Article:
The consequences of exit from non-conventional monetary policy
The consequences of exit from non-conventional monetary policy

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Abstract
This paper examines the financial and macroeconomic consequences of changes in central bank balance sheets. Large-scale purchases of bonds tend to drive down long-term interest rates. But developments in global markets, which shape the world long-term rate, exert some powerful constraints. Exchange rate effects can also be significant. The prospect of divergent balance sheet policies (balance sheet normalization by the Federal Reserve but further large purchases by the European Central Bank (ECB) and the Bank of Japan) is pushing the dollar up. Moving balance sheets toward more normal levels is important in order to preserve policy flexibility for the future but will present central banks with formidable challenges. This task will require cooperation with treasuries without surrendering monetary policy independence. As central banks pragmatically monitor market resilience, the financial dominance trap is to be avoided.

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1. Introduction
One legacy of the monetary policies pursued since the financial crisis is that central banks
in most advanced economies now have exceptionally large balance sheets. And commercial
bank reserves (which with currency is often termed the “monetary base” or “high-powered
money”) have risen by several multiples. Neither development is a cause for panic – there
is no mechanical link between balance sheet expansion and “bad” outcomes, such as
runaway inflation or dangerous credit expansion.

Nevertheless, these policies have made the exit challenge faced by central banks more
complex, with no consensus on the “new normal” for the balance sheet of central banks.
This paper argues that the crisis has forced a critical examination of some widely held
beliefs about the division of labor between different agencies of government in
implementing macroeconomic policies. Central banks have become more dependent on
what their government decides – on fiscal policy, on government financing choices and on
regulations requiring banks and other financial firms to hold government bonds. The exit
will succeed only if central banks remain free of fiscal dominance. Central banks also have
to pay greater attention to bond market reactions – but must not become captive to
market expectations. They must remain free of what Hervé Hannoun has called financial
dominance.

The main focus of this article is on the interlinkages between the balance sheets of a central
bank, of banks and of government. The next section of the paper argues that the new
classical macroeconomics, which gained increasing sway from the late 1980s, led to an
unfortunate neglect of the financial and macroeconomic effects of changes in central bank
balance sheets. The following section explains how any analysis of such effects must take
into consideration the fact that government financing choices can shape a central bank’s
balance sheet, and thus influence the monetary implications. Section 4 reviews how many
central banks have used their balance sheets to influence the long-term interest rate. This
can create conflicts with the U.S. treasury’s debt management strategy. The empirical
evidence is that the Federal Reserve has been able to drive down the yield on 10-year U.S.
treasuries. Section 5 considers the international dimension, arguing that globalization has in
effect created a “world” long-term interest rate – under the control of no single central bank.
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The term premium in all core bond markets has been driven down to levels that are unsustainably low. This, and the substantial accumulation of interest rate risk on the balance sheets of financial firms, will confront policy-makers with many difficult dilemmas once the exit from extraordinary monetary accommodation begins.

2. Three “dogmas” about monetary quantities
The sheer size of central bank balance sheets worldwide will require a major effort by economists to understand the financial and macroeconomic consequences of changes in central bank balance sheets. Quantity variables used to have pride of place in monetary analysis. Before the mid-1980s, the key elements in mainstream analyses of monetary policy were, in addition to the policy rate, central bank market operations in government securities markets, the liquidity of financial markets and market expectations of the future. The liquidity of the balance sheets of the banks was viewed as affecting their lending decisions. How central bank purchases or sales changed the market prices of financial assets depended on the substitutability between money and other assets in investors’ portfolios. Many central banks imposed “liquid” or “reserve asset ratios” on banks. Such ratios were used not only for monetary control, but also for influencing bank lending and for keeping the banking system safe. In short, portfolio rebalancing effects were seen as highly relevant for monetary policy. Several economists in the 1950s and 1960s aimed at providing rigorous theoretical foundations for such effects. Culbertson (1957) and Modigliani and Sutch (1966, 1967), among others, highlighted the existence of market segmentation and imperfect substitution between different maturities, proposing the preferred habitat theory as a possible explanation. Despite extensive econometric research, however, there was no agreement about the size, or about the stability over time, of portfolio rebalancing effects.

But this quantity-focused theory of central banking was progressively undermined by the rise of rational expectations models associated with the new classical macroeconomics. Applied to monetary economics, this developed into the New Keynesian model. This model took account of the macroeconomic consequences of imperfections in goods and labor markets. But it assumed perfect financial markets [Hahn and Solow (1995)].

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2 Before 1971, for instance, the U.K. clearing banks were required to hold 28% of their deposits in liquid assets – short-term treasury bills counted as a liquid asset but long-term bonds did not.
The point of departure of these models was the rational intertemporal choices of a single representative agent who has perfect foresight for each future state of nature (or who could trade in complete markets). A central bank had only to set the short-term rate and markets would determine the shape of the yield curve according to expectations of future short rates and of macroeconomic prospects. Various “irrelevance theorems” were devised for government budgets and central bank balance sheets. Households would understand the implications for their future taxes of decisions about government’s or central bank’s balance sheet, and would react in ways that neutralize the putative effect of such official action (Ricardian equivalence).

The beauty of such an intertemporal approach to economic policy is that it focuses attention on the fact that policy action taken today for short-term benefit may have longer-term consequences. One such consequence is that public sector balance sheets change in ways that can constrain future policies. Another is that what the authorities have done today shapes the expectations of private agents, influencing their behavior. This intertemporal insight has an important bearing on current monetary policy debates. But the key drawback with the specific form such models took was that coordination failure among private agents was ruled out by assumption. Liquidity constraints and many other interesting macroeconomic questions were, in effect, sidestepped. Several articles in BIS (2012) explore these issues in more detail.

The New Keynesian perspective incorporating rational expectations and perfect asset substitutability also had a number of convenient implications for policymakers. It shaped what has been called the pre-crisis “doctrine” of monetary policy, and therefore was partly responsible for the severity of the recent crisis [Aglietta (2013)].
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Note three “dogmas” that are of interest for the purpose of this paper:

- **Open market operations in government bond markets (or in foreign exchange markets) do not change relative prices:** Ricardian equivalence applies to central banks; any purchase or sale of particular assets would lead only to offsetting changes in private demands, with no impact on prices. One corollary of this is that government debt management (that is, the relative supply of short-dated and long-dated bonds by the Treasury) can be separated from monetary policy.

- **The central bank short-term policy rate is the unique instrument of monetary policy aimed at macroeconomic objectives:** the impact of policies on other core financial market prices, such as the term premium in the long-term interest rate, was neglected. Developments in monetary quantities (e.g., M2 and bank reserves), seen as reacting endogenously to policy rate decisions, had little or no influence on policy. And the Taylor Rule linked only the short-term rate to macroeconomic developments.

- **The “liquidity” of the balance sheets of commercial banks is irrelevant:** if adequate capital standards are in place to ensure the viability of a bank, there is no additional need for bank regulators to worry about the liquidity of banks because a sound bank could borrow readily in interbank markets to meet any “temporary” liquidity squeeze. Hence, the failure of international regulators in the 1980s to develop common measures of the overall liquidity of a bank (and the decline in liquid asset ratios) seemed unimportant.

Not everybody believed in these dogmas of course. Quantity measures related to balance sheets continued to guide policy considerations at the Bundesbank long after they had been abandoned by other central banks. Central banks in many emerging markets retained quantity-based policies and enforced liquidity rules on banks. The size and nature of a central bank’s balance sheet was key to Bernanke’s analysis, both of the 1930s depression and of Japan’s stagnation in the early 2000s [Bernanke (2013)]. Greenspan puzzled before the crisis about why the long-term rate had proved impervious to rising short-term rates.
In any event, all three dogmas have been shown by recent events to be false. Central bank balance sheets matter. Large-scale central bank purchases of bonds (and other assets) have lowered long-term interest rates, leading economists to re-examine the portfolio rebalancing effects that the new classical school had dismissed. The neat separation between central bank open market operations and government debt management has been blurred. And banks now pay much closer attention to the liquidity of their balance sheets (with bank regulation in this area having been strongly reinforced since the crisis).

Equally, the scale of balance sheet measures taken by central banks actually reinforces the fundamental logic behind the new classical theories. An intertemporal perspective – a key insight of rational expectations – has become even more necessary. Because of the substantial lengthening in the maturity of central bank assets, the decisions taken during this crisis will have more long-lasting (and therefore more uncertain) effects than if policy action had been limited to short-term interest rates or short-dated paper.

3. The analysis of a central bank’s balance sheet
Many debates about the impact of central bank balance sheet policies on the real economy are confused by the failure to recognize three fundamental elements:

- Any change in the total assets of a central bank must be accompanied by an equal change in its total liabilities. Many analyses of the economic effects of policy-driven changes in central bank balance sheets consider only the asset side (e.g., purchases of mortgage bonds lower financing costs); but the associated changes in central bank liabilities imply changes in the assets of other sectors, which may also affect aggregate demand.
- Even if they have not done so up to now, a government could decide to step in so that the change in central bank liabilities is vis-à-vis the government, not the private sector. To do so, it could borrow in capital markets in order to increase its deposits with the central bank.
- Much of the increase in the liabilities of a central bank – particularly in a crisis – will usually be assets of the commercial banks and could therefore influence bank lending.
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Table 1 illustrates these points with simple balance sheets.

**Table 1: The banking system**

| Central banks | | Commercial banks | |
|---------------|---------------------|---------------------|
| **Assets** | **Liabilities** | **Assets** | **Liabilities** |
| Foreign assets | Currency | Currency | Deposits |
| Loans to banks | Bank reserves | Reserves | Bills, bonds, etc. |
| Government securities | | Government deposits | |
| • Bonds | • Bills | | |
| Other assets | Non-monetary liabilities | Loans, bonds, etc. | |
| | Equity | Other assets | |
| | | | Equity |

During the past decade, the size of central bank balance sheets almost everywhere has grown more than anyone would have thought likely before the crisis. Although central banks have acquired quite different assets, all have had some impact on the yield on government bonds in their jurisdiction. EME (emerging market economy) central banks (and Switzerland) have mainly bought foreign assets, with an impact on the yields of the major government bond benchmarks [Pradhan (2014)]. Before their 2015 bond buying program, the ECB had concentrated on medium-term loans to banks: this has led banks in countries hardest hit by the crisis to increase the purchase of domestic government bonds (see Table 2). In Italy and Spain, banks' holdings of bonds of their own sovereign show stronger home bias than in France and Germany [ESRB (2015)]. Valla (2014) says central banks thus supported a profitable carry trade, which helped bank recapitalization. The Bank of England, the Bank of Japan and the Federal Reserve have bought government bonds and other bonds directly. Policies aimed at lowering bond yields in the domestic market will usually cause reallocations in international bond portfolios, and so are likely to influence exchange rates (discussed further in section 5).
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Equally important, how central banks have altered the size and the nature of their balance sheets in response to macroeconomic and financial conditions can itself shape private sector expectations about what the central bank will do in the future. Sometimes, a central bank will even make an explicit commitment of its future responsiveness. At several junctures of the recent crisis, it has been the commitment of central banks to buy specific assets – even before actual purchases – that has eased liquidity constraints of holders of these assets. Investors will seek profits by buying ahead of a central bank. For these reasons, there will be no simple and mechanical link between the central bank balance sheet and financial or macroeconomic variables.

In most cases, central bank asset purchases (or loans) were in effect financed in large part by the increase in commercial bank reserves with the central bank – an expansion of the monetary base. But there is nothing intrinsic or inevitable about the link between central bank asset purchases and monetary expansion. A government could have prevented any increase in liabilities to the banks either by injecting equity capital into the central bank or by increasing its own deposits with the central bank. If a government were to finance this by issuing bonds, however, it would tend to drive up the benchmark long-term rate. Other reasons for government reluctance to increase its own borrowing included electoral sensitivities (“borrowing to help big banks”), the assessment methodologies of credit rating agencies and the difficulty of securing rapid parliamentary approval.

Table 2: Banks’ holdings of domestic government bonds*

<table>
<thead>
<tr>
<th></th>
<th>France</th>
<th>Germany</th>
<th>Italy</th>
<th>Spain</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 2015</td>
<td>3.6</td>
<td>4.6</td>
<td>11.0</td>
<td>10.3</td>
</tr>
<tr>
<td>December 2009</td>
<td>4.8</td>
<td>3.6</td>
<td>5.6</td>
<td>5.2</td>
</tr>
<tr>
<td>December 2008</td>
<td>4.5</td>
<td>2.9</td>
<td>4.8</td>
<td>3.4</td>
</tr>
<tr>
<td>December 1998</td>
<td>8.2</td>
<td>4.2</td>
<td>12.5</td>
<td>11.3</td>
</tr>
</tbody>
</table>

*As a percentage of total assets.
Source: ECB.
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In any event, no government sought to finance the bulk of the expansion in central bank balance sheets.

Nor is there any simple link between the monetary base and bank credit to the private sector: the old bank multiplier model of textbooks has long been abandoned. Nevertheless, the fact that the balance sheets of commercial banks have tended to become more liquid as central bank liabilities have increased could at some point stimulate credit expansion. The right-hand panel of Figure 1 shows the case of the U.S. - exceptional central bank asset purchases drove bank reserves (i.e., commercial bank deposits with the Federal Reserve) to over 25% of total bank deposits. But part of this increase in reserves may be permanent, reflecting a stronger bank demand for liquid assets.

**Figure 1: The balance sheet of the Federal Reserve and U.S. public debt**

The vertical lines correspond to March 2009 (LSAP1), November 2010 (LSAP2) and September 2011 (MEP).

(a) Private sector and foreign official holdings.

Sources: Datastream; U.S. Treasury; national data.
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The crisis did indeed teach banks in the advanced economies that they need to hold more liquid assets even in normal times. New international bank regulation is reinforcing this orientation. It is, however, too early to tell what banks’ new liquidity preference will be in the medium term. Moreover, there is no consensus on the impact of more liquid balance sheets on future bank behavior. One argument is that banks will lend more mainly when the prospective returns are attractive, with liquidity acting only as a constraint (that is, liquidity has a binary, on/off nature). The counterargument is that liquidity effects may be continuous. After all, the larger the stock of liquid assets, the further tail risk of sudden illiquidity and bank runs is reduced and so the more lending can be increased.

Could this bloated level of bank reserves create difficulties for central banks when they want to normalize monetary policy? There are very divergent views on this issue. Some argue “no.” An independent central bank’s control of short-term rates is enough to influence the whole structure of interest rates. The central bank can control how quickly banks run down their reserves by raising interest rates paid on reserves irrespective of the size of the central bank’s balance sheet. Others argue “yes.” Central banks have little experience of dealing with such massive reserves. Marvin Goodfriend (2014) has argued that quantitative easing (QE) is a “bond market carry trade” that could land the central bank with sizable losses if short-term rates have to rise sharply. He makes the political (not economic) argument that this might jeopardize the operational credibility of monetary policy. Resolution of this disagreement probably partly depends on the nature of the shocks to hit the economy when central bank balance sheets are still large.

A further complication is that there is little consensus about the new optimum level of banks’ liquid assets in the post-crisis world. Because several new regulations require banks and other financial institutions to have more liquid balance sheets than before the recent financial crisis, the central bank may have to leave more “liquidity in the financial system on a permanent basis” [Gagnon and Sack (2014)]. Getting this right when markets are unsettled or when monetary policy frameworks are in flux may not be easy.

3 In emerging markets, by contrast, many central banks did not want their commercial banks to become more liquid as a result of central bank purchases of foreign exchange and took positive steps to counteract this [Mohanty and Turner (2006)]. Nevertheless, increased bank holdings of government bonds in EMEs do appear to lead to an expansion in bank credit to the private sector [Gadanecz et al. (2014)].
Some have argued that, in certain circumstances, the authorities in advanced countries may want to support their exit policy by imposing quantitative rules. After such a prolonged period of monetary accommodation, the task of managing what Blinder has called the “veritable mountain” of excess reserves will not be simple. It may require a new operating regime [see Gagnon and Sack (2014)].

4 Aglietta (2014) includes required reserve ratios in his macroprudential policy instruments that should accompany monetary policy. Siegel (2013) recently argued that the exit strategy could be better managed if the Federal Reserve were to impose a 15% reserve ratio on banks (the Federal Reserve’s “third policy tool” was the expression he used). In a similar vein, Goodhart (2013) argues that banks could be required to hold a higher proportion of their balance sheet in liquid assets (“financial repression” was the expression he used). See also Feldstein (2014).

5 The Federal Reserve began paying interest on such reserves in October 2008. The decision on the rate of interest to be applied to bank reserves is the responsibility of the Board of Governors, not the FOMC. As Blinder (2010) explains, this is significant because Chairman Bernanke had himself said that this interest rate – not the federal funds rate – could be the more reliable guide to the stance of monetary policy in the early stages of exit. In addition, the interest rate on full allotment reverse repos is also likely to be important.

4 The long-term interest rate as key indicator of monetary policy
The long-term interest rate matters greatly for the macroeconomic effects of monetary policy. It affects the decisions (and the balance sheets) of all borrowers and lenders who have long-term loan or debt contracts. If changes in the long-term interest rate could be fully explained by changes in expected future short-term rates, central banks would need to worry about only the current short rate (which it controls) and expected future short rates (which it might hope to influence by forward guidance). In practice, however, the long rate can move because of a central bank buying longer-dated paper and driving down the term premium (see Figure 2). This effect recalls James Tobin’s classic work on portfolio rebalancing mechanisms in the transmission of monetary policy. Recent research has revived the old preferred-habitat models of the 1950s and the 1960s [Vayanos and Vila (2009)]. The impact of central bank balance sheet policies in shaping the term premium can be crucial. Tobin’s work has also found a recent echo in the finding of Gertler and Karadi (2013) that the changes in the term premium have come to play a significant role in monetary policy transmission in the U.S. Economists are once again recognizing not only that aggregate demand depends on the long rate (not just the short rate), which was once standard in macroeconomic models [Reifschneider et al. (1999)], but also that the term premium can be influenced by monetary policy.
Uncertainty about how and when a change in the policy rate would affect the long-term rate means that open-market operations in long-term securities could improve the chances of timing countercyclical monetary policy correctly. Equally, shocks to the long rate could frustrate the monetary policy stance the central bank is seeking to impose through its policy rate. In some circumstances, then, sales or purchases of government debt would be preferable to relying only on the policy rate. For example, the size of the adjustment in the policy rate needed to have the desired impact quickly on the long-term rate could be too disruptive for borrowers with short-term debts. Banks, whose funding costs are closely linked to the policy rate, could be especially vulnerable to sudden large movements in the policy rate. And long-term rates might well, with a lag, actually overreact, forcing a reversal of the policy rate increase.

It is an open question whether the size and nature of the central bank's asset portfolio would become a second instrument of monetary policy – to shape the yield curve and to influence bank credit. Historically – that is, before the 1980s when the New Keynesian model led many to downplay asset portfolio rebalancing effects – the central bank's balance sheet had been viewed as important for monetary policy. Ben Friedman (2014) recently argued that the central bank's balance sheet is likely to become part of the standard toolkit of monetary policy in normal times. Echoing Tobin's portfolio balance theory, he stresses that “the central bank's ability to choose what quantity of assets to purchase (with consequent increases in its liabilities) is not merely an artifact of the policy interest rate being at the lower bound.” Others have argued that, if inflation around zero were to become the new norm, the zero lower bound (ZLB) problem would resurface, putting balance sheet policy back on the agenda.

The long-term interest rate and the slope of the yield curve are also key for financial stability. In the absence of sovereign default risk, the long-term interest rate on government bonds defines the credit risk-free maturity transformation over time. It provides the basic discount rate, and is thus central to the pricing of all long-term assets. When the long-term rate is “too low,” the prices of long-term assets are “too high.”

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6 Keynes argued along these lines in both the *Treatise on Money* and the *General Theory*, and James Tobin and Milton Friedman echoed this analysis (Turner (2013)). Brainard's (1967) uncertainty principle echoes this thinking.
And a higher market value of the assets that potential borrowers own allows them to pledge more collateral in order to get new loans. A flatter yield curve reduces banks’ earnings from the maturity transformation so that higher short-term rates induce banks to reduce the supply of credit [Adrian and Shin (2011)]. For all these reasons, the management of the yield curve can be a key element of financial stability policy.

4.1 Link with government debt management
The central bank controls the overnight rate but does not have sole jurisdiction over national policies aimed at the long-term rate. This is because government debt management policies affect the maturity of government debt held by outside investors – that is, the private sector and foreign official investors – just as much as central bank market operations. Both the government and the central bank can, through their transactions, alter the portfolios of assets held by the market. Given the imperfect substitutability of bonds with different maturities (contrary to the new classical view), this allows them to influence key interest rates at different points along the yield curve. Bernanke (2002) did advocate, if the federal funds rate were to fall to zero, the Federal Reserve “announcing explicit ceiling for yields on longer-maturity treasury debt (say, bonds maturing within the next two years).” But note that the logic of portfolio rebalancing effects is independent of the level of short-term rates: it is not a special case applying only at the ZLB [Goodhart (2012) and Ellison and Tischbirek (2013)]. While it is true that asset substitutability is lower in crisis times (so portfolio rebalancing effects are stronger), the evidence cited in the next section suggests portfolio rebalancing effects are still significant in normal times. There is nothing new in the observation that the authorities can influence the yield curve. Government debt management was a key part of monetary theory and practice from at least 1930 right up to the 1980s.7

7 “Monetary policy determines the composition of the government portfolio,” was the first line of Wallace’s 1981 article expounding the logic of a Modigliani-Miller theorem for central bank market operations.
Governments and central banks failed in the 1930s to understand their power. Recall that Keynes argued strongly that the British Government in 1930 was mistaken in its “sound money” policy of lengthening the maturity of gilts. Their policy inadvertently weakened the monetary policy expansion intended by the abandonment of the gold standard (which allowed short-term rates to fall) and by foreign exchange intervention designed to depreciate sterling [see Allen’s article in BIS (2012)]. He also urged the Federal Reserve to buy long-term treasuries, but such purchases began in earnest only during World War II [Tily (2010)]. During much of the post-war period, many central banks in Europe were closely involved in government debt management – but most were not independent.

From the mid-1980s, however, the view grew that giving central banks the dual mandate of both setting monetary policy and managing government debt created a conflict of interest. Trying to keep debt service costs down (or even limiting the volatility of such costs) could conflict with the monetary policy need to adjust interest rates in the light of changing economic conditions (“fiscal dominance”). Even market perceptions of such a conflict could unsettle inflation expectations.

Government debt managers were, therefore, given a degree of independence and assigned clear objectives. They were normally expected to minimize anticipated costs over time (and avoid “spikes” in future repayments) subject to some risk tolerance limits. Two “separability principles” governed their interaction with central banks:

1. Central banks should not operate in the markets for long-dated government debt, but should limit their market operations to the bills market.
2. Government debt management should be guided by cost minimization mandates, and not by macroeconomic developments. Issuance of short-dated debt should be minimal.

The large-scale acquisition of long-dated government paper by central banks as a result of the financial crisis has obviously undermined this separation. The left panel of Figure 1, above, shows a dramatic rise in the average maturity of the Federal Reserve’s holdings of public debt, in effect taking duration risk out of the market. But note that the significant rise in the average maturity of U.S. Treasury issuance (dashed line) has worked in the opposite direction.
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Indeed, the published minutes of the Treasury Borrowing Advisory Committee reveal some interesting discussion on whether the Fed and the U.S. Treasury have been working at cross-purposes [Turner (2011)]. Larry Summers argued in a recent Brookings Panel discussion for closer coordination. He argued that the Federal Reserve's QE policies reduced dollar long-term rates by 1.37 percentage points, while the increase in the average maturity of Treasury debt issuance added back 0.48 percentage points [Greenwood et al. (2014)]. In a similar vein, a recent Vox essay by Jagjit Chadha (2014) reviews the evidence that shows that decisions about the maturity of government debt do matter for monetary policy.

It is not difficult to see why a Treasury might inadvertently offset part of monetary expansion that QE by a central bank was meant to achieve. The prospect of much higher government debt to finance makes prudent debt managers want to lengthen the maturity of their issuance. Moreover, a temporary change to the yield curve induced by central bank action may lead the debt manager to alter its issuance policy to take advantage of what it might view as a temporary interest rate “distortion.” Or it may find it can move quickly to attain a pre-existing maturity-extending objective thanks to favorable market conditions created by the central bank. In any event, there is empirical evidence that the U.S. Treasury has lengthened the average maturity of its debt issuance when the fiscal deficit is high and issued shorter term when the spread of the 10-year yield over the federal funds rate is high.

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8 Coordination in the U.K. is more explicit. The U.K. Treasury has agreed to indemnify the Bank of England against possible losses from its QE program. The Bank of England in its May 2014 Inflation Report said it would liaise with the Debt Management Office when deciding any program of sales. The thorny issue of coordination between the central bank and the Treasury is reviewed in BIS (2012).


10 Evidence is provided in Table 2 in Blommestein and Turner in BIS (2012).
5. The international dimension

5.1 The “world” long-term interest rate

The previous sections concentrated on domestic determinants of the long-term interest rate. But long-term interest rates are more and more set in global markets. International investors and debt issuers can shift their transactions from one currency to another. The yield on 10-year U.S. Treasuries is, of course, the global benchmark. But it is a benchmark that is driven by developments worldwide — and not only by U.S. growth or monetary policy. An idea of magnitudes might help to clarify this point. Detailed calculations by BIS economists suggest that aggregate borrowing in U.S. dollar bond markets by nonbanks outside the U.S. now exceeds U.S.$4 trillion — a fourfold rise since the start of 2000 [McCauley et al. (2015)]. Of this, U.S.$1.3 trillion comes from bond investors in the U.S., but U.S.$2.7 trillion comes from bond investors based overseas. It is this huge and growing volume of transactions between non-U.S. residents in dollar bond markets that has made dollar bond markets truly global. These strong global forces mean that the combination of higher U.S. short-term rates but large bond purchases in the euro area and in Japan could well result in low dollar long-term rates for a prolonged period — a revival of the Greenspan “conundrum!”

There is, of course, no unique way of measuring the “world” interest rate. But the estimate prepared by Mervyn King and David Low (based on advanced economy bond market data) is a good starting point (Figure 2). Movements in the yield on 10-year U.S. Treasuries — shown as a yellow line in the graph — dominate this “world” interest rate. The real-world long-term interest rate has been falling for more than a decade and is now close to zero. Panel B of Figure 2, based on calculations from Hördahl and Tristani (2014), shows that the decline in U.S. 10-year yields has been largely driven by a compression of the term premium — the reward for holding long-dated rather than short-dated bonds. It has, therefore, declined for reasons other than changes in expected future short rates. Note the very similar trend in the term premium in the euro area: see panel C of the figure. (French Treasuries are used in BIS calculations because French inflation-linked bonds have been issued for longer, and enjoy greater liquidity, than those of other euro area countries).
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Figure 2: Long-term interest rates (%)

(a) Sum of inflation and real yield risk premia in the 10-year Treasury yield. These are calculated using the BIS term structure model.
Sources: King and Low (©February 2014); Bloomberg; national data; BIS calculations.

If the term premium in global markets remains low once the normalization of U.S. monetary policy gets under way, then, all else equal, it would be appropriate, in the words of the President of the Federal Reserve Bank of New York, “to choose a more aggressive path of monetary policy normalization” [Dudley (2015)].

In any event, the idea from rational expectations theory that the term premium can be viewed as independent of central bank or government balance sheets has been discredited. A number of empirical studies done before the crisis had shown that shifts in the demand of large investors (e.g., foreign official demand for high-quality U.S. dollar debt and maturity arbitrage in U.S. dollar securities by European banks) did depress term premia in U.S. Treasuries [see, for example, Bertaut et al. (2011)].

11 Shin (2012) provides a comprehensive summary of these important mechanisms. European banks – not U.S. banks – held most of the special purpose vehicles holding U.S. mortgage-based securities. See also Borio and Disyatat (2011).
In addition, new prudential regulations, mark-to-market accounting rules, actuarial conventions, etc., have induced financial intermediaries to hold a higher proportion of their assets in government bonds, driving down benchmark yields. A crisis-induced flight to quality has also been important.

Several event studies have shown that the announcements of large-scale central bank bond purchases in Japan, the U.K. and the U.S. have indeed lowered long-term rates. One general shortcoming of such studies, however, is the neglect of contemporaneous changes in Treasury issuance policy. In addition, such estimates are based on the difficult financial market conditions prevailing in the post-crisis period. Capital constraints on banks and other financial firms, worries about the creditworthiness of wholesale market counterparties and uncertainty about future regulations would all inhibit arbitrage by the private sector. The new classical model would not apply in such circumstances – but may again apply in normal conditions.

To address these issues, Chadha et al. (2013) focused on long-term rates over a pre-crisis period (that is, 1976 to 2008). They examined the determinants of 5-year forward 10-year yields, an interest rate that should be less influenced by the business cycle and monetary policy than the contemporary 10-year yield. The paper used expectations of future variables, not the current readings. Computations of the size and the maturity of U.S. Treasury debt held outside the Federal Reserve are reproduced in Figure 1. The main new finding of this paper was that shortening the average maturity of total outstanding federal debt held outside the Federal Reserve by one month lowers the long-term yield by 12–13 basis points. A one percentage point rise in long-horizon inflation expectations adds about one percentage point to the forward 10-year yield. Hence, shortening the maturity of government debt issuance does lower the long-term rate, provided inflation expectations do not change.

---

12 The estimates of the coefficients of other variables were very close to those found by Laubach (2009).
13 Using a very similar specification, Iwata and Fueda-Samikawa (2013) also found that lengthening the maturity of government bond issuance in Japan pushed long-term interest rates up significantly.
A number of other recent empirical studies have also found that changes in the relative supply of bonds influences interest rates. Greenwood and Vayanos (2010) find that the relative supply of long-dated securities is positively related to the yield spreads and subsequent excess returns over short-term yields. In a similar vein (but looking from the demand side), Hanson and Stein (2012) find that commercial banks and primary dealers change the maturity of their government bond portfolios in response to changes in short-term interest rate expectations, thus affecting term premia. The preferred-habitat models of the 1960s are getting renewed attention.

Further research on how central bank purchases in major reserve currency countries have affected other government bond markets would be very useful. By way of simple illustration, Table 3 shows, for both a pre-crisis and a post-crisis period, that changes in the U.S. 10-year yield (Δ LTR (U.S.) in the table) have a greater correlation with yields in France, Germany and the U.K. than with changes in their local short-term rates (Δ STR).

Table 3: Changes in 10-year yields

<table>
<thead>
<tr>
<th></th>
<th>U.S. 10-year yield</th>
<th>Local three months</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>January 2000 - December 2007</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>0.50 (12.8)</td>
<td>0.17 (2.1)</td>
</tr>
<tr>
<td>Germany</td>
<td>0.49 (12.1)</td>
<td>0.19 (2.2)</td>
</tr>
<tr>
<td>U.K.</td>
<td>0.47 (11.0)</td>
<td>0.36 (3.7)</td>
</tr>
<tr>
<td>Japan</td>
<td>0.04 (0.7)</td>
<td>-0.08 (0.6)</td>
</tr>
<tr>
<td><strong>January 2009 - December 2014</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>0.64 (8.2)</td>
<td>0.20 (1.3)</td>
</tr>
<tr>
<td>Germany</td>
<td>0.71 (11.5)</td>
<td>0.17 (1.6)</td>
</tr>
<tr>
<td>U.K.</td>
<td>0.83 (12.4)</td>
<td>0.50 (2.1)</td>
</tr>
<tr>
<td>Japan</td>
<td>0.17 (4.8)</td>
<td>-0.20 (1.9)</td>
</tr>
</tbody>
</table>

Note: The OLS equation was Δ LTR (x) = α + β Δ LTR (U.S.) + c Δ STR (x), using monthly data where LTR (x) in the 10-year yield of government bonds of country x and STR (x) is the corresponding 3-month rate. T-statistics are given in brackets.
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Japan is an exception, perhaps because it is hard to measure interest rate effects when rates have been so low for so long. It may also be a reflection of the very strong home bias of Japanese banks and other financial institutions. The events in the summer of 2013 seem to confirm this dependence. French, German and U.K. yields actually rose in line with movements in U.S. rates despite Bank of England and ECB forward guidance on 4 July 2013 seeking to assure investors that their policy rates would remain low. All yields then fell on the Federal Reserve’s “no tapering” announcement on 18 September. Equally, events in early 2015 – dominated by new policy announcements from the ECB – show that U.S. long-term rates can be pulled down by foreign forces (in this case, the sharp decline in euro area long-term rates following the announcement of large-scale government bond purchases by the ECB).

5.2 The exchange rate
Other things equal, portfolio rebalancing effects mean that central bank purchases of domestic assets on a large scale (that is QE), driving down the yield on such assets, will lead to currency depreciation. Conversely, reversing QE will lead to currency appreciation. Figure 3 shows the balance sheets of the ECB, the Bank of England and the Bank of Japan relative to that of the Federal Reserve. During the past few years, the relative movements have been very large. And those shifts do appear to have influenced exchange rates.

At the time of writing (March 2015), the balance sheet policies of the world’s major central banks have begun to diverge in a new way. The Federal Reserve and the Bank of England, which expanded their balance sheets aggressively in earlier years, have now ended net asset purchases but the Bank of Japan is continuing to purchase Japanese Government Bonds (JGBs) on a massive scale. The ECB has also launched a major program. Expected future movements in the policy rate mirror this divergence. Markets expect the federal funds rate and the U.K.’s bank rate to rise during 2015. By contrast, euro and yen interest rates are expected to remain close to zero until end-2016.

One important consequence of these developments has been a sizable appreciation of the dollar (and to a lesser extent of sterling) and corresponding depreciations in the euro and the yen.
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The financial implications of any large and sustained dollar appreciation for non-dollar countries will be significant. International debts — bank loans, bonds, etc. — are still denominated predominantly in dollars. Partly for this reason, many non-U.S. central banks (especially in emerging markets) would be inclined to follow changes in the Federal Reserve’s funds rate. They may also raise rates to forestall too sharp a depreciation against the dollar.

**Figure 3: Central bank balance sheets and exchange rates relative to the U.S.**(a) (January 2010=100)

(a) Total assets converted to U.S. dollars at the average exchange rate of 2010. An increase in the exchange rates implies an appreciation against the U.S. dollar.
Sources: Datastream; national data.

**6. Asset prices and interest rate risk**

Lowering interest rates further out the yield curve reduced the funding costs of banks (which do not depend only on the policy rate) and helped lower bank lending rates [Illes et al. (2015)]. Getting long-term rates down brought financial asset prices in the core economies back up to pre-crisis levels, even higher. And, with the arguable exception of the Lehman debacle, central banks recognized their lender-of-last-resort role for the banking system better than in the 1930s. Gambacorta et al. (2012) find that the expansion of central bank balance sheets increased real GDP. For all these reasons, there is little doubt that QE and other exceptional policies have “worked.”
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There is, however, an intertemporal rejoinder. Will the exit from this extraordinary balance sheet position be handled well enough to avoid negative consequences in future years? There is a reassuring answer. The massive purchases of central banks have had wealth effects that should, in time, stimulate global demand. In addition, stronger asset prices should raise the value of potential collateral for new loans and, therefore, ease the borrowing constraints facing firms and households. Once stronger aggregate demand is assured, the central bank could readily unload the assets acquired during the crisis.

The problem with this reassuring answer is that the recent recession – now more than five years long – has lasted so long. Financial asset prices did get a considerable boost. Yet the hoped-for growth in real GDP that would have allowed central banks to scale back crisis-related asset purchases did not materialize. This disconnect between the rapid rise in asset prices and the persistent weakness of demand is worrying. Is this a bubble that could suddenly deflate? Or do forecasters underestimate the strength of real demand over the next couple of years?

Another worry is that global net interest rate exposures must have risen substantially since the crisis. Yields in all major bond markets have fallen to very low levels even as outstanding stocks have risen. Bond investors will lose once long-term rates increase. Much of this risk is in the banking system: sovereign exposures accounted for 19% of total banking book exposures of large international banks in mid-2012, compared with 11% at end-2008 [estimates given on page 44 of Turner (2013)]. Lower-rated corporations have also benefited from the negative or zero term premium in government debt markets, so credit risks have probably risen too. Furthermore, the link between U.S. yields and yields on EM bonds has increased substantially over the past decade, and EM bond issuance has risen [Pradhan (2014)].

The vastly increased volume of bonds outstanding, some held in leveraged portfolios, means that bond market volatility will rise much more when market sentiment changes than it did in the past when outstanding stocks of bonds were much lower. The turbulence also illustrates the dominance of U.S. Treasuries.
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A substantial rise in U.S. long-term rates took place without any change in the policy rate in the U.S.\textsuperscript{14} Such a strong and global market reaction suggests some sudden unwinding of leveraged positions and powerful contagion across markets.

It is difficult to know what lies ahead. Central banks in the advanced economies are not comfortable with the size and structure of their balance sheets. From September 2009, governors of the major central banks (including Messrs Bernanke and Trichet) expressed the hope that they would soon be able to begin their “exit” from unconventional policies. But such hopes were dashed by the deepening euro crisis from mid-2010. Not only have central bank balance sheets further expanded but – equally important – the maturity of their assets has become much longer.\textsuperscript{15}

Since their liabilities have remained of very short maturity (typically bank reserves), central banks have a growing maturity mismatch. A sizable term spread gives the central bank a positive running yield: this has boosted its profits typically remitted to the Treasury, often creating a favorable impression with parliaments. But higher short-term rates could at some point lead to central bank losses. This has no fundamental significance. The central bank does not face the financing constraint in its own currency that a private agent faces: it can print money. Likewise, a government can raise taxes. But losses could have political consequences that might weaken central bank independence. [And in some circumstances – for instance, a disruptive shock to inflation expectations – macroeconomic policy would face more intractable dilemmas: see Sims (2013)].

There will be many years ahead when central banks will have government and other bonds on their balance sheets. The accumulation of such substantial holdings was justified mainly by the crisis that confronted central banks. It is difficult to know at present what the new “normal” size of such holdings will be. How quickly central banks reduce their bond portfolio will depend on (unknown) macroeconomic or financial developments over the next several years.

\textsuperscript{14} This was quite unlike the 1994 bond market sell-off, when successive rises in U.S. long-term yields were driven by changes in expectations of future policy rates [Adrian and Fleming (2013)].

\textsuperscript{15} Some use the term “qualitative easing” to cover central bank purchase of longer-dated or higher-risk paper.
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Could central bank sales or purchases of government bonds become viewed as a second policy instrument once monetary policy begins to be tightened? Actively selling assets in secondary markets (“quantitative tightening”) could well moderate any increase in the policy rate. Both the Federal Reserve and the Bank of England have explicitly recognized this trade-off. The May 2014 Inflation Report of the Bank of England noted that “any reduction in the stock of purchased assets is likely to be associated with a lower path of Bank Rate.” The FOMC minutes in April 2011 reveal that participants noted that “for any given degree of policy tightening, more-gradual sales that commenced later in the normalization process would allow for an earlier increase of the federal funds rate target from its effective lower bound than would be the case if asset sales commenced earlier and at a more rapid pace.”

But one practical difficulty is that it is impossible to quantify how bond markets would react to central bank sales. Using estimates based on past experience of the policies that change the volume and maturity of government debt to be sold (such as those previously mentioned) fail to take account of signaling effects. News of central bank selling, even on a modest scale, could send markets a signal that is more powerful than the actual sales – “They are testing the water for further, larger sales.” Financial markets know not only the size of central bank bond holdings, but also the great strategic power of central banks as non-commercial players. The hypersensitivity of markets to guesses about future central bank sales was very well illustrated over the summer of 2013. The mention by Chairman Bernanke of what should have been obvious – that at some point the Fed would reduce the pace of its purchases – wreaked havoc in global bond markets, even with the very clear commitment of the Fed to keep short-term rates close to zero for a considerable time. The size and spread of this market adjustment suggest that many investors had highly leveraged positions.

As ElErian (2012) puts it, “in game theoretic terms, central banks are non-commercial players ... [they have] a printing press ... and the structural patience that far exceeds the ability of any other participant to remain in the trade.”
For these reasons, central banks have underlined their caution about using their balance sheets as readily as they might adjust the policy rate “because of uncertainty about how non-conventional tools will work or because of the potential costs associated with the use of such tools in terms of market functioning and the risks of future financial instability” [Dudley (2013)]. Both the Federal Reserve and the Bank of England have ceased new asset purchases on a net basis, but continue to reinvest the proceeds of maturing debt. When they ended asset purchases, both central banks underlined their determination to keep the policy rate at near zero for a long time. And both have indicated that the initial normalization steps will take the form of policy rate increases, rather than sales of assets. The Bank of England has explained its logic of sequencing by indicating “it is likely to defer sales of assets at least until the Bank Rate has reached a level from which it could be cut materially, were more stimulus to be required.”

There is great uncertainty about when and how fast central banks will reduce their holdings of bonds beyond the next couple of years, once policy rates are well clear of zero. The option of just allowing bonds to mature – apparently the easy option because it avoids contentious decisions about actual sales – would not be a neutral policy choice. It would mean central bank balance sheets remaining large beyond 2020. And it would also mean that the timing of shrinking – which would have effects on financial markets and the macroeconomy – would depend only on the pattern of past purchases and be quite independent of future economic conditions. It could even continue into the next recession.

No central bank would want to rule out active steps to shrink their balance sheets irrespective of circumstances. As the former Governor of the Bank of England has noted [King (2012)], the central bank must keep the ability to sell the government bonds on its balance sheet if needed, to maintain control of inflation, monetary conditions and the supply of credit.

The policy issues faced by a central bank set on deliberately scaling back its balance sheet have many dimensions. Should the exit be discretionary or rules based? Should the rule be quantity-based or price-based?
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Even when the central bank seeks to retain complete discretion, it would have to find a way to communicate its near-term plans. It would have to clarify to the fiscal authority its future actions in government debt markets. No central bank would want to be seen as gratuitously making the financing conditions of long-term government debt more difficult. Clarifying its future intentions could also help to stabilize market expectations. But any rule would quickly lose credibility if too inflexible. Balancing the need to stabilize market expectations with the need to adapt to an uncertain and changing reality makes it more likely that any announcement or commitment by a central bank will be limited in time and in scope.

In making a commitment, central banks have several general options. A number of quantity-based rules can be considered. For example, the central bank could commit to cease purchasing new debt as current bond holdings mature. Alternatively, it could announce a fixed amount of sales to be executed over a given time frame. Any announced plan of sales could also come with specific conditions. For example, sales could be made contingent on the borrowing needs of the government (e.g., by preventing sales when deficits are above a certain level). This would, however, have to be communicated in ways that do not raise a suspicion of fiscal dominance. The former Governor of the Bank of Japan [see Shirakawa (2013)] has repeatedly warned central banks to avoid the trap of fiscal dominance.

Any quantity-based rule could be subject to price-based constraints. For instance, sales could also be halted if market volatility were to jump or if yields were already rising strongly. An explicit interest rate ceiling could put a floor under the price of government debt. This might help banks, pension funds and others who are holding large stocks of government bonds.

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17 The Federal Reserve’s communication about planned asset sales has changed as the stock of bonds on its balance sheet has risen. At first, a policy of gradual, active sales was envisaged. The FOMC meeting in June 2011 stated that the timing and pace of sales would be communicated to the public in advance: once sales begin, the aim would be to eliminate “holdings of agency securities over a period of 3 to 5 years.” No mention was made of Treasury securities. More recently, the sense has been that bond holdings would just run off as they mature. Gagnon and Sack (2014) point out that, at the press conference following the June 2013 FOMC meeting, Chairman Bernanke said that a “strong majority” of the FOMC does not expect to sell assets during the process of normalizing monetary policy.
As Hannoun (2012) points out, however, a major risk with such policies is that of “financial dominance” – that is, the central bank fails to tighten a policy when needed because it is frightened of the bond market’s reaction. He also warned of the danger of an asymmetric policy reaction in entering and exiting balance sheet policies – if assets bought with a view to lifting markets can only be sold in a way designed not to lower markets. In a similar vein, Artus (2014) warns about falling into a trap of “irreversibility” of monetary policy ease because of fears that any abrupt rise in long-term rates would generate large capital losses for banks and institutional investors.

There is a simple intertemporal reason why asymmetric reactions in macroeconomic policy can be troubling: they can move balance sheet variables further away from desirable levels, and so constrain future policy. It was because central banks had very small holdings of government bonds at the beginning of the recession that they were in a position to buy bonds in the recession on such a large scale without compromising their credibility. If central banks had already held 30% of outstanding government debt in 2008, would they have got away with purchasing a further 30% during the crisis?

7. Conclusion
The financial crisis, and the monetary policy responses to it, is forcing a pragmatic rethinking of the theory and instruments of central banking. There is greater awareness of the inherent limitations of monetary policy, and no new, simple paradigm has emerged. “Dogmas” of the earlier “doctrine” have been proved false. Central banks have rediscovered old tools, and used them with apparent and immediate success in influencing financial variables. The near-term risks that some in the early stages of the crisis saw (e.g., higher inflation) have not materialized. Time will tell about the longer-term side effects.

18 Federal Reserve Governor Stein (2014) explains that much depends on how markets formulate their expectations of future central bank action. In current circumstances, he defends gradualism in policy to avoid unnecessarily destabilizing markets. But, in other circumstances, “one may be able to achieve a better outcome with a central banker who places a lower weight on the intermediate objective of not roiling the bond market.”

19 See Posen (2013).
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The consequences of the massive increase in long-term assets held by the central bank will last much longer, and are more uncertain, than changes in the policy rate. The effect on exchange rates of great divergence in changes in the size of the balance sheets of the major central banks is difficult to quantify. Recent large declines in the dollar value of the yen and the euro suggest such effects could be large.

The wide sweep of post-crisis policies has in effect increased the number of variables in future central bank reaction functions. And many of these variables are more susceptible to government policies than is the policy rate. Markets have much more to guess about than before the crisis. Don Kohn (2013) believes that “this second guessing that is more intense than normal” could undermine “the perceived political legitimacy of the central bank and support for its independence in the conduct of policy.”

For many years ahead, the balance sheets of central banks will remain much more extended (both in size and in the nature of assets held) than is desirable in any normal equilibrium. Markets will, therefore, have to make judgments about how central banks would seek to adjust the size and composition of their balance sheets – over a period of years – to future macroeconomic or financial shocks. Markets will also have to assess fiscal policy: any prospect of chronic government overindebtedness will make it harder to sell government bonds. Another important influence will be government’s financing choices (what maturity? more floating rate debt?). Furthermore, regulations that affect financial institutions’ holdings of government bonds have an impact that is at present difficult to gauge. During the years ahead, the level (or at least the volatility) of benchmark long-term interest rates will get more attention than in the pre-crisis period. But any policy guideline for the long-term interest rates, inevitably controversial, may remain only implicit. As central banks exit, and a normal term premium is re-established, the macroeconomic focus of government debt managers – and how they react to movements in the long-term rate – will attract more scrutiny.
Moving central bank balance sheets toward more normal levels will require coordination with Treasuries without surrendering monetary policy independence. The warnings of the former Vice Chairman of the Federal Reserve Board [see Kohn (2014)] about the increased threats to central bank independence need to be taken seriously. Clerc and Raymond (2014) strike a similar note about the need for institutional independence.

The communication of future balance sheet policies raises delicate issues. Some opacity is inevitable. When a central bank buys an asset in order to drive up its price, it is unlikely at the same time to announce a specific date for selling the asset back to the market. Doing so, and particularly if the announced date is near, would just blunt the impact of the initial purchase. It would also violate the principle that central bank policies should be “data dependent,” responding to economic developments as they actually unfold. Nevertheless, communicating at least near-term plans for their balance sheet in a convincing way can help to lead markets in the desired direction. As central banks pragmatically monitor market resilience – “How much asset sales can the market absorb now?” – the “financial dominance” trap is to be avoided.

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20 As he puts it, “instrument independence is necessary to overcome the short-term perspective of politicians, who tend to be more interested in boosting economic growth before the next election and less focused on the longer-term inflationary consequences of such actions.”
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