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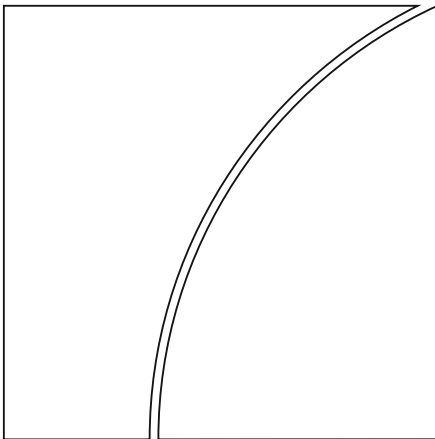
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The exit from non-conventional monetary policy: what challenges?

by Philip Turner

Monetary and Economic Department

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Keywords: Central bank balance sheet, fiscal dominance, financial dominance, exit strategy

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The exit from non-conventional monetary policy: what challenges?

Philip Turner¹

Monetary policies pursued in response to the financial crisis have shown that changes in central bank balance sheets have major macroeconomic consequences. The New Classical Macroeconomics, which gained increasing sway from the late-1980s, had led to an exclusive focus on the policy rate and a neglect of balance sheet effects. Key financial market imperfections that had been demonstrated by earlier (or contemporaneous) advances in microeconomic theory were assumed away under the guise of Ricardian equivalence. Getting their balance sheets back to 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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Contents

Introduction.....	1
Three “dogmas” about monetary quantities	1
Balance sheets	4
The long-term interest rate as key indicator of monetary policy.....	7
Empirical evidence on the long-term interest rate	10
Asset prices and interest rate risk	12
Conclusion.....	17
References	18

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 (“money”) have risen by several multiples. These policies have made the exit challenge faced by central banks more complex. But there is 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 labour between different agencies of government in implementing macroeconomic policies. The central bank has become more dependent on what the 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 and financial dominance.

The main focus of this paper is on the interlinkages between the balance sheets of the central bank, of banks and of government. Other papers in the special volume of *Revue d'économie financière* consider the full range of non-conventional monetary policy operations: the introduction by Bordes and Raymond (2014) provides a good summary. The paper is structured as follows. The first section argues that the New Classical Macroeconomics, which gained increasing sway from the late 1980s, led to an unfortunate neglect of the 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 the central bank's balance sheet, and thus influence the monetary implications. Subsequent sections review how many central banks have used their balance sheet to influence the long-term interest rate. This can create conflicts with the Treasury's debt management strategy. The empirical evidence is that the Federal Reserve has been able to drive down the yield on 10-year US Treasuries. The term premium in core 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 policymakers with many difficult dilemmas once the exit from extraordinary monetary accommodation begins.

Three “dogmas” about monetary quantities

Historically quantity variables have had pride of place in monetary analysis. Before the mid-1980s, for instance, among 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.² 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.³ 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 labour markets. But it assumed perfect financial markets. This assumption was curious, given the emphasis of earlier economic theory that it was market imperfections that give monetary policy much of its power. Even odder was the fact that major contemporaneous advances in *microeconomics*, which had shown how financial markets were imperfect, were overlooked. As Hahn and Solow clearly pointed out 20 years ago:

“In a decade that has seen vast progress in our study of asymmetric information, “missing markets,” contracts, strategic interaction, and much else precisely because those aspects are regarded as real phenomena that require analysis, macroeconomics has ignored them all.”

Arguing that portfolio rebalancing models were of limited use because they treated asset demands as exogenous, this classical school of thought strove to derive such demands from the optimising behaviour of agents subject to intertemporal budget constraints. Their models therefore took, at least as their point of departure, 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). The central bank has 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 the government’s or the central bank’s balance sheet, and would react in ways that neutralise 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 which can constrain future policies. Another is that what the authorities have done today shapes the expectations of private agents, influencing their behaviour. 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

² Before 1971, for instance, the United Kingdom 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.

³ See Vayanos and Vila (2009) for a recent revival of this preferred-habitat model.

assumption. Liquidity constraints and many other interesting macroeconomic questions were in effect side-stepped. 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). Note three “dogmas” that are of interest for the purpose of this paper:

- a) *Open market operations in government bond markets (or in foreign exchange markets) do not change relative prices.* Ricardian equivalence applies to the central bank: 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.
- b) *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 (eg M2, bank reserves etc), 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.
- c) *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 was 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 the 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 affects 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.

Balance sheets

Many debates about the impact of central bank balance sheet policies on the real economy are confused by the failure to recognise three fundamental elements:

- a) 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 (eg 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.
- b) Even if they have not done so up to now, the 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.
- c) 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.

Table 1 illustrates these points with simple balance sheets.

The banking system				Table 1
Central bank		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	Loans from the central bank	
	Equity	Bonds etc	Equity	
		Other assets		

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. EME central banks (and Switzerland) have mainly bought foreign assets, with an impact on the yields of the major government bond benchmarks (Pradhan, 2014). The ECB has 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). Valla (2014) says the central bank thus supported a profitable carry trade which helped bank

recapitalisation. The Bank of England, the Bank of Japan and the Federal Reserve have bought government and other bonds directly. Policies aimed at lowering bond yields in the domestic market will usually cause reallocations in international bond portfolios, and so likely to influence exchange rates.

Banks' holdings of domestic government bonds¹

Table 2

	France	Germany	Italy	Spain
Oct 2013	3.4	4.5	10.3	9.4
Dec 2009	4.8	3.6	5.6	5.2
Dec 2008	4.5	2.9	4.8	3.4
Dec 1998	8.2	4.2	12.5	11.3

¹ As a percentage of total assets.

Source: ECB.

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 the central bank to buy specific assets – even before actual purchases – that has eased liquidity constraints of holders of these assets. For these reasons, there is not likely to be a simple and mechanical link between the central bank's 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 – monetary expansion.⁴ But there is nothing intrinsic or inevitable about the link between central bank asset purchases and monetary expansion. A government could have prevented any monetary expansion either by injecting equity capital into the central bank or by increasing its own deposits with the central bank. If the 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. In any event, no government sought to finance the bulk of the expansion in central bank balance sheets.

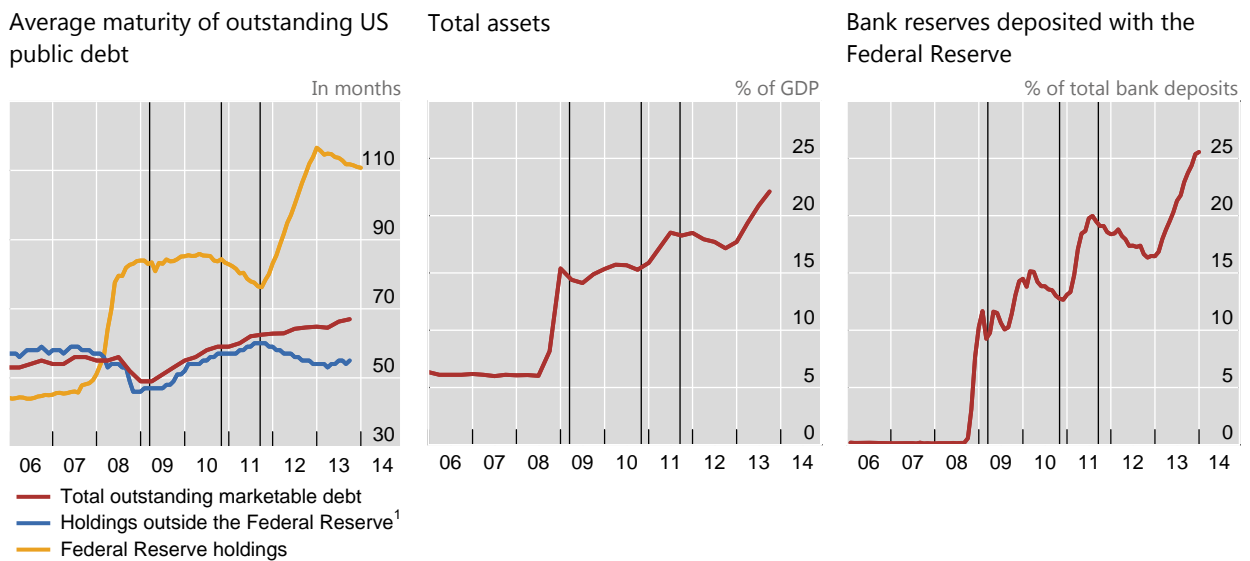
As a result of increased central bank liabilities, the balance sheets of commercial banks have tended to become more liquid. The right-hand panel of Graph 1 shows the case of the United States. Exceptional central bank asset purchases drove bank reserves (ie commercial bank deposits with the Federal 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. 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

⁴ “High-powered money” was the term that used to be used.

this orientation.⁵ 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 behaviour. 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.

The balance sheet of the Federal Reserve and US public debt

Graph 1



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

¹ Private sector and foreign official holdings.

Sources: Datastream; US Treasury; national data.

Could this bloated level of bank reserves create difficulties when central banks want to normalise monetary policy? In theory, central banks could always control how quickly banks run down their reserves by raising the interest rate paid on bank reserves. In practice, the sheer size of these reserves may create unexpected challenges. In addition, 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", to use the words of Gagnon and Sack (2014). Getting this right when markets are unsettled or when monetary policy frameworks are in flux may not be easy. Some have argued that, in certain circumstances, the authorities in advanced countries may want to support their exit

⁵ 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 does appear to lead to an expansion in bank credit to the private sector (Gadanez et al, 2014).

policy by imposing quantitative rules.⁶ 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.⁷ It may require a new operating regime: see Gagnon and Sack (2014).

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 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). But long-term rates are also influenced by variable term premia (see Graph 2 discussed below) that central bank purchases could influence.⁸ Gertler and Karadi’s (2013) new finding that the term premium plays a significant role in monetary policy transmission underlines the importance of the long-term rate.

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.⁹ In some circumstances, 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

⁶ 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 per cent 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).

⁷ 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 has 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.

⁸ The expectations theory of the interest rate assumes that bonds of different maturities are perfectly substitutable. Arbitrage would ensure that the interest rate on a n -period bond, equal the (geometric) average of the interest rates on n consecutive one-period bonds. However, if the investor plans to sell the bond before redemption, holding a long-term bond is risky because the short-term interest rate could rise. For that reason such an investor would demand compensation, or a term premium. Other investors – normally a minority – may want to “lock in” current interest rates, and so be willing to pay a premium.

⁹ Keynes argued along these lines in both the *Treatise on Money* and the *General Theory*, and both James Tobin and Milton Friedman echoed this analysis (Turner, 2013). Brainard’s (1967) uncertainty principle echoes this thinking.

movements in the policy rate. And long-term rates might well, with a lag, actually overreact, forcing a reversal of the policy rate increase.

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”. 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 induces banks to reduce the supply of credit (Adrian and Shin, 2011). For all these reasons, the management of the yield curve is a key element of the macroprudential tool-kit.

Link with government debt management

The central bank controls the overnight rate but does not have sole jurisdiction over policy 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 have the capacity through their transactions to 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 Zero Lower Bound (Goodhart (2012) and Ellison and Tischbirek (2013)). While it is true that asset substitutability is lower in crisis times (so portfolio rebalancing effects 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.¹⁰ 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.

¹⁰ “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.

But from the mid-1980s, this began to change. With inflation becoming a pressing problem, more questions were asked about the intertemporal coherence of policies: an independent central bank with a long time horizon was seen as a solution. In the interests of fiscal discipline, central banks were not allowed to finance government and held only limited stocks of long-term government bonds. There was also a growing awareness 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 minimise expected 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 minimisation mandates, and not by macroeconomic developments. Issuance of short-dated debt should be minimal.

The large-scale acquisition of government bonds by central banks as a result of the financial crisis has obviously undermined this separation. Treasuries have been lengthening the maturity of their issuance since the start of the crisis. In doing so, they were inadvertently offsetting part of monetary expansion that Quantitative Easing was meant to achieve.¹¹ It is not difficult to see why this might happen. 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 favourable market conditions created by the central bank. In any event, there is empirical evidence that the US Treasury has lengthened the average maturity of its debt issuance when the fiscal deficit is high and issued shorter term when the spread between the 10-year yield and the Federal funds rate is high.¹²

¹¹ See Blommestein and Turner in BIS (2012). The average maturity of JGBs rose from five years in FY 2000 – before Japan’s first QE policy – to almost eight years in 2013. See Iwata and Fueda-Samikawa (2013) for an analysis of Japanese evidence.

¹² Evidence is provided in Table 2 in Blommestein and Turner in BIS (2012).

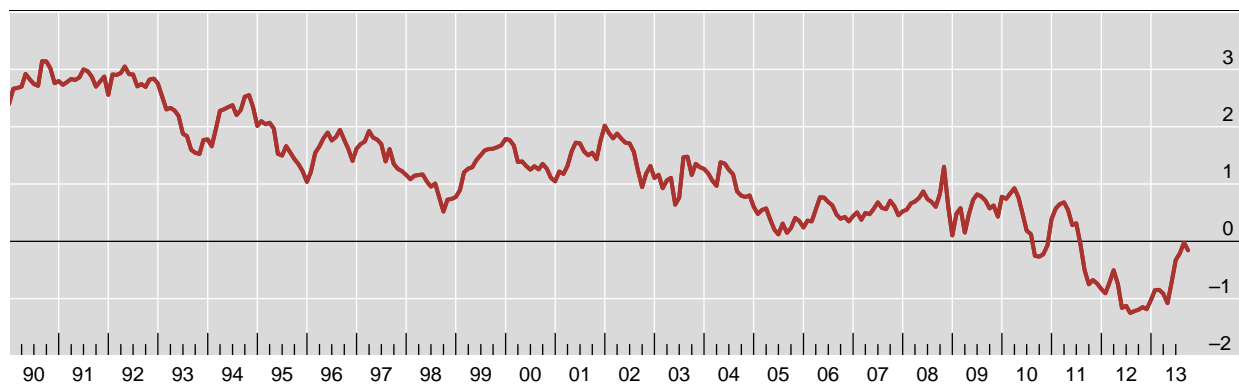
Empirical evidence on the long-term interest rate

Graph 2 shows how the term premium in US Treasuries has changed over the past 25 years (Hördahl and Tristani (2014)). There appears to have been a trend-like decline since 2000, with the low or even negative readings during the most recent years. On the face of it, 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 (eg foreign official demand for high-quality US dollar debt, maturity arbitrage in US dollar securities by European banks etc) did depress term premia in US Treasuries (see, for example, Bertaut et al, 2011).¹³ 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.

The term premium in US 10-year nominal government bond yields¹

In per cent

Graph 2



¹ Sum of inflation and real yield risk premia. These are calculated using the BIS term structure model.

Sources: Bloomberg; national data; BIS calculations.

Several event studies have shown that the announcements of large-scale central bank bond purchases in Japan, the United Kingdom and the United States 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.

¹³ Shin (2012) provides a comprehensive summary of these important mechanisms. European banks – not US banks – held most of the special purpose vehicles holding US mortgage-based securities. See also Borio and Disyatat (2011).

To address these issues, Chadha, Turner and Zampolli (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 which 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 US Treasury debt held outside the Federal Reserve are reproduced in Graph 1 (above). 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.¹⁴ Hence shortening the maturity of government debt issuance does lower the long-term rate, *provided inflation expectations do not change*.¹⁵

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 have affected other government bond markets would be very useful. But the unique position of US Treasuries must be remembered – it provides the global benchmark. Table 3 shows, for both a pre-crisis and a post-crisis period, that changes in the US 10-year yield (Δ LTR (US) in the Table) have a greater impact on yields in France, Germany and the United Kingdom than do changes in their local short-term rates (Δ STR). 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 UK yields actually rose in line with movements in US rates despite Bank of England and ECB forward guidance on 4 July 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.

The unique position of US short-term rates should also be remembered. Because the dollar is the funding currency for many activities of non-US international banks (and for short-term borrowing in capital markets) and because many non-US central banks would be inclined to follow the Federal Reserve, any sharp rise in the Federal funds rate would have major global significance.

¹⁴ The estimates of the coefficients of other variables were very close to those found by Laubach (2009).

¹⁵ 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.

Changes in 10-year yields

Table 3

	US 10-year	Local 3-months
<i>Jan 2000–Dec 2007</i>		
France	0.50 (12.8)	0.17 (2.1)
Germany	0.49 (12.1)	0.19 (2.2)
United Kingdom	0.47 (11.0)	0.36 (3.7)
Japan	0.04 (0.7)	−0.08 (0.6)
<i>Jan 2009–Nov 2013</i>		
France	0.64 (7.2)	0.21 (1.2)
Germany	0.70 (10.0)	0.17 (1.4)
United Kingdom	0.83 (10.8)	0.56 (2.0)
Japan	0.16 (4.2)	−0.20 (1.8)

Note: The OLS equation was $\Delta \text{LTR}(x) = \alpha + \beta \Delta \text{LTR}(\text{US}) + c \Delta \text{STR}(x)$, using monthly data where LTR (x) is 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.

Asset prices and interest rate risk

Getting long-term rates down has contributed to bringing financial asset prices in the core economies back to pre-crisis levels, even higher. And, with the arguable exception of the Lehman debacle, central banks recognised their lender-of-last-resort role for the banking system better than in the 1930s. Gambacorta et al (2012) show that the expansion of central bank balance sheets did increase real GDP. In this sense, QE policies have worked.

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 materialise. 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. At the core of this is US Treasury debt outstanding held outside the Federal Reserve. This rose from \$3 trillion in early 2007 (yielding an average of 5%) to \$8 trillion (with an average yield of 1%) by mid-2013. The rise of

government debt in other advanced economies – financed at yields that track US Treasuries – is well-known. 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 US yields and yields on EM bonds has increased substantially over the past decade, and EM bond issuance has risen (Pradhan, 2014).

The scale of market turbulence in global bond markets from May to September 2013 demonstrates the importance, in any correction, of the outstanding stocks of assets. Quantities matter. The vastly increased volume of bonds outstanding, some held in leveraged portfolios, means that 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 US Treasuries. A substantial rise in US long-term rates took place without any change in the policy rate in the United States.¹⁶ 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.¹⁷

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 favourable impression with parliaments. But higher short-term rates could at some point lead to central bank losses. This has no fundamental significance because the central bank does not face the financing constraint in its own currency that a private agent faces: it can print money. Likewise, the 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 warranted only by the crisis situation 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.

¹⁶ This was quite unlike the 1994 bond market sell-off, when successive rises in US long-term yields were driven by changes in expectations of future policy rates (Adrian and Fleming, 2013).

¹⁷ Some use the term *Qualitative Easing* to cover central bank purchase of longer-dated or higher risk paper.

Could central bank sales or purchases of government bonds become viewed as a second policy instrument once monetary policy begins to be tightened? Policies of Quantitative Tightening could well moderate any increase in the policy rate. Indeed, 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 normalisation 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 mentioned above) fail to take account of signalling 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.¹⁸ The hyper-sensitivity 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.

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). The Bank of England stopped expanding its Asset Purchase Facility in November 2012, but continues to reinvest the cash flows from maturing gilts. The Federal Reserve announced in December 2013 its decision to reduce its monthly bond purchases by \$10 billion. Both central banks have underlined their determination to keep the policy rate at near zero for a long time.

There is great uncertainty about when and how fast central banks will reduce their holdings of bonds in the years ahead. 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.

Few general indications have been given by central banks of the principles that might guide how they would shrink their portfolios. The Bank of England has stated

¹⁸ As El-Erian (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.”

that it would begin to sell bonds only after it has begun to raise the policy rate. It would “work closely with the DMO” to “avoid generating unnecessary volatility in the gilt market” (see Fisher, 2010). The FOMC at their meeting in June 2011 had laid down some principles for the exit strategy. One was that purchases of bonds would stop before the policy rate was increased. Another was that sales of agency securities (no mention was made of Treasury securities – see footnote 20) would come only after the first increase in the Federal funds rate. The June 2012 minutes, however, suggested that most participants no longer expected sales of mortgage agency securities during the normalisation process. There was some disagreement on whether Treasuries or agency securities should be sold first.

How could the central bank proceed in adjusting its balance sheet after the first rise in the policy rate has been decided?¹⁹ In most circumstances, central banks in tightening may prefer to rely largely on increasing the policy rate – because that is what they are most familiar with. But few central banks would want to rule out active steps to shrink their balance sheets. 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?

At one extreme, the central bank could seek to retain complete discretion. Even so, it would still have to clarify how it would coordinate in some way with the fiscal authority. Because no central bank would want to be seen as making the financing conditions of long-term government debt more difficult, it may be expedient for the central bank to swap with the Treasury its long-term bonds for Treasury bills or for floating rate Treasury bonds. Such an operation would have no effect on the amount of long-term debt in the market, but would increase the direct dependence of government financing costs on short-term interest rates. This may increase government pressure on the central bank to keep the policy rate down.

At the other extreme, the central bank could commit to some long-lasting rule specifying what it will do and how. Some believe that rules are more necessary when any government agency embarks on unorthodox policies. And a rule could simplify coordination with the Treasury as well as help stabilise market expectations. But any rule would quickly lose credibility if it is not reviewed periodically or if it does not allow enough flexibility. Balancing the need to stabilise market expectations with the need to adapt to an uncertain and changing reality make it more likely that any rule (that is, announcement or commitment) by central banks will be limited in time and 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

¹⁹ Turner (2013) outlines a schematic decision-tree for such an exit strategy.

time frame.²⁰ 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 (eg 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. 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 policy when needed because it is frightened of the bond market’s reaction.²¹ 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 economic policy are usually 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?

²⁰ For example, 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. 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 normalising monetary policy.

²¹ 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 destabilising 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”.

Conclusion

The financial crisis and the monetary policy responses to it will force a major rethinking of the theory and instruments of central banking. “Dogmas” of the earlier “doctrine” have been proved false. Central banks have rediscovered old tools, and used them with apparent success. But 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 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. Kohn (2013) believes that “this second guessing 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 judgements 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 the government’s financing choices (what maturity? more floating rate debt?). And 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 rate, 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.

Getting central bank balance sheets back to 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.²² Clerc and Raymond (2014) strike a similar note about the need for institutional independence.

Communicating decisions in a convincing way designed to lead markets will be essential. As central banks pragmatically monitor market resilience (“how much asset sales can the market absorb now?”), the “financial dominance” trap is to be avoided. Central banks are at present fortunate that inflation expectations remain low as the economy recovers, favouring the gradual and deliberate normalisation of monetary policy that now appears to be beginning. This opportunity is not to be missed.

²² 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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