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TOP_{Of} MIND

CENTRAL BANK TIGHTENING: WHAT COULD BREAK?



Central banks' aggressive policy tightening has raised concerns about what could break in a global financial system accustomed to low rates. Which financial stability risks are worth watching, whether policymakers have the tools to manage those risks, and if they could prompt central banks to slow or pause tightening, is Top of Mind. Harvard's Jeremy Stein believes that the Fed's only option is to prioritize its inflation-fighting objective today given the US' acute inflation problem, but warns that instability risks should not be discounted and the Fed may not be able to address them. Former ECB VP Vítor Constâncio, meanwhile, expects the current hiking cycle to end without significant financial breakages, but worries about QT. And GS

strategists argue that stability risks may constrain the ECB/BOE more than the Fed. Which risks to watch?—illiquidity in sovereign bond markets, open-end bond funds, pressure on sovereign and corporate borrowers in EMs and beyond—partly owing to Dollar strength—and, of course, the "unknown unknowns" nobody is watching at all.

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Financial stability concerns should weigh more on decision-making when the Fed is reasonably close to achieving its mandates... But the Fed is far from its inflation target today, so making progress towards that target must be the priority.

- Jeremy Steir

I firmly believed then [in 2018], and still do now, that interest rates cannot be used to serve several different objectives around the economy, like labor market and price stability, as well as financial stability objectives.

- Vítor Constâncio

With unemployment still low, not a drop of blood has yet been spilled. The environment will undoubtedly become much tougher and more fraught when this tightening—and more in the pipeline—actually starts to bite.

- Jeremy Stein

Central banks will likely conclude the current hiking cycle before significant financial stability concerns arise that could force them to recalibrate policy... [although] I am concerned about the potential effects of QT.

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Macro news and views

We provide a brief snapshot on the most important economies for the global markets

US

Latest GS proprietary datapoints/major changes in views

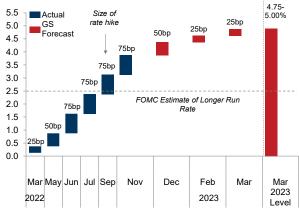
 We expect more Fed tightening in 2023 (a 25bp hike in March vs. none previously, for a peak funds rate of 4.75-5%) on the back of continued high inflation and the need to keep the economy on a below-potential growth path and prevent a premature easing of financial conditions.

Datapoints/trends we're focused on

- Midterm election results; a divided government appears likely, which we expect would reduce the size and probability of fiscal support in the event of a recession.
- Recession risk; we continue to ascribe 35% odds to a recession over the next 12m, but think the economy remains on a narrow path to a soft landing.

A slower Fed pace, but a higher peak

Rate hikes at FOMC meetings, %



Source: Federal Reserve, Goldman Sachs GIR.

Europe

Latest GS proprietary datapoints/major changes in views

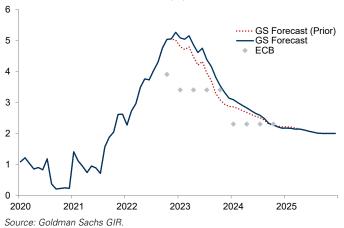
- We expect less ECB tightening in the near-term (a 50bp hike in Dec vs. 75bp previously) given the looming EA recession we expect, that the Deposit Rate is approaching neutral, and that global central banks are likely to soon slow tightening.
- We expect less BoE tightening (a 50bp hike in Dec vs. 75bp previously, for a 4.5% terminal rate) on the back of weaker growth and lower inflation due to the UK's fiscal U-turn.

Datapoints/trends we're focused on

- Euro area inflation, which we expect to peak in coming months.
- Quantitative tightening; we expect the ECB to decide in 1Q23 to start QT in 2Q23 and take the form of passive PSPP run-off.
- EA industrial production, which we expect to decline sharply.

Euro area inflation: peak ahead

Euro area HICP core inflation, % yoy



Japan

Latest GS proprietary datapoints/major changes in views

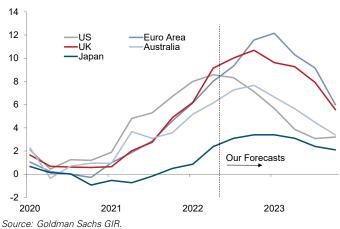
• No major changes in views.

Datapoints/trends we're focused on

- BoJ policy direction; with Governor Kuroda's term set to expire in six months, we see a <50% probability of a pivot from the current dovish stance and of an explicit rate hike in 2023.
- FX intervention; we think yen depreciation can be slowed for a while longer by the Ministry of Finance's yen-buying.
- Inflation; we think it will remain far lower than in other countries due to lower price pass-through and wage growth.
- Fiscal support; we think the government will continue to deploy it as necessary amid concerns over global growth.

Japan inflation: above target but below other regions

Headline CPI, % yoy



Emerging Markets (EM)

Latest GS proprietary datapoints/major changes in views

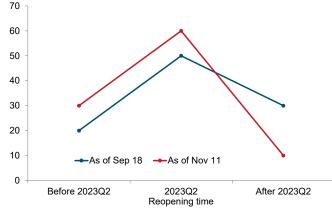
• We recently raised our 2022 China growth forecast to 3.2% following stronger-than-expected Q3 GDP data.

Datapoints/trends we're focused on

- China Covid policy; despite recent announcements of a marginal relaxation of Covid control policies, we maintain our expectation of a 2O23 reopening, though now see lower risk of delayed reopening.
- EM monetary policy; we think that a significant decoupling of EM and US inflation would be required for EM central banks to cut interest rates next year as much as currently priced.
- EM external balances, which weakened in Q3 on higher energy prices, slowing global demand, and tighter financial conditions.

Lower risk of delayed China reopening

GS subjective probability of reopening timing, %



Source: Goldman Sachs GIR.

CB tightening: what could break?

Although the market apparently took comfort from October's better-than-expected US CPI print, with inflation still far above target, it's clear that the major central banks' inflation fight is far from over. The aggressive policy tightening so far—and still in the pipe—has raised concerns about what could break in a global financial system that has grown accustomed to low rates. Which financial stability risks are worth watching, whether policymakers have the tools to effectively manage those risks, and if they could prompt central banks to slow or even pause the pace of tightening, is Top of Mind.

We first speak with Jeremy Stein, Professor at Harvard University, who was a vocal advocate of the view that monetary policy should be implemented with financial stability in mind during his tenure on the Fed's Board of Governors in the aftermath of the Global Financial Crisis (GFC). Despite this long-held view, he argues that the still-acute inflation problem the US faces today means that "the Fed's only option is to continue to make inflation its number one policy priority for now." That said, he warns that financial instability risks should not be discounted, and that the Fed's ability to address those risks is probably more limited than the market expects and than in past episodes of stress. That's not only because actions to quell stability risks—the so-called "Fed put"—would almost certainly run counter to the prevailing monetary policy goal of slaying inflation, but also because we can't assume that the tools that addressed past crises—such as the emergency credit facilities implemented at the beginning of the pandemic—could be employed today.

Vítor Constâncio, former Vice President of the ECB, has historically taken the opposite view of Stein—arguing that monetary policy should not respond to financial stability concerns—a view he stands by today even as the ECB now formally includes financial stability considerations in its policy decisions. But given that both the Fed and the ECB are already approaching the expected peak in policy rates, he expects the current hiking cycle to end before significant financial stability concerns arise that could force a recalibration of monetary policy. However, he worries about the potential effects of quantitative tightening (QT), especially in the Euro area, where incentives for banks to repay their TLTRO loans early will likely lead to an already sizable reduction in the ECB's balance sheet even before the ECB embarks on formal QT. That said, he believes Euro area policymakers have all the tools they need nowadays to avoid a repeat of the 2010 sovereign bond crisis.

But GS European rates strategists George Cole and Simon Freycenet are less sure that financial stability risks won't affect monetary policy in Europe. In their view, concerns about ratesensitive debt in both the Euro area and the UK constrain the ECB and BoE compared to the Fed in their inflation fight, likely leading to a more cautious approach from both. These risks, they say, may force an implicitly higher tolerance for inflation in Europe, although Stein and Constâncio believe that the US could potentially be headed in a similar direction as well.

So which risks—outside of a monetary policy mistake in itself—are worth watching? On both Stein and Constâncio's lists is **illiquidity in the US Treasury and other sovereign bond markets**. Praveen Korapaty, GS Chief Interest Rates Strategist, explains why cracks in the plumbing of the market's

microstructure have appeared: a surge in outstanding sovereign debt that has far outpaced intermediation capacity mainly owing to post-GFC regulations that discourage market-making in these securities. Although Stein says that these issues are easily fixable, unless and until they are, Korapaty argues that the Fed and other major central banks may be increasingly forced to use their balance sheets to maintain orderly market functioning rather than to conduct monetary policy.

Constâncio and Stein are also concerned about the asset-liability mismatches of mutual funds, and especially of **openend bond funds**, that have the potential to trigger asset fire sales in times of stress. This structural fragility was on full display in the US in early 2020 and never went away, Stein says, because the Fed bailed out these funds, but may not be able to do so the next time around. They are also worried about **mounting pressure on sovereign and corporate borrowers in Emerging Market (EM) economies** and beyond, especially, as Stein notes, given the **sharp appreciation of the Dollar**—a vulnerability that will likely persist according to GS FX strategists Kamakshya Trivedi and Sid Bhushan, who make the case that Dollar appreciation has further room to run.

Indeed, although GS FX strategist Karen Reichgott Fishman finds that FX intervention by many EM central banks (and the BoJ) has slowed the pace of domestic currency depreciation against the Dollar—if not prevented it—GS FX and EM strategists Ian Tomb and Teresa Alves point out that several Frontier economies are already in the midst of classic **EM crises** precipitated by a Dollar funding squeeze. That said, most major EMs have proven relatively resilient to these stresses, and globally-systemic EM risks appear low, in their view.

Even beyond EM, **corporate borrowers** are worth keeping an eye on, according to GS credit strategists Lotfi Karoui and Vinay Viswanathan. They argue that while fundamentals are still healthy for these borrowers, companies that have issued floating-rate leveraged loans, as well as commercial real estate (CRE) borrowers, are vulnerable to a higher-for-longer cost of funding shock. But they believe the risk of this shock threatening financial stability is lower than in past cycles.

And what about perhaps the most obvious place to look—
pension funds—given that they were at the epicenter of the
most recent stress episode that arguably increased market
focus on financial breakages in the first place? GSAM
strategists Ed Francis, Matthew Maciaszek, and Michael Moran
explain the recent pressure in the UK pension fund industry and
why a similar crisis is less likely to repeat elsewhere, which
Freycenet generally agrees with.

Finally, GS global economists Daan Struyven and Devesh Kodnani take a survey approach to assess the above—and other—financial stability risks that GS research analysts are watching. But, after all this discussion and monitoring of known risks, perhaps the biggest risks of all remain the "unknown unknowns" that we aren't watching at all.

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Interview with Jeremy Stein

Jeremy Stein is Moise Y. Safra Professor of Economics at Harvard University. Previously, he served on the Federal Reserve Board of Governors. Below, he argues that financial stability concerns should not be a reason for the Fed to pull back on tightening when inflation remains this high, but that we should not discount financial instability risks today.

The views stated herein are those of the interviewee and do not necessarily reflect those of Goldman Sachs.



Allison Nathan: You have <u>argued</u> in the past that monetary policy should be implemented with financial stability in mind. Given the current inflation problem in the US, do you stand by that view?

Jeremy Stein: Inflation is a serious problem today. Given its elevated levels and the very real risk that high

inflation could become embedded in expectations and a self-fulfilling problem, the Fed's only option is to continue to make inflation its number one policy priority for now. The risk of an unknown potential breakage in financial markets is not a reason to preemptively pull back on fighting inflation when the inflation problem is this acute. Rather than financial stability concerns, the more compelling argument for stopping or slowing down tightening at some point down the road—though not now—is that a substantial amount of policy tightening has already occurred, and it will take time for its effects to manifest.

Allison Nathan: So, when should managing financial stability risks become a policy priority?

Jeremy Stein: Financial stability concerns should weigh more on decision-making when the Fed is reasonably close to achieving its mandates. For example, in late 2019, when unemployment was roughly 3.5% and inflation was about 1.7%, the debate was centered around how aggressively the Fed should ease policy to achieve its 2% inflation target. Given how close the Fed was to the bliss point of achieving both its price and full employment mandates, burning a lot of furniture to overheat financial markets with very easy policy in an effort to push inflation up by 30bp didn't make sense. But the Fed is far from its inflation target today, so making progress towards that target must be the priority.

Allison Nathan: But isn't when the Fed is forced to act aggressively because it is so far away from its mandates precisely when financial stability risks also become acute?

Jeremy Stein: Yes; we shouldn't discount instability risks today. In fact, I'm very surprised at how orderly this period has been, all things considered. If you had asked me a year ago how the market would react to the Fed's dramatic policy shift this year, I would have expected credit spreads to be wider. This differs remarkably from, say, the 2013 taper tantrum, when the actual amount of policy tightening was tiny as compared to now, and the market reaction was very large.

Allison Nathan: What explains the orderly response this time, and does it reassure you that significant stability risks aren't likely to materialize ahead?

Jeremy Stein: I don't pretend to understand why markets have responded in such an orderly manner so far— whether it owes

to skill, luck, or something we don't understand. It could partly owe to communication, which has admittedly been tricky because the Fed doesn't want anything to break but can't give the market too much reassurance since financial conditions must tighten to move inflation in the right direction. While the Fed seemed to be catering a bit too much to the market's demand for short-term guidance about the next FOMC meeting for a while, the clear message from Chair Powell at Jackson Hole—that no matter what actions the Fed takes at the next few meetings, they've got a long way to go to bring down inflation and will be on the job until it's done—was right on point, and the best communication we've heard out of this Fed.

That said, I don't necessarily draw reassurance from the orderly behavior of markets up to this point. These moves don't tend to happen in a linear fashion, and I worry we'll see another leg to them. And it's difficult to pinpoint precisely what to worry about. We know that if you put a lot of pressure in the pipe, something is more likely to crack, but it's often not what you expect or what cracked the last time.

Allison Nathan: That said, one area of concern seems to be Treasury market liquidity. Is that concern warranted?

Jeremy Stein: Yes; the spike in Treasury market volatility in March 2020 proved that concerns over market liquidity are warranted. But the Fed could at least partially address this vulnerability with some relatively simple fixes. For example, the supplementary leverage ratio, which is a risk-insensitive capital requirement imposed on systemically important banks in the wake of the Global Financial Crisis (GFC), was unhelpful in the March 2020 episode, because it discourages banks from making markets in Treasury securities. The Fed could easily adjust this requirement so that it serves its intended purpose of acting as a backstop rather than as a primary binding constraint on market-making, and do so without weakening overall capital in the banking system by making a compensating adjustment in the risk-based requirements so that capital in the system remains the same.

The Fed could also make its standing repo facility—which lends against Treasury securities as collateral—accessible to a larger set of financial market participants beyond banks and primary dealers. If access to the facility was expanded to allow any hedge fund, mutual fund, etc. to bring Treasuries to the Fed and get cash at a moment's notice, the asset fire sales that characterized the March 2020 stress episode may not have occurred to the same extent. I have heard some express the view that such broader access could create a moral hazard problem, but what is the bigger problem—lending against Treasury collateral, or, as recently occurred in the UK, getting cornered into buying a lot of Treasuries at a time when you're supposed to be tightening monetary policy?

Allison Nathan: What other financial stability risks are worth watching?

Jeremy Stein: I continue to worry about the open-end bond fund complex, which the Fed basically bailed out in March 2020 by creating credit facilities that had a very powerful effect in stemming the large outflows and liquidations of assets from these funds at the time. While that was absolutely the right thing to do, it prevented us from learning more about the real fragility of some of these funds and created a moral hazard problem—credit spreads tightened, and business went on as usual with very little—if any—change in the underlying structure of these funds.

I also worry that the sharp appreciation of the Dollar resulting from the Fed's aggressive rate hikes is putting stress on pockets of the financial system. Corporates in many Emerging Markets borrow in dollars, which can be an inexpensive source of funding but puts substantial pressure on these economies when the Dollar strengthens. Many of these countries are relatively small, so the trade spillovers may turn out to be limited, but the bigger risk is that cracks in the financial system could emerge—when loans go bad, what banks are overexposed to these borrowers? Japan is also a potential source of concern in this context. Its debt-to-GDP is running at more than 200%, with much of that debt effectively rolling on an overnight basis given the effect of their massive QE on consolidated debt maturity. That's not a problem when interest rates are at zero, but if Japan begins to import inflation given global inflation trends and the strength of the Dollar, and the BoJ must start fighting inflation, this could become quite problematic. Many countries are facing the same issue, but Japan is an extreme case that bears watching.

Allison Nathan: Hasn't the Fed shown that it has sufficient tools to address risks like open-end bond fund volatility?

Jeremy Stein: Not necessarily. We can't assume that some of the most effective tools employed in the past—like the credit facilities that bailed out the open-end bond complex in 2020—will be available in the future, and that the Fed can always come to the rescue. Unlike other major central banks like the ECB and BoJ, the Fed is not allowed to directly buy assets beyond Treasuries. It was only able to buy corporate bonds in 2020 via a special purpose vehicle that had fiscal backing from the Treasury through the CARES Act. Employing a similar type of vehicle in today's environment would be much more difficult.

The one tool that the Fed always has at its disposal is the ability to buy Treasury bonds. But that would also be much more complicated now than it was in March 2020. Then, the Fed initially engaged in Treasury purchases to ensure orderly market functioning. But, given the pandemic-related hit to the economy, those purchases eventually went beyond market functioning, bleeding into quantitative easing (QE), with the intended purpose of aiding the US' economic recovery.

Today, initiating Treasury purchases for market functioning purposes would be much more difficult to communicate since those purchases would run counter to the prevailing monetary policy stance focused on fighting inflation. This is the dilemma the BoE encountered recently when they were forced to engage in gilt purchases to temper the spike in gilt yields

following the announcement of the UK's mini-budget. But the BoE was helped by its structure in the sense that it has separate monetary policy and financial policy committees, and the bank took great pains to have the financial policy committee execute the temporary bond purchases to signal that these purchases did not represent a shift in the BoE's policy stance. This is one reason why I favor broadening access to the Fed's repo facility; to the extent that the Treasury market needs help, I would much rather have it come from repo lending where this sort of communication problem is much less applicable.

The broader issue is that in a world in which the problem is insufficient demand characterized by too low inflation, the Fed can always try to step in and do more to reassure markets—the so-called "Fed put". But in an inflationary world, the Fed really can't do much because such actions will inevitably trip over its monetary policy objectives. And I worry that the market doesn't fully understand the extent to which the Fed is more limited in the current environment when it comes to the Treasury market, and even more so the credit market. Once defaults start to rise, the market may have to deal not only with the defaults themselves, but also with the realization that the Fed put is no longer in place. That would be another shoe that could drop.

Allison Nathan: How much more pain are we potentially in store for as the Fed continues in its pursuit of 2% inflation?

Jeremy Stein: The tightening we've experienced this year has been the easy part. With unemployment still low, not a drop of blood has yet been spilled. The environment will undoubtedly become much tougher and more fraught when this tightening—and more in the pipeline—actually starts to bite. A relatively optimistic scenario over the next year is that US policy rates reach the near-5.00% range the market is currently expecting, unemployment rises to 5.0-5.5%, and core and headline inflation decline to 3.5-4.0%—likely consistent with a mild recession. But at that point, we'll be off the steep part of the Phillips curve and lowering inflation from there will be extremely difficult. Recall that in the GFC, the unemployment rate rose to 10% with only a 50bp corresponding decline in core inflation, so the sacrifice ratio becomes very high.

In that context, one of the most bizarre aspects of financial markets these days is that 5y inflation breakevens are trading around 2.5%—I just don't see how we get there; we should be grateful if core inflation remains around 3.0% for a few years. That would obviously be complicated for the Fed given that it has adopted an explicit 2.0% target, which was a significant policy mistake; Alan Greenspan had it more right when he took a vaguer approach that basically amounted to: we'll know price stability when we see it. But, while I don't see any scenario in which the Fed renounces the 2% target, once they get closer to achieving their price stability mandate, they may be able to provide more lip service to their employment mandate and frame a tolerance for moderately higher inflation as a way to move towards their dual policy goals in a balanced way.

Navigating these shifts will likely involve some discord in the FOMC, which Chair Powell has so far done a masterful job of keeping united. But, again, as more pain is inflicted and the pressure intensifies, this won't be easy, and will surely become even more challenging if some of the breaks in the financial system we discussed materialize.

Interview with Vítor Constâncio

Vítor Constâncio is former Vice President of the European Central Bank, serving from 2010 to 2018, before which he served as the Governor of the Bank of Portugal. He is currently President of the Board at the Lisbon School of Economics and Management (ISEG). Below, he stands by his long-held view that monetary policy should not respond to financial stability concerns, which are more likely to arise from QT than from rate hikes at this point in the cycle. The views stated herein are those of the interviewee and do not necessarily reflect those of Goldman Sachs.



Jenny Grimberg: In 2018, you argued that monetary policy should not respond to financial stability concerns. Against the backdrop of the major inflation problem facing many DM economies, do you stand by that view today?

Vítor Constâncio: I gave the 2018 speech at a time when proposals to increase interest rates to contain the

buoyancy of asset prices were being contemplated, which I opposed. Two earlier debates around this subject had already transpired—one in the 1990s following the Bank for International Settlements' (BIS) idea that interest rates should be used to restrain credit growth and asset price increases, which Ben Bernanke and Mark Gertler convincingly argued against, and a second in 2013/14 when the BIS again insisted that major central banks should raise rates in the name of financial stability, which Swedish economist Lars Svensson persuasively opposed.

I firmly believed then, and still do now, that interest rates cannot be used to serve several different objectives around the economy, like labor market and price stability, as well as financial stability objectives. Central banks need two types of instruments to do so: traditional monetary policy instruments and the macroprudential instruments born out of the Global Financial Crisis (GFC) that include general regulatory measures to increase the robustness of the financial system and those focused on smoothing out the financial cycle, which typically has a longer duration than the business cycle. Only if such macroprudential instruments aren't available, which they admittedly aren't in many countries, should monetary policy consider financial stability issues, and only as a last resort. Against this view, in 2021 the ECB introduced financial stability considerations into monetary policy decisions for the first time as part of its new monetary policy strategy, providing some room for a policy of "leaning against the wind"—preemptively hiking rates in the name of financial stability—although that was not the stated aim of this policy shift.

The irony is that today we find ourselves in the opposite situation, with the discussion centered around whether the new financial stability considerations could justify stopping or slowing the recent rapid pace of tightening, also in part because the existing macroprudential instruments haven't had enough time to build up sufficient buffers to make them effective in a crisis. That said, central banks will likely conclude the current hiking cycle before significant financial stability concerns arise that could force them to recalibrate policy.

Jenny Grimberg: Why do you believe that will be the case?

Vítor Constâncio: Signs of real financial instability have yet to pop up even as central banks have continued to tighten aggressively—the recent turmoil in the gilt market was the result of poorly conceived fiscal policies rather than central bank tightening. And the chances of stability risks materializing are diminishing now that the vast majority of the expected rate hikes are behind us—policy rates are already approaching the peak rates that the market is currently pricing of around 5% and 3% for the Fed and ECB, respectively, which will likely prove enough to tame inflation. In the US, all signs are pointing to a sharp deceleration in inflation next year, reflected in recent forecasts from the IMF and the Fed, as higher interest rates curb excess demand. The Euro area's situation is more complicated as the region's energy supply will likely remain significantly impaired, so the deceleration in inflation will likely be slower, but inflation will eventually decline as the impact of the supply shock dissipates. So, the current hiking cycle likely won't trigger episodes of significant financial instability, though I would become more concerned about such episodes if rates rise well beyond their expected peaks.

Jenny Grimberg: But won't the ECB need to hike at least as much as the Fed given that energy supply will likely remain a problem and the euro will likely remain weak?

Vítor Constâncio: No. Supply shocks are playing a much larger role in Euro area inflation—the contribution of energy and food to total inflation is 69% in the Euro area compared with only 38% in the US. But to be the source of sustained inflation, these shocks would have to recur every year, which is highly improbable. So, if Larry Summers is correct that the Fed must reduce US inflation by 2.5pp to tame it, the ECB only needs to reduce Euro area inflation by, say, 1.5pp.

And the idea that the ECB will hike more because of the weaker euro doesn't have merit, for several reasons. One, following the Fed does not guarantee a stronger currency; the BoE has followed the Fed more than the ECB has up to now, yet the pound has devalued slightly more than the euro against the Dollar. Two, over the medium- and long-term a country's exchange rate is mainly determined by its relative growth prospects and expected asset valuations, not interest rate differentials. Three, exchange rates against a whole set of commercial partners—not bilateral rates against the Dollar—define competitiveness, and in those terms the euro has only depreciated by around 5% since the start of the year. And, in any case, managing the exchange rate is not an objective of ECB policy.

Jenny Grimberg: Even if this rate hiking cycle doesn't give rise to serious financial breakages, are you concerned that quantitative tightening (QT)—which the Fed has already embarked on and the ECB might start soon—could?

Vítor Constâncio: I am concerned about the potential effects of QT, which is equivalent to an increase in interest rates; Fed Vice Chair Lael Brainard recently stated that the Fed's full QT program is equivalent to a 200-300bp increase in rates, which is significant, especially when rates are already high. I am particularly concerned about ECB QT, for two reasons. One, anever present feature of a monetary union between heterogenous, sovereign countries is the risk of financial fragmentation, which could impair the transmission of monetary policy, as we saw during the 2010 Euro area sovereign bond crisis.

Two, the ECB recently decided to toughen the conditions on the targeted longer-term refinancing operation (TLTRO) program—through which it extended long-term loans to banks—after very generous conditions during the pandemic allowed banks to borrow at little cost and earn profits on reserves deposited at the ECB. So, banks will probably repay those loans early, and if they do, that will equate to a very sizable reduction of the ECB's balance sheet—€1.2tn of TLTRO loans mature in June 2023. Against this already large tightening, the ECB must move gradually to avoid financial stresses if and when it introduces formal QT. To that end, I'm somewhat comforted by the recent actions of the ECB; to the surprise of some market participants, the ECB announced that it will only begin discussing the general principles around QT in December, and President Lagarde has also said that balance sheet action wouldn't start until interest rates were fully normalized. Both are an indication that the majority of ECB members aren't in a hurry to start QT.

Jenny Grimberg: If something does break in the financial system during this tightening cycle, what could it be?

Vítor Constâncio: Several potential sources of financial instability exist. One, liquidity problems in sovereign bonds markets in the Euro area, emerging markets, and the US, where the size of broker-dealers' balance sheets has not kept up with the growth of the Treasury market. One of the most extraordinary moments of the recent IMF meetings was Treasury Secretary Yellen's public comment that she was concerned about liquidity in the Treasury market. Two, highyield bonds and leveraged loans, because the rise in interest rates and a potential recession over the next year—likely in the US and a near certainty in the Euro area—may lead firms with those types of debt instruments to default. Three, liquidity problems in mutual funds and the possibility of fire sales as a result. In the Euro area, the mismatch between the asset and liability sides of mostly open-end funds has increased in recent years, and such liquidity mismatches could be particularly problematic in times of market stress. Four, problems in China—which was also a source of financial instability in 2018—not only due to the country's growth deceleration, but also to the possibility of a housing market collapse. And five, defaults in Emerging Market economies, which may not have global implications, but are indicative of the strains in the system today.

Jenny Grimberg: How would you rate the fragility of the system today?

Vítor Constâncio: The environment seems particularly fraught. I was not concerned about this list of worries in 2020 or even early 2021; these concerns only took off when it became clear that inflation was becoming a real problem, which arguably happened in the first half of 2021 in the US, but not until late 2021 in the Euro area; recall that inflation did not exceed 3% in the Euro area until September 2021, and only at the beginning of 2022 did it become clear that the ECB would have to start raising rates, which could always have consequences for financial stability. But again, I am not very worried that these risks will materialize during the current hiking cycle, although central banks embarking on QT creates a new source of concern.

Jenny Grimberg: Given the focus on European sovereign bond markets, what tools do Euro area policymakers have to deal with potential breakages there, and to what extent can/will these tools be effective?

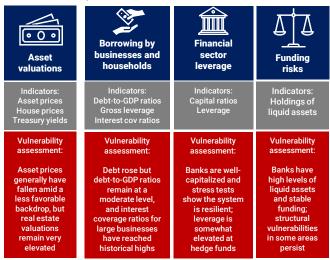
Vítor Constâncio: Nowadays the Euro area has all the tools it needs to avoid a repeat of the 2010 crisis, although they are all conditional. The ECB now has the Transmission Protection Instrument (TPI), which allows for the purchase of sovereign bonds from countries experiencing a monetary policy-induced deterioration in financing conditions, assuming that the country is compliant with the EU fiscal framework and has a sustainable public debt trajectory, sound and sustainable macroeconomic policies, and no severe macroeconomic imbalances. The ECB's Outright Monetary Transactions (OMT) program, under which the bank can also purchase sovereign bonds, goes a step further in conditionality by requiring at least a precautionary program with the European Stability Mechanism (ESM). The third tool is a full-fledged assistance program from the ESM, which is conditional on the member state implementing a macroeconomic adjustment program.

Jenny Grimberg: Ultimately, even if central banks tame inflation without triggering significant financial stresses in this cycle, should policymakers rethink their tolerance for inflation going forward?

Vítor Constâncio: Yes; when inflation finally abates, likely throughout the next year, it would be a good opportunity for central banks to revise up their inflation targets to, say, 3%. Several economists have argued in favor of an increase in central banks' inflation targets, because a higher rate would lower the likelihood that interest rates would have to touch the Zero Lower Bound and would give central banks more policy room to fight recessions. In the future, it would be useful for central banks to review and reassess their inflation targets and frameworks, especially as the world going forward will likely be one of slightly higher inflation than in recent decades. My hope is that the Fed takes the initiative to raise its inflation target, motivating other central banks to follow, because such an initiative will never come from Europe given its long history of concerns about inflation.

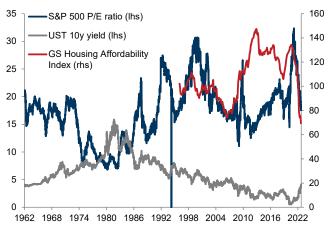
US financial (in)stability

The Federal Reserve monitors four broad categories to gauge financial stability risks in the United States



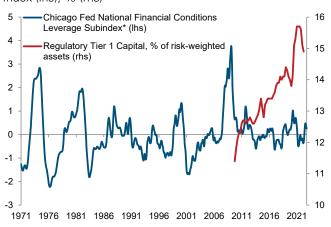
Note: Vulnerability assessment as of Nov 2022 (latest assessment done). Source: Federal Reserve Board (FRB) of Governors Financial Stability Report.

Category 1: Asset prices have generally fallen amid macro challenges, but housing affordability has declined sharply Ratio and yield (lhs), index (rhs)



Note: Higher levels for Housing Index represent increasing affordability. Source: Bloomberg, S&P Dow Jones Indices, FRED, Goldman Sachs GIR.

Category 3: Banks are well-capitalized, but capital ratios have fallen; leverage has risen, but is close to historical averages Index (lhs), % (rhs)



*Consists of debt and equity measures.

Source: FRB's Financial Accounts of the US, Chicago Fed, FRED, GS GIR.

Several potential vulnerabilities grew more than average over the course of 2021-2022, although some declined

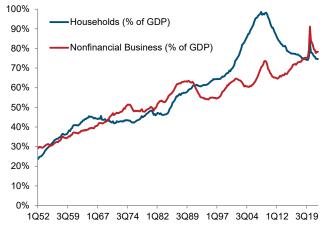
Size of select markets/sectors/indicators in each category

| | -, | , | | | | . , |
|---------------------------------------|---------------------------------|----------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | Avg ann growth, 1997-2Q22 | Growth, 2Q21-2Q22 | Growth, 2Q20- 2Q21 | Growth, 2Q19- 2Q20 | Growth, 2Q18- 2Q19 | Growth, 2Q17- 2Q18 |
| | Asset | markets | | | | |
| Equities | 8.4% | -15.0% | 47.2% | 4.5% | 5.5% | 12.3% |
| Residential real estate | 6.3% | 16.8% | 12.0% | 4.6% | 5.4% | 7.0% |
| Commercial real estate | 6.9% | 8.7% | 6.8% | 2.0% | 5.1% | 8.9% |
| Treasury securities | 8.1% | 7.2% | 9.2% | 25.1% | 6.4% | 6.9% |
| Nonfina | ancial busines | ss and house | hold cred | lit | | |
| Total private nonfinancial credit | 5.6% | 7.3% | 4.0% | 6.7% | 4.1% | 4.0% |
| Total nonfinancial business credit | 5.8% | 6.8% | 1.5% | 10.5% | 5.1% | 4.5% |
| Total household credit | 5.4% | 7.8% | 6.8% | 2.8% | 3.2% | 3.5% |
| \$ | Sectors of the | financial sys | stem | | | |
| Banks and credit unions | 6.1% | 4.5% | 7.1% | 16.7% | 3.1% | 2.9% |
| Mutual funds | 8.7% | -17.2% | 27.9% | 0.6% | 3.7% | 8.7% |
| Insurance companies | 5.4% | -7.2% | 9.1% | 7.4% | 6.3% | 2.5% |
| Hedge funds | 9.9% | 16.5% | 12.1% | -3.0% | 4.8% | 13.5% |
| | Funding | instruments | | | | |
| Total runnable money-like liabilities | 4.9% | 2.9% | 3.6% | 17.1% | 9.3% | 3.1% |

Source: FRB of Governors Financial Stability Reports, Goldman Sachs GIR.

Category 2: Households' debt-to-GDP ratio has declined, while businesses' debt-to-GDP ratio has generally increased

Debt of select nonfinancial sectors as a share of GDP

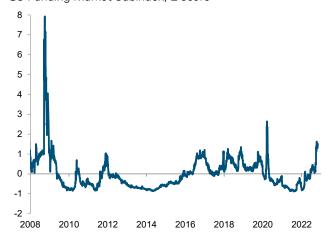


Note: Households includes nonprofits.

Source: FRB's Financial Accounts of the United States, Goldman Sachs GIR.

Category 4: Funding market stresses have increased recently, although they remain well below crisis-era peaks

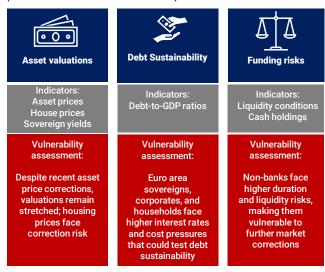
GS Funding Market Subindex, Z-score



Source: Goldman Sachs GIR.

Euro area and UK financial (in)stability

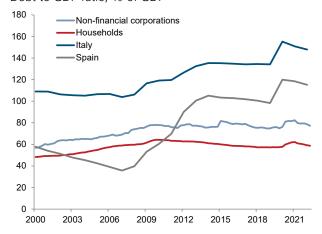
The ECB has highlighted a few areas of concern that could pose a threat to financial stability



Source: ECB May 2022 Financial Stability Report, Goldman Sachs GIR.

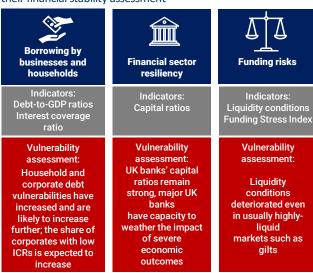
Household and corporation debt-to-GDP ratios have decreased; high debt-to-GDP ratios make some Euro area sovereigns more vulnerable

Debt-to-GDP ratio, % of GDP



Source: ECB, Haver Analytics, Goldman Sachs GIR.

In the UK, the BoE is watching a few key categories as part of their financial stability assessment



Source: BoE July 2022 Financial Stability Report, Goldman Sachs GIR.

Bund yields have increased and housing affordability has decreased significantly



Source: Bloomberg, ECB, Goldman Sachs GIR.

Investment fund duration and liquidity risks have increased, making them vulnerable to further market corrections

Years (lhs), % of total assets (rhs)



Source: ECB, Goldman Sachs GIR.

Overall, financial stresses have increased recently in the UK, nearing levels seen around COVID-19

Country level index of financial stress UK



Jan-00 Jan-03 Jan-06 Jan-09 Jan-12 Jan-15 Jan-18 Jan-21 Note: Index includes six financial stress measures that capture three financial market segments: equity markets, bond markets, and foreign exchange markets. Source: ECB Europa. Goldman Sachs GIR.

The risk in "risk free" rates

Praveen Korapaty assesses the risks to market functioning as central banks continue to tighten aggressively

As central banks around the world aggressively withdraw liquidity from global markets in their quest to slay inflation, concerns have grown about whether cracks in the plumbing of the market's microstructure that date back to the aftermath of the Global Financial Crisis (GFC) could amplify risks stemming from tighter conditions. Structural market fragility could increasingly force central banks to play a more active role in sovereign debt markets than desired and use their balance sheets to maintain orderly market functioning rather than to conduct monetary policy, as was recently the case with the BoE's emergency intervention in the gilt market.

The genesis of the problem

Outstanding sovereign debt across most advanced economies has surged, both as a share of GDP and on an absolute basis, over the past three years. Although Covid-related fiscal expenditures contributed to this increase in debt, outside of some notable exceptions like Germany, public sector debt has grown in most countries for the past two decades.

The largest of these markets, the US Treasury market, has grown to nearly five times its size from the early 2000s. At the same time, the Fed's primary dealer data suggests that the aggregate dealer balance sheet allocated to intermediating the market has largely remained unchanged, as has the amount of the repo financing that these dealers enable. Of course, the Fed's holdings of Treasuries have risen as well, to roughly \$5.6tn of the approximately \$24tn of marketable debt. But even adjusting for this growth in the Fed's balance sheet, the size of the market relative to intermediation capacity on offer has grown substantially. This growing divergence means that flow imbalances, which presumably scale with the size of the market over time, will increasingly disrupt normal market functioning.

Dealer gross balance sheet and matched book repo remain largely unchanged while UST outstanding has grown substantially Smn



*Dealer gross positions is the sum of gross long and gross short positions in nominal Treasury securities, from the FR2004, 5y moving average. Source: Journal of Financial Economics (2020), Haver Analytics, GS GIR.

A lack of flex post GFC regulations

What is meant by 'normal' market functioning or liquidity? Liquidity can loosely be defined as the ability to transfer a 'reasonable amount of risk' in a 'reasonable amount of time' without creating 'too much' volatility in prices. Facilitating smooth risk transfer requires some elasticity in intermediary balance sheets—during a flow imbalance, the intermediary dealer should be able to expand their balance sheet to warehouse risk until a matching set of buyers (or sellers) is

found. For sovereign debt with low default risk, this is largely how markets worked before the GFC.

However, following the crisis, regulators instituted a range of new capital rules, including 'leverage capital' that was tied to notional balance sheet size, as opposed to risk. Given the relatively low margins on intermediating sovereign debt, these rules have effectively ossified dealer balance sheets—the economics of deploying a marginal unit of capital towards market-making just isn't compelling. As a result, intermediaries have been forced to adopt a much more active approach to market-making to prevent flow imbalances from translating into large inventories. This active management has resulted in larger, non-fundamental price swings in sovereign debt. We track measures of "market depth"—which can be loosely thought of as the risk that can be transacted at the top (or top few) levels of the order stack across major sovereign debt markets—and all of them are substantially impaired.

That said, the breakdown in market liquidity appears episodic in particular, when the central bank is actively purchasing assets, market functioning appears normal. This is evident not only in measures of market depth, but also in other metrics, such as ones that measure how much a unit of signed order flow moves prices (price impact coefficient). The reason for this is clear: when the central bank is buying, the risk of dealers accumulating large inventories is low given the presence of a "backstop" buyer with a very elastic balance sheet. Of course, under current regulations, because the central bank is the only entity in the system with a truly elastic balance sheet, it may end up having to intervene—like the BoE recently did—and deploy its balance sheet when market functioning deteriorates. Over time, this could lead to a co-opting of central bank balance sheets away from being used primarily as a monetary policy tool to being used to maintain orderly market functioning.





Market functioning is important

Ultimately, why do we care about orderly market functioning? First, in poorly functioning markets, investors will eventually start requiring an illiquidity premium, raising the cost of sovereign debt to the public. Second, high volatility in the risk-free rate in an economy would likely translate into more risk premium required across all assets. Third, poor liquidity has the potential to greatly amplify shocks; the recent large moves in the gilt market are again an example of how illiquidity can have material real world effects, in this case, for UK pensions (see pg. 14). Finally, impaired market functioning over time will likely force central banks to take a more regular and active role in sovereign debt markets than they may desire.

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Goldman Sachs & Co. LLC

Central bank policy snapshot

| | What have they done? | What have they said? | What do we expect? |
|-----|--|--|---|
| FED | Federal funds rate: 3.75%-4.00% • Federal Reserve has increased the federal funds rate target range by 375 basis points since the start of the year. • Balance sheet shrinkage accelerated to its maximum rate of up to \$60 billion in Treasury securities per month, and up to \$35 billion in agency MBS per month. | Christopher Waller (10/6/2022) "It's hard to pause rate hikes until inflation moderates I don't see financial stability concerns slowing the Fed's rate hikes." Neel Kashkari (10/6/2022) "There are going to be some failures around the global economy But to me, the bar to actually shifting our stance on policy is very high. It should not be up to the Federal Reserve or the American taxpayer to bail people out." Lael Brainard (9/30/2022) "We are attentive to financial vulnerabilities that could be exacerbated by the advent of additional adverse shocks monetary policy will need to be restrictive for some time to have confidence that inflation is moving back to target. For these reasons, we are committed to avoiding pulling back prematurely. We also recognize that risks may become more two sided at some point." | We expect the Fed to deliver a 50bp hike in December and 25bp hikes in February and March, for a peak funds rate of 4.75-5.00%. |
| ECB | Deposit facility rate: 1.50% The ECB has increased their deposit rate by 200 bps since July. The ECB decided to adjust the interest rates applicable to TLTRO III from 23 November 2022 and to offer banks additional voluntary early repayment dates. | Christine Lagarde (10/14/2022) "Risks to financial stability have perceptibly increased since the beginning of this year." "The financial stability outlook has deteriorated as weaker economic growth, higher inflation and tighter financing conditions put pressure on the debt servicing capacity of companies and households." (11/1/2022) "Our mandate is price stability, and we have to deliver on that using all the tools we have available, choosing those that will be most appropriate and efficient." | We expect the ECB to hike by 50bp in December and February and a final 25bp hike in March for a terminal rate of 2.75%. We expect QT to be announced in 102023 and begin in 202023. |
| BOE | Ank Rate: 3.00% The BoE has increased their deposit rate by 290 bps since December last year. The BoE conducted temporary and targeted purchases of long-dated UK government bonds from September 28 through October 14. | Andrew Bailey (10/15/2022) "The Bank is monitoring developments in financial markets very closely in light of the significant repricing of financial assets." "The Bank of England has had to intervene to deal with a threat to the stability of the financial system." "There may appear to be a tension here between tightening monetary policy as we must, including so-called Quantitative Tightening, and buying government debt to ease a critical threat to financial stability. This explains why we have been clear that our interventions are strictly temporary, and have been designed to do the minimum necessary." | We expect the BoE to deliver a 50bp hike in December, followed by a 50bp hike in February and two 25bp hikes in March and May for a terminal rate of 4.50%. |
| вол | Deposit Rate: -0.10% The BoJ has made no change to the deposit rate since 2016. The MOF/BoJ conducted yenbuying interventions in September and October. | Haruhiko Kuroda (9/26/2022) "The Bank will continue with monetary easing so as to firmly support Japan's economy from the demand side and thereby encourage the formation of the virtuous cycle accompanied by wage increases." October 2022 Financial Stability Report "Japan's financial system has been maintaining stability on the whole." "However, the period of stress may be prolonged further as policy rate hikes by central banks are continued and concerns about a slowdown in foreign economies are spreading. Financial and capital markets have continued to be nervous." | We expect the BoJ to maintain NIRP and YCC until after the end of Governor Kuroda's term in April 2023. |

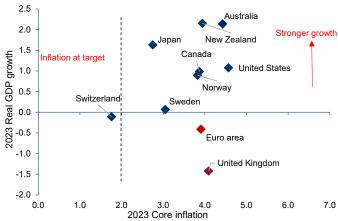
Special thanks to US, Europe, and Japan Economics teams for help with the exhibit. Source: Federal Reserve, European Central Bank, Bank of England, Bank of Japan, Goldman Sachs GIR.

ECB, BoE: fighting inflation under constraints

George Cole and Simon Freycenet explain that additional constraints in the inflation fight could lead to a more cautious approach from the BoE/ECB

As the G10 hiking cycle matures, attention is turning to potential vulnerabilities either in the real economy or financial system that could derail central bank tightening despite limited evidence that inflation is moderating. Recent volatility in the UK bond market due to pension fund forced selling, which catalyzed temporary asset purchases by the BoE, has highlighted the potential risks of rapidly rising rates. It is natural to ask whether fresh pockets of leverage will be exposed as rates rise—our best guess is that Europe is less vulnerable to the specific LDI-related turmoil in the gilt market (see pg. 15). But even without new, surprising areas of vulnerability, we expect both the BoE and the ECB to face additional constraints compared to the Fed in their inflation fight. The UK housing market and Southern European sovereign debt markets suggest a much higher interest rate sensitivity than in the US, likely leading to a more cautious approach by these central banks and an implicitly higher tolerance for inflation.

Differing growth-inflation trade-offs across the G10 GS forecasts, % yoy



Source: Goldman Sachs GIR.

A more challenging trade-off in Europe

The UK and the Euro area face a much more challenging trade-off between growth and inflation than in the US, given the impact on European energy prices from the Russian invasion of Ukraine. As net energy importers, higher energy prices represent a significant terms-of-trade shock that is set to weaken growth as well as push up inflation. Both economies are still in a state of excess demand, but rather than a good news story about the strength of the economy, this primarily owes to a sharp and likely permanent deterioration of potential output capacity. In short, the European and specifically German business model is under severe pressure at current gas prices.

In contrast, the US is more 'conventionally' overheated, with demand growing stronger than potential output, which allows for a more forceful Fed response. The UK and Euro area are likely to enter a gas-driven recession in coming quarters, which already complicates the task for monetary policy. With private

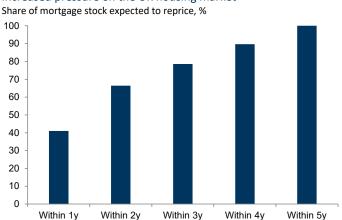
sector balance sheets weakened by the cost-of-living squeeze resulting from much higher commodity and energy prices, excessive tightening may lead to excessive deleveraging in the economy, and thus makes calibrating the level of rate rises needed to combat inflation more difficult.

The price of low inflation in the UK: a weaker housing market

The recent UK experience has shown the perils of rapidly rising rates as leverage in the pension system exacerbated a selloff in long-end gilts. A combination of dovish rate policy, high inflation, the prospect of BoE gilt sales and, finally, a planned fiscal expansion all served to turbocharge UK rates, which gained their own momentum as LDI-based strategies came under pressure (see pg. 14). Although the financial position of pension funds appeared sound (the present value of their assets exceeded that of their liabilities) exposure to higher rates via derivative positions led to significant liquidity needs and self-reinforcing negative dynamics in the gilt market. This volatility was only arrested by emergency BoE intervention to buy gilts, and, ultimately, by a significant retrenchment in the government's fiscal policy stance.

It is tempting to think that the lesson from this experience is that monetary policy needs to be conducted more slowly or cautiously in pursuit of its mandates to forestall this sort of instability. And as much as the BoE emphasized the temporary and non-monetary nature of its emergency intervention, lasting consequences for the BoE's monetary policy are apparent given that its asset sales under quantitative tightening (QT) are limited to shorter maturity gilts for now. However, in our view, inflation itself is the source of much of the interest rate volatility; until inflation is under control, rates will be at risk of repricing higher. But it is precisely the fight against inflation that poses a constraint for the BoE. The combination of weaker growth and higher rates is putting pressure on the UK housing market. With the average length of UK fixed rate mortgages less than three years, the sensitivity of household budgets to interest rates is much greater than in the US, where much longer fixed rate mortgages are common.

Increased pressure on the UK housing market

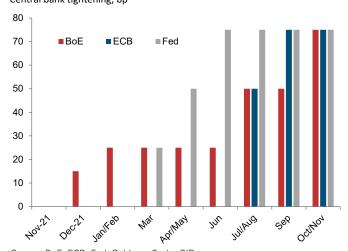


Source: BoE, Goldman Sachs GIR.

As a result, the BoE has emphasized the downside risks to growth rather than the upside risks to inflation. Further, the BoE is now specifically leaning against the market's pricing of interest rates, in an effort to *lower* mortgage rates and thus

reduce risks in the housing market. For this reason, the BoE is likely to remain a 'reluctant' hiker compared with other G10 banks, and to tolerate a higher level of inflation over time.

The BoE has underdelivered throughout 2022 Central bank tightening, bp



Source: BoE, ECB, Fed, Goldman Sachs GIR.

The price of low inflation in the Euro area: fragmentation

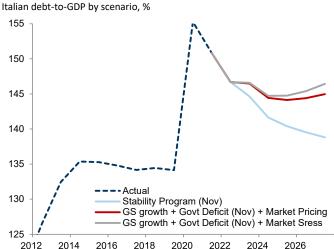
In the Euro area, a decade of zero or negative rates has likely led to a build-up of balance sheet exposure to higher rates. That said, the vulnerabilities in the European housing market and in European pension funds look relatively contained compared with other markets. For the ECB, the problem is in plain sight—the level of indebtedness across Southern Europe, and in Italy in particular.

Since the need for policy tightening became apparent last year, ECB policymakers have faced the challenge of managing market expectations to anchor sovereign credit and prevent a sharp widening in sovereign spreads. The ECB has two new lines of defense against this risk: first, securities maturing under the ECB pandemic quantitative easing (QE) program—the PEPP—can be reinvested flexibly across countries, with maturing German bonds diverted to other countries, such as Italy. Second, the ECB unveiled a new program called the Transmission Protection Instrument (TPI), which, in the event of 'non-fundamental' spread widening, can buy an *ex-ante* unlimited amount of government bonds to support a sovereign facing adverse market conditions.

These preemptive strikes against sovereign spread widening point to the fundamental tension for the ECB: can it tighten rates to lower inflation while simultaneously keeping Southern European governments solvent? This is a question posed even by ex-chief economists of the ECB. Like the UK housing market, the credit premium on sovereign credit in Europe is a potential—possibly even desirable—channel of transmission for monetary policy, but only up to a point. With the Italian debt market at risk of non-linear and self-fulfilling dynamics, the ECB faces a significant challenge in calibrating policy to control inflation without causing significant economic damage.

And yet, the ECB's narrow legal price-stability mandate will force a more hawkish response to the Euro area's current high and persistent inflation, which currently rivals that of the US. We expect at least another 100bp of hikes from the ECB, as well as an announcement of quantitative tightening in 1Q23. All of this is set to push bund yields significantly higher (we expect 2.75% for 10y bunds in early 2023), putting pressure on the all-in funding cost for the Italian government. With 10y BTP yields likely above 5% as a result (assuming our forecast of a 10y credit spread of around 250bp), we see limited margin of maneuver for the Italian treasury to keep debt-to-GDP on a declining path.

The possible paths of Italian debt sustainability



Source: Goldman Sachs GIR.

Better a hawkish or dovish mistake?

At the most recent Fed meeting, Chair Powell was clear: in the current high inflation environment, it is better to make a hawkish than a dovish mistake. This is unlikely to be the message that the BoE and ECB deliver. Facing an already-weak growth environment, and given the much greater interest rate sensitivity of the UK housing market and Italian debt market, we think the risk management considerations for the BoE and ECB point in the opposite direction. Erring on the side of keeping rates low is likely to keep inflation high, steepen curves, and weaken currencies relative to the US. Rather than the 'unknown unknowns' of financial stability risks, it is the known risks of housing and Italy that will likely see Europe muddle through by implicitly tolerating higher inflation.

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Q&A on UK pension funds







GSAM Strategists Ed Francis, Matthew Maciaszek, and Michael Moran answer key questions on UK pension funds

The interviewees are employees of Goldman Sachs Asset Management and the views stated herein reflect those of the interviewees, not Goldman Sachs Research.

Q: Why did UK pension funds recently come under pressure, and what happened to them during this period?

A: Pension fund liabilities are sensitive to movements in interest rates, and an efficient way to hedge that is by investing in government bonds. Pension funds without sufficient capital to buy bonds outright can use leverage to gain exposure, which is what many UK pension funds do. Prior to the recent events, it wasn't unusual for UK pension funds to be three or more x levered in their liability-driven investment (LDI) portfolios—the portfolios used to hedge interest rates and inflation. From January to August of this year, long-term interest rates in the UK rose almost 200bp as the BoE aggressively hiked rates, forcing many pension funds to meet material collateral demands on their leveraged LDI portfolios. Then, in September, the new UK government proposed significant unfunded tax cuts, which catalyzed another 200bp spike in interest rates over a very short period of time. This required pension funds to post even more capital, and quickly, as leverage in their LDI portfolios roughly doubled. This presented challenges for all pensions that use leverage, and a subset of pension funds—those with high levels of leverage, relative illiquidity in the rest of their asset portfolio, and weak processes, or some combination of these factors—struggled to do so, forcing them to sell their most liquid assets, including gilts. That set off a disorderly unwind in the gilt market that drove up yields and forced the BoE to step in to restore order by promising to buy gilts. This BoE action bought pension funds some much needed time to raise cash, reduce leverage, and unwind hedges in an orderly fashion, although it was the U-turn in the government's fiscal stance a few weeks later that we believe ultimately reduced the funding stress of the pension funds and largely reversed the surge in gilt yields.

Q: What is the structure of LDI funds, and what—if any—role did this structure play in the recent crisis?

A: Two different types of LDI structures exist—segregated accounts and pooled funds. In a segregated account, pension funds contract directly with counterparty banks and the design and implementation are specific to the individual pension scheme. The complex nature of segregated accounts has historically made them the preserve of larger pension funds. Over the last decade we've seen the rise of pooled LDI funds managed by large asset managers, which have provided small and mid-sized pension funds access to levered hedges for their portfolios. Today, the pooled fund industry is a few hundred billion sterling in size compared to the overall £1-1.5tn UK LDI industry. Pooled funds faced the most difficulty during the recent stress episode mainly owing, in our opinion, to the logistical challenge of having to secure additional funding from a large group of underlying investors in a very short time frame. While pooled vehicles generally set aside collateral to deal with interest rate moves, the extreme rate move in September required them to seek additional funding from their underlying investors. Asking 50 clients for £1 million each is harder than asking one client for £50 million.

That's not to say that segregated accounts didn't experience challenges during this period. Many pension funds had to raise very large amounts of cash quickly, which is difficult even within segregated accounts. Making this even more challenging was the fact that all asset classes were underperforming at the same time, so pension funds couldn't just rebalance their levered LDI portfolios by drawing upon outperforming assets. That said, the recent crisis shouldn't be viewed as a failure of LDI, which we believe has helped UK pension funds control their funding level volatility by managing liability risks and investing for growth over the last two decades. At issue was the excessive use of leverage by some pension plans and, in some instances, the complexity of the implementation through pooled vehicles.

Q: What changes—if any—do you anticipate UK pension funds will make in the aftermath of this episode?

A: Several changes will likely be made. Leverage levels for pension funds will likely decline within pooled funds and segregated accounts. Pension funds will have to accept that the trade-off between hedging and investing in illiquid assets has shifted; funds that want to be well-hedged will have less appetite for illiquid assets, and funds that want to own illiquid assets will likely have to accept that they may be less well-hedged and could experience more volatility. Leverage in pooled funds will likely be reduced, meaning they will need more capital to provide equivalent hedging levels. That suggests that pooled LDI funds won't disappear but may be less widely used.

Q: What similarities/differences make such a stress episode more/less likely in the US and Euro area?

A: Five factors distinguish the US market from the UK market that make a similar episode much less likely in the US. One, US pension plans are on average only about half as levered as UK plans. Higher funding levels in the US have led US pension funds to increase their fixed income allocations, necessitating less leverage to hedge interest rates. The duration of UK pension liabilities is longer than those in the US because a large portion of UK pension payments are inflation-linked, meaning that the final payment is higher, which pushes the weight of the liabilities further into the future. And US Treasury STRIPS—which are stripped into principal and coupon payments so offer higher levels of interest rate duration—are a way to obtain leverage without having to borrow or utilize derivatives, but no comparable investment exists in the UK. Two, leveraged LDI funds are less prevalent in the US than in the UK. Three, the size of the US Treasury market is much larger relative to the amount of leverage in US funds compared to the size of the UK gilt market relative to the leverage of UK pension funds. So, a higher proportion of investment in their domestic government bonds came from pension funds in the UK than the US. Four, no market in the world is deeper or more liquid than the US Treasury market, so dislocations in US interest rates are less likely. And five, the difference between US and UK governing systems means that fiscal proposals like the UK's mini-budget have a much lower probability of actually being implemented in the US, and the market reaction to such proposals would accordingly likely be more muted. In terms of elsewhere in Europe, the only other market with a large defined benefit pension fund industry that uses LDI extensively is the Dutch market. But, unlike the UK, Dutch pensions generally aren't inflation-linked, and funds can hedge their liability risks using the Euro market in addition to the domestic Dutch bond market. So, comparable systemic risks look limited. Now, it could be that the UK pension market was the canary in the coal mine and a symptom of an over-levered financial system, and similar crises will occur in other places as

financial systems potentially deleverage. That's certainly a risk we think about; everyone was caught off guard by the UK episode as pension funds absorbing a comparable level of interest rate increases through August perhaps lulled us into a false sense of security before the surprise budgetary announcement in September lit the fire. That said, it's not our central thesis that the UK pension crisis will

repeat elsewhere.

UK pension fund stress: a repeat elsewhere?

After a period of exceptional volatility in the UK government bond market generated in part by a self-reinforcing selling of gilts by local pension funds (see pg. 14), markets' focus has shifted to potential vulnerabilities elsewhere. Naturally, attention has turned to the Euro area given its long period of low rates and sizable contingent of defined benefit (DB) pension schemes. Despite the prevalence of these schemes in the Euro area, especially in the Netherlands, differences between pension schemes in the Euro area and the UK reduce the risk of a repeat deleveraging.

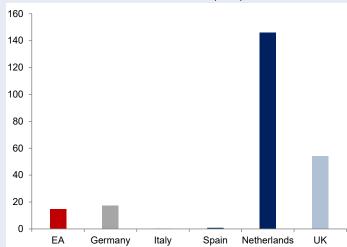
Lower DB liabilities, and exposure to government bonds

The lion's share of retirement income in the Euro area is provided by public pension schemes. This implies that Euro area private DB pension fund liabilities represent a much lower share of the underlying economies than in the UK. DB pension fund liabilities amounted to 54% of UK GDP at the end of 1H22, while they sat just below 15% of Euro area GDP, with these liabilities concentrated in the Netherlands.

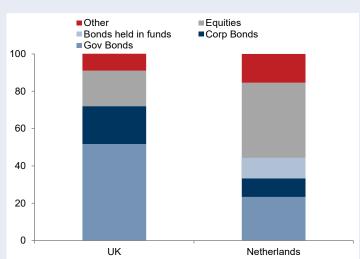
Euro area pension fund holdings are also less concentrated in both geography and asset class than in the UK. According to the Pension Protection Fund (PPF), UK pension funds allocated 72% of their holdings towards bonds, and within that about 70% towards government securities. This compares with a Euro area pension fund industry that has more diversified holdings, with Dutch pension funds allocating only 44% of their holdings towards bonds.

The size of the Euro area pension system is smaller than that of the UK as a share of the economy...

Defined benefit schemes' liabilities as % of GDP (1H22)



...and its holdings are more diversified
Pension fund holdings by geography and asset class at end-1Q22, %



Source: Haver Analytics, ECB, PPF, Goldman Sachs GIR.

Source: DNB, BoE, Goldman Sachs GIR.

Liquidity and leverage still a risk

That said, the use of derivatives to hedge liabilities against interest rate movements and the use of repo financing are sources of risk. While these strategies can protect funds against falling interest rates (and thus higher liabilities), they also generate leverage, which can lead to margin/collateral calls during large and rapid upward moves in interest rates.

The European Securities and Markets Authority (ESMA) estimated in 2020 that about 40% of Dutch pension fund liabilities are hedged, with 63% of that via interest rate swaps. Assuming these ratios have remained stable, we estimate that each parallel 100bp shift in Euro area rates generates a margin call of about €65bn. But, unlike UK peers, Euro area funds may be able to post bonds as collateral rather than cash, which could reduce funding pressures.

On the liquidity side, ECB data shows that Euro area pensions held about €200bn of cash holdings in 1H22 (half of which is in the Netherlands), or 10% of DB liabilities. An equivalent figure is difficult to obtain for the UK, although PPF reports indicate that net cash allocations are low, and net negative once repo funding strategies are accounted for.

Action to mitigate risks ahead

Although this evidence suggests less concentrated exposure to sharply higher rates in Euro area pension schemes than in the UK, these statistics provide only a partial window into the exposure to higher interest rates, and do not provide insight into aggregate or fund-level leverage—a key source of risk in the UK pension system. So, even if the Euro area avoids the self-reinforcing dynamics of gilt volatility, action to mitigate risks is likely ahead.

In the near term, we expect Euro area pension funds to reduce leverage and strengthen liquidity buffers. Over the longer term, recent events are likely to lead to increased regulatory attention, reduced demand for illiquid assets, and a further transition away from DB to defined contribution (DC) schemes, which is already underway in the Netherlands.

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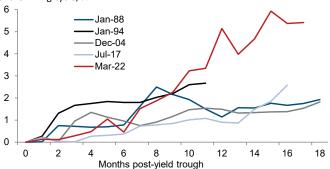
Goldman Sachs International

Assessing the risk of a funding shock

Lotfi Karoui and Vinay Viswanathan assess the risk of funding shocks in the credit market amid aggressive Fed tightening

The aggressiveness of the current US hiking cycle has fueled concerns about the ability of corporate borrowers to adjust to a higher-for-longer cost of funding environment. With the largest back-up in corporate bond yields since the late 1980s this year, corporate borrowers could be facing the biggest shock to their cost of capital in more than three decades.

The largest back-up in corporate bond yields since the late 1980s Cumulative increase in HY bond yields from the trough that preceded the start of the hiking cycle, %

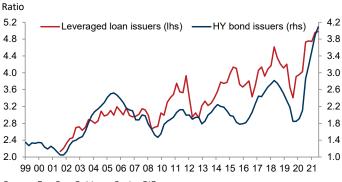


Source: Bloomberg, Goldman Sachs GIR.

Healthy fundamentals, but for how long?

The good news is that, in aggregate, the fundamental picture is still healthy. Debt servicing capacity for leveraged corporate borrowers is strong by historical standards; as of end-1H22, interest coverage ratios for HY bond and leveraged loan issuers are near their highest levels in three years. The same holds true for commercial real estate (CRE) borrowers, which collectively have \$3.5tn of mortgage loans outstanding. Robust debt issuance volumes in 2020 and 2021, coupled with impressive growth in net operating income, created a comfortable buffer for borrowers. All told, these solid fundamentals suggest low risk of an imminent payment shock.

Interest coverage ratios for HY bond and leveraged loan issuers are at historically high levels



Source: FactSet, Goldman Sachs GIR.

But the concern is whether leveraged corporate balance sheets can withstand a higher-for-longer cost of capital regime, particularly given the prospect of a more constrained environment for earnings growth. Unlike the last three hiking cycles during which the Fed and other central banks tightened financial conditions in response to a combination of firming inflation and robust economic growth, the ongoing tightening

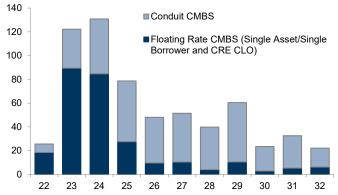
cycle is unfolding against a backdrop of decelerating growth and persistently high inflation.

In our view, a return of funding costs to pre-Global Financial Crisis (GFC) levels against a backdrop of sluggish growth would almost surely put an end to three decades of steady improvement in interest coverage ratios. This transition will likely be more abrupt for borrowers with rate-sensitive balance sheets, such as issuers in the floating rate leveraged loan market, where the deterioration in debt servicing capacity will likely become visible in upcoming quarters given the relatively small share of liabilities that are hedged against the risk of rising rates. CRE borrowers are also somewhat vulnerable; while hedging is common practice for these borrowers, so are mismatches between the duration of their interest rate hedges and their mortgage maturities. Coupled with material refinancing needs in 2023 and 2024, we expect a material increase in debt service costs for CRE borrowers in upcoming quarters. This shift will be most challenging for CRE segments like Office and Retail that are already facing relatively weak rent growth outlooks.

Rising, but not systemic, risk

While these pockets of vulnerability warrant close watch, the odds that higher funding costs morph into a threat to financial stability are lower than in previous cycles. Crucially, the investor base in fixed income markets is less financially leveraged relative to the pre-GFC period. The largest investors in the leveraged loan market—managers of collateralized loan obligations (CLO) and mutual funds—typically do not borrow against their assets. Similarly, commercial mortgage backed securities (CMBS), a popular vehicle for buying CRE debt, are primarily owned by long-term-focused investors like insurance companies. A slew of post-GFC regulatory changes have also decreased the amount of aggregate leverage in the CRE debt complex, keeping the incentives of lenders and investors more closely aligned. Combined with tighter lending standards, this should also limit the risk of a wave of bankruptcies that would trigger large-scale losses for investors and pose a threat to the broader financial system.

Refinancing needs for CRE borrowers to increase materially ahead Upcoming maturity payments for CRE loans in CMBS and CLO portfolios, \$bn



Source: Trepp, Goldman Sachs GIR.

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Financial stability risks: a survey

As central banks around the world continue to hike rates, markets are increasingly focused on risks to global financial stability. Focusing on financial instability risks in DM economies (the US, the Euro area, and the UK) that could meaningfully weigh on global GDP1, we develop a systematic survey of GS research analysts to identify areas of vulnerability. We find that financial instability risks are largest for highly-levered European pension funds and insurers and for sovereign bond markets at risk of rate and illiquidity shocks but that most systemically important sectors (housing, consumers, corporations, and banks) are in relatively sound shape.

Surveying GS research analysts

We surveyed GS research analysts covering US and European economics, portfolio strategy, credit strategy, interest rate strategy, and financials to rank risks in five core sectors of the economy and financial system. Our analysts assessed four key risk factors: (1) sensitivity to rising rates and/or Dollar strength, (2) liquidity/market functioning risk, (3) the risk from high leverage/solvency concerns, (4) spillover risk to other sectors/asset classes for each sector on a 1-5 scale and provided detail on key vulnerabilities.

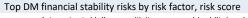
Risks in sovereign bond markets, European pension funds, insurers

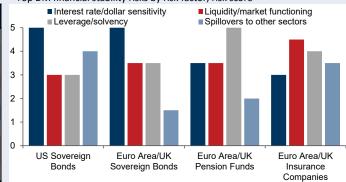
Financial stability risk scores, GS analyst survey

| Sector | US | Region Euro Area | UK |
|-------------------------------------|----|---------------------|----|
| 1. Households: | | | |
| a. Real estate | 1 | 1 | 1 |
| b. Consumer credit | 1 | 1 | 1 |
| 2. Government | 2 | 3 | 2 |
| 3. Non-financial corporations | 1 | 1 | 1 |
| 4. Banks | 0 | 0 | 0 |
| 5. Non-bank financial institutions: | | | |
| a. Pension funds | 1 | 2 | 2 |
| b. Insurance companies | 1 | 2 | 2 |
| c. Other asset managers | 0 | 1 | 1 |

Risk scores correspond to the likelihood of a significant financial instability event. 0: very unlikely (<1%), 1: unlikely (1-5%), 2: plausible (5-20%), 3: elevated (>20%).

Sovereign bonds relatively more rate-sensitive but less leveraged





For each risk factor, we show the average score from all analysts and regions included in the sector Source: Goldman Sachs GIR.

Key risk areas: sovereign bonds, pension funds, and insurance companies

Two key risks stand out. First, risks are 'plausible' or 'elevated' in US and European sovereign bond markets, especially in the Euro area, where the likelihood of a financial instability event exceeds 20%. Our analysts see the greatest vulnerability in sovereign bonds' sensitivity to rising interest rates, although they think risk scenarios would play out differently depending on the region. In the US, they judge the likelihood of a sovereign default as extremely low (especially because the Fed would likely intervene in the event of turbulence) but see some possibility of a temporary breakdown in market functioning, leading to a disorderly tightening of financial conditions. In the Euro area, solvency concerns are higher for Italian debt, given the country's challenging fiscal outlook (though spillover risks are somewhat contained due to the ECB's Transmission Protection Instrument).

Second, risks are also 'plausible' in parts of the UK and Euro area non-bank financial sector—namely, in pension funds and insurance companies. Here, our analysts are more concerned about liquidity and solvency issues, as sharp moves in rates could expose their positions in leveraged derivative investments around which there is some lack of transparency. However, the risk of spillovers to other sectors from this is smaller, limiting the likelihood of a substantial hit to growth.

Lessons from the past, and for the future

Several areas that played a key role in past financial crises seem to be on relatively sound footing. Strong household and corporate balance sheets limit risks on the consumer credit and nonfinancial corporate side and should serve as a cushion against financial shocks. Real estate is also at relatively low risk—although we expect DM home prices to fall further, mortgage quality is robust and has significantly improved since the Global Financial Crisis (partly due to stricter leverage and insurance requirements and new stress tests). And the banking sector consistently scored as the lowest-risk area, due to considerable capital and liquidity buffers.

Looking ahead, as risks are concentrated in rate-sensitive sectors (areas that averaged over a 4/5 for rate sensitivity), we expect central banks to incorporate some additional caution from financial instability risks into their decision-making. Accordingly, we think most DM central banks will begin to slow the pace of rate hikes going into 2023 (with stepdowns to a 50bp pace at the next Fed, ECB, and BoE meetings), which, all other things equal, should reduce the risk of unexpected turbulence.

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¹ We define a significant financial instability event as a breakdown in a core function of the system (intermediation, insurance, self-correction) that has the potential to

When will the Dollar peak?

Kamakshya Trivedi and Sid Bhushan explore whether the Dollar may be close to peaking, finding that a confluence of factors could lead to a peak in 1H2023

The Dollar has a lot going for it at the moment. US activity and labor markets are proving resilient, and increasing financial stability, mortgage market, and recession concerns in many other parts of the world mean that other global central banks may struggle to keep up with the Fed's aggressive pace of tightening. Indeed, central banks in Australia, Canada, and Norway have stepped down the pace of hikes, the BoE has commented that market pricing for the cycle may be too aggressive, the ECB signalled an intent to slow down its tightening pace in December given deepening recession risks in the Euro area, and several EM central banks appear to want to stop hiking given local conditions. In addition, the challenging fiscal environment—which increases the potential for policy missteps—and growing financial stability concerns could also provide a tailwind to the Dollar given the currency's 'safe haven' status. But the current strength of the broad Dollarnow approaching the highs of the mid-1980s and early 2000s and increasingly stretched Dollar valuation begs the question of whether the Dollar may be close to peaking. We think the Dollar will likely continue to appreciate over the coming months but see the potential for a confluence of factors to lead to a Dollar peak in 1H23.

Lessons from historical Dollar peaks

History provides three key lessons on when the Dollar might peak¹.

We identify six peaks of the broad Dollar Real Fed broad trade-weighted Dollar index



Note: Grey bars show NBER monthly recession classification. Source: Federal Reserve, Goldman Sachs GIR

First, Dollar peaks tend to be closely associated with the trough in US industrial production growth. In most cases, the Dollar peaks at the same time or after the trough in industrial production growth.

Peaks in the broad Dollar tend to follow the trough in US industrial activity...

US activity, percentage points relative to month of Dollar peak

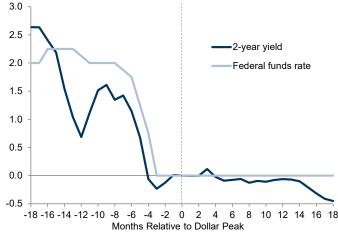


Source: Haver Analytics, Goldman Sachs GIR.

Second, this slowdown in US activity tends to be associated with an easing Fed. In almost all episodes, Dollar peaks tended to occur either when the Federal funds rate was near its trough, or at least when the Fed had been easing for several months.

...which likely explains why the Federal funds rate tends to be either near a trough or falling

US rates, percentage points relative to month of Dollar peak



Source: Haver Analytics, Goldman Sachs GIR.

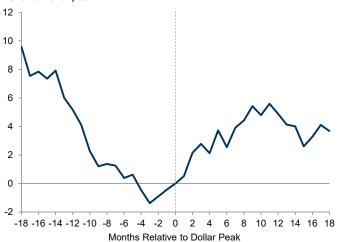
Third, Dollar peaks display a similar relationship with global as with US activity. Again, in most cases the Dollar peaks after or at the same time as the bottom in global industrial production growth.

In a nutshell, the evidence of the past few decades shows that the Dollar reaches a peak and starts weakening sustainably once a recovery in US and global economic activity is clearly on the horizon, aided by an easing Fed, and often coinciding with a trough in risky assets. This suggests that a Dollar peak is still several quarters away, since the trough in growth also seems months away and we don't expect the Fed to embark on easing until 2024.

¹ We analyze six such peaks: January 1974, March 1985, February 2002, March 2009, December 2016, and April 2020

Peaks in the broad Dollar tend to follow a trough in global industrial production growth

OECD ex. US industrial production growth (yoy), percentage points relative to month of Dollar peak



Source: Haver Analytics, Goldman Sachs GIR.

Dollar peaks in a time of high inflation

But this Dollar cycle is also very different from the many demand-driven and balance-sheet cycles of the past few decades, and more reminiscent of the high inflation cycles of the 1970s and mid-1980s. Supply-side disruptions have also played a much larger role this time around, including the pandemic-related blockages in transportation and the more recent energy supply shocks affecting much of the world.

The mid-1970s and mid-1980s experience is quite different from the historical pattern across Dollar peaks

Macro variables around Dollar peaks

| | a a & . c c a . c c | and Bondi pe | 4.13 | | |
|--------|--------------------------------|------------------------------------|-----------------------------|--|----------------------------|
| Peak | US Industrial Production | Global Industrial Production | US Inflation | Federal Funds Rate | S&P 500 yoy Growth |
| Jan-74 | A year before trough | A year before trough | A year before peak | 6 months before peak (but recent easing) | A year before trough |
| Mar-85 | 6 months before trough | A year before trough | Declining near trough | 6 months after peak (but significant easing occurred) | 6 months after trough |
| Feb-02 | Same time as trough | Same time as trough | At trough | Near trough (easing) | 6 months after trough |
| Mar-09 | Same time as trough | Same time as trough | At trough | At trough | Same time as trough |
| Dec-16 | A year after trough | A year after trough | Increasing near peak | Near trough (tightening) | A year after trough |
| Apr-20 | Same time as trough | Same time as trough | At trough | At trough | Same time as trough |

Note: Shading means that variable follows the standard pattern. This means the Dollar peaks at the same time or after troughs in US and global activity and equity price growth, near the trough in inflation, and the Fed funds rate has eased. Source: Goldman Sachs GIR.

Looking more closely at the 1985 cycle—which also came amid a backdrop of high inflation—while the Dollar peak was very clear (contemporaneous with the Plaza Accord), some of the other macro patterns were a bit different than in subsequent Dollar cycles. The trough in US and global growth didn't occur

for several months, and the Federal funds rate was still near its peak, although the Fed had started easing meaningfully. And in the mid-70s, the Dollar peak also occurred in a period of deteriorating US and global growth and some Fed easing (although this was temporary), but a key difference was that inflation was still relatively high and increasing but had declined meaningfully in the mid-1980s².

So, when will the Dollar peak?

The experience of the two high inflation episodes of the 1970s and mid-1980s suggests that it may not be necessary to have a substantial easing of Fed policy or a trough in inflation for the Dollar to peak; an earlier peak is possible once it becomes clear that the Fed may be approaching a pause in rate hikes, or if Fed communication pivots credibly, even if US activity is still slowing.

When could we see such a confluence of factors in the current context? At some point in 1H23, Europe may be past the worst of its winter recession, and China could ease its Dynamic zero-Covid policy (ZCP), leading to an improvement in the global growth backdrop. At the same time, new leadership at the BoJ may have telegraphed a gradual exit from yield curve control. And even if Fed tightening potentially causes a later trough in US growth, the experience of the 1970s suggests that the Dollar could still peak, especially if the peak in US rates is in sight alongside a moderation in US inflation and the labor market.

Timing the peak in the Dollar is always tricky, and there are risks in both directions. The timeframe of a Dollar peak may be pushed out if the US moves squarely towards a recession, financial stability concerns become more prominent, or there is a marked worsening in the risk-taking environment. In those instances, the Dollar should continue to benefit from a safe-haven bid, and the Fed may need to shift to easing until a recovery in activity is perceptible, in which case the Dollar cycle may come to resemble the cycles of the more recent decades.

On the other hand, an unexpected end to the Russia-Ukraine War or an early end to China's ZCP would likely set in motion the macro and market dynamics that could contribute to an earlier Dollar peak. Such a development would alleviate Europe's acute energy supply shock, moderate the upside risk to global energy prices, and foster a better environment for global growth and risk assets—all of which would be conducive for a peak in the Dollar.

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² Identification of the Dollar peak is much harder in the 1970s because the Fed's real broad indices do not extend back to the start of the decade, and because the end of Bretton Woods makes it harder to interpret currency movements. We identify January 1974 as a Dollar peak based on a granular analysis of thirty FX crosses.

FX interventions: buying time

Karen Fishman argues that central banks will likely continue to conduct FX interventions over the near term as the Dollar continues to strengthen, given their recent success in slowing the pace of currency depreciation

The recent significant and relatively rapid Dollar rally in response to the Fed's aggressive hiking campaign to rein in inflation has led several central banks to unilaterally intervene in FX markets to dampen the downward pressure on their domestic currencies. But the historical efficacy of unilateral interventions is fairly limited, and the fundamental drivers of the recent Dollar moves—higher US yields and a challenging global growth outlook—are likely to persist over the near term, raising the question of how successful these interventions can really be. We find that interventions are unlikely to prevent further currency weakness over the longer run if the current macro backdrop remains unchanged—especially if central banks continue to intervene on a unilateral rather than coordinated basis—but that they can slow the pace of currency depreciation, and are therefore likely to remain a feature of the FX market in the near term as the Dollar most likely continues to strengthen.

Interventions back in vogue...

Several EM central banks have directly intervened in FX markets this year, including in Thailand, India, Korea and the Philippines, as well as in China, where the PBOC verbally intervened. IMF data suggest that global holdings of FX reserves excluding gold have fallen by nearly \$1tn since end-2021. While much of that decline is attributable to valuation changes driven by the stronger Dollar, a material portion likely owes to FX intervention. We estimate, for example, that roughly \$19bn of that decline is due to the BoT's intervention (4% of Thailand's GDP) and roughly \$44bn owes to the RBI's intervention (just under 2% of India's GDP), with official data reporting some of the largest monthly operations in recent months since 2008. Recent data from Japan's Ministry of Finance (MoF) also shows over ¥9tn—or ~\$60-65bn, just shy of 1.5% of Japan's GDP—of FX operations since August, with the majority conducted in October alone.

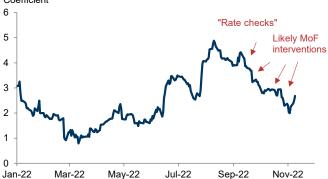
...to some success

The recent experience of Japan is a good example of how FX operations can be effective even if the domestic currency continues to weaken, as has generally been the case for most of the currencies subject to interventions this year. Prior to September, Japanese officials had repeatedly used verbal intervention to try to slow the rapid pace of JPY depreciation and the growing interest in speculative shorts, but to little avail. As a result, the MoF directly intervened in the FX market in September and likely over several days in October. These operations directly reduced the sensitivity of USD/JPY to moves in the 10-year USD-JPY real rate differential, even prior to official confirmation of the intervention, thereby slowing the pace of JPY depreciation. This experience suggests that even though the current policy mix of the BoJ's yield curve control (YCC) and the MoF's FX intervention looks ultimately unsustainable as countries cannot i) manage the exchange rate while ii) operating independent monetary policy and iii) allowing

free capital flow (the "impossible trinity" or "trilemma"), it could be effective and sustained for a while longer if both sufficient reserves and incremental benefits remain.

Japan's intervention success

3m rolling beta of daily USD/JPY returns to 10y real swap rate differential Coefficient



Source: Bloomberg, Goldman Sachs GIR.

More interventions ahead, mostly EM and unilateral

As FX interventions can be successful in slowing the pace of currency depreciation and buying time for policymakers even as depreciation pressures persist, central banks selling FX reserves to support their domestic currencies seems to be a reasonable course of action against the backdrop of a strong Dollar. With Dollar strength likely to persist over the coming months (see pgs. 18-19) and growing risk of further appreciation in the medium-term, we expect more FX interventions ahead, although perhaps at a lower frequency if the pace of Dollar appreciation slows. We expect this to mostly be an EM story, though; outside of Japan, interventions by DM central banks have historically been rare, and we continue to see low odds of that changing in the near- to medium-term. Finally, while the magnitude of Dollar strength has prompted some discussion of potential coordinated intervention to weaken the Dollar—which has proven successful in the past—such action would likely require US participation to be effective. But given US policymakers' focus on resolving the US inflation problem, we do not expect a new Plaza Accord anytime soon.

G7 FX interventions have been rare in recent decades

| Date | Economy | Exchange Rate | (\$bn) | Intervention | Coordinated |
|------------------|----------|------------------|-----------|--------------|-------------|
| 1/12/1999 | Japan | USD/JPY | 5.8 | Weaker JPY | Unilateral |
| 6/10/99-4/3/00 | Japan | USD/JPY, EUR/JPY | 84.3, 5.7 | Weaker JPY | Unilateral |
| 9/22/2000 | Eurozone | EUR/USD, EUR/JPY | 1.4, 1.3 | Stronger EUR | Coordinated |
| 9/22/2000 | US | EUR/USD | 1.3 | Stronger EUR | Coordinated |
| 9/22/2000 | Japan | EUR/JPY | 1.3 | Stronger EUR | Coordinated |
| 11/3/2000 | Eurozone | EUR/USD, EUR/JPY | 2.5, 0.6 | Stronger EUR | Unilateral |
| 11/6/2000 | Eurozone | EUR/USD | 0.9 | Stronger EUR | Unilateral |
| 11/9/2000 | Eurozone | EUR/USD, EUR/JPY | 1.5, 0.7 | Stronger EUR | Unilateral |
| 9/17/01-9/28/01 | Japan | USD/JPY, EUR/JPY | 26.7, 0.6 | Weaker JPY | Unilateral |
| 5/22/02-6/28/02 | Japan | USD/JPY, EUR/JPY | 32.5, 0.2 | Weaker JPY | Unilateral |
| 1/15/03-3/16/04 | Japan | USD/JPY | 314.7 | Weaker JPY | Unilateral |
| 2/24/03-5/9/03 | Japan | EUR/JPY | 1.5 | Weaker JPY | Unilateral |
| 9/15/2010 | Japan | USD/JPY | 24.8 | Weaker JPY | Unilateral |
| 3/18/2011 | Japan | USD/JPY | 8.6 | Weaker JPY | Coordinated |
| 3/18/2011 | Eurozone | EUR/JPY | 1.0 | Weaker JPY | Coordinated |
| 3/18/2011 | US | USD/JPY | 1.0 | Weaker JPY | Coordinated |
| 3/18/2011 | UK | GBP/JPY | 0.2 | Weaker JPY | Coordinated |
| 3/18/2011 | Canada | CAD/JPY | 0.1 | Weaker JPY | Coordinated |
| 8/4/2011 | Japan | USD/JPY | 57.2 | Weaker JPY | Unilateral |
| 10/31/11-11/4/11 | l Japan | USD/JPY | 116.3 | Weaker JPY | Unilateral |

Source: BoJ, MoF, Federal Reserve, ECB, BoC, Department of Finance Canada, BoE, HM Treasury, Goldman Sachs GIR.

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An EM crisis?

lan Tomb and Teresa Alves assess the risks of an Emerging Market (EM) crisis as the Fed continues to hike rates to fight inflation

An aggressive and extended Fed hiking cycle that has led to an historic surge in the Dollar has raised the question of whether the Fed's attempts to solve the US inflation crisis could create crises elsewhere—with EM economies that are dealing with their own high inflation and growth risks in the crosshairs. In fact, EM crises are already occurring in many Frontier sovereigns, even as many major EMs have proven relatively resilient to these stresses so far. While concerns of broadening EM pressures will remain as long as central banks are forced to act aggressively to rein in inflation, we recommend select exposure to EM assets, and believe globally-systemic EM risk remains low.

A crisis in Frontier markets...

The reality is that classic EM crises—in which a combination of hard currency liabilities and limited Dollar reserves create a Dollar funding squeeze—are already occurring at a similar rate as during the Global Financial Crisis (GFC) and the pandemic. For now, however, these crises have mostly been limited to high-yielding Frontier sovereigns, which have lacked access to funding markets since the spring, leading to large currency depreciations and spreads trading at distressed levels. In some instances, sovereigns are now facing only corner solutions to address their crises, including IMF-led debt restructuring (Ghana), obtaining bilateral assistance from regional partners (Egypt, which also secured an IMF deal last month), signalling for bilateral debt relief (Pakistan, which is also in an IMF program), and, in Sri Lanka's case, outright defaulting on its debt. While market pricing of Frontier sovereigns already largely reflects debt distress, their continued lack of market access and limited FX reserves means that further idiosyncratic left-tail risks could materialize, especially should US rates remain higher for longer, as we expect. In addition to the countries pursuing corner solutions, Mongolia and Kenya also screen as vulnerable to these stresses.

The number of EM credit sovereigns in crisis is near historic highs Number of sovereigns (lhs), bp (rhs)



Note: Excludes Russia and Belarus.

Source: Cruces and Trebesch (2014), Catao and Mano (2015), Moody's, Bloomberg, Datastream, Goldman Sachs GIR.

...but not in most major EMs

In most major EMs, by contrast, the watchword has been "resilience", particularly for FX and local rates investors. A large share of these countries' sovereign debt is denominated in local currency, which significantly lessens the strains imposed

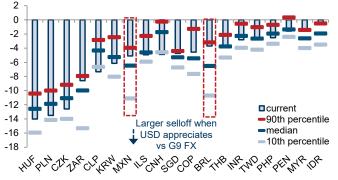
by a historically-strong—and strengthening—Dollar. Overall, EM and ex-US DM central banks have faced the same challenge over the past two years: balancing the risk of persistently high inflation exacerbated by FX weakness against the risk of a slowdown in growth. And EM has featured some of the most prominent policy success stories in managing this challenge, with several EM central banks, such as the COPOM in Brazil, hiking early and aggressively to tackle inflation, with some success so far. Partly as a result of this policy vigilance, on an equal-weighted, total return basis, EM currencies have outperformed G9 currencies by ~10% over the past two years.

The corollary of sustained EM resilience, however, is that the risk-reward for EM assets has fallen relative to their DM peers, so investors should stay selective. Assuming that FX resilience continues to have a cooling effect on EM domestic inflation, we see somewhat more opportunities in EM local rates compared with the more pro-cyclical parts of the EM asset complex.

Beware of risks outside the sovereign space

Pockets of active left-tail risks exist within EM outside of the sovereign space. Worrying examples include Colombia and Hungary, where the currency and local rates outlooks embed the potential for a vicious spiral of FX depreciation and rising inflation, especially considering widening external deficits and geopolitical risks in both. And, in Korea, growing financial stability concerns may limit the extent of policy rate hikes (which could lead to opportunities in the local rates space). More broadly, so long as upside risks to inflation, downside risks to growth, and concerns around financial stability persist globally, so does the risk that more EMs come under pressure. That said, globally-systemic EM risks currently look low, and outside of Frontier sovereigns the pressures facing EM and DM economies are more similar than different this time around.

BRL and MXN have been particularly resilient to Dollar strength Estimated % appreciation of each currency vs USD given a 10% appreciation in the USD vs G9 FX, using rolling 1-year samples estimated over the post-GFC period (results control for a broad set of non-USD market factors)



Source: Thomson Reuters, Goldman Sachs GIR

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FX intervention, explained

Monetary authorities and/or central governments at times intervene in foreign exchange markets to influence the value of their currencies by buying and selling domestic and foreign currencies. Such interventions may be unilateral or coordinated with foreign authorities. Historical interventions have had various degrees of success in moving exchange rates consistent with the desired direction of the intervention (see pg. 20 for more details).

Who has the authority to intervene?

How is the intervention conducted?

When did authorities last intervene?

What is the size and composition of FX reserves?

United States

The Federal
Reserve and the US
Treasury both may
intervene in the FX
market. While the
Fed has separate
legal authority to
engage in FX
operations, they are
conducted in close
consultation and
cooperation with
the Secretary of the
Treasury.

Interventions, at the direction of the Fed or the Treasury, are executed by the New York Fed. When a decision is made to intervene, the New York Fed's Open Market Trading Desk buys/sells dollars/foreign currency. The foreign currencies used to intervene have historically come equally from FX reserves held in the Fed's System Open Market Account (SOMA) or the Treasury's Exchange Stabilization Fund (ESF), regardless of who initially directed the intervention.

Since 1996, the US has only intervened in FX markets on three occasions: (1) June 1998, purchasing yen in the context of Japan's plans to strengthen its economy, (2) Sept 2000, buying euros in a coordinated intervention initiated by the ECB out of concern about the potential implications of euro exchange rate movements on the global economy, and (3) March 2011, selling yen following a sharp rise in FX volatility as a result of an

As of September 30, the ESF and SOMA together held around \$34bn in foreign currency reserves, split between euro- and yendenominated assets. A significant portion of reserves are invested on an outright basis in government-backed securities, and some may be held on deposit at the BIS and foreign central banks.



The Eurosystem conducts FX operations in accordance with Articles 127 and 219 of the Treaty on the Functioning of the EU.

Interventions may be carried out either directly by the ECB (i.e., in a centralized manner) or by National Central Banks (NCBs) acting on behalf of the ECB on a "disclosed agency" basis (i.e., in a decentralized manner). Any intervention relating to another EU currency is carried out in close cooperation with the relevant non-Euro area NCB.

The Eurosystem has only intervened in the FX market in 2000—engaging in both coordinated and unilateral interventions to strengthen the euro—and in 2011—the coordinated intervention to sell yen after the earthquake in Japan.

earthquake in Japan.

As of end-Sept, the Eurosystem held around \$300bn and the ECB around \$55bn in foreign currency reserves, split between dollars, yen, and CNY.

United Kingdom The UK government and the BoE may both intervene in the FX market, authority granted to them by the May 1997 Letter from the Chancellor to the Governor of the BoE.

Interventions are carried out by the BoE, which acts as either an agent of the government or at its own discretion. When acting as an agent, the BoE buys/sells currency using the government's holdings of FX reserves, which are held in the Exchange Equalisation Account (EEA). The BoE has a separate pool of FX reserves that it uses when intervening on its own account.

The UK last intervened in the FX market in 2011, as part of the coordinated intervention to sell yen with other G7 central banks. Prior to that, the UK had not intervened in at least a decade.

As of end-Sept, the UK government held around \$97.6bn and the BoE around \$9.2bn in foreign currency reserves, split between dollars, euro, yen, and CNY.

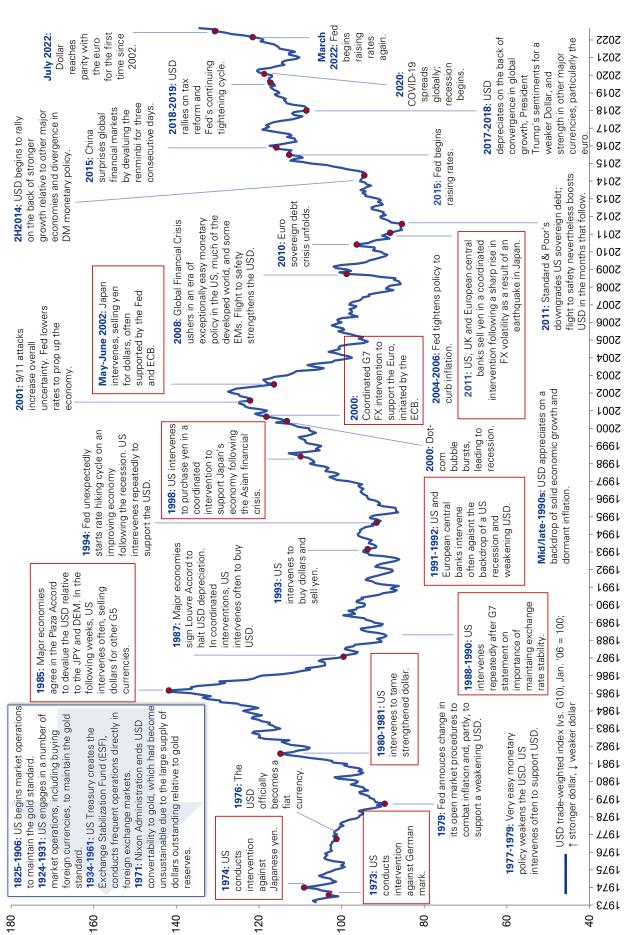
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FX intervention is carried out under the authority of the Ministry of Finance (MOF). The BoJ conducts FX interventions on behalf of and at the instruction of the MOF. The Foreign Exchange Fund Special Account (FEFSA), which falls under the jurisdiction of the MOF, is used for interventions. The MOF gives the BoJ specific instructions for FX intervention based on relevant market information provided by the BoJ.

Japan bought ¥2.8tn in September and ¥6.4tn in October. As of end-Sept, Japan held around \$1.1tn in foreign currency reserves.

Source: New York Fed, US Treasury, European Central Bank, Bank of England, Bank of Japan, IMF, Haver Analytics, Goldman Sachs GIR.

Dollar ups and downs



Source: Federal Reserve Board, Congressional Research Service, Haver Analytics, various news sources, Goldman Sachs GIR.

Market pricing as of November 10, 2022.

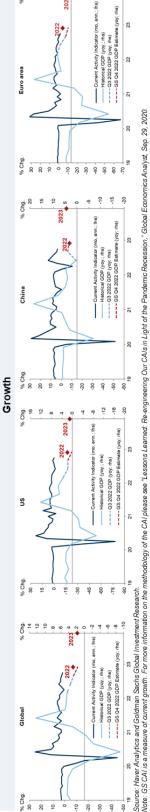
Summary of our key forecasts

GS GIR: Macro at a glance

- housing downturn in China and elsewhere. We expect the global inflation surge to peak this quarter, and think the combination of a moderation in demand growth, improvements in goods Globally, we expect annual average GDP growth to slow to a sluggish 1.8% in 2023 reflecting sizable drags from tighter financial conditions, the protracted energy crisis in Europe, and the supply, and tighter monetary policy will be sufficient to bring inflation back toward DM central banks' targets over the next two years.
 - In the US, we expect GDP growth to slow to 1.9% in 2022 and 1.0% in 2023, reflecting a negative impulse from tighter financial conditions. We see a 35% probability of entering a recession wage growth, or firmer shelter inflation could keep inflation somewhat higher for longer. We expect the unemployment rate to stand at 3.6% by end-2022 before rising to 4.1% by end-2023 over the next year, although we think any recession would likely be mild. We expect core PCE inflation to decline to 4.6% by end-2022, although further supply chain disruptions, stronger and 4.2% by end-2024.
- We expect the Fed to deliver a 50bp hike in December followed by 25bp hikes in February and March, for a peak funds rate of 4.75-5.00%, though we see risk that a higher peak rate will be needed to reverse overheating enough to bring inflation down. On the fiscal policy front, a divided government appears to be the likely outcome of the midterm election, which we expect
 - In the Euro area, we expect a moderate recession in 4022-202023 and GDP growth to contract by -0.4% in 2023, driven by continued significant gas supply disruptions owing to the war in Ukraine and slowing growth momentum. We expect headline inflation to peak at around 12.9%yoy in January before falling back to around 4.7% in December 2023. would reduce the size and probability of fiscal support in the event of a recession.
- We expect the ECB to hike by 50bp in December and February and a final 25bp hike in March for a terminal rate of 2.75%, though more persistent inflationary pressures and stronger secondround effects could push the ECB to a higher terminal rate.
- In China, we expect full-year real GDP growth of 3.2% in 2022 and 4.5% in 2023. On a sequential basis, we expect 3.5% qoq ann. growth in 4022 after a very strong rebound of 16.5% in 3022 recession in several major economies. Tensions in the European energy market also continue to loom large, with Russia suspending natural gas flows through the Nord Stream gas pipeline WATCH INFLATION AND EUROPEAN ENERGY. On the inflation front, more persistent inflationary pressures could lead to extended central bank hiking cycles, which could raise the risk of We see the risks to our baseline tilted to the downside due to the latest Covid resurgence in large cities such as Guangzhou and Chongqing.

indefinitely and the European import ban/price caps on Russian oil set to take hold, skewing risk towards a more severe and protracted downturn in Europe.

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Source: Bloomberg, Goldman Sachs Global Investment Research. For important disclosures, see the Disclosure Appendix or go to www.gs.com/research/hedge.html

Glossary of GS proprietary indices

Current Activity Indicator (CAI)

GS CAIs measure the growth signal in a broad range of weekly and monthly indicators, offering an alternative to Gross Domestic Product (GDP). GDP is an imperfect guide to current activity: In most countries, it is only available quarterly and is released with a substantial delay, and its initial estimates are often heavily revised. GDP also ignores important measures of real activity, such as employment and the purchasing managers' indexes (PMIs). All of these problems reduce the effectiveness of GDP for investment and policy decisions. Our CAIs aim to address GDP's shortcomings and provide a timelier read on the pace of growth.

For more, see our CAI page and Global Economics Analyst: Trackin' All Over the World – Our New Global CAI, 25 February 2017.

Dynamic Equilibrium Exchange Rates (DEER)

The GSDEER framework establishes an equilibrium (or "fair") value of the real exchange rate based on relative productivity and terms-of-trade differentials.

For more, see our GSDEER page, Global Economics Paper No. 227: Finding Fair Value in EM FX, 26 January 2016, and Global Markets Analyst: A Look at Valuation Across G10 FX, 29 June 2017.

Financial Conditions Index (FCI)

GS FCIs gauge the "looseness" or "tightness" of financial conditions across the world's major economies, incorporating variables that directly affect spending on domestically produced goods and services. FCIs can provide valuable information about the economic growth outlook and the direct and indirect effects of monetary policy on real economic activity.

FCIs for the G10 economies are calculated as a weighted average of a policy rate, a long-term risk-free bond yield, a corporate credit spread, an equity price variable, and a trade-weighted exchange rate; the Euro area FCI also includes a sovereign credit spread. The weights mirror the effects of the financial variables on real GDP growth in our models over a one-year horizon. FCIs for emerging markets are calculated as a weighted average of a short-term interest rate, a long-term swap rate, a CDS spread, an equity price variable, a trade-weighted exchange rate, and—in economies with large foreign-currency-denominated debt stocks—a debt-weighted exchange rate index.

For more, see our FCI page, Global Economics Analyst: Our New G10 Financial Conditions Indices, 20 April 2017, and Global Economics Analyst: Tracking EM Financial Conditions – Our New FCIs, 6 October 2017.

Goldman Sachs Analyst Index (GSAI)

The US GSAI is based on a monthly survey of GS equity analysts to obtain their assessments of business conditions in the industries they follow. The results provide timely "bottom-up" information about US economic activity to supplement and cross-check our analysis of "top-down" data. Based on analysts' responses, we create a diffusion index for economic activity comparable to the ISM's indexes for activity in the manufacturing and nonmanufacturing sectors.

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GS MAP scores facilitate rapid interpretation of new data releases for economic indicators worldwide. MAP summarizes the importance of a specific data release (i.e., its historical correlation with GDP) and the degree of surprise relative to the consensus forecast. The sign on the degree of surprise characterizes underperformance with a negative number and outperformance with a positive number. Each of these two components is ranked on a scale from 0 to 5, with the MAP score being the product of the two, i.e., from -25 to +25. For example, a MAP score of +20 (5;+4) would indicate that the data has a very high correlation to GDP (5) and that it came out well above consensus expectations (+4), for a total MAP value of +20.

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We, Allison Nathan, Jenny Grimberg, Ashley Rhodes, Teresa Alves, Sid Bhushan, George Cole, Karen Reichgott Fishman, Simon Freycenet, Lotfi Karoui, Devesh Kodnani, Praveen Korapaty, Daan Struyven, Ian Tomb, Kamakshya Trivedi, and Vinay Viswanathan 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.

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