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Economic Research:

A QE Q&A: Everything You Ever Wanted To Know About Quantitative Easing

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Despite the wailing from many corners of the financial markets about central banks' embrace of the monetary policy tool known as quantitative easing (QE), mysteries and misconceptions about QE abound. And, as the U.S. Federal Reserve continues its stated process of reducing the amount of its monthly bond purchases (known, also somewhat inaccurately, as "tapering"), the warnings about impending disaster are growing ever louder.

While some of those warnings are well-considered and contain important caveats and nuances, by the time they hit main street, they create the impression among the wider public, and particularly among investors, that central banks have blithely paddled into treacherous waters from which they have no realistic hope of escape.

To provide a more reasoned and well-grounded understanding of what exactly QE is (and is not) and to have a better idea of what will (and won't) happen as QE policies are unwound, here I pose--and attempt to answer--several common questions about QE as well as some rather thorny ones.

Overview

- QE, the purposeful expansion by a central bank of its balance sheet beyond its normal size by acquiring assets financed by creating excess reserves, can be viewed variously as: what central banks do at the zero interest rate bound; a central bank-engineered asset swap that changes the composition of the aggregate portfolio held by the public; or a debt management/refinancing operation of the consolidated government;
- QE is likely to be observed only when the efficacy of monetary policy is low, suggesting it needs to be deployed in an aggressive and forceful manner for it to have the desired easing effect;
- While these adages contain some germs of insight, it is misleading to characterize QE variously as "printing money," "helicopter money," "monetizing fiscal deficits," or an "inflation accident waiting to happen," the last notably because banks may start to "lend out" their excess reserves;
- Notwithstanding some degree of market volatility likely being unavoidable, the unwinding of QE (and zero interest rate policy) is a simple process conceptually and in principle operationally one that central banks should be able to manage reasonably smoothly;
- The idea, popular in some quarters, that governments and central banks may be able to kill two birds with one stone--reducing accumulated sovereign debt and unwinding QE--by the two parties agreeing to cancel out central bank holdings of government debt (or permanently monetize it) does not survive serious scrutiny.

How do central banks implement monetary policy in normal times?

In normal times, central banks use the overnight interest rate in the interbank market as their main policy instrument (the federal funds rate in the U.S.). In the interbank market, banks lend and borrow bank reserves (deposits banks hold at the central bank) among themselves. Central banks can control this interest rate by adjusting the level of reserves (a liability of the central bank) either up (if there are too few reserves, and so there is upward pressure on the interest rate) or down (if there are too many reserves, and so there is downward pressure on the interest rate).

Usually, the central bank makes this adjustment around the overall level of reserves corresponding to the minimum reserve requirements the central bank itself sets. That is because, when the central bank does not pay any interest on reserves (as was generally the case before the financial crisis), banks want to lend their excess reserves (reserves above the minimum required level) to other banks, and this puts downward pressure on the overnight interest rate. But if banks as a whole have insufficient reserves, they will try to borrow reserves from one another, putting upward pressure on the interest rate.

What is "quantitative easing"?

Under "quantitative easing," or "QE," the central bank deliberately expands the size of its balance sheet by acquiring assets (usually government debt securities, but in principle any asset) paid for by creating reserves. Because the starting point will be a situation in which the level of reserves is around the minimum required level, a central bank doing QE will be creating a large amount of excess reserves.

What are central bank reserves, and how do they fit into a central bank's balance sheet?

Central bank reserves are one of three key liabilities of a central bank, the other two being banknotes-in-circulation and government deposits. Together, reserves and banknotes form what is called "high-powered money" or the "monetary base" or just "central bank money." The central bank is the government's fiscal agent, so government deposits provide a key link between fiscal and monetary activities of the consolidated government (the government including the central bank). But they are usually only a small fraction of central bank liabilities because governments generally keep little cash on hand, either because they run budget deficits or pay down debt when they run surpluses.

A central bank's balance sheet can be written in simplified terms as:

$$\text{Assets (A)} = \text{Reserves (R)} + \text{Government deposits (GD)} + \text{Banknotes-in-circulation (BK)}$$

Or in rate-of-change terms as:

$$\Delta A = \Delta R + \Delta GD + \Delta BK$$

This shows that three, and only three, things influence the level of reserves, assuming the other two items do not

change:

- Reserves go up (down) when government deposits go down (up);
- Reserves go up (down) when banknotes-in-circulation go down (up);
- Reserves go up (down) when central bank assets go up (down).

The first relationship reflects the fact that, when the government makes net payments to the private sector, the private sector's deposits in the banking system go up by that amount, and the banking system's reserves are the asset-side counterpart to those deposits. The second reflects the fact that, when the public withdraws cash (banknotes) from a bank, the bank obtains the banknotes by having the central bank debit its reserve account. The third relationship reflects the fact that the central bank can acquire assets by creating electronic money. This third relationship is the balance-sheet basis of QE.

The above is a simplified, or stylized, analysis of a central bank's balance sheet. In the real world, it's more complicated, and items on the balance sheet vary across countries, depending on institutional and legal rules. Other common forms of central bank liability include reverse repurchase agreements, term deposits, and central bank bills. The central bank's creation of these liabilities all involve a corresponding reduction in reserves--i.e., they involve changing the form of central bank liabilities, but not the amount. So, for expository purposes, they can all be subsumed under reserves. Some central banks also have capital and capital reserves on the liability side of their balance sheet, but these are more akin to accounting artifacts and bear little resemblance to the capital or equity of a for-profit business enterprise.

How do bank reserves relate to foreign exchange reserves?

They are totally different things (on different sides of the [consolidated] government's balance sheet), not to be confused, despite both often being referred to in shorthand as "reserves." Foreign exchange reserves are assets that governments or central banks (depending on institutional arrangements) acquire when they intervene in foreign exchange markets. Bank reserves are on the liability side of the central bank's balance sheet, or the liability side of the consolidated government's balance sheet.

Foreign exchange intervention by the central bank or the government (the Treasury) has an impact on central bank reserves. If the central bank intervenes on its own account, it acquires foreign exchange reserves by creating bank reserves. It will then likely "sterilize" (offset) that increase in bank reserves by selling other domestic currency assets or by issuing bills (another kind of central bank liability). If the Treasury does the intervention (or the central bank does it as the Treasury's agent), the Treasury will raise intervention funds by issuing bills or bonds to the public, which will reduce reserves by that amount (and raise government deposits at the central bank by the same amount). Reserves will go back up by the same amount when the Treasury acquires the foreign exchange. If the Treasury raises the intervention funds by issuing bills or bonds to the central bank, the central bank will likely sell those bills to the public to reverse the increase in bank reserves that occurs when the Treasury intervenes.

How does QE fit into a central bank's monetary policy tool kit?

Monetary policy works in two stages: First, it influences (eases or tightens) financial conditions (the cost and availability of credit and the value of various financial assets). Second, the real economy responds to the changes in financial conditions. The main monetary policy tool central banks usually use is the overnight interest rate, which in turn influences the entire yield curve and, indirectly, a variety of other financial assets (such as credit spreads, foreign exchange rates, and equity prices) because asset markets are linked by arbitrage relationships (the so-called "search for yield" is one such manifestation).

QE is one of the things central banks do (or can do) when they have exhausted their conventional interest rate ammunition. That's when they have lowered their policy rate to or close to zero (the "zero interest rate bound" or "zero bound") but still need to ease monetary policy further to achieve their goals (usually some mix of the generally complementary goals of low but stable inflation and an economy operating at or close to full capacity). QE can be thought of an extension of interest rate easing at the zero bound.

Couldn't a central bank implement negative interest rates rather than do QE?

Not really, or at least not as an effective measure--despite all the media attention the European Central Bank (ECB) sparked when it announced just such a policy in June of this year. A central bank charging a negative interest rate on bank reserves is not conducting monetary easing by cutting interest rates in the normal sense. For instance, the central bank charging an interest rate of negative 1% on bank reserves instead of zero would not be equivalent in interest rate-cutting terms as the central bank reducing its policy rate to 1% from 2% or to zero from 1%. It is qualitatively different. In the latter cases, short-term borrowing costs for banks have fallen, and competition will lead those borrowing costs to be passed on to some extent to borrowers in the wider economy, thus producing easier financial conditions. But a central bank charging a negative interest rate to banks does not make lenders in the wider economy predisposed to lend at a negative rate; the downward pressure on market rates stops at zero.

Interest rates in general are positive because of the time value of money and repayment risk. Money represents an immediate claim on consumption or other investment opportunities, so for a lender to part with his or her money for a certain period for a particular project, he or she needs to be compensated for foregoing those opportunities (that is, be promised some interest on the principal lent as well as the return of the principal in full at some time in the future). Moreover, the borrower may not be able or willing to repay the money he or she has borrowed in full and on time.

Thus, in general, a lender would rather not extend new credit or lend money at hand if the deal was that he or she would receive less than the full principal of the loan back at the date of maturity (a negative interest rate). If borrowers ask for loans at negative interest rates, in general, they would simply have no takers.

When the issue of negative interest rates is discussed in the context of monetary policy at the zero bound, something much more specific and unique to central banks is being mooted. Because a central bank creates reserves and banks must hold reserves, in principle, the central bank could charge a negative interest rate on those reserves. But that would not make wider interest rates in the economy negative or put any more downward pressure on them than a zero

rate would.

Let's consider the ECB's June 5 announcement that reserves in excess of minimum required levels would be charged 10 basis points (bps; from June 11). A negative interest rate on bank reserves is more appropriately viewed as a central bank-imposed tax on the banking system rather than as a negative interest rate per se. This is likely why ECB President Mario Draghi at that time said, with respect to possible further cuts in interest rates: "I would say that for all the practical purposes, we have reached the lower bound. However, this doesn't exclude some little technical adjustments and which could lead to some lower interest rates in one or the other or both parts of the corridor. But from [sic] all practical purposes, I would consider having reached the lower bound today." If negative interest rates really made sense as a monetary policy easing measure, why would the central bank stop at 10 bps? What about minus one or minus five?

Normally when a central bank does QE, it in effect controls the size of its balance sheet: Given changes in banknotes (BK) and in government deposits (GD) in any period, the central bank's asset purchases (or lending) in that period determine the size of the balance sheet (this follows from the central bank balance-sheet identity above). The reserves that the central bank creates, conditional on the impact of BK and GD, have to be held by the banks in aggregate (individual banks of course may borrow and lend those reserves among themselves). This is why QE and a negative deposit rate make for odd bed-fellows: The central bank would be simultaneously forcing banks to hold a given amount of reserves and charging them for the privilege!

It is not surprising therefore that the ECB has introduced a negative deposit rate but is not doing "normal" QE. The main way the ECB has expanded its balance sheet since the financial crisis (beyond that associated with the normal increase in banknotes) is via full allotment short-term and long-term refinancing operations (lending against collateral). This differs from QE notably in that the aggregate decisions of the banks determine how much the central bank's balance sheet expands. In normal QE, banks in aggregate have no choice other than to hold the reserves the central bank has created by buying assets. However, as in the ECB's case, if banks are deciding how much (how many reserves) to borrow and are being charged for holding the excess reserves created at the same time, it would be expected that banks would react to the negative deposit rate (tax) by decreasing their borrowings from the central bank, shrinking the central bank's balance sheet in the process.

Looking at ECB balance sheet data, this is exactly what appears to have happened (see table). The ECB's balance sheet is now 5% smaller than it was when the negative deposit rate was announced.

Change In ECB Balance Sheet In Eight Weeks After Negative Deposit Rate Introduced Compared With Change In Prior Eight Weeks

(Bil. €)

After negative deposit rate introduced

--Assets--		--Liabilities--	
Refinancing operations	(119.8)	Banknotes	13.6
		Reserves/deposits	(79.8)
		Government deposits	(29.4)
Total	(112.6)		(112.6)

Change In ECB Balance Sheet In Eight Weeks After Negative Deposit Rate Introduced Compared With Change In Prior Eight Weeks (cont.)

Before negative deposit rate			
Refinancing operations	16.5	Banknotes	13.7
		Reserves/deposits	(48.3)
		Government deposits	31.4
Total	3.2		3.2

Sources: ECB website and calculations by Standard & Poor's.

Why do central banks need a tool like QE?

QE is arguably essential to inflation-targeting. In an inflation-targeting regime, the central bank tries to achieve a low but stable rate of inflation, usually 2%. To do so, it needs two kinds of tools: those that tighten financial conditions if inflation threatens to be above 2% consistently and those that ease financial conditions if inflation threatens to be below 2% consistently. In the former case, the central bank has a tool it can use in an unlimited fashion to try to tighten financial conditions: the short-term interest rate. It's always possible to reach a high enough interest rate that tightens financial conditions sufficiently to slow down the economy and bring down inflation. But the latter case has a problem: The central bank cannot use the short-term interest rate in an unlimited fashion to try to ease financial conditions with a view to preventing inflation from falling too low or turning into outright deflation. QE, however, gives the central bank an analogous tool to an unlimited ability to cut interest rates. In principle, the central bank can expand its balance sheet without limit by buying assets held by the private sector or, in an extreme case, debt securities issued directly by the government.

Why is it so important that the central bank have, and be seen to have, an unlimited capacity to ease financial conditions?

A key variable in central banks' ability to achieve their inflation targets (with some noise, over the medium term, say two to three years) is their ability to influence the public's expectations about the future course of inflation. In particular, if the central bank can convince the public of two things, it should be able to "anchor" the public's inflation expectations around its inflation target: First, that the central bank is confident it has the tools to achieve its inflation target. Second, that it is determined to use those tools to that end.

Inflation has a significant self-fulfilling component. Actual inflation is heavily influenced by the public's inflation expectations: If the public, by and large, expects inflation in the future to be, say, 2% on average, then actual inflation is likely to trend toward that level because the expectation of 2% inflation in the future will get built into wage- and price-setting behavior. If the central bank can convince the public that it intends to operate monetary policy to obtain 2% inflation, and is able to do so (even if, because of supply or demand shocks, inflation deviates from the target), inflation will tend to return to target because of the "gravitational" pull of self-fulfilling expectations.

A game-theory perspective is instructive here. The central bank's management of the public's inflation expectations to achieve the inflation target can be viewed in terms of the central bank using credible threats. To prevent inflation from

becoming unanchored on the high side of its target, the central bank threatens to "punish" the public if it allows its inflation expectations to deviate from the central bank's target. It can punish the public by hiking interest rates without limit and forcing the economy into recession (recall Paul Volcker).

Clearly, the central bank could do this. But is it a credible threat? That is, if the public were to disregard the central bank and start to expect high inflation and, therefore, trigger high inflation, would the central bank have the incentive to follow through on its threat? The answer--if the central bank is a "technocratic" institution with a clear mandate from the government and the independence of operational decision-making to pursue that mandate--is "yes." That is why central bank "independence"--what the U.S. Federal Reserve describes as "independent within the government" rather than "independent of government"--is so critical.

But what if inflation deviates from target to the downside? Then, in an analogous fashion, the central bank needs to be able to threaten to "punish" the public if it allows its inflation expectations to undershoot the central bank's target. The central bank must be able to communicate something like the following message: "If you the public don't believe that we the central bank can do whatever it takes with our monetary policy tools to prevent inflation from slipping below target, and possibly into outright deflation, we will punish you by taking the necessary action to achieve our goal." "Punishment" here is in the sense that, if the public gets its inflation expectations wrong on the downside, it will not have optimized its wage- or price-setting behavior (nominal and, therefore, real wage growth will have been too low) or its financial portfolio decisions (it will be too invested in cash). QE, which has no theoretical limit, gives the central bank that credible threat.

The beauty of this game-theory angle is that, precisely because the central bank's "threats" (or, in kinder language, "promises") are seen as credible, in equilibrium the public's inflation expectations remain "well-behaved," and the central bank never has to follow through on them. Of course, the public has to learn that the central bank has a target, the tools to achieve it, and the determination to use those tools to do so. Future economic historians may view the recent period of large-scale and extensive QE by major central banks, particularly those by the Bank of Japan under Governor Haruhiko Kuroda as it tries to end a two-decade deflation, as establishing that fact on the downside of the inflation target in the same way Paul Volcker's inflation-subduing policies in the early 1980s did on the upside.

Mechanically, how does QE work?

Very simply. The central bank buys assets (usually government debt securities, but in principle any asset) from the private sector and pays for those assets by creating bank reserves--that is, by issuing a liability (central bank money). In theory, this process has no limit or, more accurately, the only theoretical limit is the stock of assets in existence. In modern monetary systems, the central bank is the monopoly (only) supplier of bank reserves or banknotes, the two components of monetary base or what the public usually regards as "money."

There are, of course, legal limits on what assets the central bank can buy. Consider the Federal Reserve. The Federal Reserve Act authorizes the Fed, as part of its open-market operations aimed at achieving its monetary policy objectives, to purchase debt securities issued by the U.S. or any foreign government. So, in principle, if the Fed faced a serious threat of deflation, it could proceed to purchase all government debt in existence, regardless of currency

denomination. That is a pretty powerful tool for the Fed to have in its back pocket. A *reductio ad absurdum* argument would suggest that the Fed, by "threatening" to do QE in this way if necessary to achieve its objectives, could counter deflation and trigger sufficient inflation. The fact that the public "knows" this (because the Fed tells it, and the public believes the Fed) means it will never have to behave in this extreme way.

Conceptually, how does QE work?

When the central bank buys assets and pays for them by creating bank reserves (or deposits in the banking system, which in turn create bank reserves as their asset counterpart), the composition of the aggregate portfolio of financial assets held by the public changes. It is this ability of the central bank to unilaterally change the composition of the public's aggregate portfolio that allows QE to create easier financial conditions. This follows from portfolio theory and what is called the "portfolio rebalance effect."

The effect works like this: Assume financial markets are in equilibrium. In that case, market prices will have adjusted such that the public is willing to hold the stock of existing assets in their countless individual portfolios just in the proportions that they have chosen to at those market prices. To entice the public to hold a different stock of assets, given that the assets that the central bank supplies (bank reserves or bank deposits) are not perfect substitutes for the assets that it acquires, asset prices will have to change in the course of the central bank doing its QE.

For instance, theory suggests that, to entice the public to part with longer-term government debt securities in exchange for bank reserves (if a bank is the seller) or demand deposits (if the seller does not have a reserve account at the central bank), bond prices would have to go up a bit. For the public to want to hold those more liquid, shorter-duration securities, the asset that the public is being swapped out of--longer-term government debt securities--have to become a little less relatively attractive. They become less attractive by virtue of their yield going down slightly (depending on the amounts and substitution elasticities involved, the market price movements needed to reestablish equilibrium may be minuscule). This is why former Federal Reserve Chairman Ben Bernanke regularly explained the portfolio rebalance effect of QE in terms of "putting downward pressure on longer-term interest rates."

But QE has broader financial easing effects because of the linkage of all financial markets. Once the central bank has disturbed the composition of the public's aggregate portfolio, the market price adjustments required to restore equilibrium, in theory, can affect all financial markets. So, for instance, for the public to be induced to hold the increased stock of liquid, short-duration assets (money) supplied by the central bank, equities may have to become slightly less attractive to hold at the margin in the new equilibrium. This occurs by virtue of equity prices going up a bit.

Similarly, for domestic corporate bonds and foreign government bonds (among other assets), corporate bond prices should rise a bit, and the exchange rate of domestic currency should depreciate a bit to restore equilibrium. This is because, with the central bank supplying more "money," in the new equilibrium corporate bonds and foreign assets have to become slightly less attractive than they were before for the public to be willing to hold that money rather than switch into those assets (it is that process of "switching in" that makes them less attractive).

So, theoretically and all other things being equal, QE should lead to (slightly) lower government bond yields, tighter

corporate bond spreads, higher equity prices, and a weaker domestic currency. All of these asset-price moves are in the direction of creating easier financial conditions, more conducive to stimulating an increased level of economic activity. This is why, in explaining how QE works, as well saying it puts downward pressure on longer-term interest rates, Chairman Bernanke always added that it "[eased] financial conditions more broadly."

How does QE relate to government debt management?

When the central bank buys just government (or government-guaranteed) debt securities, QE can be conceptualized as a debt-management or debt-refinancing operation of the consolidated government (the government inclusive of the central bank). QE changes the profile of government debt in the hands of the public. When the central bank buys Treasury debt securities by issuing bank reserves, the consolidated government in effect is retiring those Treasury debt securities and refinancing them into bank reserves. The net effect is to remove duration, or interest rate risk, from the market (transferring it to the consolidated government, which will have to refinance at higher interest rates in the future, once QE has succeeded) and lower the consolidated government's debt financing costs.

To better understand this point, it is useful to go back to monetary basics and understand the role that government debt itself plays in the monetary system. When the government spends more than it takes in--that is, runs a budget deficit--in the first instance, it is creating deposits in the banking system equal to the amount of the deficit, because the deficit just measures the net transfer from the government to the public, and the same amount of bank reserves (on the asset side of the banking system's balance sheet). Say, to begin with, the government has no deposits at the central bank and spends \$100 more than it takes in. Deposits in the banking system go up by \$100, as do reserves, and government deposits go into a \$100 overdraft. To extinguish the overdraft, the government issues \$100 of debt securities to the public, and the \$100 of bank deposits created by the deficit disappear, along with the \$100 of reserves. The net effect of all of this is: no change in the central bank's balance sheet; no change in the banking system's balance sheet (assuming the nonbank public bought the bonds); and \$100 of government debt securities in the hands of the public. QE just reverses the "sterilization" or "neutralization" of money (bank deposits and bank reserves) that occurred when the government issued debt securities in the first place.

How does QE relate to the "shadow banking system"?

The "shadow banking system" is a nebulous term which refers to the financing and risk-transformation activities of such entities as securitization vehicles, asset-backed commercial paper conduits, hedge funds, money market mutual funds (MMF), markets for repurchase agreements (repos), investment banks, and mortgage companies that operate in the "shadows" of the deposit-taking (or "deposit-creating") commercial banking system. The key difference between the regular banking system and the shadow banking system is this: Regular banks create credit (loans) by creating deposits, whereas so-called "shadow banks" extend and deploy credit by transferring title to existing deposits rather than being able to create new ones.

Take a repo transaction between a MMF and a hedge fund, for instance. The MMF provides \$100 of cash to a hedge fund by taking, say, \$105 of Treasury securities as collateral, to be repaid in one week's time with interest. It is

common to describe this kind of transaction in terms of the hedge fund "financing" the Treasury securities (or 95.2% of the amount, accounting for the 4.8% haircut) by doing the repo transaction, but the hedge fund already owned those Treasury securities and must have had a corresponding liability (for example, investor funds) already financing them. What the hedge fund now has is \$100 more cash (on deposit at a bank) to invest, financed by a \$100 repo liability. But that \$100 increase in cash is exactly matched by the MMF's decrease in cash. Money has just been moved around the system, rather than being newly created. The underlying deposits must have come from somewhere to begin with and there are two possibilities: bank lending/credit creation, suggesting that the shadow banking system is in fact "latched onto" the traditional banking system, and government deficits. The latter suggests a link to QE: QE increases deposits in the banking system (undoing the "neutralization" of money from the issuance of government debt in the first place) and thereby the "raw material" that the shadow banking system thrives on.

Some observers worry that QE may be counter-productive because it reduces the amount of collateral in the system: The more QE the central bank does, the less collateral there is in the shadow banking system to leverage into new credit creation (see, for instance, Andy Kessler, "The Fed Squeezes the Shadow-Banking System," Wall Street Journal, May 22, 2013). This concern seems misplaced: Repo transactions just move around existing cash (bank deposits)--QE, even if it removes collateral, puts new cash into the system.

What is the difference between "quantitative easing" and "credit easing"?

The term "credit easing" is used to refer to central bank policy actions aimed at improving the "transmission" of monetary policy. The term came into currency in 2008 when the Fed and other central banks took emergency actions to counter the dangerous (to the stability of the financial system) and depressive (to economic activity) effects of the financial crisis. Many of these actions can be thought of as a resurrection of traditional "lender of last resort" operations in a modern guise.

When a central bank does credit easing (CE), it will often be expanding its balance sheet, lending to, or acquiring assets from, the banking system on the left-hand side of the balance sheet while creating bank reserves on the right-hand side. Mechanically, that resembles QE. But, in principle and sometimes in practice, a central bank can do CE without expanding its balance sheet beyond its normal non-QE size, by changing the composition but not the total amount of the assets it holds. So, in Venn diagram terms, it's useful to think of QE and CE as overlapping. In some cases, the central bank does QE without doing CE, and, in others, it does CE without doing QE (what might be called "pure CE").

The distinction between QE and CE (other than the unusual case of pure CE), however, is not so hard and fast. For instance, the Fed's large-scale mortgage-backed securities purchases are QE but, to the extent they aim to improve the transmission of monetary policy by lowering mortgage rates, they are CE. A similar argument can even be made for central bank purchases of longer-term government debt securities. QE is best seen as any policy whereby the central bank actively expands its balance sheet beyond the size associated with minimum reserve requirements and CE as usually (that is, other than pure CE) being a special subset of that, with many varieties of assets associated with it.

Is QE a powerful monetary easing tool?

This question on QE, as with any monetary policy tool or action, doesn't really make much sense posed independently of the context. Policy efficacy is context-dependent. If central banks cut interest rates to zero and did QE in a situation of full employment and buoyant inflation, the result would almost certainly be to cause the economy to overheat and trigger runaway inflation. But central banks take policy actions to achieve their goals calibrated to the circumstances they face.

If, as in recent times, central banks are forced to operate at the zero bound and to venture deep into QE territory, this is happening for a reason (such as a financial crisis and deep recession, followed by a prolonged period of private-sector deleveraging), and that same reason is likely to severely constrain QE's effectiveness. But constraining its effectiveness is not the same thing as rendering it totally ineffective. Rather, it means central banks, faced with such circumstances, have to calibrate the use of a tool that has relatively muted potency to the scale of the policy challenge. That explains why central banks like the Fed have done QE on a fairly dramatic scale but with limited success in terms of stimulating a higher rate of economic activity in a short period of time.

Is QE "printing money"?

To the extent that it involves the central bank creating bank reserves to acquire assets, QE can be called "printing money," but it is not very informative to do so. Bank reserves are the most basic form of central bank "money," and the central bank can and does create them electronically out of thin air. That does sound at least like the "electronic printing of money." But the QE kind of "money printing" is quite different from the sense in which the term is usually used: either Milton Friedman's "helicopter money" or wanton deficit financing by the central bank.

How is QE not the same as "helicopter money"?

Milton Friedman's idea of "helicopter money" was that the government could always trigger inflation (strictly a one-off rise in the price level) by dropping banknotes from helicopters. Friedman's notion was that this exogenous increase in the money supply would be absorbed by rising prices as more money than existed before would be chasing the same amount of goods and services. This is different from QE and is better viewed as a government tax cut permanently financed by the central bank (the word "permanently" is important here). Given that the government could not realistically distribute cash by helicopter, and, in most banking systems, the cash would be a liability of the central bank, not of the government, the closest operational arrangement for implementing a "helicopter money" policy would be for the government to give all households a check for, say \$10,000, and finance the associated increase in the government deficit by issuing nonmarketable (nonsaleable) zero-coupon perpetuities to the central bank.

Although the balance-sheet mechanics are similar, there are a couple of key differences between this form of helicopter money and QE. One is that, ostensibly at least, central banks undertake QE independently of fiscal policy, taking the government's fiscal policy stance as given. Helicopter money is a joint operation of the monetary and fiscal authorities. In fact, it is probably best viewed as a monetary operation of the consolidated government. The second, related to this

point, is that a helicopter money operation has to be permanent, whereas QE is reversible. The government debt securities acquired by the central bank in a helicopter money operation have to be permanently held by the central bank, whereas under QE the central bank can sell the government debt securities it acquires at will. When it does, bank reserves (the part of the helicopter money the public chooses not to hold as banknotes) will be extinguished.

Is QE the same as "financing" or "monetizing fiscal deficits"?

To the extent that the central bank holds government debt issued to finance the budget deficit, QE can be described this way, but this description is misleading and misses the point. Central bank "financing" or "monetizing" of fiscal deficits usually refers to cases in which the central bank is not given an inflation mandate and operational independence from the government but is subservient to the Treasury and is used as a financing arm of the government. History and theory suggest that, if governments run large and recurrent fiscal deficits and use the "printing press" (the central bank's balance sheet) to finance them, then inflation will result. This is a far cry from modern-day QE. Again, the context (monetary policy needing to be operated at the zero bound) and institutional setting (independent central banks with price stability mandates) are important.

Does QE operate through a stock or a flow effect?

In theory, QE operates by changing the stock of assets in the hands of the public. This means that technically central banks are "doing QE," not just when they are continuously expanding their balance sheet but also when they have completed a certain amount of asset purchases and are holding onto the assets purchased. But it takes a flow to accumulate a stock, so it is not surprising that market participants tend to focus on the flow of asset purchases by central banks. This makes for some confusing terminology, however. Some commentators refer to the Fed completing its "tapering" of asset purchases (announced in September and December 2012, totaling \$85 billion a month) as "ending QE." But when the Fed ends its tapering (likely in October 2014), it will still be "doing QE"--it will just not be doing incrementally more QE.

How can a central bank exit from QE?

The process of a central bank ending or unwinding QE is conceptually simple and operationally straightforward. QE would be unwound when the central bank had reduced the size of its balance sheet back to normal, with "normal" being a situation in which the level of reserves was around the minimum required level--that is, a situation of roughly zero excess reserves. For instance, as of the two weeks ending July 23, 2014, depository institutions held \$2.716 trillion of reserves at the Federal Reserve, of which \$92 billion were required reserves and \$2.624 trillion were excess reserves. For the Fed to unwind QE (today), it would have to extinguish those \$2.624 trillion of excess reserves. That would mean reducing the size of its balance sheet by getting rid of \$2,624 billion of assets it currently holds, which would take its balance sheet to about \$1.783 trillion from its current \$4.407 trillion.

A central bank does QE (expands its balance sheet) by acquiring assets financed by creating reserves. The unwinding of QE is simply the reverse process: The central bank shrinks its balance sheet by shedding assets, thereby

extinguishing reserves. In principle, the central bank can do this very fast or very slow (or anywhere in between). The fast method is for the central bank to sell assets to the private sector. The slow method is for the central bank to let assets "roll off" or "run off" its balance sheet when they mature.

Here is how asset sales work. Say the central bank sells \$100 of government debt securities to a hedge fund (via a primary dealer). The central bank's balance sheet shrinks by \$100, as \$100 of government debt securities disappear on one side of its balance sheet and \$100 of bank reserves are extinguished (disappear) on the other side. The hedge fund's cash at the bank goes down by \$100, and its holdings of government debt securities go up by \$100. The balance sheet of the bank goes down by \$100 as the hedge fund's \$100 deposit (a liability for the bank) disappears, and its reserves at the central bank (an asset for the bank) go down by \$100 in tandem. All very simple.

When it comes to how asset roll-offs work, there are two cases, corresponding to whether the asset needs to be refinanced (for example, a government debt security) or the asset is being extinguished (for example, a mortgage-backed security). Suppose the central bank waits for the government debt security to reach maturity rather than sell it in the market. That makes things a little more complicated than above, but they end up in the same place. The government needs to find \$100 to repay the central bank. It issues a new debt security to the hedge fund: The government's deposits at the central bank go up by \$100, the hedge fund's cash at the bank goes down by \$100, and the bank's reserves at the central bank go down by \$100. The government pays the \$100 to the central bank, and the government debt security held by the central bank disappears. The net result is the same as the asset sale: The central bank's balance sheet is smaller by \$100, as is the bank's, and the hedge fund has a \$100 government debt security rather than a bank deposit.

The case of the Fed holding mortgage-backed securities (MBS) to maturity (which it has signaled it intends to do) is a little different because an MBS reaching maturity is extinguished as the underlying mortgage is repaid, rather than needing to be refinanced as is generally the case with government debt. Suppose \$100 of MBS held by the Fed reaches maturity. Abstracting from intermediaries, the mortgage holder pays the Fed \$100 by writing a check on a \$100 deposit at the bank. That extinguishes \$100 of reserves on the bank's balance sheet and on the Fed's, and the \$100 of MBS disappears.

Money is fungible. The \$100 bank deposit, in the aggregate, is just the \$100 bank deposit that was created when the central bank did that bit of QE in the first place. There is one qualification: Part (or even all) of that \$100 deposit (again, in the aggregate) may have leaked into banknotes-in-circulation, reducing bank reserves as it does. But, to the extent that it does, that is a part of QE that does not have to be unwound because the government debt securities acquired by creating bank reserves are now the asset on the central bank's balance sheet backing the increased banknotes. They need to be there--and permanently so--as long as the banknotes remain in the hands of the public.

Will the Fed be able to raise interest rates while continuing to "do QE" (maintain an enlarged balance sheet)?

Yes. Because the Fed now pays interest on reserves, it can separate its decisions about the target policy rate from decisions about the size of its balance sheet. If the Fed did not pay interest on reserves, the existence of excess

reserves in the system would force the overnight rate to fall to, or very close to, zero as banks tried to lend their excess reserves to other banks to get any interest rate better than zero. To target a positive federal funds rate (the rate in the overnight interbank market for federal funds, i.e., reserves), the Fed first would have to expunge all or most of the excess reserves in the system. Interest-rate targeting would be held hostage to the need to first unwind QE. This was the situation the Bank of Japan faced when it unwound its QE in March-July 2006.

By paying interest on reserves, however, the Fed can avoid this problem. Rather than try to "offload" their excess reserves at whatever rate they could get (which is not much), banks would now be happy to hold the excess reserves at the rate remunerated by the Fed. The interest rate paid on reserves should then become the anchor rate for the whole yield curve, in much the same way that the federal funds target rate becomes the anchor rate for the yield curve in normal times.

How do overnight reverse repurchase transactions fit in?

The Federal Reserve is intending to use overnight reverse repurchase (repo) transactions (ON RRP) with a wider variety of counterparties than usual when it starts to raise interest rates while maintaining an enlarged balance sheet (not just primary dealers but also banks, government-sponsored enterprises [GSEs], investment managers, and money market funds). This is because it worries that paying interest on reserves may not be enough to put a floor under interest rates, given that some holders of reserves, notably GSEs, are not paid interest on reserves, and the abundant "liquidity" associated with QE in short-term money markets other than the overnight market for federal funds (reserves) may stymie the Fed's ability to set a floor under short-term interest rates. Reverse repo transactions convert reserves into a slightly different form of central bank money, leaving the size of the Fed's balance sheet unchanged. Suppose the Fed does a \$100 ON RRP with a money market fund (MMF). Here's what happens: The MMF's bank deposit goes down by \$100, as do bank reserves, and the MMF now owns, what, in effect, is an overnight deposit at the Fed. The amount of Fed liabilities is unchanged, but a \$100 of reserves has transmuted into \$100 of ON RRP.

Some observers have expressed concerns about the distorting effects that the ON RRP facility might have on money market functioning, bank deposit flows and corporate funding markets (see, for instance, the op ed by Sheila Bair in the Wall Street Journal of July 25, 2014: "The Federal Reserve's Risky Reverse Repurchase Scheme"). Used willy-nilly without regard to calibrating monetary policy settings to achieving the desired outcomes, these concerns might be germane. But viewed as a tool the Fed can use during the QE unwind process to increase its interest-rate control while leaving the amount of central bank money unchanged, many of these concerns seem to be overstated or unwarranted. For instance, Ms. Bair states that: "Banks could confront a sudden outflow of deposits, particularly those which are uninsured." True, but that outflow of deposits would just be reversing an inflow of deposits (due to QE) that created excess reserves in the first place. And that: "Borrowers in the short-term debt markets will have to compete with [the ON RRP facility] for investment dollars ... Nonfinancial companies could find themselves unable to find buyers for their commercial paper." This sounds far-fetched, but, if it were the case, Ms. Bair's proposed alternative to the ON RRP--"The Fed can always sell government securities as part of its normal open-market operations"--would be worse. Such an operation would not just remove the deposits from the system (the source of the "investment dollars" above), but, unlike the ON RRP, it would reduce the overall amount of central bank money in the system.

Will the unwinding of QE be hugely disruptive to financial markets?

Not necessarily. Of course, the unwinding of QE likely will involve some short-term volatility in financial markets as investors adjust their expectations of the future course of the economy and of monetary policy and reflect this in their portfolio positioning. The unwinding of QE is likely to entail market participants revising their expectations regarding the future course of policy interest rates. Long-term interest rates are likely to rise substantially, both because the unwinding of QE will remove the depressive impact of QE on the term premium and because market participants will be revising up their longer-term interest rate expectations. Such adjustments are a normal part of any process of reversal of monetary accommodation by a central bank, although they will likely be more acute and challenging for central banks this time given that QE has been uncharted territory for central banks and for market participants.

However, much of the concern expressed about QE unwinding's possible disruptiveness seems to be based on a fundamental misunderstanding of QE. A prevalent view is that the market will not be able to absorb the huge amount of assets that the central bank will be trying to put back into private-sector portfolios. The attempt to do so, it is feared, will lead to a market "crash."

This overlooks the fact that, for every dollar of QE that the central bank needs to unwind, there is a dollar of "money" (bank reserves or bank deposits) that the central bank created when it did the QE in the first place. QE is often described, misleadingly, in terms of the central bank "pumping liquidity into the system," but QE is akin to a central bank-imposed asset swap (a swap imposed on the private sector), and the unwinding of QE is just the reversal of that asset swap. When a central bank doing QE "pumps liquidity into the system," dollar-for-dollar or yen-for-yen, it is also "sucking assets out of the system." When a central bank unwinds QE, it might be described as "dumping assets back into the system"--something that conjures up images of disruption--but it is able to do that only because the "liquidity" is already in the system to be "sucked out" in exchange.

Moreover, if the attempt to unwind QE at a certain rate does cause too much market disruption, such as interfering with monetary policy goals, the central bank can calibrate by slowing down or even stopping asset sales, relying on the run-off of assets or even reinvesting as assets mature. This might leave too much QE in the system and financial conditions too loose, in which case the central bank could compensate by raising the interest rate paid on reserves. The central bank has two tools for adjusting the degree of monetary easing: the size (and composition) of its balance sheet (a tool it does not proactively use in normal times) and the policy interest rate. That gives it two independent margins along which to tighten (or ease) monetary policy. The central bank has considerable flexibility when it comes to calibrating the speed and nature of its exit.

When a central bank exits QE, does it have to shrink its balance sheet back to its pre-QE size?

No, because, over the course of QE, both the public's demand for banknotes and the level of reserves associated with minimum reserve requirements are likely to have risen. To the extent that they do, part of the excess reserves created when the central bank does QE will be converted into banknotes-in-circulation and an increase in required reserves,

respectively, and the corresponding part of the assets purchased under QE (strictly speaking, money and balance-sheet assets being fungible, an equivalent amount) will need to be permanently held by the central bank as the asset backing for those banknotes and additional required reserves.

Again, consider the Federal Reserve. As of the end of August 2008, just before it started to aggressively expand its balance sheet, first in response to the financial crisis (QE) and then as a more regular monetary policy (QE), the Fed had \$795.7 billion of Federal Reserve notes as liabilities, and required reserves were \$8.6 billion, out of a balance sheet of \$909.0 billion. Three rounds of QE later, the Fed's balance sheet is \$4.407 trillion (as of July 31, 2014), but Federal Reserve notes now total \$1.242 trillion, and minimum reserves (the two weeks ending July 23, 2014) are \$83.4 billion. The \$446.3 billion increase in Federal Reserve notes and \$74.8 billion increase in required reserves represent an increase in the size of the Fed's balance sheet over the course of QE that it will never have to unwind, unless the public were to unexpectedly decrease its demand for banknotes and for bank deposits (the amount of which propels required reserves), or the Fed were to lower its minimum reserve requirements.

Is QE an "inflation accident" waiting to happen?

No. Central banks have used QE to achieve their mandates during the unusual circumstances in which the threat to the inflation target has been "from below" (too low inflation or outright deflation) rather than "from above" (too high or runaway inflation). The aim is to bring about easier financial conditions to keep inflation from dropping and staying below target and to help the economy return to full operating capacity. The fact that central banks have been prepared to use this unconventional tool, and others, should give the public more confidence, not less, that they will keep inflation under control when the threat is one of too high rather than too low inflation.

Many of those who criticize QE on the grounds that eventually it will lead to runaway inflation, or at least worry about that possible outcome, likely are implicitly or explicitly using a "money multiplier" kind of model and have a "monetarist" view of inflation's determinants. The textbook exposition of the money multiplier describes a world in which the supply of reserves by the central bank multiplies into a much larger expansion of credit and money supply. This happens as banks use their excess reserves to create new loans, which in turn create deposits, thereby turning part of the excess reserves into required reserves but leaving more to fund more lending, with the whole process of money supply expansion continuing until the excess reserves have been fully "soaked up." If this textbook mechanism actually worked in the real world, which it doesn't, the massive increase in excess reserves under recent QE would have translated into a huge increase in money supply and, according to simple "quantity theory"-type monetarist logic, would have provided the monetary fuel for runaway inflation as "too much money chased too few goods."

Suffice it to say the textbook money multiplier model does not correspond to real world central banking and credit creation. For one thing, although not presented as such, the money multiplier model could only possibly apply to the case of zero interest rates. This is because, when the central bank is targeting a positive interest rate (the usual case), under real world institutional arrangements, banks would not attempt to get rid of excess reserves by lending more to nonfinancial borrowers in a time-consuming convoluted process. Rather, they would immediately try to lend their excess reserves to other banks in the interbank market, thus forcing the overnight interest rate to, or close to, zero. To hit its interest-rate target, the central bank would need to absorb the excess reserves, so the time-consuming

convoluted process described in the textbooks would never even be able to get going.

This changes at the zero bound and under QE because, by definition, the central bank does not have to absorb the excess reserves any more in order to hit its interest rate target.

But, more to the point, the textbook exposition has things the wrong way around. Typically, it says that banks can use part of their deposits to create loans because they have to hold only a fraction as reserves and that the loans then create more deposits. Part of those deposits has to be held as reserves, but the remainder can be "lent out." And this process continues until the money supply is in line with reserves (that is, no excess reserves are left).

Actually, it is the other way around: Banks don't "make loans" "out of deposits" or "use" deposits to make loans. They create deposits when they initiate a loan. The deposit so created, to the extent that it does not "leak" out of bank deposits into banknotes, increases the amount of required reserves. The central bank then "has to" supply the additional required reserves (a requirement the central bank itself sets) by, for example, buying or lending against government debt securities held by the banks (so-called "open market operations"). If the central bank supplies more reserves than the banks require (QE), that does not mean the banks will lend more as a result. Whether banks lend or not depends on three things: most importantly whether there are willing borrowers; secondly, on whether the banks have enough equity; and, least importantly (because central banks always supply the necessary reserves) on whether banks have reserves. It is not surprising that demand for bank loans is weak when QE is in force because it is the debt deleveraging process that stymies the efficacy of monetary easing and forces the central bank to operate at the zero bound and enter QE territory in the first place.

Could central banks unwind QE by agreeing with the government to cancel the debt securities they hold?

Since the financial crisis and Great Recession, two big macro phenomena have occurred in key parts of the developed world: Governments have run big budget deficits, leading to a steep rise in government debt outstanding, and central banks have bought large quantities of government debt under the guise of QE. This poses two challenges for governments and their central banks over the medium- to long-term: for the former, to reduce debt levels (something that would require governments to run budget surpluses for a long time) and, for the latter, to unwind QE. Some observers, skeptical that either can be done or done easily, have pondered the possibility of a "kill two birds with one stone" solution. Given that the central bank holds a large amount of government debt, and the same debt sits on both sides of the consolidated government's balance sheet, the debt could be reduced and QE unwound by having the government and the central bank agree to cancel the debt involved.

On the surface, this idea sounds appealing, but if it sounds too good to be true, it is. As party-pooing economists are fond of saying, there is no such thing as a free lunch.

One problem is that the central bank forgiving the government debt securities it had acquired (in an amount equivalent to excess reserves) helps to unwind QE only on one side of its balance sheet, the asset side. If the central bank forgave the government debt securities it had acquired (in an amount equivalent to excess reserves), there would have to be an adjustment on the liability side of the central bank's balance sheet. Otherwise, QE would only have been half unwound.

The central bank canceling excess reserves it had created under QE is unthinkable. For one thing, it would likely bankrupt large parts of the banking system as a chunk of its assets disappeared in smoke, and it would defeat the purpose of the exercise.

The flaw in this idea is that such a debt cancellation would not change one iota the debt obligation of the consolidated government to the public. This is because the consolidated government had to issue a different form of debt--bank reserves--in order to buy back the debt in the first place. A debt cancellation between the government and the central bank does not affect this debt.

A variant on this idea is that of the central bank possibly being able to permanently monetize the government debt. For instance, the central bank could agree to convert the portion of the government debt securities it owns corresponding to its excess reserves into nonmarketable zero-coupon perpetual debt. The debt would sit on the central bank's and the government's balance sheets forever, would never have to be repaid, and would cancel out as far as the consolidated government's balance sheet is concerned. A free lunch?

Not quite. The excess reserves will still be there. Unless the idea of the independent inflation-targeting central bank is to be tossed out the window, the central bank will need to be able to conduct monetary policy. The permanent monetization solution means the excess reserves will never be removed, until they gradually (or, if inflation breaks out, not so gradually) transmute into banknotes-in-circulation. To calibrate its monetary policy, the central bank, at some point, will have to raise the interest rate it pays on reserves, likely sooner rather than later, if it does not have the option of unwinding QE by selling assets or letting them run off the balance sheet. Again, this defeats the purpose of the whole exercise: While the consolidated government gets to avoid paying interest on the component of its debt permanently held by the central bank, it ends up having to pay it on the excess reserves that are issued instead.

Can banks "lend out" their excess reserves? What can they do with them?

Many commentators speak as if banks could, if they wanted to, "lend out" their reserves. The word "out" here is very important. Banks can and do lend their reserves to other depository institutions that have reserve accounts at the central bank. But banks cannot just turn their reserves into loan assets to nonbank borrowers, such as corporates or households. The relationship of bank credit creation to bank reserves is more complicated than that.

An individual bank with excess reserves can do only three things with them. In no case does the aggregate level of reserves change. First, a bank can keep reserves on deposit at the central bank. Second, it can lend the reserves to another bank, assuming that another bank wants to borrow them. This interbank lending and borrowing of reserves is intrinsic to the operation of the interbank market and monetary policy in normal times (when the interest rate is positive and the central bank is maintaining a position of approximately zero excess reserves). But, under QE, most banks have excess reserves, so they do not need or want to borrow reserves from other banks. Third, a bank can use its reserves to buy assets, such as government debt securities, either from other banks or from nonbanks. When it does, the bank reserves are transferred to the bank selling the asset or, if the seller is a nonbank, to its bank, as the asset-side balance-sheet counterpart to the deposit created. Again, the aggregate level of reserves is unchanged.

Banks cannot directly convert reserves into loan assets. What a bank can do is to make a new loan, thus

simultaneously creating a deposit (owned by the borrower) on the other side of the balance sheet, in the hope or expectation that the borrower will convert part or all of that deposit into banknotes and that those deposits will not be re-deposited, thus reducing its reserves by that amount. But that process is a far cry from the banks simply "lending out" their reserves.

Does QE relieve a reserve constraint on bank lending?

No. In normal times, banks are not reserve constrained. The central bank always supplies enough reserves to the banking system, and transactions in the interbank market ensure that reserves get distributed around the system to the banks that need them at any point in time.

In times of financial distress, when counterparty risk is high, this changes. Banks with excess reserves may be unwilling to lend them to banks with too few reserves (to meet minimum reserve requirements, or to meet unexpected withdrawals of deposits, or the inability to roll over short-term funding), or to other banks, full stop. Then the central bank needs to supply reserves directly to the banks that need them, and, anticipating a possible future fall in liabilities, those banks may demand a level of reserves far in excess of legally mandated minimum requirements. This is what happened on a large scale in the 2008 financial crisis and in the later eurozone sovereign debt crisis.

Are there differences in the way central banks have done QE?

Yes. The four major central banks--the Federal Reserve, the Bank of England (BoE), the Bank of Japan (BOJ), and the ECB--have varied in the way they have conceptualized, communicated, and implemented QE.

One distinction relates to whether the central bank puts the emphasis on the asset or the liability side of its balance sheet in terms of conceptualizing and communicating the expected transmission channel of QE. The asset-side approach, favored particularly by the Fed (but also by the BOJ under governor Masaaki Shirakawa), focuses on the effect that QE has on asset prices by lowering term and risk premia. The liability-side approach, associated more with the BoE and the BOJ under governor Haruhiko Kuroda, is more monetarist in flavor and focuses more on the effect that the forced expansion of the monetary base by the central bank or creation of central bank money has on nominal spending and inflation expectations.

Differences in the way central banks conceptualize QE--and the theory and empirical evidence are hardly fully settled--affect the way they communicate. The Fed eschews the term "quantitative easing," notwithstanding the market terminology of QE1, QE2, and QE3, preferring to use the vapid term "LSAPs" (large-scale asset purchases). The BoE, on the other hand, called its policy QE right out of the blocks. The BOJ, which pioneered QE in 2001, was a reluctant traveler under former governor Shirakawa (April 2008-March 2013), describing (from October 2010) its rather timid (under the circumstances) balance-sheet expansion as "comprehensive monetary easing policy." Under current governor Kuroda, the BOJ did a 180-degree turn and with gusto launched into what it calls "quantitative and qualitative easing," the two Q's capturing the liability- and asset-side effects of QE, respectively.

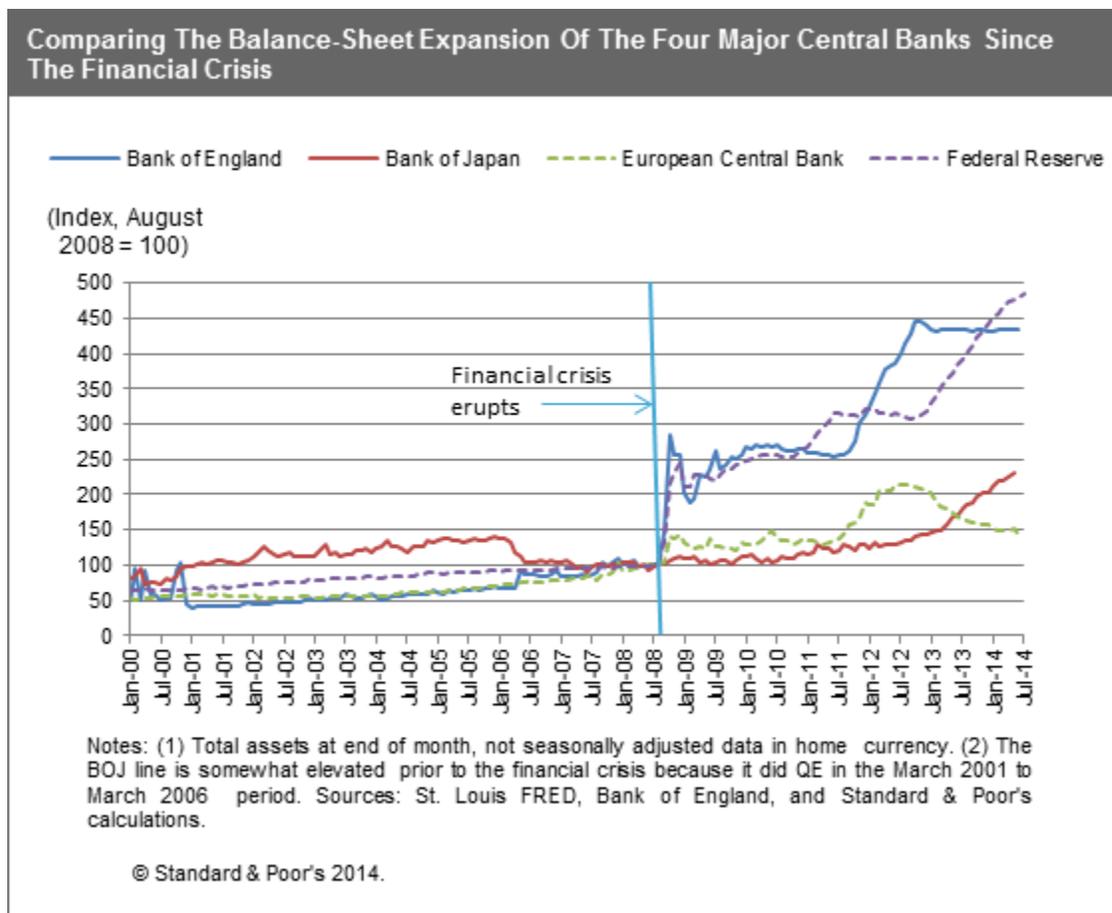
The Fed, the BoE, and the BOJ have all implemented large-scale asset purchase programs, buying mainly (the BOJ),

overwhelmingly (the BoE), or exclusively (the Fed) government debt securities, or, in the Fed's case, government-guaranteed assets. The BoE took the approach of announcing that it would purchase and hold a set amount of assets (initially £75 billion, but subsequently raised in several steps to £375 billion), as did the Federal Reserve until it switched in fourth-quarter 2012 to an open-ended approach, buying a set amount per month tied to achieving its policy goals rather than to a terminal date. The BOJ expands the monetary base by a set amount per year (¥60-¥70 trillion)--again tied to achieving its objectives rather than a terminal date.

The ECB is alone among the major central banks in several ways. For one, it is in the unique situation of being a central bank in a monetary union (the eurozone) that is not a fiscal or political union (although the eurozone has some elements of both). Reflecting the associated institutional, legal, and political constraints, the ECB to date has eschewed doing outright QE, although it has left the door open to doing so.

That said, the ECB has done two sets of "QE-like" operations, communicated as credit easing rather than QE: two rounds of covered bond purchases and outright purchases of sovereign bonds of eurozone periphery countries (the Securities Market Program). The main way the ECB has expanded its balance sheet, however, is by providing reserves against collateral in full-allotment long-term refinancing operations. These have also been unique in that the ECB allows banks to decide how many reserves to take from the central bank. So, in a sense, it is the decisions of the banks that propels changes in the size of the balance sheet, rather than the central bank forcefully expanding its balance sheet as in "normal" QE.

These differences are reflected in how much the major central banks have expanded their balance sheets since the financial crisis erupted in full force in September 2008, which provides a rough measure of how "aggressive" their QE has been (see chart): 385% for the Fed, 334% for the BoE, 165% for the BOJ, but just 41% for the ECB. Accounting for the increase in banknotes in this period, these figures become: 336%, 314%, 135%, and 22%, respectively.



How does QE relate to central bank "forward guidance"?

In conventional inflation-targeting, the central bank communicates its objectives, its current policy setting(s), and how it assesses the state of the economy and its likely evolution, leaving market participants to try to figure out what this likely means for the future evolution of the central bank's policy settings. "Forward guidance" refers to communication (the "guidance" part) by the central bank about what it sees as its likely monetary policy settings in the future or about what it will condition those settings on (the "forward" part). This forward guidance can take on many forms, varying in specificity and conditionality and has done so since the financial crisis as central banks have experimented with different approaches and learned from one another. The central bank may signal how long it expects to keep current policy settings (including its bias to ease or tighten policy) in place by using temporal phrases, such as "an extended period" or by using future dates. Or it may go further and condition the evolution of its policy on the evolution of target economic variables, such as inflation and the unemployment rate. Central banks can give forward guidance about interest rates or QE.

Is QE causing asset price bubbles?

Probably not, but that is something to watch. An asset price bubble occurs when asset prices are pushed further and further above their "underlying" or "fundamental" value by, for a while, self-fulfilling expectations of rising asset prices. By definition, asset price bubbles burst. Central banks don't want that. They want to ease financial conditions and support a stronger recovery from a deep recession and near-miss with depression and deflation but do so without triggering another round of asset price bubbles. QE works by helping produce easier financial conditions, including causing investors to "stretch for yield." This stretch for yield is part of the hoped-for transmission mechanism of QE, and signs that it is working should not be automatically taken as evidence of new asset price bubbles forming.

That is not to say that QE (and extended zero interest rate policy) has not led to "rich" asset valuations and mispricing in some segments of financial markets or even more generally. The trick for central banks is to create a virtuous feedback loop between these asset price effects and economic activity, so asset prices that might look stretched to begin with help to bring about subsequent increases in economic activity that help to justify them as the economy evolves. Take the U.S. The S&P 500 stock index is about 52% above its August 2008 level, but nominal GDP is 16.5% higher than it was then (and 20.6% above its second-quarter 2009 trough). After more than five years of zero interest rates and QE, the U.S. stock market may be getting ahead of itself, with valuations pushing toward the top of historical ranges. But it is a fair bet that both the stock market and nominal GDP would have been far lower had the Fed not adopted the aggressive policies that it has.

Does QE lead to more income inequality, and, if so, should the central bank take that into account?

Because monetary policy works through its effects on financial conditions (availability of credit and various interest rates and asset prices), as well as improving the state of the overall economy, it will likely have some distributional effects. Given that QE likely has worked more through asset price effects than the traditional lending channel, relative to conventional interest rate policy, these distributional impacts may have more pronounced than usual. QE, while being good for the economy overall, may have disproportionately benefited the holders of existing financial assets (stocks and bonds)--the relatively wealthy--and so may well have exacerbated income inequality.

But, unless it was the case that any such increase in income inequality could be shown to have a negative impact on real GDP growth of a magnitude that outweighed the positive effects on growth of the monetary easing--a highly doubtful proposition--the fact that monetary policy might improve the lot of some more than others is hardly a reason for central banks not to do their basic job: support the macro economy. Asking central banks to take into account negative effects of their policies on the distribution of income would be neither practical nor desirable. Other policies and arms of government are more suited to that important task (on this topic, see the recent article "How Increasing Income Inequality Is Dampening U.S. Economic Growth, And Possible Ways To Change The Tide," published Aug. 5, 2014, on RatingsDirect.)

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