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Economic Research:

QExit Q&A: Everything You Ever Wanted To Know About The Exit From Quantitative Easing

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QExit Q&A: Everything You Ever Wanted To Know About The Exit From Quantitative Easing

*(**Editor's Note:** The views expressed here are those of S&P Global's chief economist. While these views can help to inform the ratings process, sovereign and other ratings are based on the decisions of ratings committees, exercising their analytical judgment in accordance with publicly available ratings criteria.)*

When it comes to monetary policy, the Global Financial Crisis and Great Recession continue to cast a long shadow. The four major developed world central banks are the Federal Reserve, the Bank of England (BoE), the Bank of Japan (BOJ), and the European Central Bank (ECB). Nine years after the global financial system suffered the financial equivalent of a massive cardiac arrest, these central banks are all still doing quantitative easing (QE), either on a stock basis (the first two) or on both a flow and a stock basis (the latter two). How they will eventually unwind their stock of QE, and with what effects, has long been pondered, but up until now has been largely an academic question. With the Fed about to start to unwind its QE, this is all about to change, raising a number of questions about the process. We try to answer them here.

Overview

- QE is when a central bank attempts to ease monetary policy by expanding its balance sheet, acquiring assets financed by creating excess reserves. QExit reverses this process, returning the central bank's balance sheet to its normal size (determined mainly by the public's demand for banknotes and the amount of minimum required reserves).
- Just as QE is a very mild form of monetary easing, the unwind of QE, by the central bank selling its assets or letting them run off its balance sheet as they mature, is a very mild form of monetary tightening: QExit is likely to be largely an innocuous process.
- The "funding" to absorb the government debt securities the central bank returns to private hands when it unwinds QE is already in place in the form of the reserves the central bank created when it did QE in the first place and which it is now trying to expunge.
- The monetary tightening associated with QExit occurs because returning government debt securities and other assets to private hands disturbs financial market (asset price) equilibrium in the opposite way as QE did in the first place, notably restoring the term premium that QE suppressed.
- Fears that QExit will damage central banks' balance sheets and interfere with monetary policymaking are largely unfounded: Both QE and QExit are best understood, in the main, as involving changing the form of the liabilities of the consolidated government to the public. It is the consolidated government's balance sheet, not the central bank's, that is key.

What does QExit mean?

QExit is shorthand for "the exit from QE." It refers to the process whereby central banks that did QE in the past return (shrink) their balance sheet to a normal or more normal level.

So QExit has nothing to do with Grexit and Brexit, right?

Correct. Grexit refers to the question of whether Greece was going to or will in the future leave (exit from) the euro area (it hasn't so far and there are no indications that it is likely to in the foreseeable future). Brexit refers to the exit of the U.K. from the European Union (this process began after the U.K. triggered Article 50 of the Treaty on the Functioning of the European Union on March 29 this year).

Is "exit" the right way to frame this issue?

Not really. The exit from QE is much more a process than an event. The word "exit" implies a discrete process, as if passing from a state of "being in" to one of "being out," or in this case from "doing QE" to "no longer doing QE." The process of central banks "exiting from QE" is likely to be very long and drawn out when it starts, and some central banks (notably the ECB, the BOJ, and the BoE) are not likely to start that process for a long time (measured in years not months). That said, we won't try to fight a losing battle against a term that has become common, and we will use the "exit" framing here.

Why is this topic getting attention now?

In a word, the Fed. The Federal Reserve has been signaling for some time that it is getting close to starting the process of reducing the size of its balance sheet to more normal levels. After announcing after its June 13-14, 2017, Federal Open Market Committee (FOMC) meeting the details of how it intends to shrink its balance sheet, the Fed announced after its July 25-26, 2017, FOMC meeting that it expected to begin the process "relatively soon." We expect the Fed to pull the trigger on the unwind process at its Sept. 19-20, 2017, FOMC meeting.

What is the right way to think about QExit?

It is very simple. QExit is just reversing QE, so the key to not getting bamboozled by the endless talk you are going to hear about QExit in coming years is to understand QE. The more you understand QE, the more you will understand QExit.

What is the right way to think about QE, then?

Let's take it in steps. QE is all about the central bank increasing the size of its balance sheet (in order to ease monetary policy), so we need to have a good handle on the balance sheet of a central bank before we can even get to first base.

Is a central bank's balance sheet just like any other balance sheet?

A little "yes" and a big "no." Yes, in that it has assets on one side (the left-hand side) and liabilities and equity on the other side (the right-hand side) and has to obey the usual arithmetic of balance sheets. No, in that a central bank is an

altogether special entity, whose most fundamental job is to operate and regulate the monetary system of the economy. In the case of a privately owned, profit-seeking firm, the asset side of the balance sheet in a sense is primary and the liability side is secondary (think Modigliani-Miller theorem): It is the assets of the firm that define its raison d'etre; how these assets are financed is somewhat secondary, and on that side of the balance sheet equity is the most important item because it represents the "ownership" of the firm. In the case of a central bank, the liability side of the balance sheet is primary and the asset side is secondary: The central bank holds assets in order to supply money to the economy, not usually for their own sake, and on the liability side capital (equity) is the least significant of the major components.

What are the main components of a central bank's balance sheet, particularly on the liability side?

In simplified and identity form, a central bank's balance sheet can be written as:

Assets (A) = Reserves (R) + Banknotes (BK) + Government Deposits (GD) + Capital (C)

The most common assets a central bank holds are government debt securities and various claims on banks (repurchase agreements, loans, etc.), often using government debt securities as collateral. Reserves, sometimes called "central bank money" (not to be confused with foreign exchange reserves, which sometimes make an appearance on the asset side), are the deposits at the central bank of banks and other financial institutions that maintain an account with it. The interest rate that the central bank sets on reserves anchors and influences the whole of the term structure of interest rates.

Together with banknotes, these two components comprise what is commonly known as "base money" or the "monetary base." The central bank is the banker to the government or its "fiscal agent," so the government maintains a deposit account with the central bank, too, meaning that all fiscal transactions of the government with the public involve the central bank's balance sheet (a very important but usually overlooked fact). The capital account of the central bank is not very consequential because the central bank is usually a part of the government (what is known as the "consolidated government"). The capital of the central bank is little more than a residual accounting item, which appears on both sides of the consolidated government's balance sheet (1) and so in effect cancels out (2).

What determines the size of a central bank's balance sheet in normal times?

In normal times, the size of the central bank's balance sheet and the rate at which is grows over time reflect broadly the growth of the economy, relating to R and BK above, and is not something that the central bank directly targets.

As the economy grows, the public tends to demand more banknotes, which the central bank passively accommodates (when you go the ATM to withdraw a $100 from your bank account, save some machine malfunction, the notes do come out--you don't get a message saying "the central bank has decided it has created enough banknote liabilities and is going to start rationing them"). In normal times, the central bank adjusts reserves to be in line with the overall level of minimum required reserves (the level of reserves that banks must maintain on average over time), which the central

bank also sets (3). The level of minimum required reserves is linked to the amount of bank deposits, which in turn reflects growth in bank lending (because deposits are created when banks lend). So the level of minimum required reserves tends to increase slowly over time as banks increase their lending and the amount of bank deposits grows.

I'm getting lost--why does the central bank in normal times keep the actual level of reserves in line with minimum reserve requirements?

The reserve accounts at the central bank are where all the countless transactions that occur in the banking system every day get netted out, as banks settle up their positions with one another. Banks need to satisfy their minimum reserve requirements (and may want to hold a small buffer of excess reserves, that is, reserves in excess of their minimum reserve requirements), so will want to borrow reserves from other banks if they are short and lend reserves if they have too many. The short-term (usually overnight) interest rate in the interbank market for central bank reserves is usually the "policy rate," that is, the target interest rate of the central bank. By targeting this interest rate and by influencing the market's expectation of its future path, the central bank can influence the whole term structure of interest rates and, because of arbitrage relationships, indirectly, all asset prices.

The central bank has two ways in which it can target the overnight interest rate. In precrisis normal times the central bank would announce a target rate and then adjust the level of reserves to achieve that rate. This was relatively easy: If there were (significant) excess reserves in the banking system, banks in aggregate would be wanting to lend their reserves to one another, because reserves typically earned zero interest (by law or central bank decree), and this would put downward pressure on the interbank rate; if there were insufficient reserves in the banking system, banks in aggregate would be wanting to borrow reserves from one another, because the central bank would penalize them if they could not satisfy their minimum reserve requirements, which would put upward pressure on the interbank rate. By adjusting the level of reserves to be more or less in line with the amount of minimum reserves, the central bank could guide the interbank rate to be in line with its target.

Under QE the situation changes. QE produces a large amount of excess reserves, so, if the central bank did not pay interest on reserves, the short-term rate in the interbank market would collapse to (or very close to) zero. But, by paying interest on reserves, the central bank can regain control of the short-term interest rate, the anchor rate of the whole yield curve. This is exactly what the Fed is currently doing. Say the Fed wants the federal funds rate (the overnight rate) to be 1% and assume that all banks have excess reserves. Then it can pay interest of 1% on (excess) reserves. Banks no longer have an incentive to try to "offload" their reserves in order to earn some interest income, because they can earn that interest income by leaving their reserves with the Fed (the reserves will be "with the Fed" either way, but it is the impulse to try to lend them to other banks and the associated downward pressure on the interest rate that changes).

Who or what determines the level of reserves?

The central bank does. Rearranging the central bank balance sheet identity, ignoring equity to simplify, and expressing it in changes not levels yields:

$$\triangle R = \triangle A - \triangle BK - \triangle GD$$

Only three things influence the overall level of reserves in the banking system: reserves go up when the central bank adds to its assets (this is how it pays for them); when banknotes go down; and when the government spends more than it takes in (from the public) (runs a budget deficit). Because at any point in time the latter two are exogenous to, and observable by, the central bank, it can determine the level of reserves simply by adjusting its asset holdings accordingly (e.g., via open-market operations), increasing its assets if it wants to increase reserves, shedding assets if it wants to decrease reserves. This is why the central bank can do QE and can unwind QE.

Let me ask again, then, what's the right way to think about QE?

QE is the process whereby the central bank purposefully expands the size of its balance sheet by acquiring assets financed by creating reserves (sometimes misleadingly termed "printing money") with a view to easing financial conditions and thereby further stimulating economic activity.

The problem with this common way of characterizing QE is that it puts a one-sided focus on the size of the central bank's balance sheet, conjuring up the image of runaway money printing (reserve creation) and stirring up (unfounded) fears of credit growth and later inflation exploding as part of a textbook money multiplier process. This has been the dog that didn't bark in the almost nine years of this great monetary policy experiment.

What this characterization misses is that, for every dollar (or euro or yen or pound) of money the central bank "pumps in" when it does QE, it "sucks out" a dollar (or euro or yen or pound) of government bonds or other assets from the private sector's aggregate portfolio in the process. QE is a "wash" when it comes to the total asset holdings and (instantaneous) purchasing power of the private sector (4). There are several ways to understand how and why QE works, but they all revolve around the same basic fact: The central bank can alter the composition of assets in the hands of the private sector and by doing so disturb the existing asset price equilibrium. QE works through the "portfolio rebalance effect": as investors rebalance their portfolios in response to QE, asset prices return to (a new) equilibrium, easing financial conditions in the process (5). That all sounds quite technical, but it is the nub of the issue.

QE works because the assets that the central bank buys (takes out of private-sector portfolios) (usually some form of government debt securities) are not perfect substitutes for the assets it provides in exchange (reserves or reserves and bank deposits, depending on whether the seller of the asset has an account at the central bank or not, respectively). By altering the composition of the aggregate portfolio of assets held by the private sector, the central bank disturbs the prevailing asset price equilibrium and in the course of that asset price equilibrium being restored, as investors rebalance their portfolios, financial conditions are eased.

Asset price equilibrium refers to a theoretical situation (akin to a frictionless plane in physics) such that every investor is holding exactly the portfolio of assets he or she wants. At any point in time, the total stock of assets in the economy is fixed, so in aggregate investors have to hold them. But the prices of those assets will adjust, as investors trade with one another, until everyone is happy to hold the assets they do.

Now the central bank comes along and swaps $100 billion of reserves for $100 billion of Treasury securities. The central bank determines both the quantity and the price of those reserves, the price being the interest rate on reserves. But now there are more reserves and fewer Treasury securities in the private sector's portfolio. To restore equilibrium, that is, to make investors indifferent between holding a now larger amount of reserves and the now lower amount of Treasury securities available, the price of those Treasury securities has to go up (a bit), reflecting their now relative scarcity, that is, the yield has to go down; otherwise the market could not have been in equilibrium to begin with.

Another way to view QE, in as much as the central bank is buying government debt securities, is as a debt-refinancing operation of the consolidated government (that is, the government and the central bank), whereby the consolidated government, via the central bank, retires government debt securities and issues central bank money in their stead.

This way of looking at QE evokes what I have termed returning to the Monetary Garden of Eden (6): a prelapsarian state before the distinction between "monetary policy" and "fiscal policy" existed. When the government runs a budget deficit, it creates central bank reserves. If the Treasury and the central bank were not separated, the government could just create reserves (deposits with the government bank that the government never has to repay). With the two separated and assuming the government cannot fund its budget deficit by having its deposit account at the central bank go into permanent and unlimited overdraft, the government has to issue debt securities to fund its budget deficit. When it does, reserves go down by that amount. QE, by retiring those debt securities, restores the reserves that the government originally created when it ran the deficit.

How do you apply the understanding of QE to understand QExit?

Simply reverse everything. In the same way that the central bank raising its target interest rate reverses its previous cuts, QExit involves reversing the expansion of the balance sheet that QE entailed. If QE eased financial conditions by disturbing the prevailing asset price equilibrium, then QExit tightens financial conditions by disturbing the newly prevailing asset price equilibrium in the other direction. If QE changed the composition of the private sector's aggregate balance sheet by replacing government debt securities (and possibly other assets) with reserves and bank deposits, then QExit changes the composition back again, replacing reserves and bank deposits with government debt securities. If QE is just a debt-financing operation of the consolidated government in one direction (Treasuries to reserves), then QExit is just a debt financing operation of the consolidated government in the other direction (reserves to Treasuries). If QE put downward pressure on the yield curve by taking duration out of the bond market and reducing the term premium, then QExit puts upward pressure on the yield curve by returning duration to the bond market and increasing the term premium. If QE is a very weak form of monetary easing--which it manifestly is--then QExit must be a very weak form of monetary tightening.

How do the balance-sheet mechanics of QExit work?

There are two ways, in principle, for a central bank to implement QExit: allow the balance sheet to shrink gradually as the assets it holds mature and "run off" the balance sheet; or shrink the balance sheet more actively by selling assets to the private sector. The Fed has announced that it will rely on run-off, selling assets only when the shrinkage of the

balance sheet through run-off is insufficient to meet its pre-announced monthly targets for reducing the size of its balance sheet.

In the case of asset sales, the balance sheet mechanics are simpler and just reflect the central bank balance-sheet identity (in change terms) analyzed above. Say the Fed were to sell $10 billion of the Treasury securities it holds. Then the Fed's balance sheet would shrink by $10 billion, that amount of reserves disappearing when the Treasuries leave the balance sheet. Whoever bought those Treasuries had to pay for them, and the act of paying for them extinguished the reserves. Take the most simple case of a bank with an account at the Fed buying the Treasuries. It paid the Fed for those Treasuries by having its account at the Fed debited by $10 billion. The size of that bank's balance sheet does not change, but its composition does, reserves going down by $10 billion and holdings of Treasury securities going up by the same amount.

What if a hedge fund bought the Treasuries? The impact on the Fed's balance sheet is as before. The hedge fund had to pay by cash, so it writes a check to the Fed for $10 billion, and when the Fed cashes that check the hedge fund's bank deposit of $10 billion disappears, along with $10 billion of reserves on the other side of its bank's balance sheet. Think of it this way: Money is a liability of the central bank, so when it sells an asset and receives money (as an asset) in return for it, it just cancels that money out.

When QExit takes the form of Treasuries running off the balance sheet as they mature, the effect is the same as above, but the process is a bit more convoluted. Say $10 billion worth of Treasury securities reach maturity. The Fed is no longer going to roll those Treasuries over, that is, buy the new Treasuries the government issues to replace (repay) the old ones. Instead the government will have to refinance these Treasury securities in the market. Let's say a hedge fund buys them. That purchase extinguishes $10 billion of the hedge fund's bank deposits and reserves (just as in the previous example). Government deposits at the Fed go up by $10 billion as a result. Then the government uses that $10 billion deposit at the Fed to repay the Treasury securities when they come due, extinguishing the Treasury securities and its deposit at the Fed in the process.

The process is a little simpler when it comes to run-off of mortgage-backed securities (MBS). When a MBS matures or is pre-paid, no refinancing takes place because the underlying mortgage obligation disappears, along with the bank deposit the mortgagee uses to extinguish it. Say there is run-off of $10 billion of MBS. The Fed's balance sheet shrinks by that much and somewhere in the banking system $10 billion of mortgage obligations and $10 billion of bank deposits disappear too.

Does QExit imply a wall of new debt issuance by the government and raise the specter of a funding squeeze?

No, that is not the right way to think about it. Government debt securities do need to be refinanced during the unwind of QE. But, all the funding to refinance those government debt securities is already in place in the form of the reserves that were created when QE was implemented and that QExit aims to extinguish.

If QE was an exercise in rampant money printing, is QExit a process of money destruction, raising the specter of a credit crunch being triggered?

No, you can sleep easy on that front. Central banks do print money, physically (banknotes) and electronically (reserves), but when they do QE they don't print money in the way some people fear. The money printing that is potentially inflationary comes in two forms: governments running too-large budget deficits and banks lending too much.

In the conventional way of thinking, the government has to raise money (by issuing debt securities) in order to finance a budget deficit. But hold on a minute: money in the modern world (apart from emerging crypto currencies) is a liability of the government. Take a look at a U.S. dollar bill: it is a Federal Reserve note (a liability of the Fed and therefore of the U.S. government), signed by the U.S. Secretary of the Treasury and by the Treasurer of the U.S. (a different position). Why does the government have to raise money (its own debt) in order to spend that money?

It is more helpful to understand the process this way: The government creates money when it runs a budget deficit and then it changes that money into a different form of government liability when it issues debt securities (QE reverses this process and QExit reverses it yet again).

The other way that money comes into existence is via bank credit creation: Banks lend by creating deposits. Those deposits are considered to be part of the "money supply" and are convertible into banknotes at par.

Early on in the QE experiment, a lot of people, including surprisingly enough many central bankers, fretted that QE would lead to a lot of money creation, because these people had a textbook fractional reserve-banking model of credit creation in their heads. The standard textbook model bears no resemblance to way things work in the real world, but this never deterred a good economist (7). It posits that when the central bank creates excess reserves banks rid themselves of them by creating so much new lending that the excess reserves are no longer excess, that is, banks have initiated so much new lending, which has created so many new deposits, that the reserves supplied by the central bank are now all required reserves, given the minimum required reserves set by the central bank.

It is never explained in the textbook model where all the borrowers come from to take the other side of the transaction in the explosion of bank lending. But more importantly this model seriously misrepresents the way that central banks conduct monetary policy in normal times. Central banks do not try to ease monetary policy by expanding the supply of reserves and hoping that the textbook money multiplier process works, the money multiplier being the ratio of (usually M2) money supply to base money (8). Rather they adjust the short-term interest rate in the interbank market for (lending and borrowing) central bank reserves and, in order to do so, need to ensure that there are no excess reserves! (see earlier explanation).

The only time that central banks depart from this procedure is when cutting the interest rate to zero (or even slightly into slightly negative territory, as the ECB, the BOJ, and several other European central banks have done) does not provide enough monetary stimulus to get the economy on a quick enough path back to full employment and around 2% inflation. These circumstances only seem to arise when massive secular de-leveraging forces are unleashed by the unwinding of an asset and credit bubble (Japan post-1990 and most of the developed world post-2008), which are the

very circumstances in which you would not expect the willing borrowers to be there to accommodate the massive increase in bank lending implied by the textbook money multiplier model.

Suffice it to say the explosion of credit growth that many feared in the early stages of the post-2008 QE experiment never eventuated (undeterred, many of the money multiplier theory proponents put this down to a coincident "collapse of the money multiplier," just as the central bank started doing QE, rather than realizing that the money multiplier is just a ratio, not a structural representation of the posited underlying behavioral relationships).

All of this being the case, QExit does not imply that credit destruction will be triggered as central banks expunge excess reserves. Rather than that textbook process being observed (on the assumption of there being a fixed money multiplier), a steady "recovery" in the money multiplier will be observed, as the denominator in the ratio falls dramatically and the numerator is relatively little affected.

What do empirical studies suggest about the effect of QE on the term premium?

There is now an extensive academic and central bank research department literature attempting to gauge the quantitative effects of QE by the Fed, the BOJ, and other central banks on the term premium and longer-term interest rates (9). These studies use a variety of econometric techniques and report a wide range of quantitative estimates, but typical estimates fall in the 20 to 100 basis point range. Gagnon (2016) surveys 24 studies and finds that the median effect is about 50 basis points for a purchase equal to 10% of GDP, with the medians for the U.S., the U.K., and the euro area being much higher than for Japan. Bonis, Ihrig, and Wei (2017) estimate the cumulative effect of the Fed's Large-Scale Asset Purchases, as the Fed terms its QE, and its maturity extension program (10), as being to reduce the 10-year Treasury yield term premium by about 100 basis points.

Will QExit lead to longer-term interest rates going up?

That should be the case. QE pushed down (nominal) interest rates along the yield curve, and QExit should push them back up. This follows from the reversal of the "portfolio rebalance effect" (the impact on asset price equilibrium from the central bank changing slightly the composition of the aggregate financial portfolio of the private sector) or, more specifically, the withdrawal of the downward pressure of QE on the term premium. The above estimates of term premia compression indicate the rough order of magnitude of the expected rises in longer-term interest rates that QExit should entail.

Will QExit cause the QExit currency to appreciate?

There is nothing predetermined about the way currencies move in response to economic, policy, and other external developments, only theories and models that try to explain or predict how they should. All other things equal, economic theory predicts that monetary easing in a country will put downward pressure on the foreign exchange value of that country's currency, and vice versa for monetary tightening. QExit is a form of monetary tightening, so a reasonable assumption is that, all other things equal, it will put upward pressure on the currencies concerned.

But there are a number of caveats. All things are never equal--there are always numerous things going on that impact foreign exchange markets. I like to use the analogy of the exchange rate of a country being like a buoy floating (untethered, of course) in the ocean. At any point in time the buoy will be subject to numerous cross-currents below the surface, that ebb and flow in strength, and as a net result the buoy will bobbing around or drifting in a seemingly random fashion. Relative monetary policy settings represent one such cross-current, but it can easily be overpowered by others. And because the QExit process is set to unfold very gradually over several years, it represents quite a mild cross-current.

Another caveat is that what matters for the highly efficient foreign exchange markets is not so much what monetary policy settings are currently expected--these have already largely shifted the position of the buoy (that is, been discounted)--but the surprise or unexpected component of monetary policy settings. It is too simplistic to say, for instance, that the U.S. dollar is set to strengthen because the Fed appears to be on the cusp of starting a multiyear process of QExiting. Market participants are already aware of that likelihood and so it has already been reflected in their portfolio positioning and therefore in market foreign exchange rates (11).

Won't QExit trigger currency appreciation because part of the liquidity the central bank injected via QE had flowed into emerging markets and will now be withdrawn?

That is not the right way to think about it. When a central bank does QE, it creates reserves (a liability item on the central bank's balance sheet, as distinct from foreign exchange reserves). Reserves, despite often being termed "liquidity," do not flow like water. In aggregate, reserves do not "flow" anywhere, least of all into foreign currency assets: They "sit" on the balance sheet of the central bank in domestic currency.

QE influences foreign exchange rates indirectly via the "portfolio rebalance effect" discussed above. The perturbation of the composition of the aggregate financial portfolio of the private sector that QE produces must show up in the portfolios of some individual investors (using that term to include traders). Some investors will likely react to the fact that they now have fewer government debt securities and more cash (bank deposits) in their portfolio by deciding to use some of that cash to buy foreign currency assets. Others may decide to do so because the policy action of the central bank conveys information to them and alters their view of the future course of the domestic and overseas economies.

It is the attempt by investors to rebalance their portfolios, not some "flow" of "liquidity," that causes foreign exchange rates (and other asset prices) to move.

When QExit is completed, will the central bank's balance sheet go back to the same size as when it started QE?

No. It will go back to its "normal" size, not to its original (pre-QE) size. The reason is that the normal size of a central bank's balance sheet increases gradually over time as the economy grows and the demand for credit and banknotes, which determine the main components of the central bank's balance sheet, does as well (see earlier discussion).

Take the Fed as an example. At the time of the financial crisis, the Fed's balance sheet was around $900 billion in size. Now it is about $4.47 trillion. If the Fed were to instantly unwind its QE today (an unrealistic thought experiment), it would reduce its balance sheet to around $1.83 trillion, roughly the sum of required reserves, banknotes, Treasury deposits, and capital. Given the Fed's QExit is set to take several years, the normal size of its balance sheet is set to continue to grow in the interim, so when the Fed finishes unwinding its QE the size of its balance sheet will be considerably more than $1.83 trillion, more like $2.2 trillion or $2.3 trillion, if things go according to the existing plan and the economy cooperates (12).

The general point is: The longer a central bank takes to unwind its balance sheet after QE, the less QExit it ends up having to do.

Do central banks need to unwind their QE?

Surprisingly, the answer is "not really," even assuming that central banks stick to their mandates. It has become clear from the experience and experiments of the past few years that central banks have two tools with which to operate monetary policy: the level of the (short-term) interest rate and the size (and composition) of the balance sheet (13). A central bank that wants to ease monetary policy can either cut the interest rate (up to a point, not too deep in negative territory) or expand its balance sheet (pretty much without limit, other than legal ones). A central bank that wants to tighten monetary policy can either raise the interest rate (there is no limit on how far) or shrink its balance sheet (back to a normal size, assuming it was extended to begin with).

These two tools are substitutes and complements. They are complements in that they mutually reinforce each other. But, over relevant ranges, they are substitutes in that a central bank wishing to ease monetary policy could choose to do so by either cutting interest rates or by expanding the balance sheet (QE); and a central bank that had done QE, wishing to tighten monetary policy, could choose to do so by either raising interest rates or by shrinking the balance sheet (QExit).

Say, for instance, that the Fed wanted to achieve a certain amount of monetary tightening in order to achieve its objectives (maximum employment, price stability, and moderate long-term interest rates) (14), but had decided to maintain the current extended size of its balance sheet and to achieve QExit in the most passive (and time-consuming) of ways: by continuing to reinvest the proceeds of all maturing securities and allowing the normal size of the balance sheet to eventually catch up with its QE-expanded size (this would, of course, take a long, long time).

This would be a policy choice. But it would imply, relative to the policy of starting to unwind QE in line with the game plan it announced in June 2017 while continuing to gradually raise the federal funds rate, a somewhat faster pace of rate hikes. The faster pace of rate hikes would be needed to provide the monetary policy tightening compensation for the fact that the monetary policy tightening associated with the balance sheet unwind would not be taking place.

If central banks don't actually need to unwind their QE, why do they plan to do so?

To be accurate, the Fed is the only one of the major central banks that has done large-scale QE to have announced its QExit strategy. We don't know what the QExit plans of the other central banks are yet. But, central banks being birds of a feather that tend to flock together, we can probably safely assume that when the other central banks get around to contemplating their QExits they will use the Fed's approach as a template, particularly if it is seen to have worked.

To answer the question, though, central banks want to unwind their QE because they see QE as an "unconventional" or "last resort" policy, and therefore as something they would not want to be doing when economic and market conditions had returned to normal (15). Although the four major central banks, with various timings (16), have all been aggressive QE-ers, they have also been reluctant and uncomfortable QE-ers. The discomfort comes principally from the fact that QE, by its very nature, blurs the line between monetary and fiscal policy, as conventionally conceived, and, in the mind of the central bank and of many observers, threatens to compromise the "independence" of the central bank from the political sphere and from the imperatives of government finances.

How does the unwind of QE relate to negative interest-rate policy?

There is no direct connection. As long as central banks are able to pay interest on reserves, they have two independent policy tools they can use: the short-term interest rate and the size and composition of the balance sheet. Several central banks have a negative policy interest rate and have done QE, most notably the ECB and the BOJ. The main difference with the Fed is that these central banks pushed through the zero interest rate bound (17). The Fed could have done that, too, but chose not to. When it comes to easing monetary policy or tightening monetary policy, central banks have considerable flexibility as to how they calibrate their interest rate and balance-sheet settings. When the ECB and the BOJ eventually get around to starting to unwind their QE, following the template of the Fed, they will probably start by raising their policy interest rates and taking them into positive territory before they start to shrink their balance sheets, but in principle they could do the reverse: maintain a negative policy rate while starting to shrink their balance sheets.

How is the Fed intending to implement its QExit?

The Fed announced in June this year its detailed plan for unwinding QE, after many years of minuted FOMC discussions (dating back to April 2011) and earlier public communications about its balance sheet-unwind thinking (notably the Policy Normalization Principles and Plans it released in Sept. 2014). The plan involves two central planks: allow the balance sheet to shrink by regular pre-announced amounts, and begin small and build somewhat gradually to the maximum monthly amount of balance-sheet shrinkage.

Specifically, once the Fed raises the flag on QExit, it will allow run-off of maturing securities to reduce its holdings of Treasury securities by up to $6 billion per month and its holdings of MBS and agency debt by up to $4 billion per month, increasing these caps each quarter by $6 billion and $4 billion per month, respectively, until reaching maximum monthly caps of $30 billion and $20 billion per month, respectively (12 months after starting). This means that, if the amount of run-off from maturing securities in any given month is more than the prevailing cap, the Fed will reinvest those proceeds, but if the amount happens to be less the Fed will not sell securities to make up the difference.

Does the Fed's approach make sense?

Yes. Given the uncharted territory of QExit, it makes sense for the Fed to make the process as transparent and predictable as possible. The Fed wants to keep its and the market's focus on the interest-rate channel, which is much more familiar territory for all concerned. The Fed QExit plan sets up the balance-sheet unwind as something that almost just "runs in the background."

An interesting feature of the scheme is that the degree of quantitative tightening, although modest by virtue of how QE works, ratchets up each quarter for a year after the program begins. Given that the economy is getting closer and closer to full employment, but monetary policy works with a lag, one of the risks that the Fed must feel it faces is getting behind the curve, finding the economy hitting its speed limit at a time when monetary policy settings are still quite accommodative. The Fed may be taking out a bit of insurance against such an outcome by pre-programming a bit of escalation of quantitative tightening into the scheme.

Will QExit lead to central banks incurring losses and possibly becoming insolvent and thereby impairing their ability to conduct monetary policy?

This concern is largely unfounded and a red herring. Even if central banks were to incur losses on some of their bond holdings from QE, it is very unlikely that such losses would be large enough to wipe out the central bank's capital, and even if this extreme situation were to occur it can be easily fixed (18) and should not impede monetary policymaking.

The concern comes from the fact that central banks tend to do QE when interest rates are low (and bond prices high) and QE aims initially to push longer-term interest rates even lower (and bond prices even higher). But, if the policy works, economic activity, inflation, and nominal interest rates will all go up (and bond prices down), and if the central bank sells the bonds at that point it will likely incur capital losses.

This is all true, but largely irrelevant. The objective of the central bank, an arm of the government, is to improve social welfare, not to make money. But, central banks tend to make a lot of money, money which they regularly transfer to the national coffers. This is because they typically hold interest-bearing securities but fund these with banknotes, which pay no interest or, in the past or normal times at least, noninterest-bearing reserves, making central banks machines to collect so-called "seigniorage."

More to the point, the capital item on the central bank's balance sheet is irrelevant when it comes to the central bank conducting monetary policy and carrying out its other activities. The central bank is an arm of the (consolidated) government and does not need equity any more than any other branch of the government does. When it comes to the central bank's balance sheet, equity is more like a balancing item than something the central bank needs in order to operate.

A variant of the balance-sheet health concern relates to the need that is likely to arise--and already has in the case of the Fed--for the central bank to use interest on excess reserves as its main tool to tighten monetary policy. If the central bank has created a very large amount of excess reserves and is expunging them only very slowly, but has to

raise the interest on reserves a lot, it will have to pay a significant amount of interest to banks. In a rapidly rising interest-rate environment conceivably the central bank could, for a while, end up earning negative carry, the average coupon on its bond holdings being lower than the interest rate it pays on reserves (it will still enjoy the seigniorage associated with its banknotes, of course).

Take the Fed, for instance. The Fed has created about $2.33 trillion of required and excess reserves, on which it currently pays 1.25%, so that adds up to an annual bill of about $29.15 billion, money that it would never had had to fork out if it had not done QE and had kept to its previous policy of not paying interest on reserves. What if the Fed raised its target interest rate to 3% or even much higher? You can do the math.

But, this fear misses a crucial point. Every dollar (or euro or yen or pound) of excess reserves on which the central bank is paying interest relates to a dollar (or euro or yen or pound) of government debt securities on which the consolidated government no longer has to pay interest to the private sector. The central bank has to pay interest on that dollar of excess reserves because it bought a dollar of government debt securities. The interest that the government has to pay on that dollar of government debt securities is now "round-tripping" or cancelling out within the consolidated government: Assuming the coupon is 1%, the Treasury pays one cent to the central bank, and the central bank returns that one cent (even if the central bank does not return the one cent to the Treasury, for various accounting or budgetary reasons, it is one cent that stays within the consolidated government).

Think of it this way: The consolidated government pays itself, taking money out of one pocket and putting it the other. To understand QE and QExit, it is misleading to focus on the balance sheet of one pocket; we need to look at the combined balance sheet of the two pockets.

Is the risk of the central bank's balance sheet being damaged a good reason not to do QE in the first place?

No, there may be other good reasons for governments not to have relied on QE as much as they did--it may have been better to use fiscal policy much more aggressively, for instance--but worrying about the impact of QE and QExit on the balance sheet "strength" of the central bank is not one of them.

Does the fact that QE results in government debt securities sitting on both sides of the consolidated government's balance sheet mean the government can cancel out its debt, and does QExit mean giving up this apparent free lunch?

QE results in government debt securities being on the asset side of the central bank's balance sheet and the liability side of the Treasury's balance sheet, that is, on both sides of the consolidated government's balance sheet. In principle, it would be possible for the government to cancel them out. However, this would create a number of legal, institutional, and operational issues and would not alter one iota the amount that the consolidated government owes to the public. All QE does is change the form of that debt obligation from government debt securities to central bank money. QExit changes it back again.

If the central bank is to maintain control over its monetary policy, it will have to raise the interest rate it pays on

reserves. Interest-bearing reserves are just another form of government debt obligation. QE, as a permanent feature of the monetary landscape, does not obviate the need for the government to pay interest on its debt--it just changes the identity of the party that writes the checks to the public from the Treasury to the central bank. Again, we see the blurring of monetary and fiscal policy that QE entails.

There is, however, one crucial difference between the debt obligations of the government toward the public being in the form of central bank reserves as opposed to government debt securities: Because they have a maturity date (unless they are structured as a perpetuity), the latter, in principle, carry a risk of default, whereas the former, by virtue of being money, cannot default. Indeed, central bank reserves can be thought of as a callable perpetuity, where the central bank has the right to call the debt and refinance it into a government debt security.

While there is no default (principal repayment) risk associated with central bank reserves, a priori there is a significant risk of the government defaulting on the real value of this debt obligation via inflation and, as history has shown, in some cases even hyperinflation. Governments committing the Original Sin (of unbridled money printing) is what led to Adam (the Treasury) and Eve (the central bank) being banished from the (Monetary) Garden of Eden in the first place and to having to assume their somewhat arms-length and fraught relationship.

How close are the other major central banks (the BoE, the ECB, and the BOJ) to their QExits?

Not close at all, although the BoE is arguably the closest. For the process of QExit to begin, first the central bank has to stop doing QE on a flow basis. Even then, it is likely to be a considerable time before the central bank starts the QExit process. The Fed stopped expanding its balance sheet in October 2014 and is only now on the cusp of entering QExit territory.

The BoE, having accumulated a stock of QE between March 2009 and October 2012, restarted its asset purchase program in August 2016, after the Brexit referendum shock, and completed it in the second quarter of this year. The BoE now has a cumulative QE stock of £445 billion, comprising £435 billion of gilts and £10 billion of corporate bonds. Headline inflation in the U.K. (three-month average; ditto below) is running at 2.7% year on year, and core inflation is running at 2.5% year on year. Objectively, the BoE looks the closest of these three major central banks to beginning QExit, but with the headwinds from Brexit uncertainty and fallout likely to pick up in the next two years, the BoE is likely to be in no hurry to start to unwind its balance sheet. If it feels the need to tighten monetary policy in order to meet its inflation target, it is more likely to raise interest rates and let the sleeping dog of QE lie.

Both the ECB and the BOJ, on the other hand, are still in full-fledged balance-sheet expansion mode, albeit doing QE in quite different ways.

The ECB is following what, after the Fed's QE3 (launched in September 2012 and extended and further articulated in December 2012) and the BOJ's QQE (Quantitative and Qualitative Monetary Easing) (launched in April 2013), has become the conventional QE template: expand the balance sheet by purchasing assets in a fixed monthly amount but do so in an open-ended way, the terminal timing of which is tied to attaining the central bank's goals (some mixture of stable prices and full employment). The ECB is currently buying €60 billion of assets (mainly government debt

securities) per month (19) and has announced it will continue to do so "until the end of December 2017, or beyond, if necessary, and in any case until the Governing Council [of the ECB] sees a sustained adjustment in the path of inflation consistent with its inflation aim" (20).

Headline inflation in the euro area is running at 1.3% year on year, and core inflation is running at 1.1% year on year. The ECB's inflation target is "close to but below 2%." The start of QExit for the ECB would appear to be a long way off.

Having amended its April 2013 QQE framework twice, the BOJ now operates a framework it calls "Quantitative and Qualitative Monetary Easing with Yield Curve Control." Specifically, the BOJ currently targets both the overnight interest rate (at minus 10 basis points) and 10-year Japanese government bond (JGB) yields at around zero percent.

Headline inflation in Japan is running at 0.4% year on year, and core inflation (that is, excluding fresh food and energy) is running at 0.0% year on year. The BOJ has committed to keep expanding its balance sheet until inflation over shoots its 2% inflation target and stays above the target in a stable manner (21). Since adopting the new framework in September 2016, the BOJ has continued to announce that it expects its holdings of JGBs to increase at an annual rate of ¥80 trillion, the amount of increase it had been targeting since November 2014 under its QQE and QQE With a Negative Interest Rate policy frameworks (22). In the BOJ's case, the start of QExit would appear to be even further away.

Should we expect to hear a lot about QExit, including plenty of misinformed commentary, in coming years?

Yes; keep this Q&A to hand and email me if you have any follow-up questions.

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Endnotes

(1) That is, the liability (right-hand) side as the central bank's capital and the asset (left-hand) side as the Treasury's ownership stake.

(2) The BOJ has issued 45% of its capital to "non-governmental persons," chiefly the banks with which it deals, the government's stake being 55%. But ownership of the BOJ's capital by private-sector companies is more akin to a membership bond (to participate in the settlements system) than a normal equity stake and what holders of that stock can do with it is governed by a Cabinet Order. As the BOJ explains it: "The Bank was established under the Bank of Japan Act … and is a juridical person, authorized by the government of Japan. It is not a joint-stock company, nor does it hold shareholder meetings." According to the Federal Reserve, "The Federal Reserve System is not 'owned' by anyone. Although parts of the Federal Reserve System share some characteristics with private-sector entities, the Federal Reserve was established to serve the public interest. The Federal Reserve derives its authority from the Congress, which created the System in 1913 with the enactment of the Federal Reserve Act."

(3) For instance, in the case of the U.S., the Fed requires banks to hold reserves equivalent to 10% of demand deposits and other similar kinds of accounts (above $115.1 million). Minimum reserves requirements in Japan are lower (2.5% is the maximum rate), but cover time deposits and certificates of deposits as well as demand deposits. Minimum reserves requirements in the euro area are 2% on deposits, debt securities, and money market paper with maturities up to two years (0% on longer maturity deposits).

(4) QE does not increase the public's purchasing power; it just changes its form. You can describe QE as the central bank "printing money," which at some level is technically correct (electronic central bank money is created), but it is not money printing in the "helicopter money" sense of the government attempting to give the public net new purchasing power. See Paul Sheard, 2016: "Helicopter Money And The Monetary Garden Of Eden," S&P Global Ratings, RatingsDirect, May 4. That being the case, QExit does not withdraw purchasing power; it just re-alters its form.

(5) The "easing of financial conditions" involves such things as: longer-term interest rates falling; equity prices rising; credit spreads tightening; and foreign exchange rates depreciating. The "tightening of financial conditions" entails pressures in the respective opposite directions.

(6) See Paul Sheard, 2016: "Time For Some Blue-Sky Thinking On The Future Of Macroeconomic Policy," March 24, and "Helicopter Money And The Monetary Garden Of Eden," S&P Global Ratings, RatingsDirect, May 4.

(7) Generations of economists have been schooled in Milton Friedman's argument, expounded in his famous 1953 book "Essays in Positive Economics," that what matters is not the realism of a theory's assumptions but the ability of a theory to predict well.

(8) See, for instance, William J. Baumol and Alan Blinder, Economics: Principles and Policy (ninth edition), Thomson South-Western, pp.597-603.

(9) For a survey of the effect of the Fed's and other central banks' QE policies, see Joseph E. Gagnon, 2016: "Quantitative Easing: An Underappreciated Success," Policy Brief 16-4, Peterson Institute of International Economics; on the Fed's policies, in particular, see Saroj Bhattarai and Christopher Neely, 2016: "A Survey of the Empirical Literature on U.S. Unconventional Monetary Policy," Working Paper 2016-021-A, Federal Reserve Bank of St. Louis, and Brian Bonis, Jane Ihrig, and Min Wei, 2017: "The Effect of the Federal Reserve's Securities Holdings on Longer-term Interest Rates," FEDS Notes, April 20; and on the effects of the BOJ's pioneering 2001-2006 QE program,

which was conducted on a much smaller scale than both its and the other three major central banks' subsequent QE efforts, see Hiroshi Ugai, 2007: "Effects of the Quantitative Easing Policy: A Survey of Empirical Analyses," Monetary and Economic Studies, 25(1), pp.1-48.

(10) Under its "maturity extension program" from September 2011 to the end of 2012, colloquially known as its "twist" operation, the Fed sold or redeemed $667 billion of shorter-term Treasury securities and reinvested the proceeds in longer-term Treasury securities.

(11) One important qualification: Excuse the double negative but just because some future event is well "discounted" doesn't mean that markets don't move when it happens. Future events, particularly of the kind relevant to markets, by definition of not having happened yet, always have a probability distribution associated with them. When the event happens as expected, that probability distribution collapses to one, as the probability attached to all other possible outcomes goes to zero. That is why even events that appear to be "well discounted" can cause markets to move when they occur. For a good discussion of this phenomenon in the context of the May-June 2013 "taper tantrum," see Jeremy C. Stein, 2014: "Challenges for Monetary Policy Communication," speech to Money Marketeers of New York University, May 4. Put differently, when a well-anticipated event actually does occur there are always some people who were not expecting it or fully expecting it or (when it comes to hedging strategies) were behaving as if they were not.

(12) This calculation assumes that the normal size of the Fed's balance sheet grows at around 4.2% per year, its average annual growth rate before the financial crisis.

(13) There is a third important tool: forward guidance about the future expected path of both the interest rate and the balance sheet.

(14) These are the three objectives of monetary policy stipulated in Section 2A of the Federal Reserve Act. A secret hiding in plain sight: The Fed actually has a triple not a dual mandate.

(15) Some academics have argued that the Fed should permanently maintain an enlarged balance sheet because this would contribute to financial stability by reducing the incentive of private-sector financial intermediaries to issue too many short-term liabilities and lead the private sector financial system to engage in too much risky maturity transformation. See Robin Greenwood, Samuel G. Hanson and Jeremy C. Stein, 2016: "The Federal Reserve's Balance Sheet as a Financial-Stability Tool," Paper presented to Federal Reserve Bank of Kansas City's 2016 Economic Policy Symposium in Jackson Hole. Stein is not just an academic economist, but is a former member of the Board of Governors of the Federal Reserve (May 2012–May 2014).

(16) Here is an interesting and revealing statistic: start the clock ticking in September 2008 when the global financial system suffered its massive cardiac arrest, triggered by the bankruptcy of Lehman Brothers (on Sept. 15), which I would argue was triggered in turn by the placing of Fannie Mae and Freddie Mac into conservatorship by the U.S. government (on Sept. 7), and ask how many months did it take for each of the major central banks to formally adopt a policy of QE (as opposed to expanding their balance sheet for lender-of-last-resort purposes). The answer: three months for the Fed (December 2008); six months for the Bank of England (March 2009); 25 months for the BOJ (October 2010); and 72 months for the ECB (September 2014).

(17) As noted elsewhere in this article, the BOJ has gone further and is now targeting two points on the yield curve, the 10-year JGB yield as well as the overnight rate, while continuing with a form of QE.

(18) If the government needed to recapitalize the central bank, it could simply have the central bank buy the bonds that it needed to issue to pay for the new capital issued by the central bank. Everything would cancel out within the consolidated government, but in this way the central bank could be capitalized to any level that was deemed desirable. The balance-sheet maneuvers associated with getting to this outcome could be quite convoluted if the government and the central bank wished to avoid appearing to be in cahoots in the artificial manufacture of central bank capital. Say the central bank needed $1 of capital: the government issues $1 of bonds to the public, reducing the public's bank deposits by $1 and reserves at the central bank by $1, and raising the government's deposits at the central bank by $1; the central bank issues $1 of capital to the government, reducing the government's deposits at the central bank by $1; to sterilize the impact of the bond issuance on the level of reserves, the central bank buys $1 of bonds from the public, raising the public's bank deposits by $1 and reserves at the central bank by $1. The net result is: the central bank holds an additional $1 of capital, backed by $1 of government bonds, and the government has an additional $1 of bonds outstanding, backed by $1 of central bank equity.

(19) This rate of purchases is equivalent, on an annualized basis, to about 6.7% of euro-area nominal GDP and to about 17% of the current size of the ECB's balance sheet.

(20) At his Jan. 19, 2017, press conference, ECB president Mario Draghi laid out four criteria for judging that the conditions for ending its asset purchases have been met: "We define our objective first of all in the medium term, over a medium-term horizon. That's the relevant policy horizon. Second, it has to be a durable convergence, so it cannot be transient. Third, it has to be self-sustained. In other words, it has to stay there even when the extraordinary monetary policy support that we are providing today will not be there. Fourth, it has to be defined for the whole of the eurozone. I think these are the four features that always characterised our objective." The third criterion is particularly noteworthy and establishes a high hurdle.

(21) For a detailed analysis of the BOJ's current framework, see Paul Sheard, 2016: "The Bank of Japan Breaks New Ground Yet Again – And It May Work This Time," S&P Global Ratings, RatingsDirect, Oct. 7.

(22) Such a rate of purchases is equivalent, on an annualized basis, to about 15% of Japanese nominal GDP and to about 16% of the current size of the BOJ's balance sheet. In actuality, however, the BOJ's holdings of JGBs have been increasing at annualized rate of about ¥42.77 trillion since the new framework was introduced, corresponding to about 8% of Japanese nominal GDP and to about 8.5% of the current size of the BOJ's balance sheet.