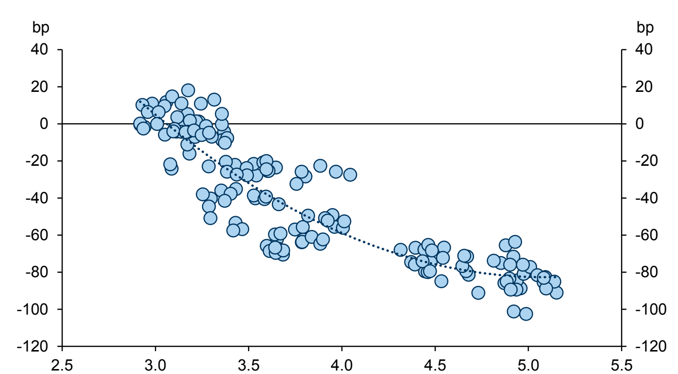
Exhibit 4: Yields tend to decline more significantly when a Fed pause is followed relatively quickly by rate cuts
Median change in 2y and 10y UST yields, indexed to final pre-pause Fed hike*, conditioned on whether cuts occur within a 6m window



*pause defined as last of a series of hikes, with no additional hikes in the subsequent six months

Source: Goldman Sachs Global Investment Research, Haver Analytics

Exhibit 5: The US curve has become stickier even as the terminal rate has repriced higher
USD 2s10s OIS vs terminal rate



Source: Goldman Sachs Global Investment Research, Goldman Sachs

In terms of levels, we expect 10y UST and bund yields will peak at 4.5% and 2.75% respectively, both in the first half of next year. There are two reasons we believe benchmark yields are likely to head higher even though the market pricing of terminal rates in already mostly in line with our baseline projections. First, we believe market pricing of 5y5y yields has further upside in some regions. We have previously argued (in the context of the US) that investors appear to be placing too much weight on Fed projections and recent history when forming their beliefs on the "long run" rate, and that this might be leading them to underprice the short run neutral rate for this cycle. We've noted that investors will likely update these low priors as central banks ratchet up the policy rate beyond the perceived neutral rate—to the extent that we use 5y5y yields as a proxy for the neutral rate, we already observe this happening both in the US and Euro area. Second, we think the easing priced for next year will dissipate at least partially, lifting front-end yields.

Specific to Europe, there are three key reasons why we believe Bund yields will settle higher in the first half of next year. First, by our forecasts inflation is yet to peak, and we expect inflation to realize somewhat higher than what's implied by current market pricing. The stickiness of European inflation suggests that not only will European traded

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

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

inflation settle higher (see inflation section), but so will the inflation risk premium, contributing to a higher term premium in European rates. Second, we expect German fiscal policy to cushion the supply shock, with €125bn of net issuance in 2023 (€110bn via bonds). Tightness in European energy markets is likely for more than just the coming winter, and as a result we expect to see consistent pressure for fiscal policy to subsidize the economy until an eventual supply side adjustment occurs. Finally, we expect the ECB's balance sheet policy—both through incentivizing TLTRO repayments, and via passive runoff of the PSPP portfolio—to cheapen Bunds both on an absolute and relative basis. Taken in aggregate, we think the outlook supports being short Bunds outright. In the UK, meanwhile, we expect investors to also require additional compensation for inflation risk despite a clear intention by fiscal authorities to consolidate debt in upcoming years. Net issuance remains elevated and BoE QT is the most aggressive among the G3, in it provides duration supply to the private sector directly (see QT section). With the BoE a 'reluctant hiker', and with inflation continuing to surprise to the upside we expect 10y Gilts at 4% in Q1 2023.

There are two sources of upside risks in our projections. First, a renewed acceleration of energy and other commodity prices could result in either central bank cycle extension or the pricing of more inflation risk premium, adding pressure to long end rates. Second, a disorderly BoJ exit from YCC could, at least in the short run, lead to a readjustment higher in global yields. Our economists' baseline is that the BoJ will stick with YCC even after Governor Kuroda's term expires in early 2Q23, but more inflation persistence and a pick-up in longer dated inflation pricing could raise the risk of a disorderly exit. That said, spillovers may not be as large as feared—after all, JGB maturities greater than 10 years have cheapened materially, while 10y JPY OIS yields are substantially above the BoJ's 25bp upper band on 10y JGB yields, and closer to our fair value estimate. Said differently, markets appear to be already anticipating a YCC exit, even if the timing remains highly uncertain. The main downside risk to our projections is a broader (and potentially deeper) recessionary outlook.

Overall, while we see reasons for investors with longer horizons turning constructive on duration, we have a short bias over the next few months. In addition to our existing bund short, we recommend taking advantage of the better entry point afforded by the recent rally by adding 5y5y OIS shorts in the US.

From a flattening to a steepening bias

Yield curves have flattened globally through this year as policymakers have front-loaded hikes, and in many cases, are close to or at multi-decade lows. Inversion is more pronounced in some regions, like the US and Canada, though we do not view this as an indication of greater recession prospects in these regions, but rather a reflection of investors' assessment that central banks are less constrained in adopting a restrictive stance. Indeed, both the Euro area and the UK may already be in recession, yet curves have not inverted to the same extent even though the ECB and BoE continue to hike. Although, as noted earlier, there is a risk of cycle extension, we believe the bear flattening trend observed in many regions this year has likely run its course. The main reason for this is the downshift in the pace of hiking, which we have argued reduces the likelihood of deeper inversion. Looking ahead, we anticipate differentiation in curve

behavior by region.

In the US, a continuation of Fed hikes in the early part of the year should see yield curves move up in a relatively parallel fashion—i.e., yield curves are likely to become sticky even as the level of rates increases. We see some empirical evidence of this already (Exhibit 5). As discussed earlier, a slower cycle should give investors time to observe the impact of tightening and update their priors on the short-run neutral rate, keeping the betas between intermediate forwards and front end rates elevated. We expect this behavior to persist until the Fed pauses. Beyond that point, we believe yield curves will begin steepen on a more sustained basis. However, the extent of steepening is likely to depend on the outlook for the economy and Fed policy. If the economy is showing signs of a sharp deceleration, we would expect a more rapid bull steepening of the curve, although we would temper expectations for the magnitude of this steepening. This is because, given the recent experience with inflation, the Fed may not be willing to cut as aggressively in the face of a growth slowdown as it has been in the past few decades. Historically, the 2s10s curve has traded with a roughly 0.4-0.5 beta to the magnitude of cumulative easing; using that rule of thumb, we should expect only 60-100bp of steepening from 150-200bp of cuts. Of course, in the event the economy is holding up following a Fed pause, markets may begin to price out (or push out) cuts, which would lower the likelihood of material steepening. Indeed, the 2s10s curve has historically traded sideways in the months following a Fed pause when economic conditions did not lead investors to also anticipate imminent cuts. In our baseline view that the economy avoids recession, outright steepeners aren't particularly appealing, though given elevated risks of a recession, our forecast shows some amount of curve steepening. However, the probability-weighted steepening we expect isn't large compared to that already priced—forward 2s10s OIS curve already implies about 60bp of steepening over the next year. Therefore, rather than outright steepeners in the US, we have thus far preferred selling shorter expiry curve floors (where elevated volatility provides an additional buffer), though we would expect to potentially transition to an outright steepener next year depending on how conditions evolve.

In Europe, the exit from negative rates and the partial unwinding of QE (that for many investors believed to be permanent) complicates the outlook for curve shape. 2s10s Bunds and €STR curves have inverted, largely due to the substantial duration rally of recent weeks. As above, we think that the fundamental drivers of inflation, fiscal policy and monetary policy are likely to exert ongoing upward pressure to yields, particularly at the long-end. This may lead to steepening in the European curve as term premium rebuilds. If we benchmark curve shape against cyclical variables using our cyclical curve model, including measures of slack, the difference between policy and neutral rates, and the distance of inflation to target, we find the current flatness of the curve is broadly fair to the cyclical macro data. But one important source of uncertainty, for investors and policymakers alike, is the appropriate neutral rate assumption. Using the same framework, a 100bp upward shift in the perceived neutral rate would suggest 40bp of 2s10s steepening. Given that we expect a relatively mild recession in Europe alongside sticky and broad inflation pressure, we think market views of neutral are likely to move higher as the ECB approach terminal rates. For this reason, we aim off our cyclical curve model and expect a modest steepening of core EUR curves. We think Bunds yields

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

trade (in market forwards) far too low relative to our—and the market's—expectations of policy rates.

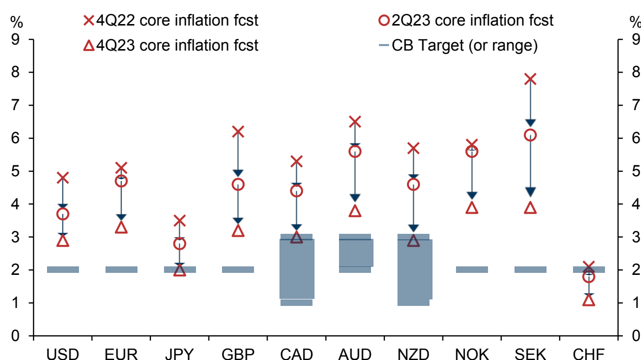
In the UK, we think that on net, the risk of BoE under-delivery on the rate front and elevated Gilt supply point to a curve steepening. Lower energy prices, leading to lower issuance, and front-end swap spread tightening are risks to our cash curve steepening view (see spread section). Finally, in the case of Japan, we note that the BoJ persisting with YCC will mean continued steepening pressure at the long end, at least through the early part of next year, despite already record steep levels.

European traded inflation set to exceed the US

US and Euro area inflation markets currently imply inflation of 6.7% and 10.3% in 2022 respectively, well above the 3% and 2.2% inflation markets had implied at the start of the year. Despite much higher realized inflation, aggressive central bank tightening has helped to keep intermediate forwards comparatively well-behaved—5y5y US inflation swaps are virtually unchanged on the year, while 5y5y HICP swaps are only 35-40bp higher.

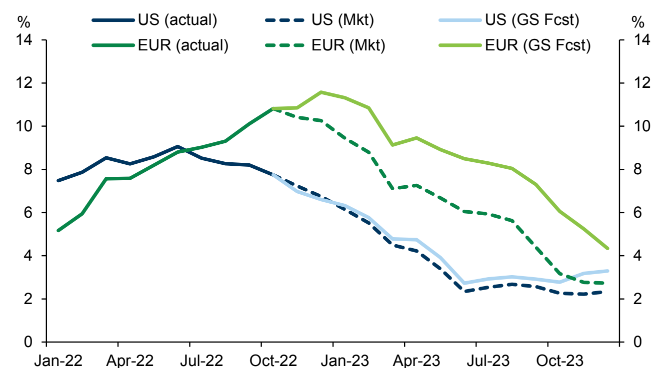
For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

Exhibit 6: Our economists expect broadly lower core inflation across G10 next year, albeit with varying magnitudes and timelines
GS G10 y/y core inflation forecasts vs central bank target



Source: Goldman Sachs Global Investment Research

Exhibit 7: Euro area HICP swaps imply a far more rapid moderation than our economists' projections, unlike the US, where the two are roughyl similar
Market-implied vs GS forecast y/y inflation path



Source: Goldman Sachs Global Investment Research, Goldman Sachs

Having hit multi-decade highs across most of G10 this year, our economists expect inflation will normalize towards more target-consistent levels in next year (Exhibit 6). Differences in the pace and timing of the expected moderation and central banks' risk management considerations will be central to the evolution of traded inflation across markets.

The US inflation market is anticipating a material and sustained deceleration in inflation that roughly resembles our economists' projections. An important development of late is the potential step down in the pace of hiking. We've argued that a slower pace diminishes the risks of substantial overtightening, which can allow for some rebuilding of inflation risk premium even as the underlying inflation trend softens; empirically, intermediate inflation has been somewhat counter-directional with front-end rate vol. While risks are that spot inflation proves somewhat stickier-than-expected, which could translate to modest upside, the Fed's focus on seeing inflation return to target means it

would likely also result in an extension to Fed tightening, which should ultimately keep traded inflation broadly in check. Overall, this leaves us with a relatively range-bound view on US traded inflation, though we see some scope for outperformance of 10s on the breakeven curve as the point trades cheap to the long-end given the level of breakevens.

We see several reasons for a more bullish inflation assessment of traded inflation in Europe. First, like the Fed, the ECB has signaled an inclination to slow the pace of hikes, even though spot inflation is likely to remain elevated for a while. Second, in contrast the relative alignment of the market and our economists' inflation profile in the US, the HICP market is implying a much swifter softening in inflation than they anticipate, pricing 6.1% by the middle of 2023 versus our economists' forecast of 8.5% (Exhibit 7). Admittedly our forecasts imply a softer path than the market in 2024, but we believe the combination of a firmer spot trajectory coupled with a slower pace of ECB tightening to be more impactful for markets next year, with HICP forwards exhibiting modest directionality with underlying inflation (whereas for the US, that has been largely absent). To be sure, ECB commentary has been hawkish on inflation, but the bank faces greater constraints on its ability to tighten, and is contending with greater supply-side challenges alongside broadening pressures from a tight labor market. Energy price caps will exert downward pressure on headline inflation in the near-term, but also argue for more support to core inflation and a more gradual softening. A stickier-than -expected inflation backdrop against which the ECB nonetheless slows its pace of tightening is more likely, in our view, to justify somewhat higher inflation risk premia. Given the above, we recommend going long 5y HICP swaps versus US CPI swaps.

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

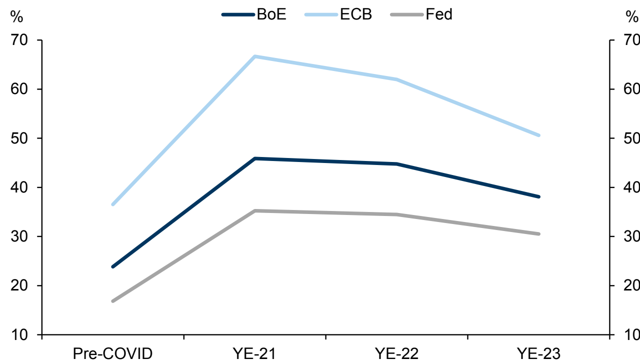
Quantitative tightening to extend past hiking cycles

Most G10 central banks have wound down their asset purchase programs this year. In some regions, they have transitioned relatively quickly into quantitative tightening (QT), whereas in others, the runoff process looks poised to begin next year. As QT shifts the burden towards private buyers, we expect sovereign bond free float to rise. The loss of a backstop buyer should keep liquidity conditions poor, leaving already challenged market functioning vulnerable. This backdrop should also result in tighter swap spreads and higher funding costs. Differences in approaches to QT implementation and fiscal authorities' issuance decisions have varying market implications; we discuss these in the volatility, supply and spreads, and money markets sections below. Exhibit 8 summarizes our expectations for changes in Fed, ECB, and BoE balance sheet size over the next year.

In the US, our baseline is that Fed QT continues in its current form, with $60bn and $35bn monthly caps on Treasury and MBS runoff respectively. While the Treasury caps will be hit reliably through next year, organic MBS runoff will likely be below the caps—we expect the Fed's balance sheet to shrink by around $1tn next year. Ongoing QT should keep market functioning impaired, and dislocations along the Treasury curve are likely to persist, though a less volatile macro environment and/or implementation of Treasury buybacks could alleviate this somewhat. On the liability side of the Fed's balance sheet, we expect RRP balances will begin to decline more noticeably early next year, unlike this year, where reserves losses have dominated. Risks around TGA

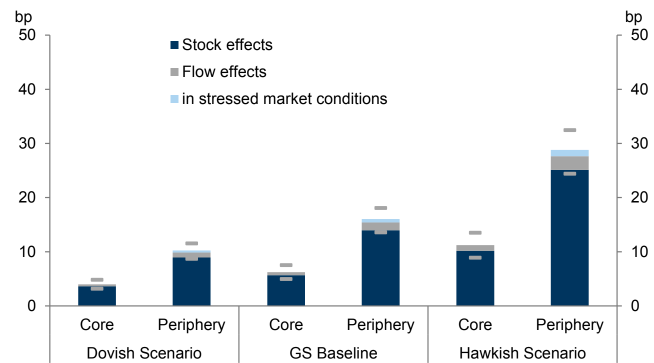
(Treasury could opt for lower levels and be forced to run down its cash balances in the event of a protracted debt limit standoff) and the Fed's recording of negative net income should act as partial offsets to reserve drain. Overall, we do not expect QT will lower reserves to the point of scarcity in the next year.

Exhibit 8: Our expectations for QT imply a material reduction in central bank balance sheet sizes next year
BoE, ECB and Fed balance sheet as % of nominal GDP with YE22 and YE23 projections



Source: Goldman Sachs Global Investment Research, BoE, ECB, Federal Reserve

Exhibit 9: In our baseline, ECB QT next year should push 10y Bund yield about 10bp higher, all else equal
QT impact on 10y core and peripheral yields in various scenarios



Source: Goldman Sachs Global Investment Research

In Europe, our economists expect QT to be announced in 1Q23 for a start in 2Q23 via passive run-off of the PSPP portfolio. We expect that the ECB will continue to reinvest the PEPP portfolio (until end-2024 as per current guidance), and retain the option to use those PEPP reinvestments flexibly to help contain risks to sovereign credit. Taken together, we estimate that the ECB's sovereign bond portfolio will shrink by about €150-200bn over 2023 out of a possible €250bn (given the possibility of monthly caps) including a roughly €50bn decline in holdings of German bonds. By our analysis, this is likely to be worth around 10bp higher in 10y Bund yields (Exhibit 9). On the sovereign credit side, our estimates suggest that the bearish impulse from QT is likely to be both stronger and more uncertain in periphery yields (see more detail on the sovereign spreads section). However, if we include the potential capacity to direct PEPP reinvestments from the core to the periphery (as we estimate happened during the summer), this "Bund-centric" version of QT could be worth up to 20bp higher in Bund yields without a major widening impact on sovereign credit. With the ECB moving away from forward guidance, we expect the 'rate signaling' effect of QT to be limited, but we think it will coincide with a downshift in the pace of hikes in any case. It is worth noting that QT will come in the wake of a sharp reduction in ECB balance sheet, TLTRO loan repayments will be a far bigger driver of balance sheet shrinkage next year (more in the money markets section below).

In the UK, one consequence of the recent volatility in Gilt markets, followed by the BoE's emergency Gilt purchases, is likely to be a slightly more cautious approach to the BoE's QT plans. An illustration is that asset sales—for Q4 2022 at least—have been limited to sub-20y maturity Gilts. However, BoE communication suggests a relatively firm intention to press ahead with a £80bn reduction (roughly half of which via active sales) in the stock of Gilt holdings over the coming 12 months in spite of recent volatility. Whether and how much of the recent £19bn financial stability operations will

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

be unwound is also unclear, though the MPC has started the process, initially "demand-led" (i.e., without preset reverse auction size); long-end sales will depend on well-behaved market functioning. We expect asset sales, alongside ongoing issuance needs and high inflation, to contribute to higher term premium across the UK curve. At the front end, as QT ease tensions in UK repo markets, we believe gilt yields will underperform vs swaps, alleviating the current dislocation in 2y Gilt swap spreads.

Transitioning to a lower rate volatility regime

Although we believe interest rates have not yet peaked, we see reasons for optimism that conditions supporting a sustained downshift in rate vol may be falling into place, beginning with a step down in the pace of hiking across G10. Ongoing quantitative tightening, recession concerns, and continued risk of external spillovers are potential sources of risk to our rates vol view.

Implied rate vol has already pulled back materially from cycle highs seen in early October across US, Euro area, and UK rates markets, as daily yield swings have moderated from the extremes seen following the release of the UK budget and subsequent market breakdown. We see two reasons that volatility could continue lower. First, a slower pace lowers the right tail around how high rates could plausibly rise in the near-term, while also compressing the left-tail on diminished risks of overtightening—this should be most relevant to the front end. Second, the anticipation (and eventual realization) of a pause in the hiking cycle should significantly reduce volatility of the expectations component of yields, leaving term premia component the bigger diver of rates volatility.

The case for a sustained reduction in rate vol is strongest in the US, where upper left vol has been noticeably directional with front-end curve steepness (Exhibit 10). Fed officials have made the case for slowing down the pace of hikes irrespective of how data evolve, and the October CPI print has on the margin strengthened the case for a more gradual path moving forward. As discussed earlier, the ECB appears similarly inclined to slow the pace, even though it has not yet gotten the same sort of support from declines in spot inflation, perhaps because it faces more constraints on policy tightening. This means that there is more scope for (inflation) risk premia fluctuations in the Euro area. The BoE, for its part, has been a reluctant hiker, though admittedly, the recent reversal of previously announced fiscally expansionary measures to modest fiscal consolidation has lowered the need to hike aggressively. The combination of Fed facing fewer constraints, its signaling on the pace of hikes, and recent inflation news should, in our view, see US vol moderate on both an outright and on a relative basis versus European and UK rates vol. Recession, or a more acute deterioration in activity data that necessitates substantial policy easing (beyond the inversion already priced into the forward curve), is a risk to this view. However, we do not see these risks materializing in the near term, and have recommended selling 6m2y USD receivers to take advantage of the elevated level of vol, in addition to positioning for higher shorter term yields.

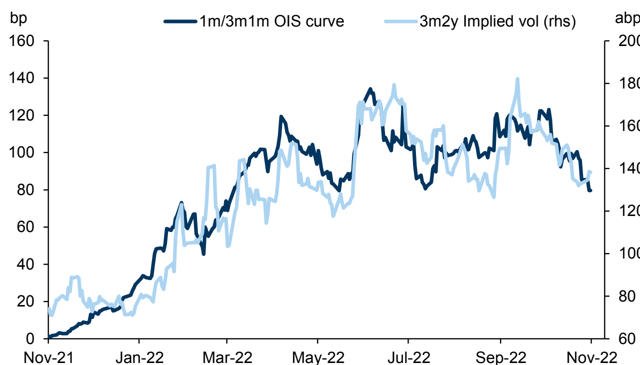
A transition to a world where the rate path is a reduced source of volatility may make it more possible to monetize vol premium on an unhedged basis as large, durable yield trends fade. However, balance sheet policy means that market microstructure fragility is

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

likely to keep daily realized volatility somewhat elevated, with a higher level of vol on average (and wider range of implied vol levels) in lower liquidity environments (Exhibit 11). While the BoE's intervention in October and subsequent adjustments to asset sales indicated that the central bank backstop exists in times of heightened stress, it is also notable that the response occurred on a temporary and reactive basis. Ongoing QT means that improvement in market liquidity from currently impaired levels is unlikely, and a reduction in rate volatility will have to come from a change in fundamentals. Active sales (as is the case for the BoE) present a greater source of risk than the more passive approach the Fed is taking (and that we expect from the ECB).

Exhibit 10: Upper left US vol has been fairly directional with the slope of front-end pricing, suggesting scope for further moderation as hikes slow

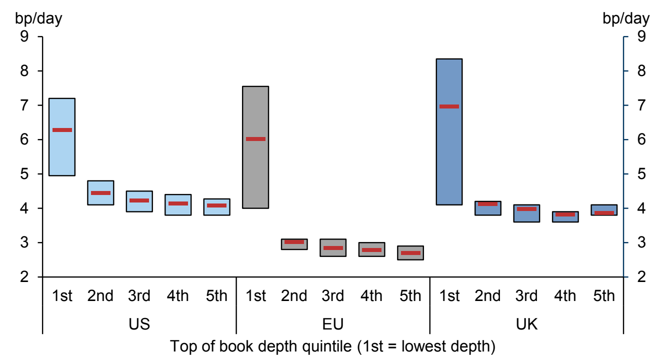
1m/3m1m OIS curve slope vs 3m2y USD implied vol



Source: Goldman Sachs Global Investment Research

Exhibit 11: Lower levels of market depth are associated with a higher average level of rate vol and wider distribution of vol levels

Interquartile range and average of 1y10y implied vol by quintile of top of book market depth



Source: Goldman Sachs Global Investment Research

Finally, we note that there are limits to how much domestic factors alone can lower vol without similar shifts abroad. Lower domestic uncertainty but ongoing foreign spillovers would likely keep volatility elevated in intermediate and longer maturities, where term premia spillovers are more pronounced, supporting steeper tail curves (a shift away from the inversion that defined tail curves in 2022). In addition to somewhat more persistent volatility in Euro area and UK rates, an adjustment in BoJ YCC policy would at least temporarily boost global rates vol. We think this warrants pairing higher conviction vol shorts (in the US) with longs elsewhere (Europe).

One part of the USD vol surface where we are somewhat more constructive is on long expiry vol on longer tails. At current rate levels, we expect little-to-no Formosa call activity, and therefore limited new long-dated callable supply. Vega supply from this issuance had weighed on "deep vega" in both 2020 and 2021, but has abated through the course of this year, and should remain low under our rate forecasts. Meanwhile, recent behavior suggests a shift in hedging dynamics, as long-end expiry curves have exhibited a more positive correlation with higher yields. We think an explanation for this may be that dealer Bermudan books have extended sufficiently that they are losing vega in further selloffs, resulting in net vol demand on higher rates. Given our baseline that yields across the curve can move somewhat higher early next year, we expect both supply and hedging dynamics ought to support long-dated long-end USD vol on a relative basis.

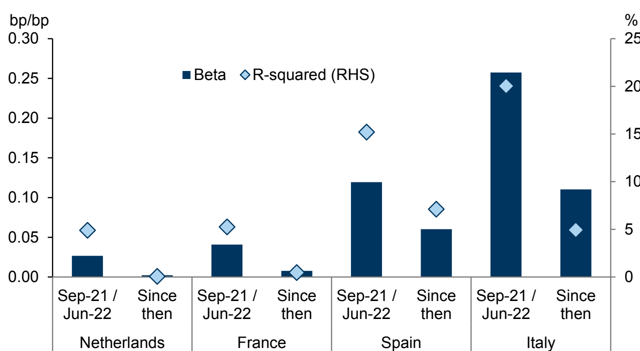
For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

Wider European Sovereign spreads

The repricing wider in sovereign spreads YTD has generally tracked the repricing of duration, with spreads generally widening according to their beta to Bund yields. (see here for example). However, despite our expectations that the terminal rate will be reached in 1H23, we think there is room for spread widening throughout the year. As Exhibit 12 shows, the impact and explanatory power of changes in 1y1y ESTR for spreads has already declined notably since the summer. In part, this is due to the ECB's TPI announcement which, alongside the use of PEPP reinvestment flexibility in the summer, likely insulated sovereign credit markets from a sharper widening. However, as ECB policy increasingly focuses on reducing demand - including from government spending - via both higher policy rates and a smaller balance sheet, we expect spreads to widen alongside the rise in core rates we expect into Q1 2023.

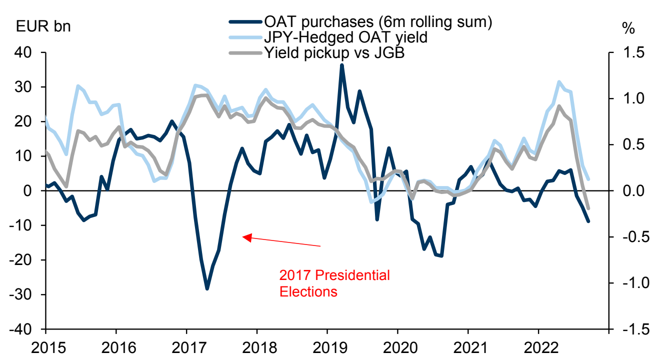
Exhibit 12: Policy rate expectations are losing their power in explaining sovereign spreads

Regression of sovereign spreads on 1y1y ESTR



Source: Goldman Sachs, Goldman Sachs Global Investment Research

Exhibit 13: Japanese buying of OATs is sensitive to hedging costs, political risk



Source: Goldman Sachs, Goldman Sachs Global Investment Research

This year has shown that a high inflation environment can provide a tailwind for sovereign credit. Government revenues are high across the Euro area, and despite significant monetary policy tightening, spot real yields still remain low. However, with current and subsequent winters likely to require recurrent fiscal support, and with ECB QT an imminent headwind for sovereign bonds, we expect sovereign spreads to widen from current tights. Ahead of the September ECB meeting, the median expectation of analysts surveyed by the ECB was for QT to start in Dec-24, whereas ahead of October ECB meeting that expectation had shifted to Jun-23[1], with an expected balance sheet reduction of €70bn in 2023. Our expectations of €150-200bn balance sheet reduction over next year suggest Italian credit spread widening of 20-30bp. Though the ECB's anti-fragmentation plan should help in mitigating risks, we believe this policy backdrop, in a year of ample financing (and re-financing) needs, will see BTP-Bunds trading 230bp in Q1, alongside our Bund forecasts of 2.75%.

As we move through the winter, we see the possibility that as the deep recession tail is priced out, which could be a source of further tactical relief to sovereign spreads. However, the lasting growth effects of the energy price squeeze and the shift in market

[1] The 25th percentile (most hawkish) expected QT to start in Dec-23 ahead of the Sep ECB meeting, against Apr-23 ahead of the Oct ECB meeting

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

focus to a more hawkish ECB—including via balance sheet tightening—will likely mean this relief is short-lived. This combination of higher core yields and ECB QT, alongside elevated fiscal needs, is likely to see sovereign spreads widen as we reach the peak in policy rates.

Country-wise, high reliance on gas suggest the growth outlook is most at risk in German and Italy. France is less dependent on gas, but a comparatively much slower debt consolidation beyond 2023, especially when combined with the potential for political gridlock, present risks to OATs. Another headwind for semi-core debt is low foreign demand for European fixed income securities, in particular from Japanese investors given rising FX-hedging costs (Exhibit 13). In that set-up, Spain is a relative bright spot against EMU-4 given its more friendly energy profile and less narrow fiscal path. Similarly, Portugal screens particularly well on energy front, and European Commission forecasts show a clear outperformance against Italy and Spain, in both growth and fiscal fundamentals. Though we take note of the challenging liquidity in Portuguese debt, we see scope for ongoing compression in PGBs vs Bonos. Our end-23 targets for 10y OAT-bunds, BTP-bunds, and Bonos bunds are at 65bp, 260bp, and 130bp.

More free float, and tighter swap spreads

The evolution of central bank balance sheets will be an important factor in determining sovereign bond supply to the public next year. Quantitative tightening will mean more net supply to the market across the US, Euro area, and UK, and bias towards tighter swap spreads. The supply swing is likely to be somewhat larger in Germany and the UK compared to the US despite a more rapid runoff in the US, on account of differences in issuance needs (and strategies; Exhibit 14). Consequently, we expect bund and gilt spreads to tighten versus UST spreads, where belly and long-end swap spreads look comparatively cheap. We also like spread curve steepening exposures across the G3, but see important nuances in the underlying drivers. In European markets, we expect the move steeper to be more clearly front-end led, as increasing availability of short-term securities improve monetary policy transmission, while in the US, both the front-end and long end could participate.

In the US, this year saw the two ends of the spread curve diverge—shorter term Treasuries were well-supported while long-end swap spreads tightened significantly, pushing the spread curve to historic extremes (Exhibit 15). For the front-end, the backdrop of constrained bill supply saw bill yields trade rich versus OIS and buoyed shorter coupon spreads as well. Meanwhile, despite evidence from stripping activity of building structural demand potentially related to pension de-risking, the poor liquidity environment amid rising yields manifested in weakness of long-end spreads. The belly of the curve was caught somewhere in between, but appears to have outperformed underlying drivers (where the long-end spreads underperformed)—there is some evidence of short-gamma behavior in the belly versus long-gamma dynamics at the long-end that may have played a role, leaving belly spreads directional and long-end spreads counter-directional with the move higher in yields.

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

Exhibit 14: Supply forecasts for 2023, local currency

Supply Forecasts, Calendar Year 2023, Local Currency	Net Issuance (Gross-Redemptions)		Central Bank Flows		Net Supply Available to Public	
	2022	2023	2022	2023	2022	2023
US, $bn	**1409**	**1309**	**-205**	**-723**	**1614**	**2032**
Excluding bills	*1274*	*269*	*-168*	*-649*	*1442*	*918*
Euro Area, €bn	**500**	**529**	**211**	**-187**	**289**	**716**
European Union	*108*	*105*	*24*	*-20*	*84*	*125*
Germany	*93*	*110*	*46*	*-48*	*46*	*158*
France	*114*	*114*	*34*	*-37*	*80*	*150*
Italy	*45*	*64*	*47*	*-31*	*-2*	*95*
Spain	*91*	*53*	*30*	*-22*	*61*	*75*
Netherlands	*11*	*27*	*6*	*-11*	*5*	*38*
Belgium	*14*	*34*	*7*	*-7*	*7*	*40*
Austria	*15*	*13*	*8*	*-5*	*7*	*19*
Portugal	*2*	*3*	*5*	*-4*	*-3*	*7*
Finland	*7*	*7*	*3*	*-3*	*5*	*10*
UK, £ bn	**36**	**174**	**-24**	**-85**	**60**	**259**
Japan, ¥ tn	**33**	**25**	**25**	**15**	**8**	**10**
Excluding bills	*43*	*35*	*30*	*20*	*13*	*15*

** 1) Issuance projections have been estimated from projected deficit (GS estimates, Treasury DMOs or European Commission forecasts) and outstanding LT debt maturing including FX bonds.*
Net issuance figures for Euro Area countries include non-central government debt issuance

Source: Goldman Sachs Global Investment Research, Haver Analytics

A number of these factors should reverse in 2023, helping to drive UST spread curves steeper. First, we expect a significant increase in T-bill supply over the coming year or so—about $1tn on net in 2023, which should see the bill share of USTs outstanding rise from the bottom towards the top end of Treasury's 15-20% target range, thereby alleviating the richness visible at the front-end of the curve. Although Treasury could consider reversing a portion of the nominal auction cuts from the last year, we don't expect that to be necessary until late 2023. This should limit the supply impact for the long-end, where we think there is scope for further de-risking demand, while a less negative risk asset backdrop could see rebalancing support re-emerge. Additionally, the bond selloff that has contributed to long-end spread cheapening will likely have come to an end. Given this outlook and current valuations, we have recommended 2s30s swap spread curve steepeners; we see scope for 15bp of cheapening in 2y spreads, 10bp in the belly of the curve, and relatively range-bound (to modestly wider) long-end spreads in 2023.

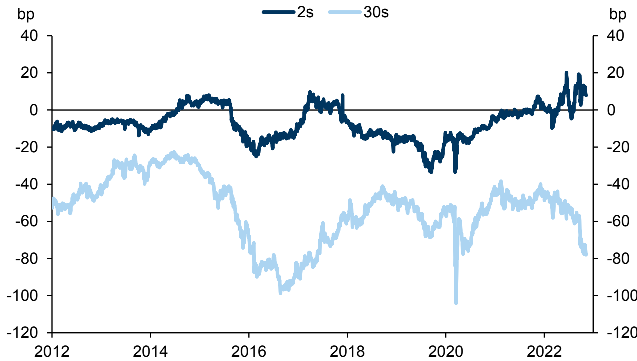
In Europe, with a likely recession in 1H23, our economists expect Euro area governments to extend most of the energy-related fiscal spending measures well into next year. Volatility in gas prices creates uncertainty around our estimates, but we expect issuance needs to remain elevated across the major European economies (Exhibit 16). As the ECB wound down its asset purchases this year, net bond supply to the private sector turned positive for the first time since the pandemic. This is only set to increase further as the ECB, per our forecast, activates QT in 2023. With the bank likely to retain PEPP reinvestment flexibility and the TPI designed to support peripheral bond markets, we think that QT will initially impact core markets as much as the periphery. We expect Bund yields to reach their peak in early 2023 alongside a maturing

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

ECB hike cycle, but peripheral spreads to remain under pressure throughout 2023 as the scale of the refinancing needs come into focus.

Exhibit 15: The contrasting in performance between well supported front-end Treasury spreads and the long-end saw the spread curve invert to historic extremes

2y and 30y UST-OIS swap spreads



Source: Goldman Sachs, Goldman Sachs Global Investment Research

Exhibit 16: Issuance needs are fairly elevated in Europe next year

Net bond supply as a share of GDP

Source: Haver Analytics, European Commission, Goldman Sachs Global Investment Research

Beyond the rise in Bund yields, we also expect Bunds to cheapen vs swaps through next year. German fiscal spending is set to remain high as the economy faces at least two winters of elevated energy prices. At the same time, ECB balance sheet policy is increasingly geared to raise German borrowing costs: i) QT, discussed above, is likely to weigh on duration broadly, ii) incentivizing TLTRO repayments (discussed below) should help lower excess liquidity and thus demand for cash-like instruments like front-end Germany, and iii) increased capacity in the ECB's securities lending program over year-end should provide a backstop against swap spread widening. That being said, we believe that after the recent sharp tightening, the repricing going forward is likely to be more gradual. One source of uncertainty remains European banks' hedging needs via swaps. Recent ECB analysis suggests these flows have peaked and are abating, but until the policy rate is decisively near terminal, these flows will likely remain a factor slowing the tightening of spreads.

In the UK, the multi-year fiscal outlook is now much more restrictive than other G10 peers. However, much of the planned fiscal tightening is likely only after the next election, and in the near term, government support for the economy via the Energy Price Guarantee remains substantial. Combined with a BoE intent on reducing the size of its balance sheet, including with £40bn of active sales over the next twelve months, the UK faces a historic rise in net supply to the private sector. Short maturity Gilts are among the richest vs swap rates globally, with 2y OIS–Gilt spreads reaching 140bp, in part due to the high ownership share of the BoE of sub-10y maturities. BoE asset sales for Q4 are skewed to shorter maturities, which alongside ongoing issuance needs should alleviate the scarcity of front-end gilts. With domestic and global catalysts for a front-end led swap spreads tightening in the UK, we recommend shorting 2y Gilt spreads.

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

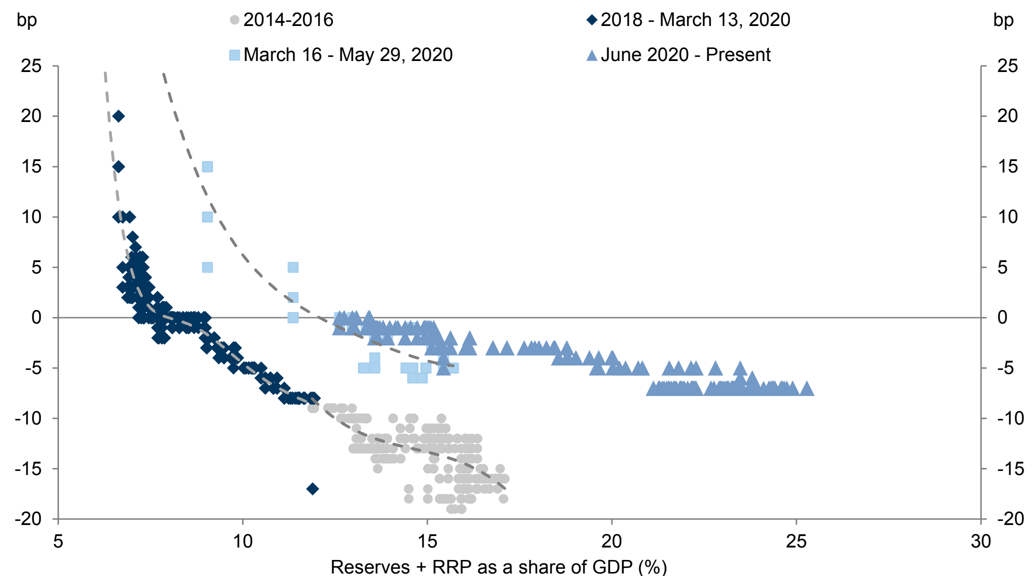
For the exclusive use of ANGELA.GAMMINO@COMMUNITYGROUP.IT

Money Markets in 2023

The effects of quantitative tightening will feature prominently in the evolution of money market rates next year. In the US, while reserves have dropped about $860bn versus just a $131bn decline in the overall balance sheet size year-to-date, we expect QT to increasingly manifest in lower RRP balances in 2023. That shift in the composition of runoff reflects an evolution of the factors that contributed to reserve declines in the first place. First, the increase in Treasury bill supply discussed previously should alleviate front-end collateral scarcity that had driven both short term paper and secured funding costs meaningfully richer over the last year. Our expectation for $1tn in net bill supply in 2023 is consistent with material cheapening of bills versus OIS, taking bill yields towards flat to OIS (from ~20bp through currently). That should in turn draw money fund balances at the RRP facility back into bills. Over the past year (October 2021 to October 2022), MMF Treasury holdings have fallen from 37% to 24% of AUM, while repo exposure had risen from 36% to 48%, largely reflecting increased RRP usage. Second, given the shrinking of bank deposits and scale of the decline in reserves, it is likely that banks start to compete somewhat more via higher rates either to retain deposits and/or attract more wholesale (repo) funding. Thus far, bank deposit rates, in aggregate, have been slow to adjust and TGCR currently 3-5bp below the RRP offer rate.

Exhibit 17: The drop in total excess liquidity should translate to a gradual drift higher in fed funds relative to IOER over the coming year

Fed funds effective spread to IOER versus reserves + RRP as a share of GDP



Source: Goldman Sachs Global Investment Research, Federal Reserve

Relative to end-October levels, we expect balance sheet runoff and shifts in other Fed liabilities to correspond to a combined drop of $1.25bn in combined reserves and reverse repo balances with the Fed by year-end 2023, with about $500bn coming from reserves, and the remaining $750bn coming from lower RRP balances. It is the combined decline that we think ultimately matters most for where the effective rate sets (Exhibit 17), with our expectation consistent with a roughly 4bp drift higher in the effective rate versus IOER. The liquidity drain also implies cheapening of SOFR vs fed

funds, with the added impact of rising bill supply likely sufficient to see SOFR converge to (or slightly above) the fed effective rate by late next year. Given market pricing for a much more gradual convergence, we continue to favor 6m1y SOFR/FF basis tighteners.

Potential sources of risk to our outlook are a protracted debt limit standoff, which would at once temporarily curb bill supply and slow the process of liquidity draining as Treasury runs down its cash balance. Though a more modest effect, an extension of Fed rate hikes increases the headwind to Fed net income, raising the value of the deferred asset and boosting other liabilities. Finally, money fund reform proposals could see increased liquidity requirements and the introduction of swing pricing to prime money funds (the goal of which would be to pass through costs of redemption and the potential adverse effects on market liquidity). To the extent that results in a rotation out of prime funds, and migration into government funds, it would likely dampen some of the upward pressure on repo rates and bill yields we currently anticipate.

In Europe, the key driver for money markets is likely to be a decline in excess liquidity as the ECB shrinks its balance sheet following its extraordinary pandemic-era stimulus (Exhibit 18). The two biggest sources of this liquidity drain will be:

1. TLTRO repayments, which amounted to €296bn in November, incentivized by the ECB's adjustment of TLTRO terms. TLTRO loans due by June 2023 are €1.1tn.
2. QT, which we expect to be announced in Q1 2023. We expect the ECB to run off PSPP passively, which will average around €200bn of balance sheet shrinkage per year.

In addition, the ECB has introduced changes to its operational framework to improve monetary policy transmission to core repo markets in particular. First, the ECB temporarily adjusted the remuneration of government deposits, which were previously capped at 0% to prevent an additional supply of funds in European money markets as the policy rate moved into positive territory. And second, the ECB recently eased the conditions for lending securities against cash collateral, as a precautionary step ahead of year-end strains in funding markets. Non-renewal of these policies is possible, which may temporarily contribute to additional demand for cash-like instruments. But the direction of travel towards lower liquidity is a more durable long-run trend.

Given the starting point of record-high excess liquidity in the Euro area, and its non-linear relationship with overnight unsecured rates, we expect only a modest repricing upward of ESTR against DFR, of about 2-3bp by end-23. The historical relationships between excess liquidity and BOR-OIS bases suggests a €1tn reduction in excess liquidity worth about 10-15bp of widening in 3m BOR-ESTR. The potentially near-complete repayment of ECB financing over 12-15m makes in our view a compelling case for basis widening from current tights as excess liquidity is drained.

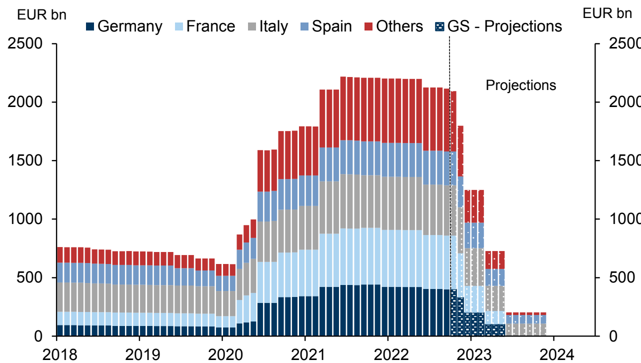
In the UK, reserve balances are set to fall as well, but the liquidity drain in Sterling markets is likely to be more gradual. We expect the main driver to be the BoE's QT plan, with £80-100bn in reserve loss, or 4% of GDP against 11% in the EA. The BoE has also provided £200bn of loans to UK banks on advantageous terms via the TFSME in 2020-21, but the time to maturity of 4 years at inception and banks' revealed preference

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

until now suggest very limited appetite to repay those loans before end-23.

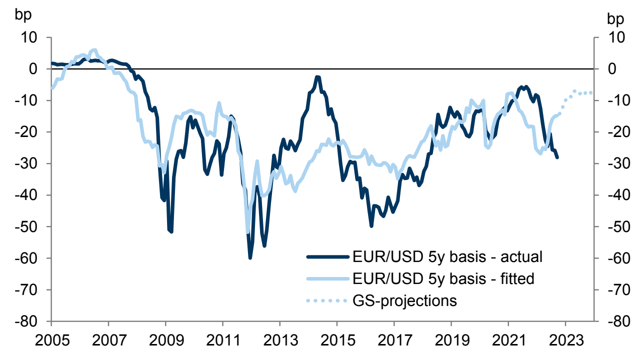
From a cross-currency standpoint, we note that the reduction in liquidity varies across G3 economies. The ECB is likely to have a relatively cautious approach in unwinding its sovereign bond portfolio, as it is more constrained than the Fed, including by sovereign risk. However, large TLTRO repayments imply a steeper normalization of the level of bank reserves than in the US. To quantify possible changes in cross currency funding as a result of the relative monetary policy outlooks, we model[2] the 5y XCCY EUR/USD basis as a function of the policy rate differential, the ratio of excess liquidity in the EA vs the US (expressed a share of GDP), the 10y BTP-Bund spread to capture Euro-area specific risks (and bank risk), and the ratio of IG corporate bond spreads in the US vs Europe, to incorporate the possible impact of Yankee/reverse Yankee issuance. As shown in Exhibit 19, this suggests scope for the basis to tighten modestly from current levels, over the next year.

Exhibit 18: We expect TLTRO outstanding to shrink rapidly by end-23...



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

Exhibit 19: ... Catalysing a potentially sharper liquidity drain in the Euro area vs the US, despite a more gradual decline in bond holdings



Source: Goldman Sachs, Goldman Sachs Global Investment Research

2023 G10 yield forecasts: Peaks, and the aftermath

Our year-ahead forecasts reflect many of the themes discussed above. In this section, we highlight our G10 yield forecasts through 2026, as well as our expectations for G4 yield curves through 2024. Unlike this year, where yields witnessed one of the largest resets higher seen in the past few decades, driven by central banks hiking aggressively to combat inflation, we think next year will be characterized by a slowing of the pace of hikes followed by a pause. This is likely to occur against a backdrop where inflation, while normalizing from extremely elevated levels, is still above central bank targets in most cases, restricting their ability (or willingness) to ease. Exhibit 20 shows our forecasts, as well as deviation from forwards over the next year. Outside of Japan, our forecasts are considerably above forwards across most of G10, largely reflecting a view markets are pricing either low terminal rates or too little term premium (or both).

[2] We build on existing literature, see for instance ECB here or BIS here

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

Exhibit 20: G10 yield forecasts and deviation from forwards

G10 10-Year Yield Forecasts	USD	DEM	GBP	JPY	CAD	CHF	SEK	NOK	AUD	NZD
Current	3.81	2.01	3.24	0.25	3.12	1.04	2.04	3.24	3.61	4.18
1Q23	4.35	2.75	4.00	0.25	3.70	1.60	2.45	3.75	4.25	4.75
2Q23	4.50	2.75	4.00	0.25	3.80	1.60	2.45	3.75	4.40	4.75
3Q23	4.40	2.75	4.00	0.25	3.75	1.60	2.45	3.75	4.40	4.60
4Q23	**4.30**	**2.75**	**4.00**	**0.25**	**3.65**	**1.50**	**2.35**	**3.65**	**4.30**	**4.50**
1Q24	4.20	2.60	3.90	0.25	3.60	1.50	2.35	3.65	4.20	4.35
2Q24	4.10	2.50	3.80	0.25	3.55	1.50	2.35	3.60	4.10	4.25
3Q24	4.05	2.25	3.75	0.25	3.50	1.45	2.30	3.55	4.00	4.20
4Q24	**4.05**	**2.25**	**3.75**	**0.25**	**3.45**	**1.45**	**2.30**	**3.50**	**4.00**	**4.20**
1Q25	4.05	2.25	3.75	0.50	3.45	1.40	2.25	3.45	4.00	4.20
2Q25	4.05	2.25	3.75	0.50	3.45	1.40	2.25	3.45	4.00	4.20
3Q25	4.05	2.25	3.75	0.50	3.45	1.40	2.25	3.40	4.00	4.20
4Q25	**4.05**	**2.25**	**3.75**	**0.50**	**3.45**	1.40	**2.25**	**3.40**	**4.00**	**4.20**
1Q26	4.05	2.25	3.75	0.50	3.45	1.40	2.25	3.45	4.00	4.20
2Q26	4.05	2.25	3.75	0.50	3.45	1.40	2.25	3.45	4.00	4.20
3Q26	4.05	2.25	3.75	0.50	3.45	1.40	2.25	3.40	4.00	4.20
4Q26	**4.05**	**2.25**	**3.75**	**0.50**	**3.45**	1.40	**2.25**	**3.40**	**4.00**	**4.20**

Deviation from Forwards	USD	DEM	GBP	JPY	CAD	CHF	SEK	NOK	AUD	NZD
1Q23	0.55	0.65	0.67	-0.09	0.59	0.54	0.43	0.48	0.57	0.60
2Q23	0.72	0.65	0.65	-0.13	0.72	0.54	0.45	0.49	0.68	0.58
3Q23	0.63	0.65	0.61	0.07	0.70	0.53	0.47	0.50	0.65	0.41
4Q23	**0.54**	**0.65**	**0.59**	**0.03**	**0.61**	**0.42**	**0.40**	**0.42**	**0.51**	**0.28**

Source: Goldman Sachs Global Investment Research, Bloomberg

In terms of yield curves, we believe most regions will trade with either a steepening bias (Exhibit 21), or experience near-parallel shifts; curve flattening will likely come to an end as most central banks look to slow down their pace of hiking. Later in the year and through 2024, we expect bull steepening in the US and UK, but modest bull flattening in the Euro area.

Exhibit 21: G4 yield curve forecasts

G4 Curve Forecasts	USD				DEM				GBP				JPY			
	2y	5y	10y	30y	2y	5y	10y	30y	2y	5y	10y	30y	2y	5y	10y	30y
Current	4.48	3.98	3.81	3.91	2.11	1.99	2.01	1.93	3.18	3.30	3.24	3.39	-0.03	0.09	0.25	1.41
1Q23	4.85	4.50	4.35	4.45	2.15	2.35	2.75	2.70	3.30	3.75	4.00	4.25	-0.04	0.05	0.25	1.65
2Q23	5.00	4.65	4.50	4.60	2.15	2.40	2.75	2.70	3.50	3.75	4.00	4.25	-0.04	0.05	0.25	1.75
3Q23	4.80	4.55	4.40	4.50	2.15	2.40	2.75	2.70	3.75	3.75	4.00	4.25	-0.02	0.05	0.25	1.75
4Q23	**4.60**	**4.45**	**4.30**	**4.40**	**2.15**	**2.30**	**2.75**	**2.70**	**3.75**	**3.75**	**4.00**	**4.25**	**0.00**	**0.05**	**0.25**	**1.75**
1Q24	4.40	4.35	4.20	4.30	2.10	2.25	2.60	2.60	3.70	3.75	3.90	4.25	0.02	0.05	0.25	1.75
2Q24	4.20	4.20	4.10	4.20	2.00	2.20	2.50	2.50	3.50	3.70	3.80	4.25	0.05	0.05	0.25	1.75
3Q24	4.05	4.05	4.05	4.15	2.00	2.15	2.25	2.35	3.35	3.60	3.75	4.25	0.05	0.10	0.25	1.50
4Q24	**3.95**	**4.00**	**4.05**	**4.15**	**2.00**	**2.10**	**2.25**	**2.20**	**3.20**	**3.40**	**3.75**	**4.20**	**0.05**	**0.15**	**0.25**	**1.50**

Source: Goldman Sachs Global Investment Research

United States: Following an anticipated downshift to a 50bp hike at its December meeting, we believe the Fed will ratchet down the pace of hikes yet again to 25bp at the February 2023 FOMC. Beyond that, they expect two additional 25bp hikes, taking the terminal rate to 5-5.25% in 2Q23, and a pause thereafter. Unless we are wrong about avoiding recession, we do not believe the Fed will cut rates next year. This is because, although we expect core PCE inflation to moderate substantially from current levels, it will likely end 2023 around 3%, still above the Fed's target. Further, our economists do not think that a sharp increase in the unemployment rate will be necessary to engineer

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

this slowdown—they project only a 0.5% increase in the unemployment rate, and a growth rate that is still positive, albeit clearly below potential. This is mainly because we are projecting a bounce in consumers' real disposable income growth, which should help partially offset the drag from tighter financial conditions. US rates markets appear pessimistic relative to our outlook, pricing both a lower terminal rate, and earlier and deeper cuts. As a result, our yield projections for both 2023 and 2024 are above forwards, more so at the front end for next year, and somewhat more uniformly across the curve in future years. We forecast 10y yields will peak in 1H23 at 4.5%, before modestly declining to 4.3% by the end-2023. Our 2y yield projections are more substantially above forwards than our 10y projections, largely on account of our belief that the Fed will either be less aggressive in cutting rates than investors are anticipating, or because rates market investors' recession are too high.

Canada: We expect 10y yields in Canada to selloff by a similar magnitude as the US, albeit to a somewhat lower mid-2023 peak of about 3.8% before a modest decline to 3.65% by year-end. A weaker growth outlook and faster progress on inflation ought to allow the BoC to end its tightening cycle sooner, and at a lower terminal rate than the Fed. Canada's growth outlook faces a greater headwind from housing and will likely see GDP growth slip to 0.8% in 2023 (Q4/Q4). Though our economists expect growth to remain below trend on a sequential basis, it should re-accelerate through the year from a 4Q22/1Q23 trough. The more direct translation of house prices into inflation (via homeowner's replacement cost) means that the impact from housing deflation will show up relatively quickly in inflation, supporting a moderation over the course of the year. While there tends to be a somewhat weaker relationship of price inflation with wage growth than in the US, there is some risk that sticky wage growth keeps inflation a bit firmer than our baseline, under which we see headline inflation falling to 2.7% y/y by 4Q23. Our economists expect a 50bp BoC hike in December followed by a 25bp hike in January to a 4.5% terminal rate, modestly above the peak priced by the market. More than a materially higher terminal rate, we think the more front-loaded cut pricing in Canada—it is the only G10 rates market priced for net cuts in 2023—coupled with higher yields abroad should see yields underperform the forwards, as we do not expect rate cuts until 2024. Additionally, the BoC holds about C$90bn in bonds with 2023 maturity dates, representing nearly 25% of holdings; while signals from the Fall 2022 debt management consultation indicated a desire for more bill supply (which would partially limit duration impact from runoff), rising bond free float should be a net support to term premium as well.

Euro area: We see clear headwinds for European duration in the near-term and expect 10y bund yields to rise to 2.75% in 1Q23. First, an energy-intensive German industry and fiscal support to households over the winter imply ongoing pressures on funding needs. Secondly, we see continued upside to traded inflation, on the back of our commodity analysts' bullish oil forecasts. Third, ECB balance sheet policy, including both adjustments to the ECB's operational framework, as well as the activation of QT, all suggest bund yields should move higher. Forwards imply historically low bund yields vs the expected evolution of policy rates—we think this will prove too low given the high inflation environment. Beyond Q1, we believe the outlook for global duration will turn more symmetric, with slower global growth offsetting bearish impulses from ECB

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

balance sheet policy. Conditional on eventual declines in inflation, we expect 1H23 to be the peak in long-end yields. The outlook for sovereign spreads is likely to remain challenging through most of 2023, with recent strong performance at odds with fiscal fundamentals and the monetary policy impulse in our view. Though we think it will prove manageable, QT will be an important test for sovereign credit, especially given large refinancing needs. We look for a widening in 10y BTP-bund spreads to 260bp by end-23.

UK: Asymmetry around UK yields is relatively clear, in our view, with our expectation that 10y Gilts yields will rise to 4% in 2023. Tighter fiscal policy, confirmed in last week's budget, has been an important stabilizer of the Gilt market following exceptional volatility in September and October. However, we think the recent rally is overdone. Near-term Gilt Issuance is likely to stay elevated compared to recent history, and active sales by the BoE to compound the supply impact to the private sector. Further, although our economists now think the peak in headline and core inflation is behind us, this is largely as a result of the government Energy Price Guarantee. Ongoing support to demand combined with sustained strength in UK labor markets will require more policy tightening in our view, despite a potential recession—we expect a terminal Bank rate of 4.5%. With the BoE leaning against market pricing and potential constraints from UK housing market risks, we like steepening exposure in the UK curve. An offsetting factor is our expectation of a front-end led tightening in Gilt swap spreads as BoE asset sales continue to skew towards shorter maturities at least in Q4 2022.

Japan: A big question for global fixed income markets is whether the BoJ will relax or abandon its 10y JGB YCC target in 2023 following Governor Kuroda's term. Our economists believe that a change in leadership will not result in a rethink of policy over the next year, and any changes are likely to be gradual. This is despite inflation remaining above, and indeed diverging further from, the target level. The current mix of accommodative monetary and fiscal policy, along with a potential rebound in commodity prices presents further upside risks to inflation, in our view. Through this year, the policy mix has resulted in higher JGB yields (beyond the 10y maturity point) and a cheaper currency. The BoJ and MoF have intervened in both markets, with the BoJ using a heavier hand in enforcing its yield cap. With some more room left in the global yield selloff, we believe long end JGB yields will also increase modestly—30y JGB yields could top out at 1.75-1.85%, further steepening the curve. We see the extent of the selloff as limited for a few reasons. First, global yields are set to peak in the first half on next year. Second, long end JGBs are already the best option for domestic investors, both on FX-hedged basis (because of large policy rate differentials) and on an unhedged basis (because of the cheap yen). Finally, although our fair value model suggests that 10y JGB fair value is around 70bp, substantially above the BoJ's tolerance limit of 25bp, markets are already anticipating a relaxation of this cap to some extent—10y JPY OIS swaps trade at 52bp, and the 10s30s curve is 117bp.

Australia/New Zealand: Compared to most of G10, the Australian curve stands out as fairly steep, with significant hike pricing in 2023, only modest cuts across 2024 and 2025, and a 5y rate that is somewhat above the market's pricing for terminal this cycle. Despite this, we see scope for at least near-term upside to yields, looking for 10y ACGBs to achieve a peak of 4.4% by the middle of the year (followed by small decline

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

into year-end), supported by higher global yields and our economists' expectation for the RBA. Though the bank has stepped down its hiking pace to 25bp increments, our economists anticipate it will remain vigilant against risks of falling behind the curve amid elevated leading indicators on wages and stickier-than-expected inflation, and we look for continued 25bp adjustments to a 4.1% terminal rate by May (nearly 50bp above market pricing for the May meeting and 20-25bp above the peak rate, priced closer to year-end). The steady pace of 25bp hikes should, in our view, continue to support relatively parallel shift in yields across the curve. Housing is a source of downside risk to the growth and policy rate outlook, with our economists anticipating a 15-20% peak to trough decline in prices. We think the relative steepness of the AUD curve is somewhat justified by the housing-specific risks; to the extent they result in an earlier end to hikes or start of rate cuts, it would argue for greater risk premia due to the potential that other sources of inflation pressure aren't fully addressed.

While not as steep as the Aussie curve, the Kiwi curve is pricing the highest terminal rate pricing across G10. Markets are at a modest premium to the 5% peak rate our economists expect from the RBNZ, with their baseline for another 75bp hike in November followed by 50 and 25bp hikes in February and April respectively. We see a peak NZD 10y yield of 4.75%, with a modest degree of outperformance in the back half of the year. While the downshift in the pace of hikes is somewhat later, the continuing acceleration in wage growth and less frequent policy rate decisions ought to justify markets embedding risk of a more extended hike cycle until there is evidence that underlying inflation pressures are moderating.

Sweden, Norway and Switzerland: We expect yields in Sweden and Norway to move higher as inflation pressures remain broad and sticky. However, an earlier start to rate hikes, coupled with elevated sensitivity of domestic housing markets to higher rates, is likely to see a more gradual approach and earlier peak in rates from the Riksbank and the Norges Bank vs the ECB. The Norges Bank recently slowed the hiking pace to 25bp despite further upside surprises in inflation and activity, citing a cooling housing market and the 250bp cumulative tightening seen to date. The Riksbank, meanwhile, has highlighted financial stability concerns from the highly indebted commercial property companies and the high level of indebtedness among households. Housing is indeed a source of risk, with a large share of mortgages resetting within a year and a large mortgage debt stock in both countries. We expect 10y SEK and NOK yields at 2.45% and 3.75% in 1Q-23, outperforming Bunds. In contrast, Swiss inflation was 3% YoY in October and has been consistently lower than in the Eurozone. Swiss yields have reflected the different inflation outlook, with 10y government bonds yielding around 1%, the second lowest in G10, after Japan. Although we continue to see upside in Swiss yields given the SNB's stricter inflation mandate (0%-2%) and global spillovers, we expect a smaller yield increase vs bunds, particularly given the potential switch from policy rates to balance sheet policy by the SNB on account of currency considerations.

Praveen Korapaty, George Cole, William Marshall, Simon Freycenet, Ravi Raj

The authors would like to thank Alberto Sannicandro for his contribution to this report.

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

Disclosure Appendix

Reg AC

We, Praveen Korapaty, George Cole, William Marshall, Simon Freycenet and Ravi Raj, 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

Disclosure

Options risks

General Options Risks – The risks below and any other options risks mentioned in this research report pertain both to specific derivative trade recommendations mentioned and to discussion of general opportunities and advantages of derivative strategies. Unless otherwise noted, options strategies mentioned in this report may be a combination of the strategies below and therefore carry with them the risks of those strategies.

Buying Options - Investors who buy call (put) options risk loss of the entire premium paid if the underlying security finishes below (above) the strike price at expiration. Investors who buy call or put spreads also risk a maximum loss of the premium paid. The maximum gain on a long call or put spread is the difference between the strike prices, less the premium paid.

Selling Options - Investors who sell calls on securities they do not own risk unlimited loss of the security price less the strike price. Investors who sell covered calls (sell calls while owning the underlying security) risk having to deliver the underlying security or pay the difference between the security price and the strike price, depending on whether the option is settled by physical delivery or cash-settled. Investors who sell puts risk loss of the strike price less the premium received for selling the put. Investors who sell put or call spreads risk a maximum loss of the difference between the strikes less the premium received, while their maximum gain is the premium received.

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

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

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.

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

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. 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.

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 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 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. 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.

© 2022 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.

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