

TOP *of* MIND

THE RUNDOWN ON RUNOFF



Nearly nine years since it first launched QE, the Fed is set to begin shrinking its \$4.5tn balance sheet. What this uncharted process will mean for policy, assets, and the banking system is Top of Mind. We feature perspectives from the D.E. Shaw group's Brian Sack, who helped oversee QE while at the New York Fed, and GS Chief Economist Jan Hatzius. Both expect runoff to be orderly and manageable, ultimately leaving the Fed with a relatively large "terminal" balance sheet size. And both believe that QE will remain a viable option in the Fed's policy toolkit. GS strategists then outline potential asset implications: a gradual rise in bond yields and contained effects on other markets—even those that were hard-hit during the "taper tantrum"

(think MBS and EMs). However, changes to the macro backdrop or to Fed leadership are risks to watch. Beyond the Fed, our chief economists for Europe and Japan discuss the drivers influencing ECB and BOJ balance sheet policies.

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I expect the Fed to decide to maintain [a floor system] in the longer run, and hence I doubt its balance sheet will ever fall below \$3tn in assets.

- Brian Sack, Director of Global Economics, the D.E. Shaw group

The one potential cost of QE that we cannot yet fully assess is the difficulty of exiting it. But we think that this, too, will prove to be manageable.

- Jan Hatzius, Chief Economist, Goldman Sachs

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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

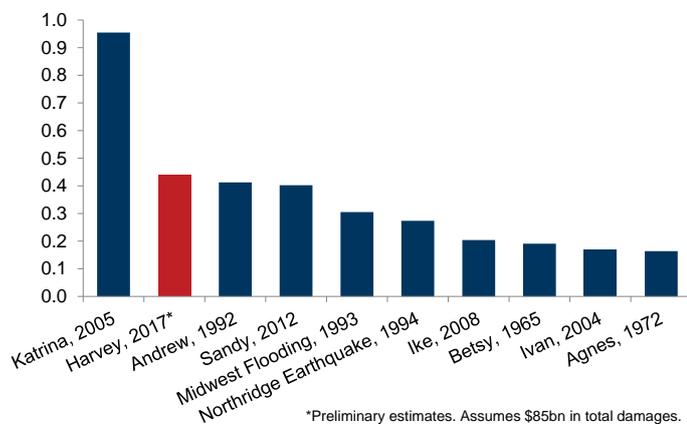
- We lowered our Q3 GDP tracking estimate by 0.8pp to 2.0% on hurricane effects; however, we expect growth to rebound and raised our Q4, Q1, and Q2 GDP forecasts by 0.4pp, 0.2pp, and 0.4pp, respectively, to 2.7%, 2.5%, and 2.4%.

Datapoints/trends we're focused on

- Shifting fiscal risks, as the structure of the recent debt limit extension will likely make the next debt limit increase necessary by March; we believe this lowers the odds of tax legislation being enacted in 2018, to around 40%.

The hit from hurricanes

Hurricane property damages as a % of US GDP



Source: National Hurricane Center, Goldman Sachs Global Investment Research.

Japan

Latest GS proprietary datapoints/major changes in views

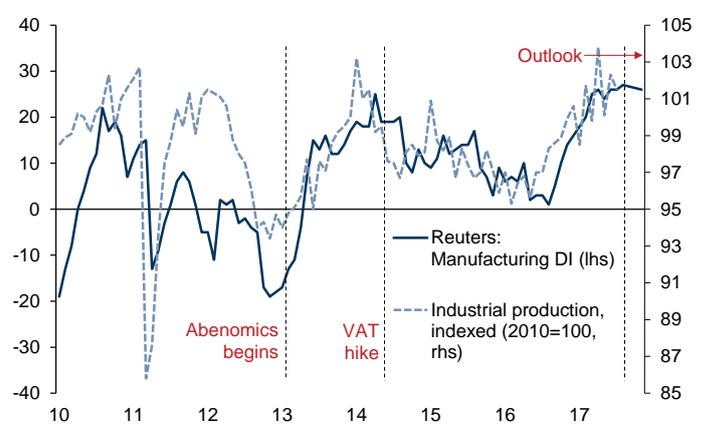
- We raised our Q3 GDP tracking estimate to 1.2% qoq ann. from 0.5% previously, reflecting July data and a smaller pullback effect from Q2 GDP, which was revised to 2.5% qoq ann. from 4.0% (mainly on private capex).

Datapoints/trends we're focused on

- A post-crisis high in the August Reuters Tankan survey of manufacturers, driven by external demand and stable forex.
- Evidence that Japanese consumers have become more price-sensitive over time—likely a key drag on inflation.

Sentiment on the rise

Manufacturing DI (lhs) vs. IP, indexed to 100 in 2010 (rhs)



Source: Thomson Reuters, METI.

Europe

Latest GS proprietary datapoints/major changes in views

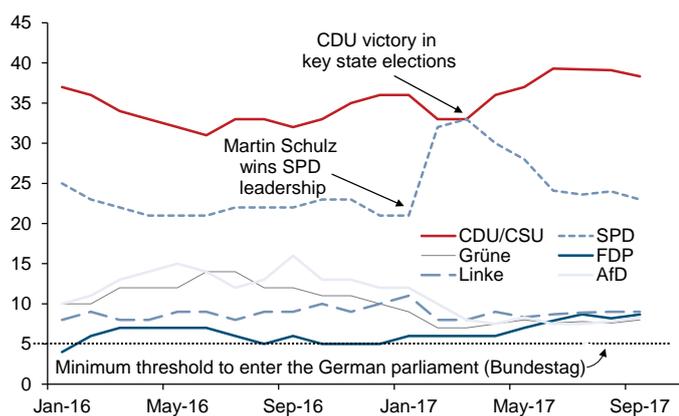
- We raised our 2017 GDP growth forecast for France to 1.6% from 1.2%, incorporating better-than-expected data; and upgraded Italy to 1.4% from 1.0% on expectations for fiscal easing. We forecast Euro area GDP growth of 2.2% in 2017 and expect a mild deceleration in H2 relative to H1.

Datapoints/trends we're focused on

- Signs that the ECB will increasingly use forward guidance on rates, particularly when tapering begins (likely next year).
- Strong support for Merkel's party ahead of the German elections, suggesting policy continuity to a large extent.

A vote for continuity

Avg. German voting intentions across five main opinion polls, %



Source: Wahlumfragen.de.

Emerging Markets (EM)

Latest GS proprietary datapoints/major changes in views

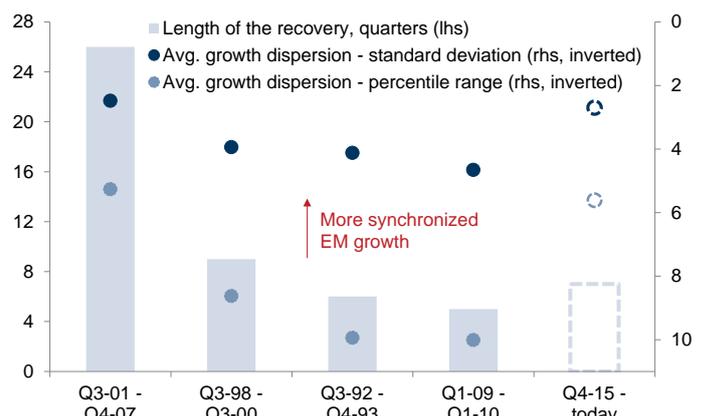
- No major changes in views.

Datapoints/trends we're focused on

- A synchronized upswing in growth across EM, which may portend a longer period of EM economic expansion.
- A rise in August China manufacturing PMIs, pointing to solid activity growth going into the Party Congress in October.
- A larger-than-expected deceleration in India's growth in Q2.
- The recent downside surprise in Russian inflation; the central bank said it will consider a cut of 25bp or 50bp this month.

Synchronized recoveries tend to last longer

Length of economic upswings and levels of growth dispersion



Source: Haver Analytics, Goldman Sachs Global Investment Research.

The rundown on runoff

Nearly nine years since it first launched Quantitative Easing (QE), the Fed is finally set to begin shrinking its \$4.5tn balance sheet. What this uncharted process means for policy, asset markets and the banking system is Top of Mind.

We kick off with a retrospective from GS Chief Economist Jan Hatzius on the lessons learned from QE. In short, he concludes that balance sheet expansion was an effective policy tool that came with fewer costs than many observers had predicted. At this point, he sees just one potential unknown downside associated with QE: the difficulty of exiting it. But with financial conditions easing this year even as the expected timing of normalization has been pulled forward, Hatzius is optimistic that the process will be orderly and manageable.

Brian Sack of the D.E. Shaw group, who helped design and oversee QE while at the New York Fed, is similarly confident that balance sheet runoff will go smoothly, even if it ultimately overlaps with ECB tapering as we expect. In Sack's view, this is not only because the Fed has clearly communicated its plans, but because the expectation that QE is redeployed in the future may keep some downward pressure on the term premium (the compensation for duration risk in long-term bonds). He also reiterates his long-held view that the balance sheet's "terminal size" should be larger than in the past, and doubts the balance sheet will ever dip below \$3tn again. Our US economics team generally agrees, and digs further into the mechanics of balance sheet policy on pgs. 8-9.

So what would such an orderly normalization look like for bonds and other assets? We expect QE's fading portfolio balance effects to add an estimated 20bp to 10-year Treasury yields this year, 15bp next year, and 10bp/year from 2019-2021, which we believe should prove digestible for both US equities and corporate bonds (see pg. 11). And in the EM space, GS strategists Ian Tomb and Lorenzo Incoronato see little risk of another "taper tantrum," as solid growth and improved external balances have put EMs in a better position than before to weather increases in US/core rates. That said, they see a more favorable outlook for EM equities, FX, and credit spreads than for local bonds, where investors will need to be more selective going forward.

Even in mortgage-backed securities (MBS), where the Fed owns roughly 30% of outstanding agency securities, we think the impact of runoff will most likely be limited. Indeed, GS Senior Mortgage Strategist Marty Young points out that, against expectations, MBS spreads have actually *tightened* this year. He anticipates only modest spread widening from here—not enough to justify a short position. A more notable outcome of the QE unwind, in his view, could be its effects on volatility; Fed ownership of MBS has likely suppressed rate vol in recent years, suggesting that vol could eventually pick up as more securities shift back into the hands of private investors.

So what could go wrong? For one, future changes to Fed leadership have the potential to alter the FOMC's runoff plans. And GS Co-Chief Markets Economist Francesco Garzarelli emphasizes that the rates market's reaction to runoff—which will likely drive other asset markets' responses—is entirely contingent on the macro backdrop. Given the market's

conviction in inflation remaining low and runoff substituting for rate hikes, even a small shift in investor expectations could lead to a sharp sell-off in bonds. Again, this is not our mainline view, but a risk to keep in mind.

Looking beyond the markets to the banking system itself, some observers have raised concerns that draining QE-related liquidity could trigger deposit outflows, potentially leading to funding stress. However, our Financials equity analysts take a more sanguine view. Their analysis suggests that banks have treated most deposits created by QE as short-term liquidity rather than reliable, longer-term funding. Moreover, post-crisis rules require that banks hold safe assets against these deposits dollar-for-dollar, further preparing them to manage any outflows. Slower deposit growth as the Fed unwinds QE should therefore be fairly manageable for banks. But normalization may have other effects: The team flags higher interest rates for consumers and a likely uptick in bank M&A as two likely consequences.

Given that the Fed is not the only central bank carefully managing its balance sheet policies, we also take the opportunity to assess the state of asset purchase programs at the ECB and the BOJ. GS Chief European Economist Huw Pill reminds us that the ECB is no stranger to shrinking its balance sheet, which fell from EUR 3.1bn in 2012 to just over EUR 2bn in 2014. Reassuringly, the process went smoothly—although that contraction reflected reduced demand for central bank liquidity, not a deliberate policy decision. While ECB tapering (which we expect next year) is likely to have bigger implications than this earlier experience, Pill argues that those implications will likely depend more on the *composition* of the central bank's balance sheet than the size.

While all eyes are on the Fed and the ECB, it's worth pointing out that the BOJ has already been quietly reducing its Japanese government bond purchases for almost a year. This has led some market participants to expect the BOJ to lower or abandon its purchase target. However, GS Chief Japan Economist Naohiko Baba believes that the central bank has no intention of doing so, lest that result in appreciation of the yen. Instead, he expects the BOJ to proceed with the status quo for now, as reaching even 1% inflation, let alone the 2% target, appears all too remote. That said, with a new BOJ governor taking the helm in April 2018, this is a place to watch.

With all of this talk about exit policies, a closing thought about future easing (whenever the economy next requires it). As Hatzius points out, even if rates ultimately rise to the 3.25-3.50% range as we expect, this may not leave enough conventional easing capacity to sufficiently address the next shock. In other words, an eventual return to balance sheet expansion may very well be in the cards.

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QE: what we've learned

Jan Hatzius argues that balance sheet growth achieved its aims at relatively low costs—and may eventually return as a policy tool

The Federal Reserve stands on the cusp of balance sheet rundown, and the ECB is moving gingerly toward the exit as well. What lessons have we learned about quantitative easing (QE), and what are the implications for the future conduct of monetary policy?

QE is quite effective

There is now a great deal of research covering the effects of QE in the US, the Euro area, the UK, and Japan. One strand of this research focuses on the impact of surprise QE announcements on bond yields and other financial variables. This is a good approach for showing that QE has significant short-term effects on financial conditions but is less suitable for pinning down magnitudes and long-term effects. Another strand of research estimates equations for the level of bond yields or the term premium as a function of QE and other economic control variables. This allows us to quantify the medium-term effects of asset purchases and therefore nicely complements the first approach.

Taken together, these studies suggest that QE lowers the level of bond yields by 3-5 basis points for each 1% of GDP. Moreover, it is generally the expected *stock* of central bank bond holdings that matters, not the ongoing *flow* of central bank bond purchases. This is particularly clear in the US, where flow effects are largely absent in the data. In the Euro area, the evidence is more mixed, but even here we find bigger and more significant stock than flow effects. The limited flow effects seem to be concentrated in the European periphery, probably because bond market liquidity is lower there or ongoing purchases are more powerful in creating “fiscal space” for cash-strapped governments.

Beyond the direct impact on bond yields, QE also eases financial conditions more indirectly, via a combination of a weaker exchange rate, higher stock prices, and/or reduced credit and sovereign spreads. Directionally, these effects are similar to those of conventional monetary policy moves. That said, QE is a bit less powerful than a short-term interest rate cut when both policies are scaled by their effects on bond yields. The main reason is a proportionately smaller impact of QE on the exchange rate, probably because currencies are mostly driven by cross-country differences in expected policy rates and the “credit easing” parts of QE would be expected to have a smaller exchange rate effect (as they work more like a fiscal expansion). This also implies that QE probably has a smaller mechanical impact on inflation and smaller spillover effects on foreign economies compared with conventional policy rate moves.

QE does not look very costly

The idea that QE mechanically causes high inflation—a popular one in the early post-crisis period—has proven false, as inflation has mostly surprised on the downside. To be sure, QE can matter for inflation, but the process is indirect and mostly

works via the strength of the economy and the labor market. In this regard, QE is no different from conventional monetary policy.

We also see no strong evidence that QE has created an asset market bubble. Although valuations have risen sharply from their post-crisis lows, their *level* is not obviously excessive given the very market-friendly economic environment of above-trend growth, low inflation, and low interest rates. Moreover, credit growth and private sector net borrowing—key metrics for the vulnerability of the economy to asset price busts—also remain moderate. And again, we see no material difference between QE and conventional monetary easing. Both can contribute to asset bubbles when used in excess, but the relationship is far from mechanical.

The one potential cost of QE that we cannot yet fully assess is the difficulty of exiting it. But we think that this, too, will prove to be manageable. The 2013 “taper tantrum” did look concerning for a while, but it ultimately reflected nothing more than a temporary misunderstanding between Fed officials who said and meant “tapering” and market participants who heard “tightening.” And while we cannot yet assess the impact of the actual balance sheet runoff, the early signs also look encouraging. Markets have sharply pulled forward their expectations for the beginning of the runoff from mid-2018 at the start of the year to September 2017 now, and yet, financial conditions have continued to ease. The ride will likely get rockier at some point. But we think this is largely because it is always difficult to withdraw monetary accommodation to achieve a soft landing, not because QE necessarily complicates that process.

QE might well return

It is good that QE has turned out to be such a useful tool, because we may well need it again in the future. Over the next few years, we expect the Fed balance sheet to shrink and the funds rate to rise to 3¼-3½%, well above current market pricing. But from a longer-term perspective, even a 3¼-3½% funds rate may not be high enough to create enough conventional easing capacity. After all, in the average postwar recession, the Fed has cut the funds rate by over 5 percentage points. Unless monetary policymakers in the US and elsewhere raise their inflation targets or get comfortable with much more negative rates during downturns—and we have our doubts on both—QE could thus become a standard part of the policy arsenal in recessions.

The Fed’s imminent balance sheet adjustment is therefore unlikely to mark a return to the status quo ante, where the short-term interest rate was the only tool of monetary policy. We expect a reduction in total balance sheet size from the current \$4.5tn to perhaps \$3-\$3½tn, but nothing like the sub-\$1tn that prevailed before the crisis. And beyond the reduction over the next several years, the next significant move in the Fed’s balance sheet could well be a renewed expansion.

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Balance sheet background

Fast facts

\$4.5tn

Size of the Fed's balance sheet today—roughly \$1tn greater than the GDP of Germany.

400%

Approximate growth of the Fed's balance sheet since 2008.

23%

Value of Fed assets as a percentage of US GDP. (Comparables for the ECB and BOJ are 38% and 92%, respectively.)

17%

The share of outstanding US government debt held by the Fed (\$2.47tn).

30%

Share of outstanding MBS held by the Fed (\$1.77tn).

0

Quantity of MBS held by the Fed prior to QE.

\$478bn

GS estimate of the cumulative fall in Fed Treasury holdings through 2019.

\$351bn

GS estimate of the cumulative fall in Fed MBS holdings through 2019.

58bp

The one-month rise in 10-year Treasury yields during the "taper tantrum," which began in May 2013.

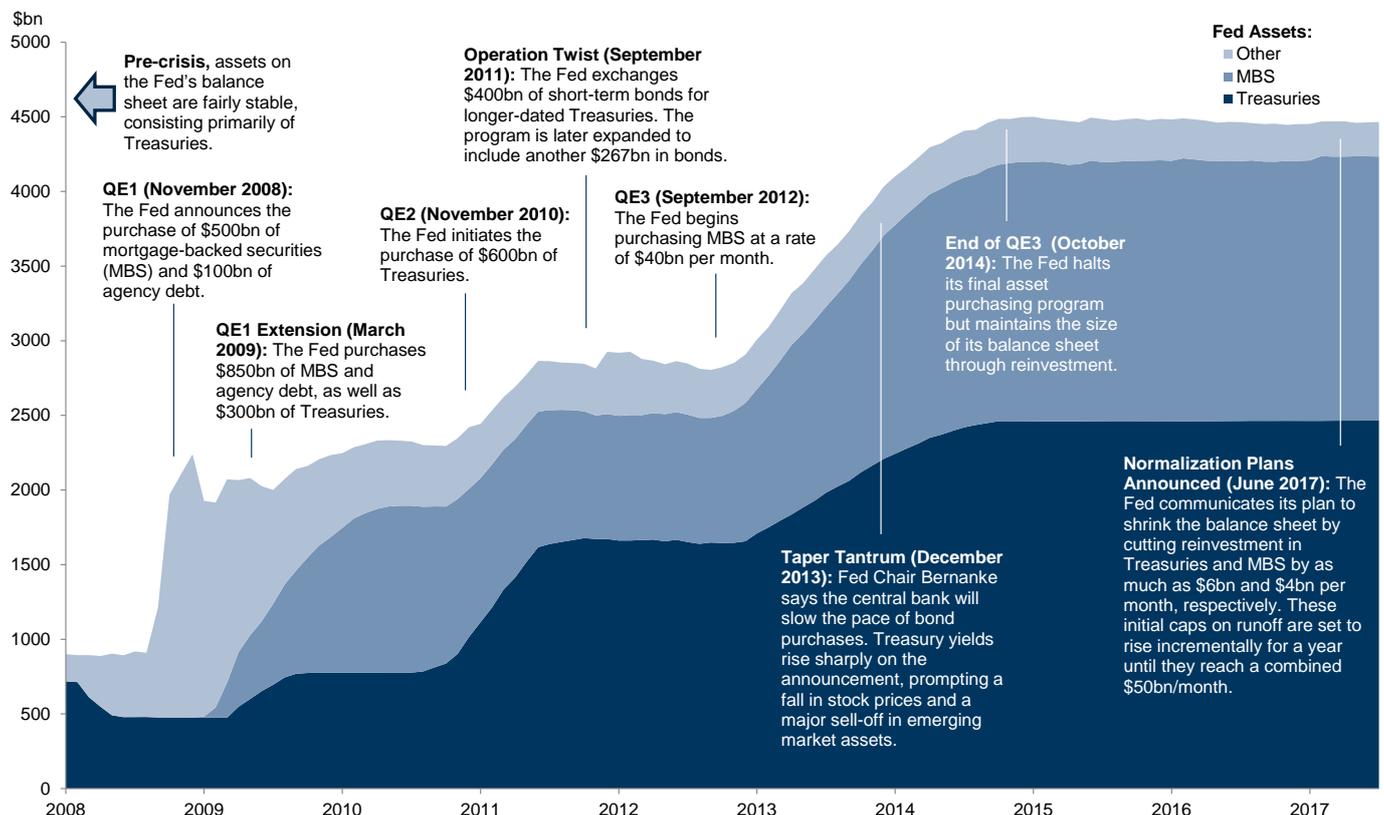
45bp

GS estimate of the rise in 10-year Treasury yields through 2019 as a result of normalization.

Source: Goldman Sachs Global Investment Research, Federal Reserve Board, U.S. Department of the Treasury, European Central Bank, Bank of Japan, Cabinet Office (Japan).

Finding the right balance

Assets on the Fed's balance sheet, \$bn



Source: Federal Reserve Board, Goldman Sachs Global Investment Research.

Interview with Brian Sack

Brian Sack is Director of Global Economics at the D. E. Shaw group. Prior to joining the D. E. Shaw group in 2013, he was an Executive Vice President at the Federal Reserve Bank of New York (FRBNY), where he served as head of the FRBNY's Markets Group and managed the Federal Reserve's System Open Market Account portfolio from 2009 to 2012. Below, he reflects on the experience with the Fed's asset purchase programs and argues that the Fed should maintain a relatively large balance sheet and be willing to deploy it as a policy tool during future downturns.

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



Allison Nathan: You were involved in both establishing quantitative easing (QE) as a policy concept and implementing it after the financial crisis. Looking back, how important was QE to the economic recovery?

Brian Sack: QE proved to be a critical policy tool. Without it, the economic recovery would have been slower, and

there would have been a greater risk of the economy getting stuck in a deflationary trap. Given that the Fed's traditional policy instrument, the federal funds rate, was constrained by the zero bound, it was very important for the Fed to convey that it still had an instrument that it would actively use to pursue its economic objectives. I think that message had very meaningful effects on expectations for the economy and on financial conditions in a way that ultimately supported the recovery.

Allison Nathan: Can we really call QE a success, given that inflation remains below the Fed's target?

Brian Sack: It's true that inflation has been disappointing. That being said, the low level of inflation today, if anything, highlights how important it was for the Fed to have been responsive with this policy instrument. If the Fed had sat on its hands and allowed a much more sluggish recovery, I think the problem of low inflation would have been more severe.

Allison Nathan: Through what channel did QE impact the economy most?

Brian Sack: In my view, QE worked primarily through the portfolio balance channel. By reducing the amount of duration risk that would have otherwise been in the market, QE pushed down the term premium for longer-term securities, thereby reducing those interest rates. As investors sought to substitute into other securities, there were positive knock-on effects to broader financial conditions. There may have also been some effect through the signals that QE provided about the path of the federal funds rate, but my intuition is that it was less important than the portfolio balance channel, especially considering that the Fed was separately providing explicit guidance on its policy rate over much of this period.

Allison Nathan: In retrospect, is there anything that the Fed should have done differently?

Brian Sack: The Fed could have perhaps defined its policy reaction function for the balance sheet more clearly. Over the earlier QE programs, the Fed's purchases moved in very large, discrete steps. In retrospect, it might have been better to move

in more moderate steps with more frequent adjustments to economic conditions, as that could have helped markets and the public better understand how the Fed intended to set this policy instrument. When market participants are able to understand and anticipate central bank actions, monetary policy tends to be more effective. The Fed ended up moving in that direction during QE3, but it arguably could have done so sooner. That said, I would note that the Fed was launching a new policy instrument and that this innovation was taking place under challenging circumstances. So, in my view, debating whether the exact implementation of the tool was optimal is much less important than the Fed's overall decision to actively use the tool.

Allison Nathan: What will it mean for the economy and for markets to put balance sheet expansion into reverse? Are you concerned that normalization could prove disruptive?

Brian Sack: We should expect the portfolio balance effects that I discussed earlier to reverse, which means that the term premium should face some upward pressure. However, there are several reasons to think that the adjustment will not be sizable or disruptive. First, QE effects tend to occur when expectations shift, not when the actual portfolio flows happen. In this case, the Fed has already communicated the plan for shrinking its balance sheet, so a decent share of the impact should be behind us. Second, the decline in asset holdings is set to take place in a gradual and predictable manner, so the Fed has successfully made this adjustment relatively "boring." And third, even once the Fed shrinks the balance sheet, the market will know that QE is an ongoing, viable tool. The prospect that the balance sheet is likely to increase again if needed could act to hold down the term premium today.

Finally, I'd note that many fundamental factors are also holding down the term premium, including low inflation expectations and the beneficial correlation that Treasury securities have with risky assets. If these factors were to shift in a manner that amplified upward pressure on the term premium, the market outcome could be more disruptive. But that would involve a fairly meaningful shift—such as sharply higher inflation expectations—which seems unlikely at the moment.

Allison Nathan: Could there be any unintended spillovers from the interaction between Fed normalization and the ECB's eventual tapering of asset purchases?

Brian Sack: I do think there are important spillovers across global markets and that the global policy environment has helped keep longer-term US interest rates low. If other central banks adjust their balance sheets in the same direction, the increase in supply and the associated effect on the term

premium could end up being larger than expected. That doesn't mean we'll necessarily have an abrupt or disruptive market outcome; it just means that whatever supply effect we were anticipating would be turned up to some degree. Of course, at this point, the ECB is only considering stopping the *expansion* of its asset holdings, not shrinking them, and the market is already anticipating these policy shifts. So I don't see a great risk of a disruptive outcome in the short run.

Allison Nathan: You are in favor of the Fed maintaining a fairly large balance sheet in the longer run. What advantages do you see to that approach?

Brian Sack: I published a [proposal](#) in 2014 with Joe Gagnon saying that the Fed should operate a floor system with a meaningful role for the reverse repo facility, while maintaining a large balance sheet. The idea was that this framework would keep overnight market interest rates near the interest rate that the Fed pays to financial institutions. We argued that such a system would give the Fed effective control of interest rates and would be operationally simpler than the prior framework. It would also make the financial system more robust by helping satiate the private sector's substantial demand for short-term, risk-free assets. To date, our experience with the floor system has been very positive, reflecting all of these advantages. I expect the Fed to decide to maintain this type of system in the longer run, and hence I doubt its balance sheet will ever fall below \$3tn in assets.

Allison Nathan: Some market observers take the opposite view, arguing that the Fed should shrink its balance sheet to pre-crisis levels based on concerns that the floor system leaves the Fed with too large a footprint on the markets, or that having a large balance sheet could compromise the Fed's independence, among other arguments. Is there merit to any of these concerns?

Brian Sack: I generally disagree with these views. I think the footprint argument is exaggerated, since the balance sheet simply transforms one type of government asset—a long-term Treasury security—into another type of government asset—bank reserves or reverse repos. Many of the other arguments in favor of a smaller balance sheet seem to be driven by nostalgia for the way things used to be or by concerns about political pressure from having a larger balance sheet. To me, it would be a shame to allow any of those considerations to stand in the way of arriving at the most effective, efficient, and robust operating framework for the Fed.

Allison Nathan: You mentioned that the balance sheet—once considered an unconventional policy option—should now be considered a viable tool...?

Brian Sack: Yes. The Fed initially proceeded with asset purchases in a very careful manner, which made sense given that we were in uncharted territory. But I think we've learned that many of the potential costs associated with QE ended up being more benign than initially feared by some observers. What's more, the Fed has now demonstrated control over the policy rate even with a large balance sheet.

Based on that experience, I think that the Fed should be more comfortable using the balance sheet when it is unable to

achieve adequate policy accommodation by lowering the federal funds rate. In my view, there is a strong chance that the Fed will have to turn to asset purchases again when the next substantial economic downturn occurs, considering that the neutral level of the federal funds rate has fallen notably.

Allison Nathan: Would it make sense for the Fed to purchase a broader range of assets in the event of a future downturn, as Fed Chair Janet Yellen suggested in a speech last year?

Brian Sack: Purchases of Treasuries and agency-backed securities—the primary assets that Congress has so far authorized the Fed to buy—have the advantage of allowing the Fed to affect the market price of interest rate risk without taking on any credit risk. Purchasing a wider set of assets—as do some other central banks—might enable the Fed to have a larger effect on financial conditions and promote faster recoveries. But it would also involve putting more taxpayer money at risk and having an imprint on a wider set of risk premiums in the market. So there is a tradeoff involved that Congress would ultimately have to consider.

Allison Nathan: Economists like Larry Summers have argued that Fed purchases of long-term government debt would have been more effective at holding down the term premium if the Treasury had not increased the maturity of its debt issuance at the same time. Should there be more communication or coordination between the Fed and the Treasury? Or would that damage Fed independence?

Brian Sack: Debt management decisions can affect financial conditions in the same way as QE; they both change the supply of duration in the market. And decisions by debt managers can at times work at cross-purposes to QE decisions by the central bank. We at the Fed were certainly aware of that throughout the post-crisis period. However, I don't see a need for policy coordination in most circumstances. The Treasury makes debt management decisions with a set of goals that differ from those of the Fed; and the Fed can take those decisions as given and set an appropriate path of QE around them.

However, there is clearly a need for communication. For example, the market effects of Fed balance sheet runoff will depend on what maturities the Treasury intends to issue to replace those holdings. And the Treasury needs to have a sense of the Fed's runoff plan as it decides how to fund the government. So certainly that type of communication should take place, and I have a hard time believing that those communications somehow impair the independence of the Fed, given that the Fed's mandate is clear.

Allison Nathan: What has been the most important lesson from the Fed's experience with QE? Is it applicable to other central banks still conducting asset purchases?

Brian Sack: We learned that asset purchases have clear benefits and limited costs. I think a key lesson for all central banks is that if they see QE as a viable policy instrument, it's important to communicate that it will be used when the circumstances call for it. That will allow markets to price central bank actions further in advance and with greater accuracy, which would only make the policy more effective.

Fed balance sheet FAQs

Our US economists answer key questions on Fed balance sheet normalization

Q: Why is the Fed planning to shrink its balance sheet?

A: The Fed’s balance sheet has grown from less than \$900bn before the financial crisis to \$4.5tn today, from 6% to over 23% of GDP. Reducing the size of the balance sheet is a natural step in removing accommodation from an economy that has now largely recovered. In addition, it would reduce the Fed’s footprint in the financial system and would give the Fed more room to expand the balance sheet in future downturns.

Q: When will balance sheet normalization start?

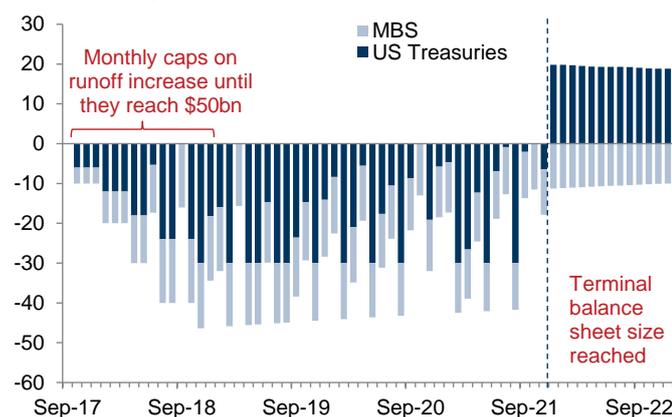
A: Minutes from the July FOMC meeting reinforced our expectation for balance sheet normalization to be announced at the September meeting. We expect runoff to begin in October.

Q: What will normalization entail?

A: Currently, the Fed reinvests all principal payments from its Treasury, agency debt, and agency MBS portfolios, holding the nominal size of its securities portfolio unchanged. Based on plans published in June, the Fed intends to initially reduce its reinvestment of Treasuries and MBS by as much as \$6bn and \$4bn per month, respectively. These monthly caps on runoff will increase every three months by \$6bn and \$4bn, respectively, until they reach \$30bn for Treasuries and \$20bn for MBS. Long-standing guidance from the FOMC suggests that asset sales are very unlikely, unless future Fed appointees have substantially different views from the current leadership.

Runoff roadmap

Monthly change in balance sheet with expected terminal size, \$bn



Source: Goldman Sachs Global Investment Research.

Q: What is the terminal size of the Fed’s balance sheet likely to be?

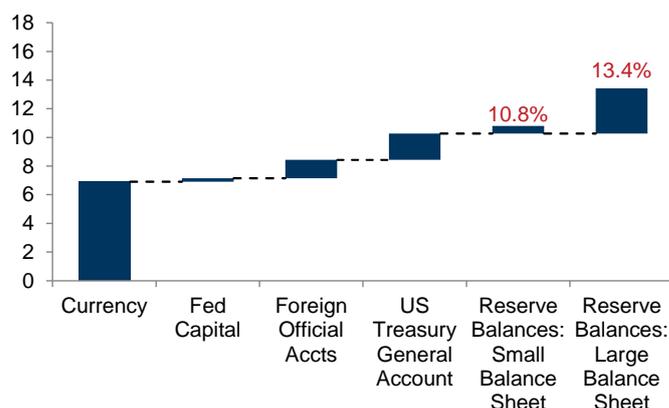
A: There are two options: a “small” balance sheet scenario in which monetary policy returns to its pre-crisis “corridor” operating framework, and a “large” balance sheet scenario in which reserve balances remain elevated (for more on these scenarios, see pg. 19). We think the “large” balance sheet scenario is more likely as the FOMC noted in its June minutes that it anticipates reducing reserve balances to “a level appreciably below that seen in recent years but larger than before the financial crisis.” However, we do not rule out a

“smaller” balance sheet as the future FOMC leadership may prefer a “corridor” operating framework.

We estimate that the large balance sheet option would imply a terminal size of 13.4% of GDP (\$2.6tn today or \$3.0tn in 2021), while the small balance sheet option would imply a terminal size of almost 11% of GDP (\$2.1tn today or \$2.6tn in 2023).

Balance sheet, decomposed

Contribution to terminal balance sheet, % of GDP



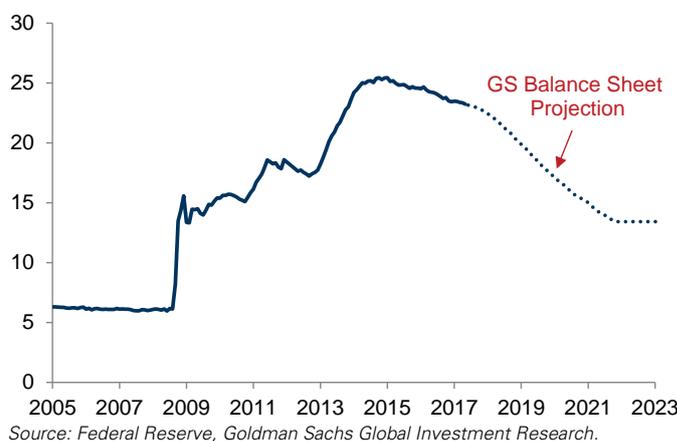
Source: Goldman Sachs Global Investment Research.

Q: How long will balance sheet normalization take?

A: Based on the runoff schedule described above, we would expect the Fed to reach our “large” estimate of its terminal balance sheet after about four years, in November of 2021.

Timing the unwind

Federal Reserve assets, % of GDP



Source: Federal Reserve, Goldman Sachs Global Investment Research.

Q: Will the terminal balance sheet include MBS assets?

A: Based on our assumption of an average annualized MBS runoff-rate of 12%, the Fed would still hold about \$1.1tn of MBS assets in November 2021.¹ We expect the Fed to maintain some agency MBS holdings in the long run to provide for more operational readiness in times of crisis (as maintaining technical expertise in the MBS market may quicken the Fed’s response to a future crisis). But eventual MBS asset sales are possible, reflecting the uncertain composition of the future Fed

¹ The pace of MBS runoff will depend on a variety of factors, including the path of interest rates, house prices, and changes in credit conditions. The pace is likely to decline over time as interest rates rise.



and the criticism of Fed MBS holdings by several potential Fed Board [candidates](#), including the economist [Marvin Goodfriend](#).

Q: Mechanically, how does ending reinvestment result in a smaller balance sheet?

A: Conceptually, one might expect the size of the balance sheet to remain stable, with the Fed swapping holdings of maturing securities for cash on the asset side of its balance sheet. But because “cash” (whether physical currency or reserve balances) is a liability of the Federal Reserve, it would not record cash on both sides of its balance sheet, but would instead record a smaller overall balance sheet.

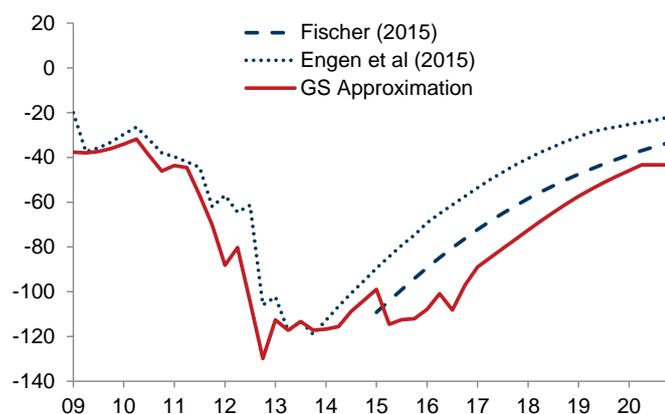
Digging deeper, the [mechanics](#) of a Treasury redemption would work as follows: (1) The Treasury security is extinguished on the asset side of the Fed’s balance sheet; (2) the Treasury general account (TGA) at the Fed is reduced by an offsetting amount on the liability side reflecting the Treasury’s payment of proceeds from the security; (3) the Treasury Department issues new debt to a non-Fed investor, replenishing the TGA; and (4) in the simplest case of a bank purchasing the new debt at auction, the bank’s reserve account at the Fed is reduced by the amount the TGA is replenished. In this way, the reduction in the Fed’s Treasury holdings on the asset side is matched by a reduction in excess reserves on the liability side, resulting in a smaller overall balance sheet.

Q: How will balance sheet runoff affect financial conditions and bond yields?

A: Shrinking the balance sheet is likely to [reverse](#) the portfolio rebalancing effects of quantitative easing, which lowered the market supply and increased the prices of risky assets. Based on the balance sheet projections outlined above, we [estimate](#) that fading portfolio balance effects will lift 10-year Treasury yields by roughly 20bp this year, 15bp next year, and 10bp per year from 2019-2021.²

Portfolio rebalancing in reverse

Model-implied portfolio balance effects of QE on 10y UST yield, bp



Source: Goldman Sachs Global Investment Research.

Q: What effect might balance sheet runoff and other fiscal policy considerations have on Treasury debt issuance?

² These figures are based on a [model](#) that provides a close approximation to similar Fed staff estimates cited by Chair Yellen. In the model, the effect on yields is proportional to the present discounted value (PDV) of the Fed’s excess assets as a share of nominal GDP.

A: Three forces could affect Treasury issuance over the coming months. First, declining Fed reinvestment will mean that the Treasury will need to finance a greater amount through competitive auctions. This should have only a minor effect in Q4, but will increase average net issuance by about \$50bn per quarter in 2018 and \$70bn per quarter in 2019.

Second, the fundamental fiscal outlook is uncertain but leans toward larger deficits than official projections, in light of potential hurricane relief spending and a potential tax cut in early 2018. The outlook in both cases is quite fluid, but either could push Treasury financing needs higher at the same time the Fed reduces reinvestment.

Third, the recent short-term debt limit increase will result in substantial swings in Treasury bill issuance. The Treasury is likely to increase issuance significantly in the next several weeks to build its cash balance, but will need to reduce it again ahead of the December 8 reinstatement. We then expect another increase in issuance shortly thereafter, followed by another pullback as the debt limit deadline approaches in February or March. This is likely to result in swings up and then back down of as much as \$200bn in Treasury bills outstanding over the next several months.

Q: How many rate hikes is balance sheet reduction equivalent to?

A: There is more than one way to translate between rate hikes and balance sheet policy actions. We focus on the impact of policy changes on the economy. Taking our [rule of thumb](#) that a 25bp rate hike is associated with a 0.15pp reduction in GDP growth, we can estimate the growth impact of a rise in bond yields due to balance sheet policy using the Fed’s FRB/US model. Allowing the increase in bond yields to affect other financial conditions, this method suggests that a 25bp rate hike is equivalent to a [24bp increase](#) in the 10-year yield.

Q: How will balance sheet runoff affect the path of the funds rate?

A: In her most recent testimony to Congress, Chair Yellen said that the Fed would take a steepening of the yield curve in response to balance sheet runoff into account in setting the federal funds rate. However, it is important to recognize that the FOMC’s projections for the funds rate already incorporate Fed officials’ baseline estimate of the impact of balance sheet runoff on financial conditions. If the eventual impact is significantly smaller or larger than expected, then the appropriate funds rate—the main instrument of monetary policy—would be higher or lower than the FOMC’s projections. But this is true of any big move in financial conditions.

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Q&A with Francesco Garzarelli



GS Co-Chief Markets Economist Francesco Garzarelli expects a moderate increase in the term premium from “quantitative tightening,” but warns that the low starting point for yields raises the risk of a sharper repricing.

Q: How will Fed balance sheet normalization impact the market for government bonds?

A: Between 2008 and 2013, the Fed purchased about \$2.5tn of Treasuries. Combined with asset purchases by the BOE, ECB, and BOJ, this significantly compressed the term premium, i.e., the compensation that investors require for bearing duration risk on longer-dated bonds, which are more sensitive to changes in interest rates. Now that the Fed is moving forward with “quantitative tightening” (QT), it will be up to the private sector to buy the additional flow of bonds that the Fed no longer wants. To incentivize those purchases, the term premium [has to increase](#). This will result in higher bond yields, even if the market’s expectation for policy rates remains stable.

Q: How much will the term premium increase?

A: If we take the effects of QE in reverse, every \$100bn of bonds that the Fed does not reinvest would add [roughly 2-3bp](#) to 10-year Treasury yields. However, this assumes that the cumulative impact of QT is spread over a period of years, which may not be the case; investors may look ahead to the entire stock of bonds that the Fed intends to roll off. Scaling our 2-3bp estimate to the total value of the Fed’s Treasury holdings suggests a “full stock” effect in the region of 50bp. Based on a different model and the Fed’s projected pace of Treasury and MBS runoff, our economists estimate that QT will add about 20bp to 10-year yields this year, 15bp next, and 10bp per year from 2019-2021; this does not take into account the spillover effects onto the US Treasury market of QE still going on overseas, which should keep the term premium in check.

Q: What will be the implications for other asset classes?

A: Prices will have to change for assets that have been valued off of very low yields, with longer-dated assets suffering the most. In equities, for example, cash flows that are expected very far into the future, such as for startups or technology companies, will likely see larger declines in their present value.

On the currency side, QT may not be as positive for the US dollar as a rate hike would be. Changes in bond yields tend to spill over across countries, so an increase in Treasury yields may not result in a one-for-one increase in yield differentials. In contrast, changes to the policy rate can create more interest rate divergence across regions, because central banks have firmer control over short-term rates. However, I would caution that this rule does not apply to some EM currencies, which react more strongly to longer-dated US rates.

Q: How has the market interpreted the Fed’s runoff plans?

A: The market’s interpretation is couched in prevailing macro expectations. Currently, those expectations are that growth is in good shape, but that inflation will remain low and perhaps fall further. Given that the market sees little need for tighter policy, investors have concluded that QT will be a *substitute* for rate hikes rather than a complement. As a result, the market is pricing just one Fed hike over the next year and a half.

In this environment, any increase in the term premium will be transferred from the central bank back to investors. As the supply of Treasuries available to the private market increases, their price will decline and their yield will rise. And investors who were already willing to buy Treasuries that yielded 2% will likely have an appetite for bonds that yield a little bit more. So if expectations of very low inflation persist, the market’s demand for bonds may increase as the Fed’s portfolio shrinks.

Term premium slump

US 10-year expected short rate vs. 10-year term premium, %



Source: Bloomberg, Goldman Sachs Global Investment Research.

In contrast to the market narrative, we expect a tight labor market and a pick-up in inflation to force the Fed’s hand to raise rates *in addition* to QT, which will be running on autopilot. That should set the stage for some dollar appreciation and perhaps a bigger decoupling of the US term structure from Europe.

Q: What are the risks to your base case?

A: The dispersion of growth and inflation forecasts today is [near historical lows](#). So even a small surprise could start to change market expectations and potentially trigger an outsized response. Investors are currently being compensated nothing for very high duration risk; if they begin to think that the Fed will need to hike rates in addition to shrinking its balance sheet, they may wait for bonds to cheapen rather than buying them as soon as yields start to rise. That could lead to significant collateral damage. For example, we estimate that a 1% “rate shock” to the US aggregate bond index would cause over \$1.2tn in losses. We are not forecasting this, but it is a real risk.

Q: What will you be watching over the coming weeks?

A: I will be watching inflation data for evidence of a pick-up, particularly in wages. And I will also be keeping an eye on the puzzling decline in US consumers’ long-dated inflation expectations. It isn’t clear whether this decline is structural or cyclical (e.g., tied to gasoline prices). But if we see these expectations normalize somewhat, that would be yet another sign that bonds are not correctly priced.

A snapshot of our views

How will Fed balance sheet normalization impact your asset class?

G10 FX

Zach Pandl, Silvia Ardagna & Team

- We do not expect Fed balance sheet normalization—as it has been communicated to date—to have a meaningful impact on the US dollar. Evidence suggests that the trade-weighted dollar and the major G10-dollar crosses are [more positively correlated](#) with US rates at the front end of the curve than at the back end, where balance sheet policy has the largest impact.
- While this implies that Fed rate hikes matter more for the dollar than balance sheet policy, they are not the only driver of the greenback. Indeed, the dollar's underperformance despite two Fed hikes so far this year (and the prospect of a third in December) demonstrates that other factors like valuation and risk-asset flows are also critical. Going forward, we forecast a [mixed outlook for the dollar](#), with gains against some currencies and losses against others; this reflects tailwinds from further Fed tightening and headwinds such as overvaluation and a cloudy outlook for US fiscal policy. We do not recommend chasing further EUR/USD strength at this time, and instead recommend opportunities tied to [relative cyclical positions](#) elsewhere in G10.

G10 RATES

Francesco Garzarelli, Alexander Demyanets & Team

- As the Fed reduces its demand for government bonds, these securities will need to come at a greater discount (i.e., offer a higher expected return), to incentivize purchases by the private sector. We therefore expect Fed balance sheet normalization to result in an [increase in the term premium](#) (i.e., the added compensation investors demand to hold long-term bonds given their greater sensitivity to changes in interest rates). This should put upward pressure on long-dated government bond yields, even if the expected path for short-term rates remains unchanged.
- Estimates of the impact of runoff on bond yields vary. Taking the effects of QE in reverse, every \$100bn of bonds that the Fed does not reinvest would add [roughly 2-3bp](#) to 10-year Treasury yields. An [alternative model](#) suggests that the fading of QE's portfolio balance effects should contribute roughly 20bp to yields this year, 15bp next year, and 10bp per year from 2019-2021; this does not account for the spillover effects of QE still going on overseas, which should keep the term premium in check.
- With the [starting point](#) for the term premium artificially depressed by QE, and wide agreement that inflation will remain low, any increase in uncertainty over the macro outlook could result in a sharper move in yields than the market currently discounts.

EM

Kamakshya Trivedi, Caesar Maasy & Team

- Fed balance sheet normalization has the potential to lift long-end rates and term premia—a concerning mix for EM given the “taper tantrum” precedent. Indeed, high-yielding EM assets appear [more sensitive](#) to policy-driven shifts in the back end of DM rate curves than the front end, and to DM term premia than rate expectations, especially when moves in term premia are rapid.
- However, increases in DM core rates are generally less threatening to EM today than in the past; EM sensitivities tend to be lower in periods of solid DM growth and healthy external balances in EM—both features of the current landscape. These factors, as well as the prospect of a [more sustained period](#) of EM growth, should be relatively more supportive for EM equities, FX, and credit spreads, and less so for local bonds.
- Given this backdrop—and the strong performance of EM local bonds so far this year—it is likely to be a [harder climb](#) for the EM local index going forward. We still expect the EM local index to deliver positive returns for the year but emphasize the importance of preserving year-to-date returns. This means hedging DM rate risks, either directly through shorts in core rates markets or in some EM low-yielders where central banks could shift in a hawkish direction. It also means focusing on higher-yielding EM countries, where local disinflation dynamics provide some cushion against core rate increases.

US EQUITIES

David Kostin, Ben Snider & Team

- Gradual, well-communicated balance sheet normalization should have a modest impact on US equity performance. At the index level, higher yields suggest downward pressure on valuations. We expect the S&P 500 forward P/E will decline from roughly 18x today to 17.3x by year-end, bringing the index level to our target of 2400 (-3.5%).
- Below the surface of the market, higher 10-year US Treasury yields should benefit the performance of the Financials sector. The correlation between Financials' excess returns and 10-year Treasury yields currently stands at nearly the highest level on record. We also recommend investors underweight “bond proxy” sectors such as Utilities and Real Estate, which typically underperform when Treasury yields rise.
- If Fed runoff proceeds faster than has been communicated, or for any other reason yields rise faster than we expect (i.e., another “tantrum”), there could be a sharper decline in equity valuations than we forecast and a more violent rotation between sectors. This could also strengthen the dollar, adding a headwind to US corporate profits and reversing the recent outperformance of foreign-facing stocks (GSTHINTL) vs. firms with high domestic sales (GSTHAINT).

US CREDIT

Lotfi Karoui & Team

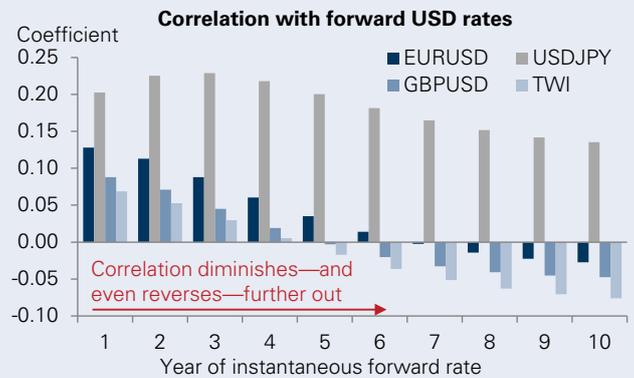
- To the extent that normalization of the Fed's balance sheet is gradual, well-communicated, and driven by a friendly mix of growth and inflation, we [do not think](#) that it will cause corporate spreads to move materially wider.
- That said, the combined effect of a higher term premium and tight spread levels will likely put downward pressure on corporate bond price returns and potentially cause a technical dislocation, driven by mutual fund outflows, for example. Barring an abrupt repricing of the term premium, we expect any technical dislocation will likely be relatively short-lived.
- Beyond the risk of a miscommunication, similar to the 2013 “taper tantrum,” the key risk to our benign view is that normalization moves faster than anticipated, due, for example, to an unexpected inflationary shock. However, given the continued weakness in inflation, this risk remains remote in our view.

Balance sheet vs. rate hike spillovers

Central banks can tighten monetary policy through rate hikes or balance sheet policies. Below, we compare how these instruments affect the exchange rate impact of Fed tightening and, in turn, the spillovers to other major economies. The upshot: Our stylized model suggests that the FOMC's plan to use the balance sheet as its next tightening step is helpful for China (as the renminbi should appreciate less than if the Fed raised rates), but offers less of a boost to growth and inflation in the Euro area and Japan (which should see their currencies weaken less than if the Fed raised rates).

1. Major DM currency pairs are more positively correlated with front-end US rates

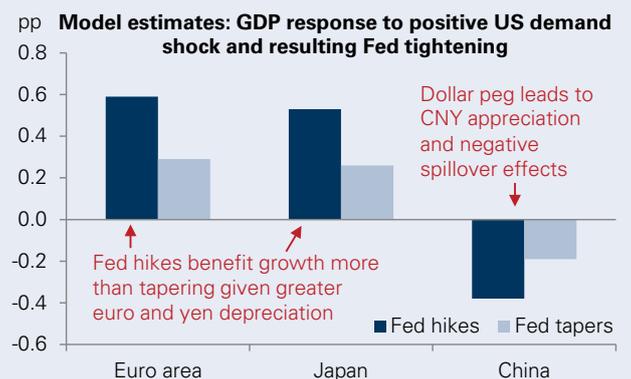
Changes in the Fed's balance sheet primarily affect the back end of the US yield curve, whereas movements in the federal funds rate affect the whole yield curve. Exchange rates are more positively correlated with front-end than longer-term US rates; in fact, the correlation of EUR/USD, GBP/USD, and the USD trade-weighted index (TWI) turns negative at more distant forward rates. The correlation of rates with the USD/JPY cross is larger throughout but also declines at the back end of the US yield curve. This suggests that tightening monetary policy via the balance sheet has smaller effects on these exchange rates than do higher policy rates.



Source: Goldman Sachs Global Investment Research.

2. Euro area and Japan benefit more from Fed hikes than from balance sheet normalization; the opposite is true for China

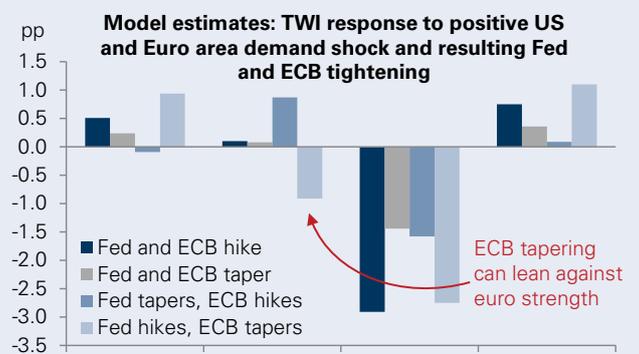
If we assume that rate hikes have larger exchange rate effects than balance sheet policies—but identical effects on domestic financial conditions—then Fed hikes should have more positive spillovers to the other major advanced economies than balance sheet runoff. In our stylized model, raising the funds rate in response to a positive shock to the US economy would lead to a larger trade-weighted depreciation of the euro and the yen. This would in turn increase output and inflation in the Euro area and Japan by more than balance sheet runoff. The opposite holds for China. The renminbi, which is pegged to the dollar, would appreciate more from Fed hikes than from balance sheet runoff, contributing to a larger hit to China GDP.



Source: Goldman Sachs Global Investment Research.

3. Simultaneous tightening by the Fed and the ECB would shift the international spillovers

The spillovers of Fed tightening would shift if the ECB were to tighten policy at the same time (to offset equal positive shocks to both economies, for example). In our stylized model, if the Fed raised rates, the ECB would need to taper more aggressively to undo the demand shock than it would if the Fed tightened via the balance sheet. However, by tapering rather than hiking, the ECB could lean against the unwanted strengthening of the euro (again, assuming that exchange rates respond more to rate hikes than to balance sheet policies). The yen, meanwhile, would weaken most if both the Fed and the ECB tightened via rates, resulting in a substantial boost to Japanese output and inflation. The effects on China would again be negative due to a stronger renminbi, especially if the Fed hiked rates and the ECB tightened via the balance sheet.



Source: Goldman Sachs Global Investment Research.

Note: This page summarizes our extension of a highly stylized model developed by Fed Governor Lael Brainard. For more on this analysis and the model's underlying assumptions, see [Global Economics Analyst: Policy Rate vs. Balance Sheet Spillovers, 28 July 2017](#).

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Goldman Sachs International

EM and the shifting mix of DM tightening

Our strategists argue that EMs are particularly sensitive to DM tightening via balance sheet policies, but positioned well for the challenge

As DM central banks look set to begin normalizing their balance sheets, a key question is whether we could see a repeat of the so-called 2013 “taper tantrum,” when a mere mention of the possibility of tapering—let alone normalization—led to a sharp sell-off in bonds and, relatedly, Emerging Market (EM) assets. Indeed, while EM has shown relative resilience to the start of the Fed’s hiking cycle, EM currencies have historically been more sensitive to shifts in long-end rates than short-end rates. Thus, Fed balance sheet normalization and ECB tapering may prove a bigger challenge for EMs than US rate hikes so far.

DM balance sheet normalization may pack a bigger punch

Part of the motivation for the shift in the mix of DM tightening toward the long end of the rates curve versus the short end is the notion—spelled out in [a speech by Fed Governor Lael Brainard in July](#)—that policy tightening that pushes long-end rates higher is likely to have less impact on the currency than a change in policy rates. Indeed, tracking minute-by-minute price action during 172 separate Fed and ECB communications in 2017 shows that DM currencies (and some of the low-yielding “DMs of EM”) tended to respond more to shifts in two-year yields, in line with Governor Brainard’s argument.

That said, some EM currencies are, in fact, more sensitive to policy-induced shifts in long-end than short-end rates. EM high-yielding currencies in particular responded more to policy-driven swings in 10-year yields, likely due to their large sensitivities to global risk. Of course, these sensitivities make sense in historical context; EM high-yielding FX was hit particularly hard as long-end core rates rose during the “taper tantrum.”

Interestingly, the JPY also scanned as particularly sensitive to long-end core rates. Since the BOJ effectively fixed 10-year Japanese government bond yields to 0% in September 2016, the JPY’s role as a macro “shock absorber” has increased, leading the currency to weaken substantially in response to

increases in the US 10-year yield. The BOJ’s yield curve control regime thus appears to offer the benefit of protection against a back-up in long-end core rates. This makes [funding](#) EM carry out of JPY—rather than the USD—a novel way to express a constructive view on EM high-carry currencies, not just in a risk-on “growth up, rates up” scenario, but also in our global base case of “growth stable, rates up.”

But fundamentals imply that EMs can handle the challenge

Two factors are likely to help EM assets successfully withstand the challenge of DM balance sheet normalization. First, relative to the “taper tantrum,” EM macro fundamentals are vastly improved. For example, we estimate that reductions in EM current account deficits alone—i.e., without considering the wide range of other fundamental improvements—have made EM high-yielders roughly 30% less sensitive to shifts in long-end core term premia than they were during the “taper tantrum.” Second, when core rate increases come alongside strong global growth (as we expect in coming months), they are more easily absorbed by EM assets. In other words, provided that core rates increase at a measured pace in coming quarters as we expect, EM assets should be able to navigate DM balance sheet normalization.

That being said, these conclusions vary by asset class. EM local bonds will likely face a “[harder climb](#)” from here. Other EM assets, however, have performed well when core rates have risen but global activity and global trade flows have remained strong. Going forward, the performance of EM equities, credit, and FX may depend as much on the health of global activity and trade as on DM balance sheet normalization and the path of core rates.

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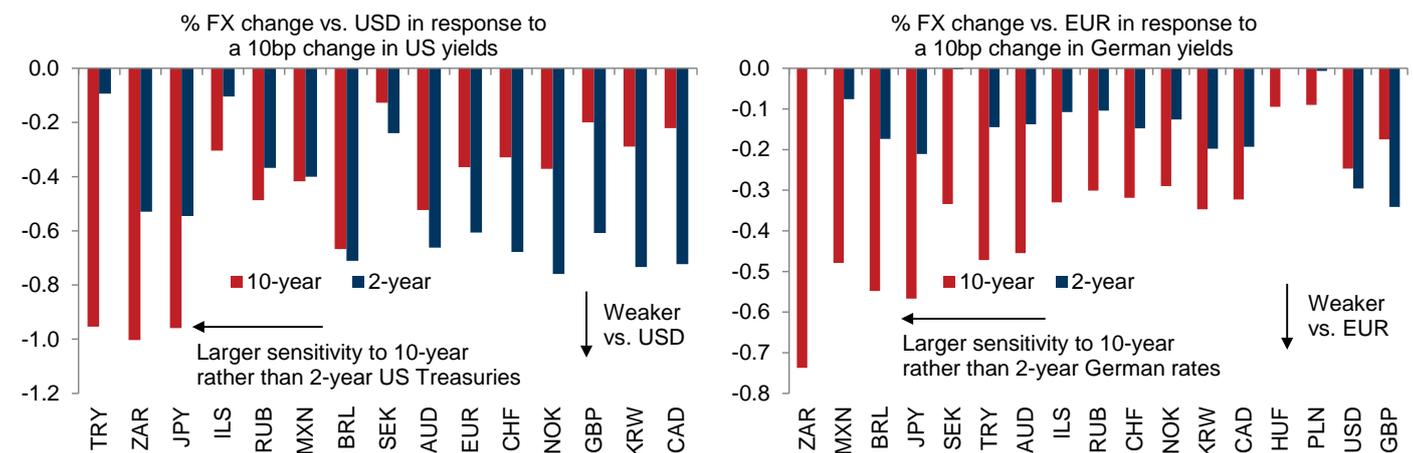
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For more, see “[EM and the shifting mix of DM tightening](#),” *Global Markets Analyst*, 20 July 2017.

EM sensitivities

Beta of five-min. FX returns vs. USD or EUR to five-min. changes in 2- and 10-year US or German government bond yields during 92 Fed communications (left chart) or 80 ECB communications (right chart) in 2017, controlling for five-min. returns in equities and oil prices.



Source: Bloomberg, Goldman Sachs Global Investment Research.

Q&A with Marty Young



GS Senior Mortgage Strategist Marty Young discusses the Fed's post-crisis footprint on the mortgage-backed securities (MBS) market and why balance sheet normalization is unlikely to cause a sharp widening of MBS spreads.

Q: Nearly a decade since the Fed bought MBS for the first time, how significant is its footprint in the market?

A: The footprint has been very large: The Federal Reserve now owns \$1.8tn of mortgage bonds, close to 30% of outstanding agency MBS. The Fed's MBS holdings grew most in 2009 (QE1), and in 2012-2014 (QE3). During 2013, Fed purchases amounted to over 55% of gross agency MBS issuance.

Q: Who sold to the Fed, and why is that important?

A: The investors whose portfolios shrank during this period, and who thus effectively "sold MBS to the Fed," were foreign investors and the government sponsored enterprises (GSEs), Fannie Mae and Freddie Mac. This matters because the GSEs and the Fed have very different investment styles. For example, the GSEs aggressively hedged the interest rate risk on their MBS assets—an activity that tended to amplify interest rate volatility. As interest rates rose and the risk of mortgage refinancing fell, MBS durations would lengthen; the investors would seek to offset this effect by selling duration (e.g., with swaps), which would cause rates to rise even further. The Fed, by comparison, does not hedge rate risk on its portfolio, and has likely dampened this dynamic. Going forward, the rates market has the potential to become more volatile as MBS shift back into the hands of investors who more actively manage interest rate risk.

Q: Will mortgage spreads return to pre-crisis levels as the Fed embarks on balance-sheet normalization?

A: Not likely. While agency MBS spreads vs. Treasuries have tightened significantly since the financial crisis, we would attribute only part of this tightening to QE. Given that other factors are also at work, we do not expect mortgage spreads to rapidly revert to pre-crisis levels. Indeed, even as the anticipated start of balance sheet normalization has been pulled forward over the past year, MBS spreads have tightened, as the market has apparently taken comfort in the slow expected pace of portfolio runoff. We look for mortgage spreads to widen by the end of the year, but only incrementally.

One factor likely keeping spreads tighter is the decline in refinancing as credit standards have tightened and origination costs have risen. MBS spreads largely represent compensation for prepayment risk, since the underlying borrowers can refinance their mortgages at any time; lower prepayment risk should therefore tighten spreads.

Lower interest rate volatility has also contributed to tighter mortgage spreads. We expect volatility to increase from its current levels, but vols may not revert to pre-crisis averages.

Finally, MBS have benefited from a positive supply/demand technical beyond the Fed's QE program, namely, the low volume of agency MBS issuance since 2008 relative to the large amount of Treasury debt issuance. Since 2009, agency MBS debt outstanding has grown by 20%, while Treasury debt outstanding has grown by 100%.

More than QE at work

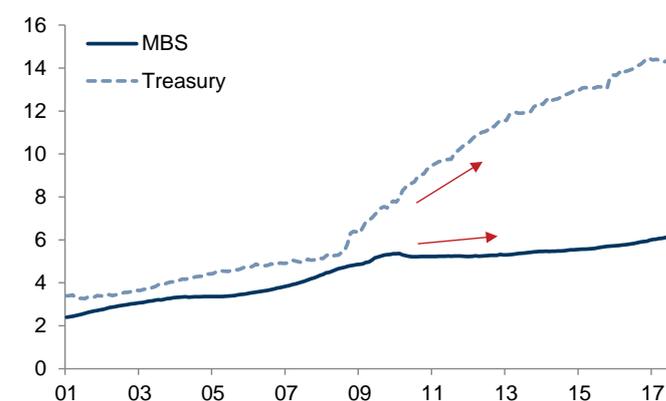
Current coupon MBS rate vs. blended 5/10y Treasury rate, bp



Source: Bloomberg, Goldman Sachs Global Investment Research.

A split in supply

Agency MBS and US Treasury debt outstanding, \$tn



Source: eMBS, US Treasury, Goldman Sachs Global Investment Research.

Q: How should MBS investors position for balance sheet normalization?

A: The incremental widening in spreads that we expect is not enough to justify a short position in MBS, in our view. Within the MBS universe, we favor leaning up-in-coupon, partly because we expect interest rates to rise (and higher-coupon securities have less duration risk), but also because the Fed's own holdings are skewed toward the lower coupons issued in recent years. For example, the Fed owns 48% of conventional 3.0% coupon MBS but only 25% of outstanding 4.5% coupon bonds. The higher-coupon pools may therefore be less prone to taper-tantrum-like spread-widening events.

Q: What could go wrong? Should we be at all concerned about a repeat of the "taper tantrum"?

A: Investors are pricing in slow, passive runoff, without outright asset sales. If the market were ever to interpret FOMC rhetoric as implying that the Fed might sell large quantities of MBS, that would likely be quite bearish for mortgages.

The financial system and the end of QE

Our Financials analysts explain why draining \$1tn of QE liquidity from the banking system will be more manageable than it sounds

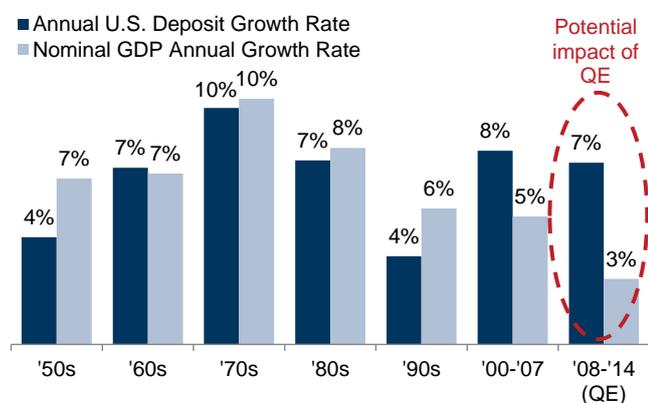
When the Fed embarked on Quantitative Easing (QE), it purchased assets in exchange for crediting the accounts of primary dealers, resulting in a major boost to the monetary supply, which artificially boosted liquidity and deposit growth. Now, with the central bank set to begin shrinking its balance sheet, these effects will be put into reverse. What will this process mean for the financial system?

Shifting into reverse

While a number of factors can influence the monetary supply—bank leverage, GDP growth, and foreign flow of funds, to name a few—in a vacuum, reducing the Fed’s balance sheet should suppress deposit growth by a comparable amount. We expect a \$1.1tn reduction in the size of the balance sheet over the next several years, although this figure could rise as high as \$2tn if the Fed opts for a smaller terminal balance sheet. On our estimates, a decline in this range would slow deposit growth by 3-4% annually. Given that deposits are a key driver of banks’ balance sheet growth, this should slow the growth of the entire banking system by a similar amount, all else equal.

QE changed the game

Annual deposit growth vs. GDP growth, %



Source: Federal Reserve, Goldman Sachs Global Investment Research.

\$1tn of liquidity outflow: not as bad as you think

Pulling over \$1tn of liquidity sounds daunting, but it is unlikely to cause outsized stress to the financial system, in our view. Funding stress only happens when banks see outflows from funding sources they thought were more stable and had paired with longer-duration assets. Both the type of deposits QE created and the new regulatory rules around how banks manage their funding have greatly reduced this risk.

By our estimates, the vast majority of deposits created by the Fed’s asset purchases were at investment funds, primary dealers, and foreign banks—the areas of the financial system that saw the most growth during QE. Banks view deposits from these entities as short-term liquidity and accordingly pair them with short-duration assets, which can easily be liquidated, minimizing the impact should these deposits be withdrawn.

New regulatory rules, mainly the liquidity coverage ratio (LCR), have amplified this trend, forcing banks to classify these types of deposits as non-operational financial deposits—“excess” cash not required for daily activities. Under the LCR, banks are required to hold the safest assets, such as US Treasuries and deposits at the Fed, dollar for dollar against these deposits to be safeguarded in case of withdrawal. Thus, banks are in a better position today than they were historically to weather any deposit outflows, markedly reducing the risk of funding stress.

Three key consequences

Reducing the Fed’s balance sheet will still have important implications. First, it may benefit consumers through higher interest rates. The new liquidity rules have made retail deposits the most valuable type of deposits for banks to hold, since retail deposits have proven to be more stable during times of stress. If banks detect funding pressure from the QE unwind, they would be incentivized to offset this pressure by gathering more retail deposits, as well as ensuring they keep the retail deposits they already have. In our view, this means banks are likely to offer higher interest rates on their checking and savings accounts, a potential positive for consumers.

Second, balance sheet normalization will likely create a modest headwind for loan growth. If deposit growth slows and banks are forced to pay more for their deposits, it would become more expensive and therefore less profitable for them to fund new loan growth. This could reduce their appetite to do so.

Third, bank M&A could increase. Bank mergers have historically been partly driven by a desire to fund growth when loan demand outstrips deposit increases. In these periods, acquisition activity tends to be focused on less profitable banks, as the deals are driven by a funding need, and M&A premiums tend to increase. If the Fed artificially slows deposit growth, we could be entering a similar phase.

Not our base case, but there are risks

The main risk to a smooth unwind of QE in our view is retail or other core deposit outflows. This could happen if the holders of such deposits become the marginal buyers for securities the Fed is no longer purchasing as they look for higher interest income on their cash. This would put outsized pressure on bank funding ratios, hurting banks’ profitability as their cost of liabilities increases, and impeding their ability to make new loans and help fuel overall economic growth.

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See also: [“Americas: Financials: The impact of the Fed reducing its balance sheet on the financial system,” 19 June 2017.](#)

ECB: composition outweighs size

Huw Pill argues that it's not the size of the balance sheet that matters most; the type of assets held by the ECB will instead dictate the market impact of tapering

Market attention is focused on the prospect of Fed balance sheet normalization. Often lost in that discussion is the ECB's experience with a shrinking balance sheet. Between June 2012 and November 2014, the ECB's balance sheet shrank by a third (from EUR 3.1bn—over 30% of Euro area 2012 nominal GDP—to just over EUR 2bn).

Reassuringly, as the ECB balance sheet shrank the world did not end. More to the point, neither did the Euro area. On the contrary, this period—in the aftermath of ECB President Mario Draghi's "whatever it takes" intervention in July 2012—marked the start of the Euro area's stabilization and subsequent recovery.

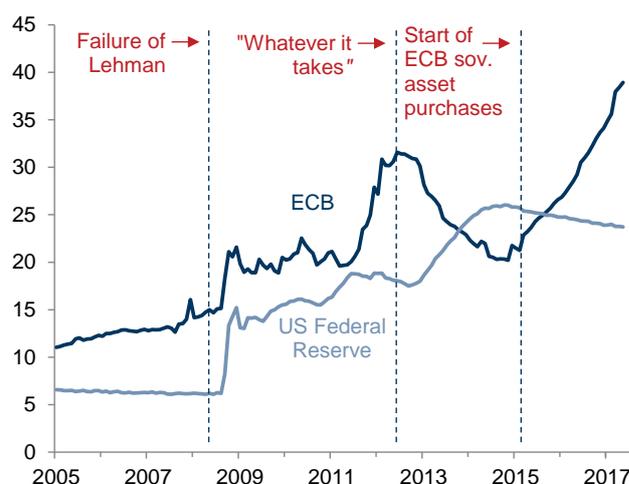
A brief history of ECB balance sheet policies

ECB balance sheet policies can be divided into three phases.

- August 2007 to September 2008.** Initially, the ECB addressed tensions in the money market by changing the timing and maturity at which it provided liquidity via its monetary policy operations. Prior to the onset of market tensions, the ECB balance sheet was already large compared with its peers' among advanced-economy central banks. This large balance sheet was big enough to accommodate the increased private demand for central bank intermediation of interbank transactions created by the emergence of market tensions without having to expand overall. Providing liquidity earlier in the reserve maintenance period and at longer maturities than normal was sufficient to reassure market participants that interbank payments would not malfunction.
- October 2008 to end-2014.** By contrast, following the failure of Lehman Brothers, the private demand for central bank intermediation expanded substantially, as key segments of the private financial market seized up altogether. The ECB balance sheet needed to expand in order to accommodate this substantial increase in transactions taking place across its balance sheet rather than in private markets. The key policy initiative in this regard was the ECB's adoption of fixed rate / full allotment (FRFA) tenders in its monetary policy operations. With the onset of the Euro sovereign and banking crises in 2011/2012, the ECB extended these FRFA operations to even longer maturities as bank funding markets in the periphery seized up. The FRFA operations guaranteed banks access to liquidity at the policy rate in potentially unlimited amounts. When market tensions mounted and the market could not satisfy liquidity needs, banks made greater recourse to the ECB operations. As market tensions eased, that private demand for central bank intermediation receded, and the ECB balance sheet shrank.
- Since 2015.** It was only with the emergence of a "deflation scare" in the Euro area in 2014 that the ECB shifted from a "passive" approach to balance sheet expansion (whereby private demand for central bank liquidity determined the size of the ECB balance sheet, with that demand fully met via FRFA operations) to an "active" approach (with the ECB driving the size of its balance sheet through increasing liquidity supply). As elsewhere, the main vehicle for these proactive liquidity injections was ECB asset purchases (i.e., quantitative easing or QE), notably purchases of sovereign debt (as government bond markets were the only ones with sufficient size and depth to permit a large-scale asset purchase program). These asset purchases have driven the renewed expansion of the ECB balance sheet since 2014.

Draghi marked the start of shrinking

Central bank balance sheets, % of nominal GDP



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

Lessons from ECB experience

The ECB's experience provides a number of lessons about the possible implications of a shrinking central bank balance sheet.

First, those implications will depend on the underlying economic forces driving the change in balance sheet size.

- For the reasons outlined above, the contraction of the ECB balance sheet from mid-2012 reflected reduced private demand for central bank intermediation as private market functioning improved in the aftermath of the calming balm provided by Draghi's "whatever it takes" intervention. In other words, a shrinking balance sheet was a symptom of success: It was the result of market tensions receding.
- By contrast, a balance sheet contraction driven by the central bank selling assets bought under QE back to the market (or failing to reinvest when assets in the QE portfolio mature) reflects a policy choice intended to influence private behavior. The Fed stands on the cusp of making such a decision, leading to a contraction of its balance sheet that may—indeed, is likely to—have different implications for the economy than the shrinking of the ECB balance sheet from mid-2012.

Second, the European experience with QE suggests that the quality of the assets bought under a QE program can matter as much as the quantity of monetary liabilities that the central bank creates.

We have long argued that an important channel for the transmission of QE in the Euro area was the creation of "fiscal

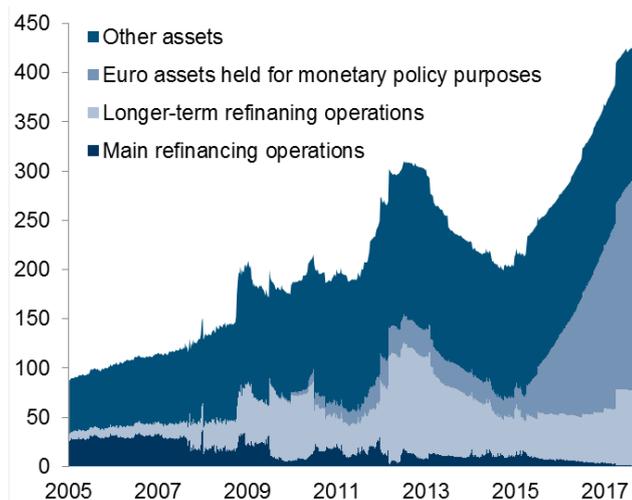
space” on the balance sheets of heavily indebted peripheral governments via the ECB’s purchase of sovereign bonds. The associated stabilization of peripheral sovereign debt markets allowed an easing of fiscal policy in the periphery from 2014 that was not possible earlier (say, at the peak of the sovereign crisis in 2011/2012), when peripheral governments were essentially locked out of funding markets owing to concerns about exit and redenomination risk. On this basis, buying an Italian government bond is likely to provide greater macro stimulus at the Euro area level than buying a German government bond, even if the liquidity created by the purchase (and thus its implications for the size of the ECB balance sheet overall) is the same.

More generally, the ECB experience suggests that the manner in which liquidity is created—via asset purchases or refinancing operations; through buying one instrument rather than another; the terms on which refinancing operations are available—matters as much as the overall volume of liquidity creation.

In short, the size of the ECB balance sheet may matter. But the composition of that balance sheet—especially the structure of the central bank asset portfolio—is likely to matter more.

Shift in composition, not just size

Assets on the ECB balance sheet, EUR mn



Source: ECB, Goldman Sachs Global Investment Research.

What to expect from the ECB

With the Euro area recovery showing greater resilience and robustness, a tapering of ECB asset purchases is in prospect. We expect an announcement to be made later this autumn that asset purchases will be prolonged into 2018, but tapered over the course of the year.

Crucially though, the ECB remains committed to reinvesting the proceeds of maturing assets in its QE portfolio. As a result, tapering of the ECB’s asset purchase program will lead (other things equal) to an end to the expansion of the central bank’s balance sheet, but not to a contraction. This is an important distinction with what is in prospect in the United States, where the Fed appears set to withdraw liquidity from the market and allow its balance sheet to shrink.

ECB tapering has become the consensus view among market participants. An important remaining issue is how the tapering will be conducted and what implications it will have on the conduct of asset purchases. For example, the self-imposed rules on sovereign asset purchases under which the ECB operates its QE policy appear likely to imply a need for greater flexibility in the composition of asset purchases in the coming year.

We have argued that this flexibility is likely to be achieved by accepting greater deviations from the ECB capital key in the allocation of asset purchases across countries. Alternatively, such flexibility may be found by purchasing more private assets (such as corporate debt) rather than sovereign assets. The set of eligible assets could even be expanded further, say to bank debt or equities (although we consider this unlikely).

So even though ECB tapering is now the consensus view, there is still something to play for in how that tapering is implemented. And since the composition of the balance sheet matters more than its overall size, the choices made by the ECB on these dimensions may have macro implications and create market opportunities.

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BOJ could miss the tightening cycle

Naohiko Baba expects the BOJ to stick to yield curve control while the quiet retreat of Quantitative and Qualitative Easing continues

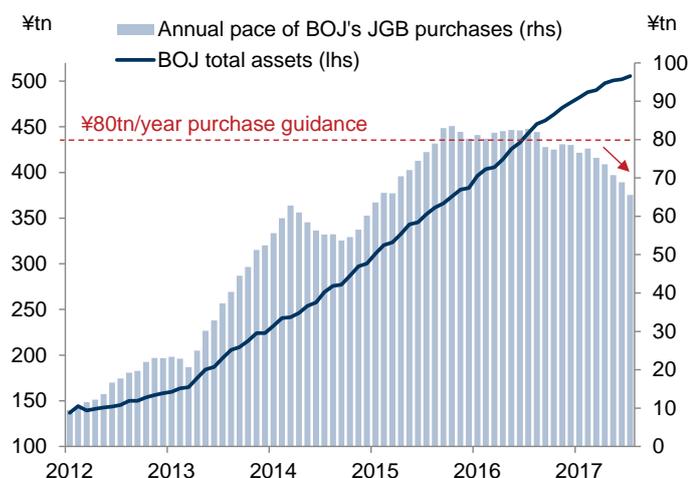
Although all eyes are focused on potential changes to the balance sheet programs of the Fed and the ECB this fall, the BOJ has in fact been quietly reducing Japanese government bond (JGB) purchases under its Quantitative and Qualitative Easing (QQE) program for almost a year. This is the case despite the BOJ maintaining its objective of purchasing ¥80tn of JGBs per year even after the introduction of yield curve control (YCC) in 3Q2016.

The reduced purchases have led some market observers to expect the BOJ to soon lower this soft purchase target, or to abandon purchase guidance altogether. We disagree on this at least in the near term. In our view, the markets would likely interpret any official reduction in the pace of JGB buying as an about-face, possibly leading to unwelcome yen appreciation. Similarly, reducing purchases of ETFs—another area where investors think the BOJ may scale back—could trigger an unintentional downturn in the stock market. We therefore think the BOJ is unlikely to officially announce tapering of QQE in the near term, particularly under the current governor, Haruhiko Kuroda, whose term expires in April 2018.

Rather, the difficulty of achieving even 1% inflation, let alone the 2% target, leads us to expect the BOJ to keep QQE—and policy rates—unchanged for some time, despite incentives for the bank to reduce accommodation. In reality, the BOJ could miss the current global tightening cycle. If and when the BOJ does begin to tighten, we think raising the 0% target for 10-year JGB yields would be the bank's first official step to policy normalization.

Quietly retreating

BOJ assets (lhs) vs. pace of JGB purchases (rhs), ¥tn



Source: Haver Analytics, Goldman Sachs Global Investment Research.

Incentives to tighten

Perhaps counterintuitively, the BOJ has incentives to begin normalizing monetary policy even if CPI inflation remains below

the 2% target. First, the bank would like to ensure some leeway to lower interest rates in the future. The BOJ, of course, would still have options to add accommodation without raising rates in advance (e.g., by taking short-term rates deeper into negative territory). However, the BOJ's extraordinary low interest rate policy has negatively affected a wide range of financial institutions, making the policy hurdle very high.

Second, there are a number of concerns about the growing side effects of persevering with the current policy for too long. As mentioned above, bank earnings, particularly for regional banks, continue to deteriorate. Japan's outlying regions are facing depopulation, fanning fierce competition in lending rates among banks amid already limited borrowing demand. The BOJ's current easing policy has just worsened the situation.

Easy BOJ policy has created other challenges as well, such as a notable deterioration in the investment performance of life insurance companies and pension funds. And low interest rates have meant a prolonged period of very low interest income for households, which is a substantial headwind, especially for the elderly and pensioners who do not benefit from wage hikes. Finally, the timing of normalizing policy needs to be chosen carefully. To avoid sharp yen appreciation, the BOJ would likely prefer to raise rates while the Fed remains in a hiking cycle.

Incentives to hold

Despite these incentives, we believe the BOJ will not be in a position to tighten policy for the foreseeable future. We think the minimum condition for the BOJ to embark on raising its 10-year yield target is likely to be inflation stabilizing at around 1% yoy for some time, especially for Japan's new core CPI excluding energy and fresh food. This coincides with recent comments made by Professor Koichi Hamada of Yale University, Prime Minister Abe's economic advisor. Our forecasts call for the new core CPI inflation to rise to +0.6% at end-2018 from the latest reading of +0.1% in July 2017, and to stabilize at +0.8% in 2H2019.

Based on this alone, we think there is still a long way to go before the BOJ puts normalization on the table. Given the uncertainty surrounding the BOJ's new leadership amid recent instability in the Abe administration, any discussion of tightening today can only be preliminary. That said, we think we can at least rule out the possibility of any policy changes before Kuroda's term expires, while the quiet retreat of JGB purchases continues in the background.

Could the BOJ wait for inflation to pick up, but still begin tightening while the Fed is hiking US rates? It's possible, given that we expect the Fed will still be tightening in 2019, although there is greater uncertainty on a more distant horizon. But it is also possible that the BOJ entirely misses the global tightening cycle this time around.

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Sizing up the balance sheet debate

Whether the Fed should shrink its balance sheet back to pre-crisis levels or keep it elevated has been a matter of debate. Below, we outline the key arguments of this debate and walk through the implications for the Fed's policy framework.

Returning to pre-crisis size of the balance sheet

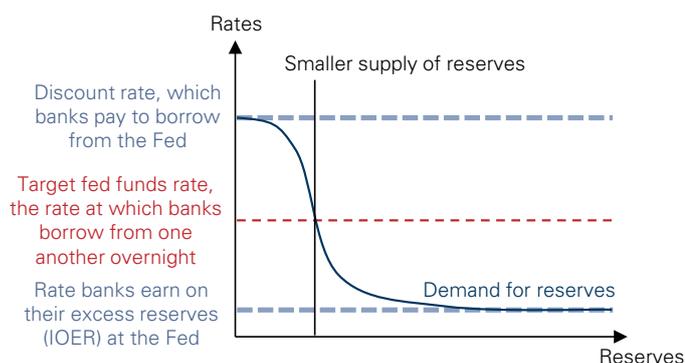
Keeping the balance sheet large indefinitely

Implications for how the Fed sets rates

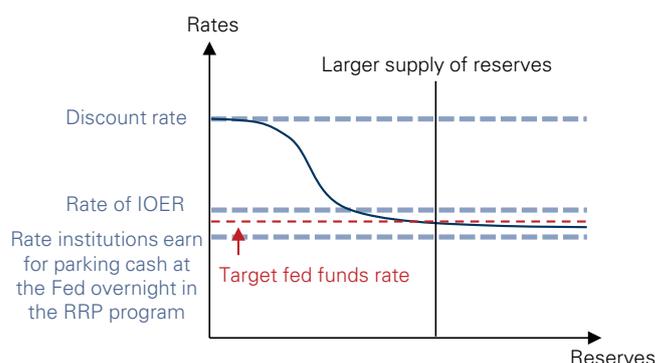
- The Fed previously used a **corridor system** to set the federal funds rate, the average rate at which commercial banks borrow from each other overnight.
- The Fed fine-tuned the level of commercial bank reserves through open-market operations (OMO), buying or selling securities as needed. For example, the Fed could sell Treasuries into the market to drain reserves from the system, make reserves scarcer, and push the funds rate higher.
- The funds rate would fall within a corridor, with the lower bound being the interest rate that commercial banks earn on excess reserves (IOER) they deposit with the Fed (pre-crisis, this was zero). The upper bound would be the discount rate, the rate at which banks can borrow from the Fed.

- Today, bank reserves are too plentiful for modest OMO to drive the funds rate. The Fed now relies on a **floor system**, which separates the policy rate from the level of reserves.
- In principle, IOER—currently 1.25%—acts as a floor for the funds rate, since banks have no incentive to lend to one another at a rate below what they can earn at the Fed.
- Not all financial institutions are eligible to earn IOER, so this floor is imperfect. The Fed reinforces it with the rate on its reverse repurchase (RRP) program—currently 1.00%—which some of these non-bank institutions can use to park cash overnight at the Fed.
- The discount rate sets an upper bound for the funds rate, but the latter typically trades in a narrow range between IOER/RRP.

Corridor System



Floor System



Why go back to a smaller balance sheet?*

- The pre-crisis framework limits the Fed's footprint on the markets, which has increased under the new framework such that the Fed is displacing private-sector participants in certain areas (e.g., reverse repo).
- QE distorted the allocation of credit, favoring MBS as an asset class, for example.
- The new framework will leave the Fed with mounting interest payments to commercial banks.
- A large balance sheet blurs the lines between fiscal and monetary policy, pressuring the Fed's independence.
- In providing liquidity to the private sector, a large Fed balance sheet may introduce moral hazard in financial institutions' ability to manage their own liquidity.
- The Fed's RRP offering might encourage sell-offs in times of market stress, with financial institutions selling assets in favor of putting their cash in the safe RRP facility.

Why keep a large balance sheet?*

- The new operating framework has proven effective so far.
- RRP may improve the transmission of monetary policy by linking the funds rate directly to a broader set of financial institutions rather than relying on banks to pass interest-rate changes on to their consumers.
- A large balance sheet enables the Fed to provide more safe, liquid assets via IOER or RRP. This helps banks meet regulatory requirements and may reduce their incentives to engage in potentially risky maturity transformation.
- By engaging regularly with market participants, the Fed may reduce the stigma associated with its discount window, which could help address liquidity shortages during a crisis.
- Holding a large and diverse balance sheet gives the Fed experience in different markets, making it better-prepared to engage in those markets if needed in a future crisis.
- Other major central banks use a floor system.

Where the Fed stands today

The Fed appears to be in favor of keeping a fairly large balance sheet. Minutes from the June 2017 FOMC meeting indicated that the committee expects reserve balances to reach "a level appreciably below that seen in recent years but larger than before the financial crisis." However, this could change based on the preferences of future FOMC leadership.

*This section is intended to present different points of view. The arguments listed do not necessarily reflect the views of Goldman Sachs Global Investment Research. Source: Goldman Sachs Global Investment Research; Todd Keister, "Corridors and Floors in Monetary Policy," Liberty Street Economics, Federal Reserve Bank of New York; Bill Nelson, "FOMC Go Home," The Clearing House; Ben Bernanke, "Should the Fed keep its balance sheet large?," Brookings Institution; various news sources.

Summary of our key forecasts

	GDP Growth (% yoy)				FX				Equity				Rates (% eop)				Revision Notes	
	2017		2018		3-mth		12-mth		3-mth		12-mth		Policy*		10-yr			
	GS	Cons	GS	Cons	GS	Cons	GS	Cons	GS	Cons	GS	Cons	2017	2018	2017	2018		
GLOBAL	3.8	3.4	3.8	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	
US	2.1	2.2	2.4	2.3	1.15	1.17	1.15	1.19	2425	-	2450	-	1.25 to 1.50	2.25 to 2.50	2.75	3.25		On August 9, we raised our 3/6/12-month EUR/\$ forecast to 1.15 (across all three time horizons) from 1.08/1.07/1.05, respectively. In addition to marking-to-market, this reflects a cloudy outlook for the dollar given questions about the prospects for fiscal policy change and weaker-than-expected price inflation in the US, among other factors. On September 9, we adjusted our quarterly GDP growth forecasts to reflect an expected hurricane-related hit to economic activity in Q3 followed by a rebound in Q4, Q1, and Q2; our 2018 growth forecast is now 2.4%, up from 2.3% previously.
EURO AREA	2.2	2.0	1.7	1.7	1.15	1.17	1.15	1.19	3500	-	3600	-	0.00	0.00	-	-		On August 9, we raised our 3/6/12-month EUR/\$ forecast to 1.15 (across all three time horizons) from 1.08/1.07/1.05, respectively. In addition to marking-to-market, this reflects a cloudy outlook for the dollar given questions about the prospects for fiscal policy change and weaker-than-expected price inflation in the US, among other factors. On September 5, we lowered our 3/6/12-month Euro Stoxx 50 forecasts to 3500/3550/3600 from 3600/3750/3800, respectively, as a stronger euro has led to a downwards turn in EPS revisions.
GERMANY	2.2	1.9	1.8	1.8	1.15	1.17	1.15	1.19	-	-	-	-	-	-	0.70	1.10		On August 9, we raised our 3/6/12-month EUR/\$ forecast to 1.15 (across all three time horizons) from 1.08/1.07/1.05, respectively. In addition to marking-to-market, this reflects a cloudy outlook for the dollar given questions about the prospects for fiscal policy change and weaker-than-expected price inflation in the US, among other factors. On September 5, we upgraded our GDP forecasts for 2017 and 2018 to 2.2% and 1.8%, respectively, from 2.1% and 1.5%, on positive signals in recent data driven largely by resilient domestic demand and robust exports still benefiting from a weak euro last year.
JAPAN	1.5	1.4	1.2	1.1	112	112	115	114	1600	-	1700	-	-0.10	-0.10	0.10	0.30		On August 9, we lowered our 3/6/12-month \$/JPY forecasts to 112/113/115, respectively, from 114/116/118 previously, both marking-to-market and incorporating downward revisions to our dollar forecast.
CHINA	6.8	6.7	6.3	6.4	6.70	6.66	7.00	6.80	-	-	80	-	3.00	3.00	-	-		On August 9, we lowered our 3/6/12-month \$/CNY forecasts to 6.70/6.90/7.00, respectively, from 6.95/7.00/7.20 previously, both marking-to-market and incorporating downward revisions to our dollar forecast.
BRAZIL	0.7	0.5	2.1	2.1	3.20	3.20	3.25	3.35	-	-	-	-	8.00	8.00	-	-		
	Brent crude oil (\$/bbl)				Copper (\$/mt)				Gold (\$/toz)				Corn (cent/bu)					
	3-mth		12-mth		3-mth		12-mth		3-mth		12-mth		3-mth		12-mth			
	GS	Cons	GS	Cons	GS	Cons	GS	Cons	GS	Cons	GS	Cons	GS	Cons	GS	Cons		
	50	53	58	53	6200	-	5500	-	1200	-	1250	1250	350	-	335	-		

Note: Recent revisions marked in red; GDP consensus is Bloomberg; all other consensus is Reuters; commodity 12-mo consensus is Reuters for 2017 average.

* CNY daily fix

Source: Bloomberg, Thomson Reuters, Goldman Sachs Global Investment Research.



Glossary of GS proprietary indices

Current Activity Indicator (CAI)

Our CAI measures the growth signal in a broad range of weekly and monthly indicators, offering an alternative to Gross Domestic Product (GDP). GDP is a useful but 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 more timely read on the pace of growth. We currently calculate CAIs for the US, Euro area, Japan, UK, and 29 other countries. For more, see *Global Economics Analyst: Trackin' All Over the World – Our New Global CAI*, 25 February 2017.

Financial Conditions Index (FCI)

Financial conditions are important because shifts in monetary policy do not tell the whole story. Our FCIs attempt to measure the direct and indirect effects of monetary policy on economic activity. We feel they provide a better gauge of the overall financial climate because they include variables that directly affect spending on domestically produced goods and services. Each FCI is calculated as a weighted average of a policy rate, a long-term riskless bond yield, a corporate credit spread, an equity price variable, and a trade-weighted exchange rate; in the Euro area we also include 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.

Global Leading Indicator (GLI)

Our GLIs provide a more timely reading on the state of the global industrial cycle than the existing alternatives, and in a way that is largely independent of market variables. Global cyclical swings are important to a huge range of asset classes; as a result, we have come to rely on this consistent leading measure of the global cycle. Over the past few years, our GLI has provided early signals on turning points in the global cycle on a number of occasions and has helped confirm or deny the direction in which markets were heading. Our GLI currently includes the following components: Consumer Confidence aggregate, Japan IP inventory/sales ratio, Korea exports, S&P GS Industrial Metals Index, US Initial jobless claims, Belgian and Netherlands manufacturing surveys, Global PMI, GS Australian and Canadian dollar trade weighted index aggregate, Global new orders less inventories, Baltic Dry Index.

Goldman Sachs Analyst Index (GSAI)

Our US GSAI is based on a monthly survey of Goldman Sachs 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 their responses, we create a diffusion index for economic activity comparable to the ISM's indexes for activity in the manufacturing and nonmanufacturing sectors.

Macro-Data Assessment Platform (MAP)

Our MAP scores facilitate rapid interpretation of new data releases. In essence, MAP combines into one simple measure the importance of a specific data release (i.e., its historical correlation with GDP) and the degree of surprise relative to the consensus forecast. We put a sign on the degree of surprise, so that an underperformance will be characterized with a negative number and an outperformance with a positive number. We rank each of these two components on a scale from 0 to 5, and the MAP score will be the product of the two, i.e., from -25 to +25. The idea is that when data are released, the assessment we make will include a MAP score of, for example, +20 (5;+4)—which would indicate that the data has a very high correlation to GDP (the '5') and that it came out well above consensus expectations (the '+4')—for a total MAP value of '+20.' We currently employ MAP for US, EMEA and Asia data releases.

Real-Time Inflation and Activity Framework (RETINA)

RETINA provides a comprehensive econometric methodology able to filter incoming information from the most up-to-date high frequency variables in order to track real GDP growth in the Euro area. Along with a GDP tracker, RETINA also captures the interrelated mechanisms of the area-wide pricing chain, providing a short-term view on inflation dynamics.



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Disclosure Appendix

Reg AC

We, Allison Nathan, Marina Grushin, David Groman, Naohiko Baba, Francesco Garzarelli, Jan Hatzius, Lorenzo Incoronato, David Mericle, Alec Phillips, Huw Pill, Jari Stehn, Daan Struyven, and Ian Tomb, 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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