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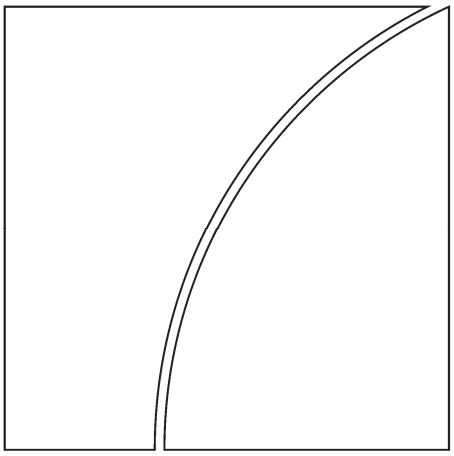

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Benign neglect of the long-term interest rate

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Keywords: Central banks, bond market crisis, exit strategy, sovereign debt management

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Benign neglect of the long-term interest rate

Philip Turner

Abstract

Large-scale central bank purchases of government bonds have made the long-term interest rate key in the monetary policy debate. How central banks react to bond market movements has varied greatly from one episode to another. Driving the term premium in long-term rates negative may stimulate aggregate demand. And a negative term premium encourages borrowers to lengthen the maturity of their debts. Such a reduction in maturity risks makes the financial system more resilient to shocks, and in particular can help emerging economies finance their heavy infrastructure and housing investment needs more safely. But an extended period of very low long rates and high public debt creates financial stability risks. Interest rate risk in the banking system has grown, and some institutional investors face significant exposures. Central banks in the advanced economies now hold a high proportion of bonds issued by their governments, most of which have so far failed to arrest the rise in the ratio of government debt to GDP. Implementing an effective exit strategy will be difficult. Current policy frameworks should be reconsidered, with a view to clarifying the importance of the long-term interest rate for monetary policy, for financial stability and for government debt management.

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Introduction

There is no explicit policy framework for the long-term yield on government bonds. A reassuring justification for this would be that, if policymakers – government, central banks and debt managers – pursue policies that stabilise the macroeconomy and the financial system, then the long-term rate would just take care of itself. The long-term rate would be determined by underlying saving and investment propensities over which central banks have little influence. The long-term rate would react in a stabilising way to the economic cycle. Such rationalisations of what might be called "benign neglect" of the long-term interest rate are not without attraction. Best left to the market, we would like to think.

But benign neglect has been brought to an end by the financial crisis. This is most evident in the central bank measures to drive long-term rates lower.[1] Yet given high government debt and the size of central bank holdings the question of what should be the policy framework for the long-term interest rate is bound to become more prominent. The long-term interest rate is key not only for monetary policy but also for government debt management and for financial stability. In principle, any policy framework should recognise this, and take account of the monetary policy/financial stability/debt management interlinkages. In practice, however, forming a consensus on this will be very hard. This paper addresses this question by exploring some of the main elements that any policy framework might have to consider, especially the implications for financial stability. These elements have major implications for the strategy of exit from large-scale central bank holdings of government bonds. The structure of the paper is summarised in the Box overleaf.

1. Is recent monetary policy unconventional?

The overnight rate (or a similar short-term rate) became the dominant monetary policy instrument in most advanced economies from the late 1980s ("conventional policy"). The size and structure of central bank balance sheets – or indeed any quantity measure – came to be regarded as of little or no significance in most (but not all) jurisdictions.[2] In earlier periods, however, much attention had been focused on the central bank's balance sheet. And it was normal for central banks to be able to use the much wider range of instruments made feasible by their balance sheets. These are now called "unconventional", but in fact have a long history.

[1] This did not, however, come entirely out of the blue. There was a debate in 2002–03, to which Bernanke et al (2004) were notable contributors, about lowering – relative to expectations of future short-term rates – the long-term rate by direct central bank action. But this debate was only about the special case of a Zero Lower Bound (ZLB), when the overnight rate had reached a floor.

[2] The notable exception among the advanced economies was the "two-pillar strategy" of the old Bundesbank. Quantity measures remained important in guiding policy considerations long after financial innovation had forced other central banks to abandon the monetary targets that had become popular in the 1980s. The ECB inherited this strategy. In addition, the Bundesbank took the view that quantity-based measures could improve the monetary transmission mechanism, and used reserve requirements to control credit creation by banks. Many central banks in the developing world maintained a similar focus on quantities – both in guiding policy decisions and in implementing them.

Several factors explain this development. The first was academic "fashion", notably the so-called new Keynesian approach to monetary theory. This was supported by a couple of important assumptions. One was that of rational agents responding rationally to policy changes. Long-term expectations of inflation, growth etc could be well-anchored by credible macroeconomic policy frameworks. The setting of the policy rate by a central bank with a credible commitment to price stability would affect the path of expected future interest rates. Given a (stable) term premium, this would determine the long-term interest rate.

A summary

The central bank balance sheet, historically regarded as a key element of monetary policy, is once again at the centre of attention (section 1). An old debate about the place of the long-term interest rate in monetary policy frameworks has been revived by massive central bank purchases of government bonds (section 2). Any analysis of the market impact of such policies must also take account of the effect of policy on the average maturity of government debt issuance. Shortening the maturity of issuance lowers long-term yields (section 3). In practice, central bank policy decisions, notably on the short-term interest rate, have often been influenced by developments in bond markets. But it is difficult to discern any pattern in the nature of these links because they have differed so much from one episode to another (section 4).

There is no consensus on the risks these policies create. Driving the term premium into negative territory may have diminishing returns in stimulating aggregate demand. The impact on financial stability is uncertain. On the one hand, there are major financial stability risks from large and opaque interest rate risks; on the other hand, firms and others are encouraged to lengthen the maturity of their debts and this reduces maturity mismatches on their balance sheets (section 5). This general conclusion applies with particular force to emerging market economies. Since around 2005, long-term interest rates in EME local currency bonds have been pulled down by lower US yields; there was little evidence of such an effect in earlier years. This should help them to nurture the domestic long-term finance they need to finance heavy infrastructure and housing investment demands associated with fast growth and rapid urbanisation without exposing themselves to maturity or currency mismatches (section 6).

Exit from massive central bank holdings of government bonds will be hard (section 7). And it will be made harder by unsustainable fiscal positions in many countries. The Conclusion argues for a reconsideration of current policy frameworks (of central banks, of financial regulators and of government debt managers). The role of the long-term interest rate in macroeconomic policy, which has been too long neglected, needs clarification. The links between the actions of central banks and the policy responsibilities of other agents of government need reassessment.

In this theoretical framework, the term premium does not depend on central bank purchases of government bonds (or on the maturity of government debt issuance). If – contrary to this assumption – the term premium **does** vary with the size and structure of the central bank balance sheet, then the overnight rate by itself will not uniquely define the stance of monetary policy. During the past 25 years, the term premium (discussed on page 12 in section 5 below) has been anything but stable. And many recent empirical studies have shown that shifts in demand of large investors (eg foreign official demand for high-quality US dollar debt, maturity arbitrage by European banks, central bank purchases etc) have depressed term premia.

Another common assumption was that the transmission to lending by commercial banks depended only on interest rates. The reserves position of banks at the central bank – which central bank purchase of government bonds will tend to increase – had no additional impact.

This new Keynesian view was convenient for newly independent central banks. They had very specific mandates for an inflation target. But in many cases they no

longer had responsibility for financial sector supervision or for government debt management (BIS, 2011a).

In their public communications, central banks also found it convenient to focus on the very short-term interest rate that was directly under their control. In their actual deliberations, however, central bankers did pay close attention to movements in the long-term rate, which were seen as shedding light on expectations and as having macroeconomic consequences. But there was no consistent central bank reaction function to changes in yields. In the 1994 bond market crisis (discussed in section 4 below), for instance, unexpectedly strong rises in long-term rates were read as signalling market doubts about the central bank's true commitment to low inflation – hence resulted in sharp and pre-emptive rises in the policy rate. In other periods, by contrast, a rise in (real) long-term yields was judged as having restrictive effects on economic activity – and hence resulted in reducing the urgency of increasing the policy rate. As a result, it is difficult to discern a pattern in central bank reactions to changes in bond yields over the past 20 years. This is true over time, and even more true across different jurisdictions.

This focus on the short-term rate naturally made it easier to separate monetary policy and financial stability. The whole spectrum of interest rates is more relevant for financial stability than the policy rate alone. Any link between the policy rate and risk-taking in financial markets is at best indirect. A number of economists have developed models for such links, and this is valuable work in progress. But there is no consensus how such links work. The more plausible arguments are based on effects due to changes in the shape of the yield curve, rather than to the level of the short-term rate itself.[3]

In any event, there was no simple or obvious correlation between the level of the short-term interest rate and risk-taking or volatility in the financial system in the years immediately before the recent financial crisis. Graph 1 illustrates this point. The steep cuts in the Federal funds rate during 2001 did not reduce risk aversion/market volatility. Nor did raising the policy rate from mid-2004 prevent the marked build-up of risk appetite (or the compression of market volatility) that famously preceded the crisis. But one important caveat, essential for this paper, is that interest rate policies that have a big effect right across the yield spectrum (and especially on the long-term rate) can have major implications for financial stability.

As King (2012) and others have argued, it was the trend-like decline in long-term real interest rates that drove up virtually all asset prices relative to income, a major factor of the recent crisis. It was not the level of the short-term rate per se. How far this decline was exogenous to financial developments and monetary policy decisions is an open question. Shin and others argue that it was partly endogenous through the expansion of the balance sheets of financial institutions. As will be argued further in section 3 below, the strategy and communication of the Federal

[3] Hanson and Stein (2012) argue that a lowering of the short-term rate (and initially a steeper yield curve) induces yield-oriented investors to move to longer-term bonds. This lowers long-term rates – even if expectations of future short rates do not alter. Another influential argument for such a link was that of Adrian and Shin: see for example their 2011 article in the *Handbook of Monetary Economics*. They argue that, empirically, there is a negative one-to-one relationship between the Federal funds target rate and the term spread (defined as the 10-year/3-month Treasury spread). Higher short-term rates reduce the profits banks make from maturity transformation (banks lend at longer maturities than they borrow). Hence increasing short-term rates induces banks to shrink their balance sheet – and this effective change in the supply of credit reduces risk-taking in the financial system.

Reserve's "measured pace" – that short-term interest rates would be raised only gradually – did help investors with leveraged bond portfolios and so put downward pressure on the term premium in the long-term rate.

2. The long-term interest rate in monetary policy frameworks

Central banks cannot avoid following developments in the long-term interest rate. Sometimes this is rather explicit. The Federal Reserve, for instance, has a triple mandate: "…. to promote effectively the goals of maximum employment, stable prices and **moderate long-term interest rates**".[4] Not just a dual mandate! In addition, economics textbooks would often expound a simple story: the central bank could create (destroy) money by buying (selling) government bonds and lowering long-term rates.[5]

The responses of central banks to the recent crisis have put the long-term interest rate at centre stage. A fundamental reason that could justify direct central bank operations in domestic debt markets is that transmission from shorter-term rates to the long-term rate is impaired. This arises because of *imperfect substitutability* across maturities.[6] Only in the limiting case of perfect certainty about future short-term rates are debts of different maturities perfect substitutes for risk-averse investors. Once the path of future short-term rates is uncertain, debt of different maturities can become imperfect substitutes. If expectations of inflation, growth etc become less well-anchored, uncertainty about future short-term rates increases.

A second reason why substitutability across maturities can decline is that banks (and other financial intermediaries engaged in maturity transformation) have capital or liquidity constraints on the scale of the maturity exposures they can assume. We saw in the crisis what can happen when such constraints on banks tighten. These two factors – uncertainty about future interest rates and balance sheet constraints facing banks – will vary over time. Hence the degree of substitutability will be time-varying, and therefore hard to quantify.

It is important to understand that this rationale for central bank transactions in government bond markets can apply to a restrictive monetary policy as much as to an expansionary monetary policy. There could be circumstances when raising the overnight rate might need to be supported by central bank bond sales. The other

[4] Federal Reserve Act of 1977.

[5] There are many rationalisations for distinguishing government bonds from government bills in textbook stories. Government bonds are not money because their holders cannot all exchange them at face value for goods or for other assets at the same time. If a large proportion of them were to try to do so, the market value of the bonds would suddenly decline constraining their purchasing power. In contrast, short-term Treasury bills are closer to money. The size of potential capital loss on sudden sale by many private holders is much smaller – hence Treasury bills can be used in transactions.

[6] A comparable portfolio balance argument applies to central bank operations in foreign exchange markets. If currencies are very close substitutes, sterilised exchange market intervention will have little effect on the exchange rate.

rationale, based on the Zero Lower Bound (ZLB), is asymmetric.[7] It justifies central bank purchases of bonds to support monetary expansion policy, but it does not justify sales to support monetary policy restriction (because the policy rate can be increased). Indeed there have been several instances in the past (most recently from 2004 in the United States – see the discussion of Greenspan's conundrum in the next section) when the failure of the long rate to rise partly frustrated the aim of policy rate increases.

Four international complications

This paper focuses entirely on closed economy channels. Since the international dimension is also important, however, mention should be made of four, somewhat related, international complications when policy focuses on the long-term rate:

(a) A central bank faces a fundamental choice between buying domestic assets and buying foreign assets. Both stimulate aggregate demand, but have a different impact on the exchange rate and thus the tradables/non-tradables split of demand.[8] The size of such effects will depend on how close foreign and domestic assets are as substitutes.

(b) Investors in government bonds are often subject to home bias, which is sometimes encouraged by domestic regulations. Hence the propensity of domestic investors to buy government bonds will influence the proportion of bonds to be sold abroad and thus the long-term interest rate.[9]

(c) Because long-term rates are normally more subject to international influences than are domestic policy rates, the central bank is less able to control its "own" long-term rate than its short-term rate. Countries are exposed to shocks to real long-term interest rates coming from abroad.

(d) The attitude of national policymakers to long-term rates may well be influenced by whether residents or non-residents hold the government bonds. If residents own the bonds, government debt is an asset as well as a liability: higher long-term rates cause a redistribution of income within the country (and are taxed). If non-residents own the bonds, in contrast, government debt is just a liability, and the interest earnings go abroad. Other things equal, reserve currency countries have reason to like low long-term rates on their bonds because they remunerate foreign exchange reserves held by others more cheaply.

[7] Operations in bond markets can be tailored to policy rate signalling. This argument is that a central bank faced with the policy rate stuck at near zero (that is, the ZLB) could simply commit to a zero overnight rate for longer ("forward guidance" – as many central banks have done). They could make this commitment bite by market operations in securities with a maturity of the period covered by forward guidance. Indeed, Bernanke (2002) did advocate, if the federal funds rates 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)".

[8] Broadly speaking, the advanced economies – the focus of this paper – have bought domestic assets. The main exception to this is Switzerland. In contrast, central banks in the emerging markets have bought foreign assets: see BIS (2012c) and BIS (2012d).

[9] There has been a major debate on this issue in Japan. The high saving rates of Japanese firms and households create a strong local demand for JGBs. This allows the government to finance very high debts at low cost. Because of home bias effects, Matsuoka and Terada (2012) argue that, as the outstanding stock of Japanese government bonds will gradually rise relative to domestic private sector financial wealth, long-term yields on JGBs will rise substantially.

3. Macroeconomic link with government debt management

Central bank operations in government bond markets and government debt management policies both affect the maturity of government debt held by the public – in this sense, they are equivalent. Although this simple point was central to much monetary theory and practice from at least 1930 right up to the 1980s, it now gets scant attention in analyses of central bank purchases of government bonds.[10]

From Keynes to Thatcher

In both the *Treatise on Money* and the *General Theory*, Keynes argued that the authorities should be ready to alter the maturity of their government debt to further macroeconomic objectives: "Central banks are always too nervous about buying long-term paper". He lost the argument in the 1930s. The government lengthened the maturity of gilts in the 1930s, and so offset the monetary policy expansion intended by the abandonment of the Gold Standard (which allowed short-term rates to fall) and by forex intervention designed to depreciate sterling. But he won the argument in 1945 at the National Debt Enquiry, and keeping long-term rates down became UK policy in the immediate post-war period.

It was James Tobin who developed rigorous models based on portfolio rebalancing. Milton Friedman in his *Program for Monetary Stability* advanced similar arguments. Both saw central bank open market operations in government bond markets (or equivalent government debt management operations) as capable of affecting the yield curve and therefore an effective instrument of monetary policy.

The *Radcliffe Report* in 1959 on the working of the UK's monetary system took a very similar perspective. Many economists who gave evidence to the Committee (including Richard Kahn, Frank Paish and Harry Johnson) said that monetary policy influenced aggregate demand via the long-term interest rate. Frank Paish established empirically an inverse relationship between the quantity of money and the long-term rate (for a summary of their views see Turner, 2011a).

The Report noted several instances when changes in the Bank rate were not enough to effectively implement a change in the stance of monetary policy. In an analysis that foreshadowed Greenspan's famous conundrum, the Report cited one episode when long-term rates moved procyclically. On this occasion, higher short rates did not, for several months, lead to higher long rates – thus partly frustrating the central bank's intention to tighten policy. After an extended lag, however, long-term rates did eventually rise – but by then the downturn was already beginning.

One of their key policy conclusions was that uncertainty about how and when higher Bank rate would affect the long-term rate meant that using open market operations to move the whole yield curve up could improve the chances of timing countercyclical monetary policy correctly. In modern parlance, their argument was that uncertainty about the consequences for other interest rates of changes in the policy rate (so-called instrument uncertainty) justified the consideration of an

[10] However, Ehlers (2012) analyses the effectiveness of the Federal Reserve's Operation Twist 2 in the context of Treasury debt management choices.

additional instrument. One such instrument could be operations in bond markets.[11] On this ground, the Report rejected HM Treasury's view that bond sales should not seek to influence the long-term interest rate. This long report reached only five conclusions, and one of them was that: "the management of the National Debt … [is] an instrument of single potency … in influencing the structure of interest rates … the monetary authorities must exercise a positive policy about interest rates, long as well as short."

Finally, there were the over-funding policies in the United Kingdom – which could be considered as Quantitative Tightening. Between 1978 and 1984, the UK government issued long-term bonds in excess of financing requirements (to the tune of about 5% of GDP, or about £75 billion at present day GDP). The idea was that sales of bonds to non-banks would curtail broad money growth, and curb inflation much more effectively than just increasing Bank rate.

But in recent years (up until the crisis) many policymakers lost sight of what had been standard monetary theory from Keynes, James Tobin, Milton Friedman and others (and practical economic policy under Thatcher). One illustration of this is the debate triggered by Greenspan's famous conundrum.

Greenspan's famous conundrum

He said that it was a conundrum that the long-term rate had continued to fall even after the Fed had started to gradually increase the Fed funds rate. Raising the policy rate thus did not prove sufficient. Two observations can be made about this:

(a) He ignored the impact of the maturity of US Treasury issuance. There was a significant shortening of the average maturity of US Treasury issuance – which might be regarded as the first QE – in 2001 and 2002.[12] By the end of 2002, new issuance had an average maturity of just two years (Graph 2). In addition, there was a specific debt buy-back programme in the context of budget surpluses. Stein (2012a) points out that, between March 2000 and December 2001, the US Treasury repurchased long-term bonds with a face value of $63.5 billion, about 10% of the value of long-term government debt then outstanding. The average maturity of US Treasuries outstanding did not rise until early 2009.

(b) The Federal Reserve could have driven the long-term rate higher in 2004 by selling the government bonds it had on its balance sheet. The Treasury could have conducted comparable operations. It could have engaged in Quantitative Tightening.

There is, in addition, the "measured pace" strategy of only gradual policy rate changes spread over two years. The intent was to affect market expectations of future policy rates and thus the long-term rate. This is discussed on pages 10–11 in the next section.

[11] The size of the adjustment in Bank rate needed to have the desired impact quickly on the long-term rate could be too disruptive for borrowers with short-term credits. And it might need to be reversed if long-term rates were subsequently to overreact.

[12] Two changes in debt management explain the shortening of average maturity. The first was the decision by the US Treasury in October 2001 to discontinue issuance of the 30-year bond. The second was a change designed to provide bills best suited to cash management: the discontinuation of the 12-month bill from March 2001 and the introduction of a new 4-week bill from February 2001.

The conclusion is that the conundrum did not just reflect demand changes in the market, but also reflected policy choices – by the US Treasury and the Federal Reserve – that in effect helped to keep long-term rates down.[13] The quantitative impact of these policies is a matter of current research. Some preliminary econometric analysis at the BIS suggests that a one-month shortening of the average maturity of US Treasuries held outside the Federal Reserve reduces the 5-year, 5-years forward rate by between 5 and 8 basis points (Chadha et al, 2013). This is a lower-bound estimate so the effects could be larger. Moreover, several event studies have shown that sharp declines in this forward rate have occurred exactly when prominent quantitative measures (QE2, Operation Twist 2, QE3) were announced.

Non-cyclical influences on the long-term rate

It would be a mistake to attribute the recent decline in long-term rates entirely to monetary policy or to other macroeconomic influences (see Turner, 2011b, and BIS, 2011a). Other forces acting include:

- The preference of official investors in EMEs for low-risk debt paper, particularly in US dollars (Bernanke's Global Saving Glut). There was also the eagerness of European banks before the recent crisis to borrow short dollars to invest in longer-term dollar assets: this excessive willingness to do maturity arbitrage in dollar markets helped to drive the term premium down.
- New prudential regulations, mark-to-market accounting rules, actuarial conventions etc induce banks, insurance companies, pension funds and other financial intermediaries to hold a higher proportion of their assets in government bonds.
- Increased demand for collateral in financial transactions in wholesale markets.

A number of recent studies have demonstrated the quantitative importance of factors listed under the first bullet (see, for example, Bertaut et al (2011)). But the quantitative effect of the other forces remains to be established.

One indication that non-cyclical forces have become important is the sharp decline in 5-year, 5-years forward rates (Graph 3). This interest rate should be comparatively free of cyclical influences. This forward real yield was indeed remarkably stable from 2005 to early 2010 at around 2 to 2½% – notwithstanding strong pre-crisis growth, the subsequent deep recession and sizable changes in the Federal funds rate. This is a little below the 2½% to 3½% range that many have taken as the "normal" real long-term rate.[14] But it is the steep drop since early 2011 – when earlier fears of global deflation had surely disappeared – that seems so out of line with historical experience.

[13] As noted below, other factors – such as strong foreign official demand for US Treasuries as developing countries accumulated reserves on a massive scale – were of course also important, and indeed probably more important.

[14] Hicks (1958) found that the yield on consols over 200 years had, in normal peacetime, been in the 3 to 3½% range. After examining the yield on consols from 1750 to 2006, Mills and Wood (2009) noted the remarkable stability of the real long term interest rate in the UK – at about 2.9%. (The only exception was between 1915 and 1964, when it was about one percent lower). Amato's (2005) estimate was that the long-run real natural interest rate in the US was around 3% over the period 1965 to 2001 and that it varied between about 2½% and 3½%.

4. Bond market vigilantes and monetary policy

This section examines two episodes of monetary policy tightening in which developments in long-term rates became very prominent in the policy debate – the 1994 bond market crisis and the "measured pace" of 2004-06 – but in very different ways.

The 1994 bond market crisis[15]

Graph 4 shows the sharp and persistent rise in bond market yields that occurred between October 1993 and November 1994. The unexpected virulence of the bond market reaction gave rise to the catch-phrase "bond market vigilante" – to describe bond market investors who sell bonds because they fear that lax macroeconomic policies will be inflationary.[16] Such fears, whether well-founded or not, inevitably colour decisions about monetary policy. Very turbulent bond markets were, at the time, widely read as warning "signals" – about inflation expectations, about the prospect of unsustainably rapid growth and about uncertainty related to the Federal Reserve's true commitment to low inflation.

By early October 1993, the 10-year yield in the United States (and a few months later in other major advanced economies) had reached a trough at a very low level – both by the standards of the previous decade and in comparison with similar stages of previous recoveries. In the subsequent three months, the long-term yield rose only moderately. Nevertheless a three-year period of trend decline had been broken. As growth picked up, worries about inflation resurfaced; but there was no evidence either of excess demand pressures or of an actual rise in core inflation (shown in the dashed blue line of Graph 4).

In February 1994, the Federal Reserve decided to raise the Federal funds rate by a ¼ point, the first such step for five years. Given that the pace of growth had picked up, and forecasts had been revised upwards, the avowed aim of monetary policy was to be "pre-emptive" – in the sense of raising interest rates before inflationary pressures emerged. Yet this modest action, taken without any sign of imminent inflation, provoked a dramatic change in market sentiment and destabilised bond markets. This surprised most observers including the Fed.

Yields on government bonds in other major countries – even in those where real activity remained comparatively weak and where central banks had actually cut policy rates – also rose sharply. By April 1994, 10-year yields in US Treasuries exceeded 7%. Although there was much discussion at the time about the Federal Reserve being "behind the curve" in its tightening cycle, there was no evidence that near-term inflation expectations (that is, over a two-year horizon) rose during 1994. By mid-1994, the Federal funds rate had been raised to 4¼% – positive in real terms measured by the movements in core consumer prices. The statement in May 1994 spoke of measures "designed to maintain favourable trends in inflation". It said that the adjustments taken up to this date "substantially remove the degree of

[15] This summary draws on the BIS's *65th Annual Report* (1995).

[16] The Concise Oxford Dictionary defines 'vigilante' as a "member of a self-appointed group undertaking law enforcement but without legal authority".

accommodation which prevailed throughout 1993". This led market participants to believe that further policy moves would be unnecessary in the short term.

Nevertheless, growth (and expectations of future growth) remained very strong. Bond yields began to rise again in August, peaking at 8% on 18 November, just after the ¾ percentage point rise in the Federal funds rate. This substantial rise in the policy rate was expected to stabilise or lower bond yields "by reducing expectations of higher inflation and further near-term policy action".[17] The further ½ percentage point rise in February 1995 reinforced the decline in bond yields.

The BIS *Annual Report* at the time argued that macroeconomic "fundamentals" such as inflation or growth prospects did not warrant such large movements in bond yields. According to the BIS, the major explanations for the sharpness of the reaction of bond yields were rather the unsustainably low rates in late 1993 (which made a rise inevitable) and the associated build-up of leverage (BIS (1995), page 106).

> "A very popular strategy since the early 1990s [as short-term rates were reduced] … had been to finance long positions by borrowing short … [leveraged players] included hedge funds, securities firms and banks … it is of course natural for banks to increase their bond holdings when demand is weak, but the scale of their investments exceeded that in past cycles".

Various market practices (such as mark-to-market accounting, the use of stop-loss triggers that could automatically trigger sales into falling markets, the lengthening in the effective maturity of mortgage bonds following reduced rates of prepayment of US mortgages when long-term rates rose and so on) had amplified the rise in long-term yields. Substantial losses made some highly leveraged bond investors more risk averse. Measures of "implied volatility" (ie from option contracts on 10-year bonds) suggest the bond market turbulence in 1994 was not anticipated as "low inflation rates in 1993 had fostered the expectation that volatility in bond markets would remain subdued". But then, once sentiment turned, market participants "overestimated the persistence of volatility … market expectations are firmly anchored to the behaviour of volatility in the proximate past and are adjusted only slowly."

Throughout all this turbulence, the message was that the Federal Reserve stood ready to raise short-term rates aggressively and pre-emptively to reassure markets of their determination to prevent inflation. The hope was that such action would stabilise the bond market. Eventually it did – but it took much longer than initially expected.

The "measured pace" of 2004-06

The 1994 bond market crisis was traumatic. A number of major institutions with leveraged bond portfolios were hit very hard, and several hedge funds failed. According to some estimates made at the time, the scale of capital losses in world bond markets was $1.5 trillion, almost 10% of OECD GDP.

[17] Minutes of the FOMC, 15 November 1994. Note that this was in an environment without the explicit forward guidance the Federal Reserve has recently adopted – they only had the current policy rate to signal their intentions about the future policy rate.

The "measured pace" of tightening during 2004-06 – a ¼ point rise at each meeting – was in part designed to avoid a similar destabilisation of bond markets. Stephen Axilrod has convincingly argued that this language was chosen not for macroeconomic reasons but instead to avert an excessively strong rise in long-term interest rates. It did indeed succeed in reassuring those with leveraged bond portfolios that the Federal Reserve would keep their short-term financing costs very low. It "was interpreted by the market as a license for continuing to bet they could keep making money by borrowing short and investing long".

This policy helped those with leveraged portfolios of all types of bonds – government bonds, mortgage debt etc. Taylor (2009) has argued that macroeconomic developments embodied in the Taylor rule justified earlier and sharper increases in the policy rate. Many share this assessment. Macroeconomic assessments always depend on judgement, however, and others argue otherwise. After all, inflation expectations did not rise in a menacing way. But it is surely implausible to argue that, given the exceptionally low level of the Federal funds rate in early 2004, macroeconomic data did not, at some point over the two-year period up to early 2006, justify less regular (and perhaps on occasion larger) movements than a ¼ point rise at each meeting. The perceived risks to the financial system of sharp changes in the long-term rate have mattered a great deal to the policy decisions of central banks even if few would acknowledge this.

5. The long-term interest rate, aggregate demand and financial stability

Real long-term rates (from inflation-linked 10-year bonds) are exceptionally low. Table 1 summarises yields for US Treasuries and UK gilts. There is a similar picture in other advanced economies. The persistence of such low real rates for so long in so many countries is unusual, if not unique. In principle, this should stimulate fixed investment and support aggregate demand. But it could engender hard-to-manage financial system risks. This section examines how such effects might work.

Real long-term rates[1] Table 1

	US Treasuries %	UK gilts %
1990–1999	4.23	3.48
2000–2009	2.46	1.84
2010	1.23	0.65
2011	0.60	0.23
2012	–0.47	–0.66

[1] From inflation-linked, 10-year bonds.

The term premium since 1990

The evolution of the term premium derived from the BIS's standard yield curve analysis is shown in Graph 5.[18] The term premium has two elements, one a real premium due to the risk associated with expected future real short-term rates and the other an inflation risk premium. During the period from 1990 to early 1993, as the policy rate was being reduced (see Graph 4), marked uncertainty about the path of future short rates combined with an inflation risk premium (in the range of 80 to 100 basis points) kept the term premium at around 250 to 300 basis points. After falling back briefly during 1993, there was a sharp upward spike during the 1994 bond market crisis. The average term premium over the period 1995 to 2001 was 140 basis points.

From early 2000, there was a downward trend in the term premium, which touched zero in 2005. At the time, many attributed this reduction in the term premium to more credible macroeconomic policy frameworks – inflation would remain low so that investors demanded a smaller inflation risk premium and the perception grew that there was less risk that real short-term rates would have to be raised by a large amount to maintain macroeconomic stability. There is much truth to this but, as argued in section 2 above, the shorter maturity of US government debt and the "measured pace" strategy of monetary policy also contributed. In any case, the term premium remained low during both the expansion phase and the contraction phase of the recent macroeconomic cycle.

Whatever views were taken about the trend decline in the term premium during the 2000s decade, the steep subsequent drop from early 2011 took many analysts by surprise. At the end of December 2012, the term premium was a *negative* 140 basis points. In effect, the sum of the inflation and real yield risk premia are negative. Even a return to the very moderate risk premia observed during the 2000s – that is, neither a shock to inflation expectations nor a shock to expected real interest rates – would suffice to entail a substantial rise in yields. Recall the 1994 bond market crisis discussed in section 4: it was *not* primarily caused by changes in macroeconomic fundamentals.

A negative term premium is likely to make financial intermediaries (eg banks) less willing to engage in maturity transformation. Could this mean that banks are becoming less willing to lend? Less willing to extend long-term loans? These would be paradoxical consequences of policies designed to stimulate aggregate demand. Such considerations do influence thinking about how interest rate changes affect the financial system and the real economy. A stable term spread is, for instance, the foundation of the theory of Adrian and Shin (2011) about the role of short-term rates in monetary transmission.[19]

Aggregate demand

Nevertheless, lower short- and long-term rates on mortgages should stimulate borrowing for housing investment. The impact on corporate borrowers is also likely to be important. Once the term premium has become negative, a marginal further reduction in the long-term rate (expected future short rates given) will make it more

[18] Described in Hoerdahl and Tristani (2011). See also Hoerdahl (2008).

[19] This was summarised in footnote 3 above.

profitable for firms to issue long-term debt in order to invest in short-term securities (or buy back shares). But it will not make it more profitable for a firm with no liquidity constraint to increase investment in plant and equipment.[20] This analysis suggests that central bank purchases of government bonds will be more effective at stimulating corporate investment "if the term premium on Treasury bonds were at plus 200 basis points instead of its current negative level" (Stein, 2012a).

The impact of public spending is more difficult to analyse. Many public authorities make long-term plans based on some reference interest rate. A discount rate is needed to value investment projects, to calculate future pension liabilities and so on. Such reference rates are often linked to some past average of the yield on long-term government bonds. If the long-term interest rate is mean-reverting, then it may be rational for policy purposes to ignore cyclical movements in the long-term rate. But if long-term rates were to remain so low for many years, such conventions would have to be reviewed. This is perhaps unlikely: even in the 1930s, when short-term interest rates were low and prices were flat or falling, the yield on consols did not fall below 3% (Graph 6).

Adopting lower reference rates would have a major impact on a wide range of public policies. This might stimulate aggregate demand. For instance, lower long-term interest rates should favour housing and other infrastructure projects. This should lift fixed capital formation, although this may be subject to diminishing returns. In the case of pension provision, however, a lower reference rate could lead to contractionary changes. Lower real long-term reference rates will increase the present discounted value of future liabilities from State pension entitlements and from pensions for government employees (which are typically unfunded).[21] If the government were to increase current taxes (or pension contributions of their employees) in response to this, there would be a contractionary effect on aggregate demand.

Financial stability

There are many links between the long-term interest rate on government bonds and financial stability. One is that, in the absence of sovereign default risk, it 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. It is, to paraphrase Stein (2013), a factor that "gets in all of the cracks" of the financial system because it is crucial for the degree of maturity transformation that banks and others choose to undertake. This is most important because the severity of the recent financial crisis owed much to excessive maturity transformation by firms (or was undertaken via certain financial products) that were ill-equipped for such a function. Yet economic theory provides no clear guidance either about the optimal degree of maturity transformation over time or about who should provide it.

A second important link works through collateral. Higher asset prices can ease liquidity constraints on borrowers: a rise in house prices, for instance, allows small

[20] As Stein (2012a) puts it, "Once term premium becomes negative … the relevant opportunity cost becomes the option to invest in short-term securities or repurchase shares".

[21] A similar logic applies to any pension scheme that is underfunded (ie liabilities exceed assets) and to individuals saving for their own old age. Corporate investment plans can also be affected by changes in the present discounted value of pension liabilities. See Bank of England (2012).

firms to borrow more from banks because the owner of such a firm can give his house as security.

Another set of links arises from balance sheet exposures. Here it is important to remember that a balance sheet has both assets and liabilities – so any analysis of financial stability risks should cover both. In principle, net exposures depend on differences between the maturity of assets and of liabilities and on the nature of contractual interest rates (notably fixed versus floating).

Much of the debate about interest rate risk focuses on the **asset** side of the balance sheet. Holders of long-term fixed-rate bonds, unlike short-term government paper, face a risk of capital losses if interest rates rise. A rise in long-term interest rates will reduce the market value of bonds held by banks and other financial intermediaries. As the near-term yield curve (ie that up to two years) has flattened, banks, seeking to maintain a return from their maturity transformation, may well have lengthened the maturity of the government bonds they hold. Statistics on the maturity of government bonds held by banks are scant and those that are available are imprecise. Nevertheless, a recent study based on US Call reports found that a lower short-term rate leads banks to lengthen the maturity of their bond holdings (Hanson and Stein, 2012). Hence a prolonged period of low long-term rates (and flatter yield curves) could well increase interest rate and maturity risks. But these balance sheet exposures are not well measured because the average maturity of bond holdings by investor is not known and because some exposures will be hedged through derivatives markets.

The interest rate exposures of even regulated banks is opaque. Under the Basel Committee's framework, there is no minimum capital charge (that is, under Pillar 1) for interest rate risks faced by banks from their banking book holdings of government bonds.[22] Goodhart (2011) explains how the Basel Committee struggled with this issue in the early 1990s. The many different facets to interest rate risk include not only risks to the stream of net interest income (depending on maturity mismatches, the interest rates used for reference for assets and for liabilities etc), but also investment risk (the risk that the value of bonds held by banks falls). Not only were the exposures of particular banks very diverse, but banks measured and managed such exposures in quite different ways. By mid-1996, it was clear that no international agreement would be possible even on a common reporting framework let alone a capital charge. In the preparation of Basel II, the Committee again tried but failed to reach agreement on a global Pillar 1 capital charge.[23] It is, however,

[22] Banking book holdings are bonds that the bank holds to maturity and which therefore do not have to be marked-to-market. A bank can thus avoid marking down, under standard accounting reporting rules, the value of its assets if the prices of the bonds it holds falls. Whatever the accounting convention adopted, however, the bank will still be worse off after a sizable decline in bond prices. Investors in bank equities will monitor such exposures, and regulators may force disclosure beyond standard reporting rules. Regulators did so during the recent euro crisis. Finally, market-value exposures matter in the event of a break-up or a merger with another bank. In short, banking book exposures to interest rate risk require capital.

[23] See Goodhart (2011), especially the chapter on the Market Risk Amendment, and BCBS (2004). Paragraph 762 of the Basel II framework released in 2004 states: "The Committee remains convinced that interest rate risk in the banking book is a potentially significant risk which merits support from capital. However, comments received from the industry and additional work conducted by the Committee have made it clear that there is considerable heterogeneity across internationally active banks in terms of the nature of the underlying risk and the processes for monitoring and managing it. Nevertheless, [where there is sufficient homogeneity across banks, national] supervisors … could establish a mandatory minimum capital requirement."

addressed within the Basel framework's supervisory review process (ie Pillar 2). Moreover, the implementation of Pillar 2 in recent years has enabled supervisors to collect detailed information about a bank's internal practices – a valuable pre-requisite for ultimately determining capital requirements. Work is underway within the Basel Committee to establish a harmonised capital charge for interest rate risk in the banking book.

Reminded regularly by their regulators, banks are of course aware of interest rate risks. Their actual exposures are therefore endogenous. One way they may compensate for the market risks from their long-dated government bonds would be to shorten the maturity of their private assets. By shortening the maturities of their loans, this risk can be shifted to their private borrowers – there is some evidence of such shortening of their loans to households, small firms etc. We need to know more about the endogenous responses of financial intermediaries.

But low long-term interest rates also affect the **liability** side of balance sheets. A flattening of the yield curve encourages firms to replace short-term debt with long-term paper. Stein (2012b) therefore argues that central bank purchases of long-term debt have encouraged an "extension of debt maturity by both financial and nonfinancial firms" … a good thing from a financial stability perspective. How far low long-term rates have led firms to extend debt maturities over the past two years is not known.[24] Firms may delay any such move if they expect long-term rates to fall still further. Any sudden or widely shared change in such expectations would itself drive rates higher.

One final observation concerns conventional indicators of financial vulnerability such as house price/rental income and credit/GDP ratios, which have become very prominent in discussions about macroprudential policies. Often they are treated as constants. Yet they actually depend on the underlying long-term rate. If the long-term rate is mean-reverting over a time horizon relevant for policy, then it may be acceptable to treat it as a constant for practical purposes. But if there are lasting deviations from long-run means, assuming constancy could lead both households and policymakers astray.

Government bonds in a crisis

One important financial stability dimension is that government bonds serve as a buffer in a crisis. They provide the private sector with assets that are liquid and, if the government remains creditworthy in the currency of the bond, reliable in adverse economic circumstances. Holmström and Tirole (2011) argued that, with macroeconomic shocks that affect all households and firms simultaneously, private sector assets are not useful as a buffer. This may argue for government bond issuance at times greater than government financing needs. They did not discuss the distinction between short-term bills (which protect holders from capital losses) and long-term bonds (which lock in income flows).

This emphasis on the liquidity services of government bonds echoes Keynes's view, which was that risk-averse investors should be offered some minimal, safe return on their capital. To encourage them to lend long, the return on bills would be lower than that on longer-dated bonds. Shifts in the private sector's willingness to assume maturity risk are not well-anchored in fundamentals but are driven by psychology – hence he felt that the government should just accommodate private

[24] Section 6 below argues that this effect has been sizable for EME corporates.

sector preferences. This may be an argument for a more relaxed attitude about benchmarks for maturity of issuance. In any event, several economists have recently explored this promising area by constructing models in which government bonds provide liquidity (eg Canzoneri et al, 2012).

Is there a macroprudential perspective for the long-term interest rate?

Prudential requirements and accounting conventions that lead financial institutions to increase their holdings of government bonds may make individual firms and portfolios safer. But what is the aggregate impact on the financial system as a whole?

We know that the total potential impact of a fall in bond prices on the private sector must have increased substantially because the stock of government bonds held outside the central bank has risen so much.[25] Table 2 shows the change in longer-dated US Treasuries held outside the central bank. The total increase from January 2007 to June 2012 was about $4.8 trillion. At the same time the weighted average of yields fell from 4.9% to 0.9%. This has generated significant capital gains for those who had bought bonds five years ago – and has presumably stimulated private aggregate demand. At the same time, however, it has exposed all to significant risk of capital losses once interest rates renormalise.

Treasury debt held outside the Federal Reserve[1] Table 2

	Total outstanding ($ trillion)	1 to 5 years	Over 5 years to 10 years	Over 10 years	
		% shares			
31 Jan 2007	2.8	54.0	27.1	18.9	
30 June 2012	7.6	62.0	24.6	13.4	
		Average of market yields[2]			**Average**
31 Jan 2007		4.925	4.825	5.02	**4.91**
30 June 2012		0.4175	1.39	2.38	**0.92**

[1] Treasuries outstanding minus Federal Reserve's SOMA holdings. [2] The first number reading across is the average of 1-, 2-, 3- and 5-year yields. The second number is the average of 7- and 10-year yields. The last number is the 20-year yield.

Source: BIS calculations based on US Treasury and Federal Reserve reports.

But we do not know much either about the distribution of interest rate exposures or about the likely operation of bond markets under stress, when leveraged investors are forced to sell. Five key questions are:

1. *Where do these risks ultimately reside?* Much of this interest rate exposure is probably with the banks which have increased their holdings of government bonds since the onset of the crisis. Such exposures typically do not require much, if any, capital because local currency government bonds usually have a zero credit risk weight and because, under the current Basel framework, there is

[25] However, not all such exposures are with the private sector because holdings of foreign official institutions have also increased.

no minimum capital charge for interest rate risk faced by banks from their banking book holdings of government bonds.[26]

Nevertheless, banks may try to offset such exposures by changing the nature of other assets. Banks may have adjusted their private sector assets to mitigate the increased risks of holding government bonds. For instance, some banks may have shortened the maturity of their lending to the private sector to compensate for their increased maturity exposures vis-à-vis the government.[27] Such shifting of interest rate risk may increase the default risk of their borrowers. Other financial intermediaries (insurance companies, pension funds etc) may also have shifted risks.

2. *How diversified are portfolios?* The riskiness of a bond depends not only on the variance of its own return but also on its covariance with other assets in the portfolio. So more needs to be known about whole portfolios – for example, the equity/bond mix. When economies start to grow, a rise in the price of equities might partly compensate investors for losses on bonds. It would be those investors with limited equity exposures (banks?) who would suffer more in this scenario.

3. *How leveraged are interest rate exposures of investors?* A market dominated by leveraged investors will usually be volatile in a correction – as the 1994 bond market crisis (discussed in section 4) demonstrates. Investors who finance bond holdings by short-term loans can be forced by their creditors to sell when the value of the bonds (pledged as collateral) falls. When market volatility rises, they can be subject to larger 'haircuts'. Therefore forced sales by leveraged investors into a falling market have often been a major ingredient of bond market crises.

4. *Do banks and other financial firms with leveraged positions have enough capital to withstand a sharp fall in bond prices?*

[26] See page 14 above for a discussion of interest rate risk. On the credit risk of government debt, note that the current Basel Framework does provide for non-zero risk weights for sovereign debt. Although the zero risk weight is envisaged under the standardised approach of Basel II (which was carried over into Basel III), the internal ratings-based (IRB) approach requires banks to allocate capital according to their own assessment of a country's credit risk. But it seems that few (if any) major international banks actually departed from applying zero risk weight to the local currency bonds issued by their own government. Hannoun (2011) argues that large and sophisticated banks are meant to follow the IRB, and not the standardised approach. He concludes that the accumulation of sovereign risk on the balance sheets of banks up to 2009 was the result of "market participants' complacent pricing". He points out that the European Union's Capital Requirements Directives, which had introduced a generalised zero risk weight for all EU central government debt denominated and funded in domestic currency, is not in line with the spirit of Basel II.

[27] There is anecdotal evidence on lending in some countries. In addition, BIS statistics clearly show that the reduction in international lending of European banks over the past two to three years has been concentrated at the longer end (in trillions of US dollars):

	Total	<1 year	Up to 2 years	Over 2 years	Unallocated
2010 Q1	10.9	4.8	0.6	3.5	2.0
2012 Q2	9.3	4.6	0.4	2.5	1.8
Change	–1.6	–0.2	–0.2	–1.0	–0.2

Source: BIS *International Banking Statistics*.

5. *Have portfolio allocation decisions become more procyclical?* Some regulations (eg Solvency II) and accounting conventions could make the bond market more cyclical (BIS, 2011b and Turner, 2011b).

Getting answers to these questions is not straightforward, which is itself a warning signal. Scenarios prepared by the Bank of Japan suggest that a significant rise in interest rates could not only impair banks' capital but could also force them to curb lending – and so set up an adverse feedback loop between the financial system and the real economy (see Bank of Japan, 2012, especially pp 79ff). In addition, the dynamics of a bond market under stress can be very powerful, and may even lead to a run on the market (Shirakawa, 2012).[28]

6. The long-term interest rate and EMEs

The decline in real long-term interest rates in the major advanced economies has been mirrored in a similar decline in the emerging markets. Graph 7 shows a simple average of yields on 10-year bonds for eight major emerging market countries: Brazil, Korea, Malaysia, Mexico, Poland, South Africa, Thailand and Turkey.[29] All have floating exchange rates and domestic bond markets that are open to non-resident investors. The average nominal long-term interest rate in this group of countries has fallen from 8% at the beginning of 2005 to 5% by late-2012. Inflation (measured by the year-on-year change in consumer prices) has shown no clear trend, and is currently a little over 4%. Hence real long-term rates have also fallen.[30]

The flattening in the yield curve in most EMEs can encourage firms, governments and households to lengthen the maturity of their local currency debts. The ability to borrow long in their own currency is of paramount importance for financial stability in EMEs – almost every crisis in these countries was caused by currency or maturity mismatches. Governments have lengthened the maturity of their debts considerably over the past decade. But corporations and providers of mortgages for households may not always have been able to take full advantage of this because of shortcomings in local debt markets. The development of local debt markets has often been held back by exchange controls, taxation arrangements, weak collateral arrangements and the lack of effective bankruptcy laws: see BIS (2012a) and Mizen et al (2012). The expansion of bond issuance by EME corporates over the past decade (Table 3) is therefore particularly encouraging. Between 2007 and 2012, such issuance tripled in dollar value, reaching $963 billion. The average maturity was 7½ years, implying a significant lengthening from the early 2000s.

[28] Shirakawa argues that several factors could magnify the impact of an initial shock in the government bond market. One works through collateral practices: because government bonds serve as collateral in wholesale financial transactions, a decline in their price could damage liquidity in funding markets, inducing further selling. Another works through volatility: a rise in volatility can induce banks which rely on historical data to measure risk to sell even if their mean expectations do not change.

[29] Note that for Turkey the 9-year bond was used and for Brazil the 3-year bond.

[30] Traditionally, financial repression and captive savings markets have kept the real interest rate on government debt in developing countries as a whole negative (–2.7% over the period 1999–2008, according to Escolano et al, 2011, compared with +2.6% for advanced economies).

Bond issuance by EME corporates Table 3

	2000	2005	2007	2010	2011	2012
Volume ($ billion)	60	193	327	547	733	963
Average maturity (years)	4.8	7.7	7.6	7.6	6.5	7.5

Note: This covers both international and domestic issues of non-bank firms.

Source: BIS based on Dealogic.

Table 4 shows a simple regression to measure the relative impact of changes in domestic short-term interest rates and changes in the benchmark international long-term interest rate on changes in the long-term interest rate in emerging economies. The notation in the table is quarter-to-quarter changes (except for DP):

10YUS = Yield on 10-year US Treasuries

R = Yield on domestic 3-month paper

DP = Rate of inflation, measured by the year-on-year change in consumer prices

The dependent variable is the quarter-to-quarter change in the yield on 10-year domestic government bonds. The estimates are pooled OLS regressions using quarterly data.

International bond yields, domestic short-term rates and EME bond yields Table 4

	10YUS	R	DP	Adj R^2	Durbin-Watson statistic	F	Number of observations
2000 to 2004	0.35	0.20	–0.02	0.05	1.7	3.4	143
	(0.8)	(3.0)	(0.9)				
2005 to 2012 Q3	0.51	0.24	0.01	0.22	1.8	24.1	248
	(5.6)	(6.2)	(0.8)				

t-statistics are given in parentheses.

In the first half of the 2000s decade, changes in yields on 10-year US Treasuries had no impact on changes in the yields on comparable bonds in the EMEs. Changes in the domestic 3-month rate had a significant impact, a 100 basis points rise at the short end being associated with a 20 basis points rise on 10-year paper. From 2005, a 100 basis point rise in US 10-year yields is associated with a 51 basis point rise in comparable EME securities, which is larger than the impact from a rise in domestic short-term rates. Short-term trends in inflation appear to exert no influence in either period.

This stronger link between US yields and yields on EM bonds is probably mirrored by the increased sensitivity of cross-border capital flows to interest rate differentials across countries. A decline in interest rates (long or short) in the advanced economies encourages capital flows to EME debt instruments and banks. In order to limit the financial stability risks this may entail, EME central banks may be induced to lower their policy rate below that justified on macroeconomic grounds. Bruno and Shin (2012) have shown that a widening in the US term spread (for example as the Federal funds rate is reduced) increases US dollar bank lending to

EMEs, and this may lead to currency mismatches which increase financial system risks.

These connections clearly require further examination. There are grounds for thinking that more needs to be known about the consequences of prolonged periods of negative term premia in advanced economies on long-term interest rates in EMEs. In one study which also incorporates specific local determinants (and which is therefore more informative than the simple results shown in Table 4), Miyajima et al (2012) also find that the impact of the US 10-year yield has grown in recent years. They find that the fiscal balance explains much of the cross-country differences in the long-term interest rate in the EMEs, both before and after the crisis.

7. Exit from central bank holdings of government bonds

Central banks in the advanced economies are not comfortable with the size 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. Several challenged the wisdom of this assessment at the time (eg Gagnon, 2009), and such hopes were in any case dashed by the deepening euro crisis from mid-2010. Since then, central bank balance sheets in the advanced economies have grown (from around $6.7 trillion at end-2009 to $10 trillion by end-2012) and the maturity of assets has become longer. Hence an easy exit without central bank sales of government bonds would take many years – at least to the end of this decade.

The rise of central bank assets has necessarily been accompanied by a rise in central bank liabilities. A major element has been an increase in money – mainly commercial bank reserves with the central bank.[31] Central bank purchases of bonds from residents increase commercial bank deposits. In a crisis, deposits with the central bank tend to rise. Such reserves are now at unprecedented levels … in the United States, for instance, reserves now exceed 17% of total bank deposits (Graph 8).

- What will be the impact of very liquid balance sheets on the future behaviour of banks? There is no consensus. Theorists tend to play down such effects; but practitioners in central banks often think otherwise – witness the attention paid to open market operations, reserve requirements and so on. Much will depend on the specific characteristics of banking markets in different countries, on the nature of bank liquidity regulation and on how central bank operations with commercial banks work.
- Managing such a large liquidity overhang could be difficult. Technically, central banks have the tools to drain liquidity from the banking system. But success with marginal and gradual adjustments in a normal cycle may not be a good guide to exiting more extreme conditions – particularly if markets are unsettled and the policy framework unclear. How far would short- and long-term interest rates have to rise in such circumstances to drain liquidity?

[31] The Federal Reserve began paying interest on such reserves from October 2008. The interest rate is currently 0.25%.

The practical and political difficulties in implementing significant increase in interest rates are not to be underestimated. Allen in BIS (2012b) explains the United Kingdom's difficult challenges in the 1950s and the 1960s: the authorities did not opt for the large rises in interest rates that would have been needed, but instead relied on direct control of bank credit expansion. Filardo and Yetman (2012) show what the huge expansion in forex reserves has meant for the domestic liabilities of central banks – which are often assets of domestic banks. This has required many central banks to resort to ad hoc non-interest-rate policies – such as raising reserve requirements – to contain the feed-through to domestic bank credit. Goldstein and Lardy (2009) argue that the large volume of sterilisation bonds outstanding in China could discourage the authorities from liberalising interest rates.

Central bank sales of government bonds

Over the very long period when central banks have (unwanted) government bonds on their balance sheet, central bank sales or purchases of government bonds could be viewed as a second policy instrument. It could complement the policy rate (and forward guidance about the policy rate). A few economists have begun to explore in general terms in what circumstances central banks might operate with two targets, but this work is in its infancy. Adão et al (2011) argue that targeting both the short rate and the long rate would solve the problem of multiple equilibria associated with uncertainty. Kulish (2007) explores the use of a Taylor-rule with a long-term not a short-term rate. He argues that the long-term rate can be a better instrument of monetary policy when agents are worried about inflation volatility. These papers are significant because they develop a case for explicit consideration of the long-term rate that is more general, and more symmetric, than the special case of the Zero Lower Bound. Governor Stein of the Federal Reserve has recently argued that, even when the ZLB is in the past, "this second instrument might continue to be helpful, not simply in providing accommodation, but also as a complement to other efforts on the financial stability front".

Central bank purchases or sales of government bonds may well prove to be a less reliable instrument than the policy rate. It was argued above that its efficacy depends on the degree of substitutability between short-dated and long-dated paper. This will be time-varying and difficult to predict. It may also be endogenous to expectations engendered by central bank policy frameworks. In addition, such purchases (and sales) done on a large scale may be regarded as quasi-fiscal in nature, and so attract unwelcome political attention. In most circumstances, the policy rate may remain the central bank's preferred instrument; but there can be circumstances when a "positive policy" on the long-term rate is required as the *Radcliffe Report* argued more than 50 years ago. On this point, Stiglitz (2013) draws an analogy with optimal taxation literature: "… no theorem says that optimal [central bank] intervention should be limited to short-term rate setting … [in the case of tax policy] we know that optimal intervention (taxation) involves … a large number of small interventions rather than one large intervention." Moving the whole yield curve up would affect all borrowers, and this may be preferable to concentrating all the adjustment only on those with short-term debts.

Central bank holdings of long-term assets will not automatically run-off quickly. Any decision to sell government bonds on a scale large enough to increase the long-term rate would have to take account of:

(a) Direct effect on government financing costs;

(b) Impact on the balance sheets of financial firms. The value of assets held by banks, insurance companies, pension funds etc will be affected. Some exposures will be highly leveraged.

Adopting QE was the easy part. A declining long-term interest rate helps the government refinance its large and growing debts cheaply. It generates capital gains for the holders of government bonds. So few complaints are heard from government or from holders of government bonds. But the exit will be quite different when the long-term rate of interest rises. There will be lots of complaints.

A decision-tree on an exit strategy

Magnitudes are large. The Bank of England and Federal Reserve currently hold more than 30% of marketable government debt with maturities of 5 years or more. So decisions about sales could well have a significant impact on market prices. And news of any central bank sales could send markets a signal that is more powerful than the actual sales. Markets know how large is the stock of bonds central banks are holding, and they also know central banks are uncomfortable with such holdings. And market participants know that central banks have great strategic power as non-commercial players.[32]

There has been no official commitment on exactly how or when central banks will reduce their portfolios of government bonds. Given an uncertain macroeconomic outlook and the lack of recent experience of active central bank sales, this is hardly surprising. Nevertheless, a few general indications have been given. The Bank of England has stated that it would begin to sell bonds only after it has begun to raise interest rates. 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 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 below) would come only after the first increase in the Federal funds rate. (The Bank of Japan, which has avoided purchasing bonds with a maturity longer than three years, has made no statement about selling).

Chart 1 shows a simple decision tree to cover the many complex policy choices. This chart lays out the key dimensions that any exit strategy must consider. Many interesting questions are to be addressed:

(a) *Should it be rules-based or should it be discretionary?* It might be possible to design a hybrid: the central bank could have discretion for bonds with a residual maturity of less than one year. But it could be subject to rules for longer-dated bonds.

[32] 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."

(b) *Should the rule be quantity-based?* Three quantity-based possibilities seem plausible:

- One would be to allow maturing bonds to run off. This would give a clear signal to markets as to when to expect central-bank-held bonds to return to the open market. It would also simplify coordination with the Debt Management Office (DMO) or the Treasury. As part of the deal allowing the central bank to purchase significant amounts of government bonds, the Treasury might decide that the central bank should in principle hold such bonds until maturity. As the Governor of the Bank of England has stressed, however, without "the ability to reverse its policy [by] selling gilts and withdrawing money from the economy, the central bank would run the risk of losing control over monetary conditions." Another danger is that, if a pattern of central bank purchases but never any sales were to be established, the issue of asymmetric response – central banks acting only in an expansionary direction – would need to be addressed.
- A second would be some fixed quantity of sales over a certain period – expressed either as a value or as a percentage of central bank holdings. Depending on how tightly such a rule were written, the central bank would still have some room to manoeuvre. The FOMC meeting in June 2011 said 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". It is noticeable that no mention was made of Treasury securities. The implicit assumption at that time appears to have been that such debt would be allowed to run off as it matured. After two rounds of the Maturity Extension Program, however, this may no longer be tenable.
- A third rule would give preference for new Treasury financing. For instance, a large fiscal deficit in a future year would mean that the Treasury has to cope with particularly heavy new financing. In such circumstances, the central bank might be allowed to sell fewer bonds out of fear that such sales could put upward pressure on yields and so increase the government's cost of borrowing. The words "fiscal dominance" come to mind in characterising such a rule.

In practice, any rule would have to make allowance for the maturity of bonds sold by the central bank. Selling longer maturity paper would "put more duration back into the market" than selling short-dated paper.

(c) *Should the rule be price-based?* Such rules could also take several forms. For instance, the government could simply set a maximum for the benchmark yield, above which no central bank sales would be permitted. But this would deprive the yield curve of all allocative function. So a softer version of such a rule might incorporate a range for the benchmark yield to guide the volume of sales: the central bank would enjoy complete freedom if the yield were below the rule's lower bound, but would face progressively tighter limits as market yields rose. The range could be set by administrative fiat. The centre of the range could move with a moving average of past yields … a crawling peg for the benchmark yield?

Alternatively, the rule could be couched in terms of market volatility. The central bank could be prohibited from selling bonds in volatile market conditions.

(d) *If there is to be discretion, who should decide?* The key question is whether the central bank or the DMO/Treasury should decide. Discretion raises two issues. The first is: who exercises such discretion. Giving pre-eminence to the monetary implications of such transactions would argue for giving the central bank this discretion. And it could be argued that the central bank has the flexibility to adapt best to macroeconomic conditions. But giving greater weight to government financing considerations *might* argue that the DMO should exercise this discretion.[33] The banking regulator might also want a say because an unexpected drop in bond prices could hurt the financial institutions it supervises.

The choice about who exercises this discretion could well evolve over time. For instance, the monetary policy implications of balance sheet decisions may get more weight in the early stages of exit (when the policy rate is very low) than at later stages. One way of shifting responsibility from the central bank to the Treasury would be for the central bank to swap with the Treasury its long-term bonds for Treasury bills. Such an operation would have no effect on the debt in the hands of the public. But it might have implications for future refinancing operations of the government.

A second issue with discretion is whether any constraints would be applied to protect the policy interests of that agency which does not control policy decisions. Two examples of possible constraints are given in Chart 1.

This stylised review of possible policy choices suggests that, once the scope of monetary policy has been widened to include central bank purchases or sales of government bonds, fiscal policy and financial stability considerations could constrain (or could be perceived as constraining) monetary policy in many new ways. The separation between monetary policy and government debt management policy, which had been the prevailing orthodoxy guiding policies from the early 1990s to the financial crisis, becomes less tenable. The difficulty for economists is that there is no well-established and agreed theory on government debt management as tool of monetary policy. A recent BIS workshop which addressed the macroeconomics of government debt management revealed significant divergences of view (BIS, 2012b). This workshop also revealed that, in recent years, the US Treasury and the Federal Reserve have been acting at cross purposes. The Treasury has been lengthening its maturities since the outset of the crisis: the average maturity of issuance in late 2012 was 85 months, compared with around 54 months in 2007 (Graph 2).[34] At the same time, Federal Reserve purchases have been reducing the average maturity of government debt in the market (Blommestein and Turner in BIS (2012b)).

History suggests that monetary policy choices have been constrained by fiscal considerations or by large bank holdings of government bonds. There have been many instances worldwide of episodes when heavy government refinancing needs

[33] The word "might" deserves emphasis. Because governments can tax and issue money, they do not face the same financing constraints as a private borrower (Turner, 2011a). Hence government debt managers' worries about refinancing costs are sometimes misplaced.

[34] Over the period 1982 to 2010 as a whole, a lower Federal funds rate (and a steeper yield curve) seems to have led the US Treasury to lower the average maturity of issuance, perhaps to take advantage of low near-term interest rates. The more general point is that, historically, government debt management decisions have not been truly independent of macroeconomic conditions: this question merits further research.

have constrained even decisions about the policy rate. The Serial Funding operation in the United Kingdom in November 1951 is one striking instance (Allen, 2012). The Bank Rate was raised from 2 to 2½% and, in order to reduce the cost to itself of raising short-term rates, the Treasury simultaneously issued large volumes of one to three-year paper. With this operation, they replaced more than a quarter of Treasury bills outstanding. Once this longer-term paper had been sold, a subsequent increase in Bank Rate from 2½% to 4% in March 1952 imposed large losses on the holders of these bonds.

There have also been instances of interest rate exposures of banks constraining monetary policy choices. On this, Eichengreen and Garber (1990) quote the Federal Reserve in 1945:

> "A major consequence … of … increasing the general level of interest rates would be a fall in the market values of outstanding Government [bonds] … which could have highly unfavourable repercussions on the functioning of financial institutions and … might even weaken public confidence in such institutions."

They point out that operations had to be undertaken in the immediate post-war period to reduce the interest rate exposures of banks *before* the Federal Reserve could feel comfortable raising policy rates. It is hard to see putting similar arrangements in place today.

Government debt, fiscal policy and the volatility of interest rates

Juggling monetary policy and government debt management considerations in the exit phase will be especially hard in the current unsustainable fiscal situation of the major advanced economies. The line between fiscal and monetary policy has been blurred (Iwata, 2012). The prospect of high and rising government debt/GDP ratios for some years could at some point unsettle expectations. High government debt/GDP ratios will make future fiscal deficits more sensitive to debt service costs – and so increase the risk of a destabilising dynamic. Higher interest rates would mean bigger deficits, which might in turn drive interest rates still higher. It is difficult to know how a future generation of politicians would react to such developments: political pressures on central banks could intensify.[35] Doubts about future policy frameworks create Knightian uncertainty – much harder to deal with than stochastic risk.[36] This seems likely to raise intrinsic interest rate uncertainty in the years ahead.

Secondly, macroeconomic models show that governments cutting large budget deficits create big swings in the natural rate of interest (Canzoneri et al in BIS (2012b)).

[35] With large or persistent budget deficits, monetary and fiscal decisions cannot be independent. Chadha and Nolan (2004) for instance showed that a persistent fiscal deficit can set a limit to how far the central bank should raise the short-term real interest rate. As Cecchetti et al (2010) say, history shows that countries that ran high public debts eventually ended up with high inflation because governments were unwilling to pay high interest rates.

[36] See Hoogduin and Wierts in BIS (2012b). In a similar vein, El-Erian (2012) argues that the probability curve for expected macroeconomic outcomes, which has already developed fatter tails than the traditional bell-shaped curve, could become bimodal.

Finally, the structure of finance could aggravate any macroeconomic shock. A key element of all recent bond market crises is that leveraged investors – including banks – are forced to sell into a falling market.

Contrary to what is often asserted, financial markets have become more edgy about future interest rates. Graph 9 shows that the volatility of 5-year yields, five years ahead has risen. Moreover, preliminary econometric analysis suggests that large budget deficits have increased the variability of this forward-looking yield.

8. Conclusion

At the time of writing, long-term real yields on government bonds in advanced economies are negative. The steep drop in long-term real forward rates – which *should* be relatively unaffected by short-term policy rates or by cyclical forces – since early 2011 is a particular surprise. Even during the turbulent years between 2005 and 2010, the forward real rate hovered in the 2 to 2½ percent range, only a bit below the level found to prevail in studies over many decades (and even centuries). It is not clear how to reconcile this decline with high and rising government-debt-to-GDP ratios in most advanced economies.

Interest rate risk exposures in the private sector have grown. For instance, the calculation reported in Table 2 of this paper shows that, by mid-2012, the average of market yields on US Treasuries held outside the Federal Reserve was about 1%, compared with 5% in early 2007. The outstanding stock of debt outside the central bank has grown by $4.8 trillion. There have been similar developments in other advanced economies. While the precise distribution of interest rate risk exposures is not known, much of it is likely to be in the banking system. In the major advanced countries, banks' holdings of sovereign bonds as a proportion of their risk weighted assets has risen sharply since the onset of the crisis. Data compiled by the Basel Committee on Banking Supervision show that, for 30 large international banks, sovereign exposures accounted for 19.1% of total banking book exposures at the end of June 2012, compared with 11.4% at the end of December 2008[37] (Graph 10).

Regulatory capital charges on banks for holding local currency government bonds (and similar quasi-government securities) are low or even zero. There is a case for fuller public disclosure on interest rate exposures, and perhaps some attempt by financial stability authorities at aggregation. Banks and other financial institutions need to have capital to cover such risks.

Given the greater links between financial markets worldwide, extremely low long-term rates is a global phenomenon. Since 2005, even yields in EME bond markets have been strongly affected by yields in the advanced economies and are now down to 1% in real terms (average of the eight countries analysed in section 6).

In any event, it is clear that both central banks and the financial system have been pushed into uncharted territory. The central bank, commercial banks and other financial firms are holding large and growing stocks of government bonds, at yields that imply negative term premia. With massive government debt and uncertain fiscal prospects, it is very difficult for the private sector to know what to expect in

[37] See the discussion on page 14 about the lack of a capital charge on interest rate risk in the banking book.

the next few years. The extraordinary expansion in the balance sheets of central banks, which averted the danger of global depression, causes additional perplexity. Any unsettling of expectations could create all the usual problems of multiple equilibria. Could a crisis force the authorities into sub-optimal choices? They will not be able to assume, as they had in the decade or so before the crisis, that the long-term rate will just take care of itself. As Cecchetti et al (2010) have warned, the most likely manifestation of the risk that long-term inflation expectations could suddenly become unanchored is an unexpected and abrupt rise in government bond yields at medium and long maturities.

How to react to a bond market crisis

Reacting to a 1994-style bond market crisis would be much more complex today given huge central bank holdings of government bonds. Should the authorities take a laissez-faire stance, and allow a steep drop in bond prices? Even without a crisis, when and on what scale should the central bank sell the government bonds it holds?

There are at least three dimensions of policy to consider, and on each dimension a plausible interventionist argument could be made:

1. *Monetary policy*. When markets are disturbed, and expectations not well-anchored, the substitutability between short-term and long-term paper declines. Therefore there could be very good monetary policy reasons for increased open market operations to hold down long-term rates (or to moderate their volatility) in periods of stress. The ECB has advanced this argument during the recent crisis. And the Federal Reserve is mandated by law to maintain "moderate long-term interest rates." Some recent research has indeed pointed in the direction of targeting the long-term rate for monetary policy purposes.

2. *Financial stability*. Excessive market volatility can cloud the usual price discovery process. Banks, pension funds and insurance companies could all face heavy losses – at least in accounting terms – from mispricing. It could be argued that emergency bond purchases by the central bank would remove tail risks from markets and perhaps safeguard financial stability. The success of central banks in lowering long-term rates over the past couple of years will be remembered by those advancing this argument in the future.

3. *Government debt management*. The macroeconomic policy framework for such decisions is not clear. In a crisis, when investors become more reluctant to buy long-dated paper, it could make sense to issue short. On the other hand, it might be more prudent to keep issuing long as a precaution in case the crisis worsens. The recent euro area crisis illustrates the wisdom of such precaution.

There are, of course, obvious traps in all such arguments for intervention in what should be a market process. Any perception in markets that the central bank's commitment to price stability has been diluted would be troubling.

How would these three dimensions of policy interact? Would it require new policy frameworks? Many would share the view of a former Deputy Governor of the Bank of England (Gieve, 2012) that the "beguiling simplicity and neat separation of decision-making [in current monetary policy frameworks] needs to give way to a policy framework and structure of institutions that promotes coordination of the various policy instruments in the pursuit of interlocking objectives". The greater is

instrument uncertainty, the more attractive are policy packages of several instruments. Many also worry that people expect too much of monetary policy.

It is never easy to weigh short-term gains from a given policy against the longer-term costs. Deciding what to do, and when, in the face of macroeconomic and financial market uncertainty does not depend only on what has intellectual appeal. It also depends on which policies carry conviction with the markets, and this can change unexpectedly. In any event, the benign neglect of the long-term interest rate is probably over, but we have no framework for what comes next.

Many difficult questions would need to be answered in considering any new policy framework. How to determine the range for any "optimal" level of the long-term rate, especially as it is likely to change over time? How do attempts to lower long-term rates (narrowing or even reversing the term spread) affect the lending policies of banks? Do policies that lower long-term rates have macroeconomic effects that become weaker but financial side-effects that become stronger when the term premium is substantially negative as it is at present? What is the quantitative impact of changes in the policy instruments at the disposal of central banks on long-term rates? What logic should determine the maturity of debt issued by governments? How should measures aimed at long-term rates be coordinated with central bank decisions on the policy rate and with other economic policies?

These questions are so difficult that it is all too easy to understand the attractions of benign neglect. But there is clear evidence that central banks purchasing government bonds (or debt managers shortening the maturity of issuance) can lower the yield on government bonds. The realisation, long dormant, that central banks do have the power to control long-term interest rates – within limits that are uncertain and dependent on market expectations – will doubtless spur further analysis.

This paper has argued that even a preliminary consideration of simple economic/financial connections suggests that the impact of low long-term rates on aggregate demand and on financial stability is much more nuanced than is often supposed. Many questions remain open. Information on interest rate risk exposures in the financial system is scant. Because responsibilities for policies that are likely to affect the long-term rate are shared by many distinct agents of government (central bank, financial regulator, the debt management office and the finance ministry), much hangs on decisions about the design of the overall policy framework.

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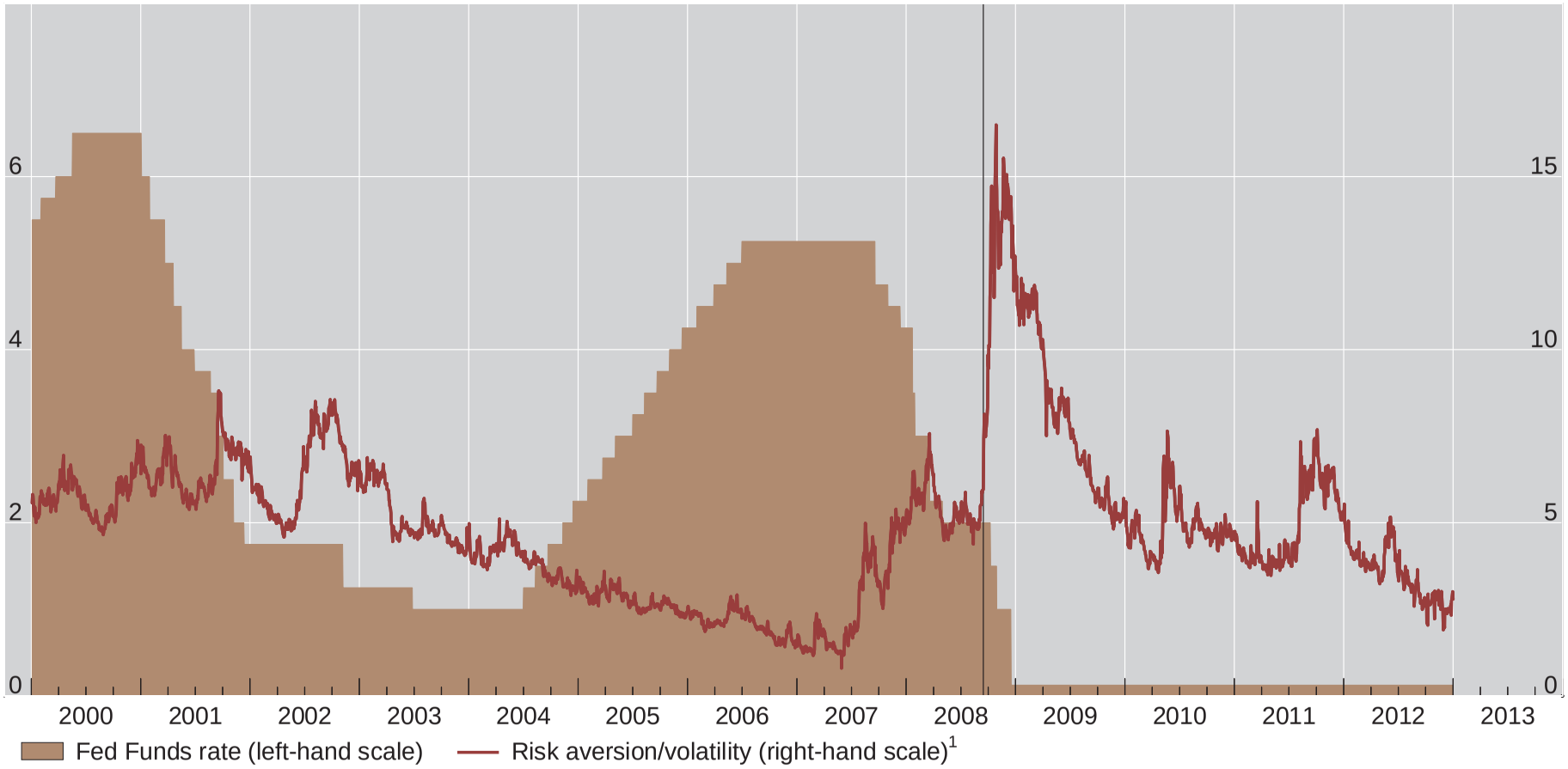
Graphs and chart

Graph 1

Policy rate and risk in financial markets

In per cent



The vertical line marks the Lehman bankruptcy on 15 September 2008.

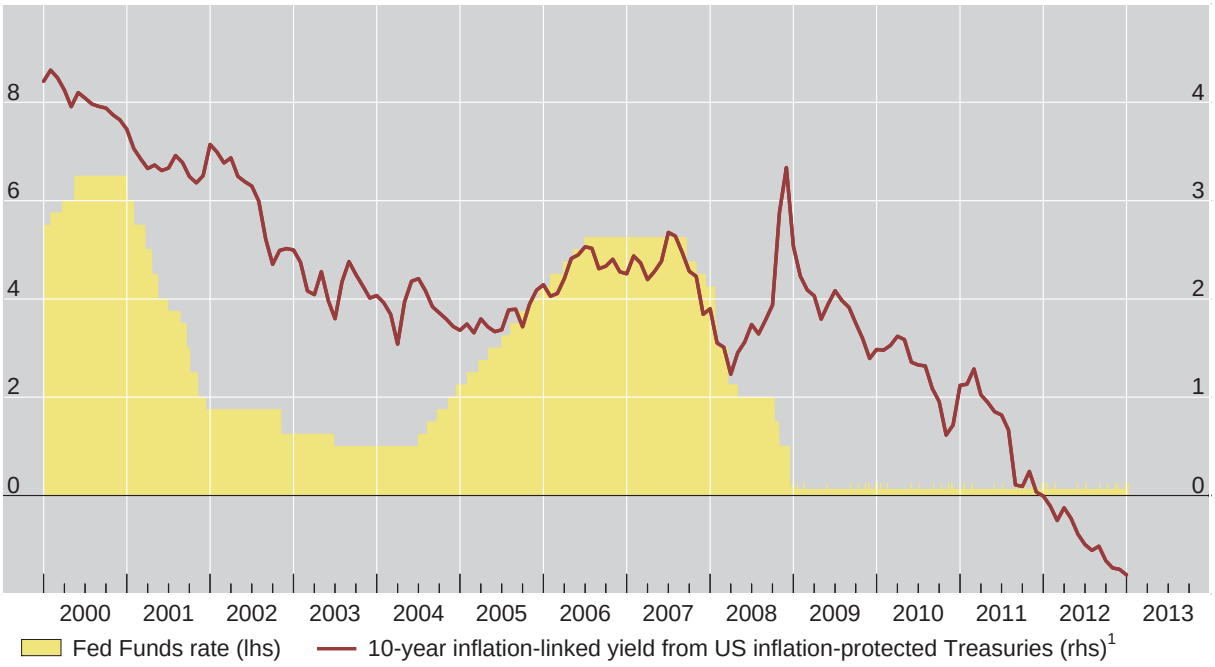
[1] Simple average of standardized scores of EMBI Global spread, US corporate high yield spread (Merrill Lynch US High Yield index), implied volatility of US equities (VIX index), implied volatility of US Treasury bonds (Merrill Lynch MOVE index) and implied volatility of G7 exchange rates (JPMorgan GVXF7 index).

Sources: Bloomberg; Datastream; national data.

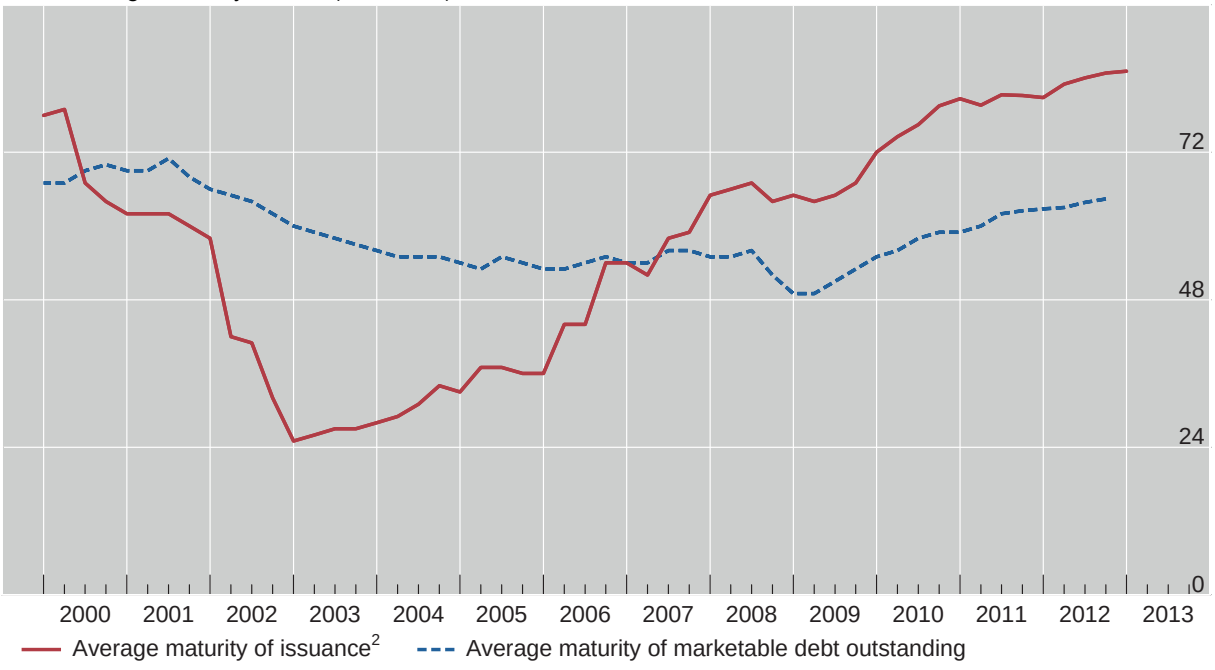
Graph 2

The Greenspan "conundrum"

A. Interest rates (in per cent)



B. Average maturity of debt (in months)



[1] Ten-year Treasury inflation-indexed zero coupon yields (TIPS). [2] One-year moving average; shown at the end.

Sources: US Treasury; national data; BIS calculations.

Graph 3

US 5-year 5 years ahead zero-coupon real yields and inflation compensation

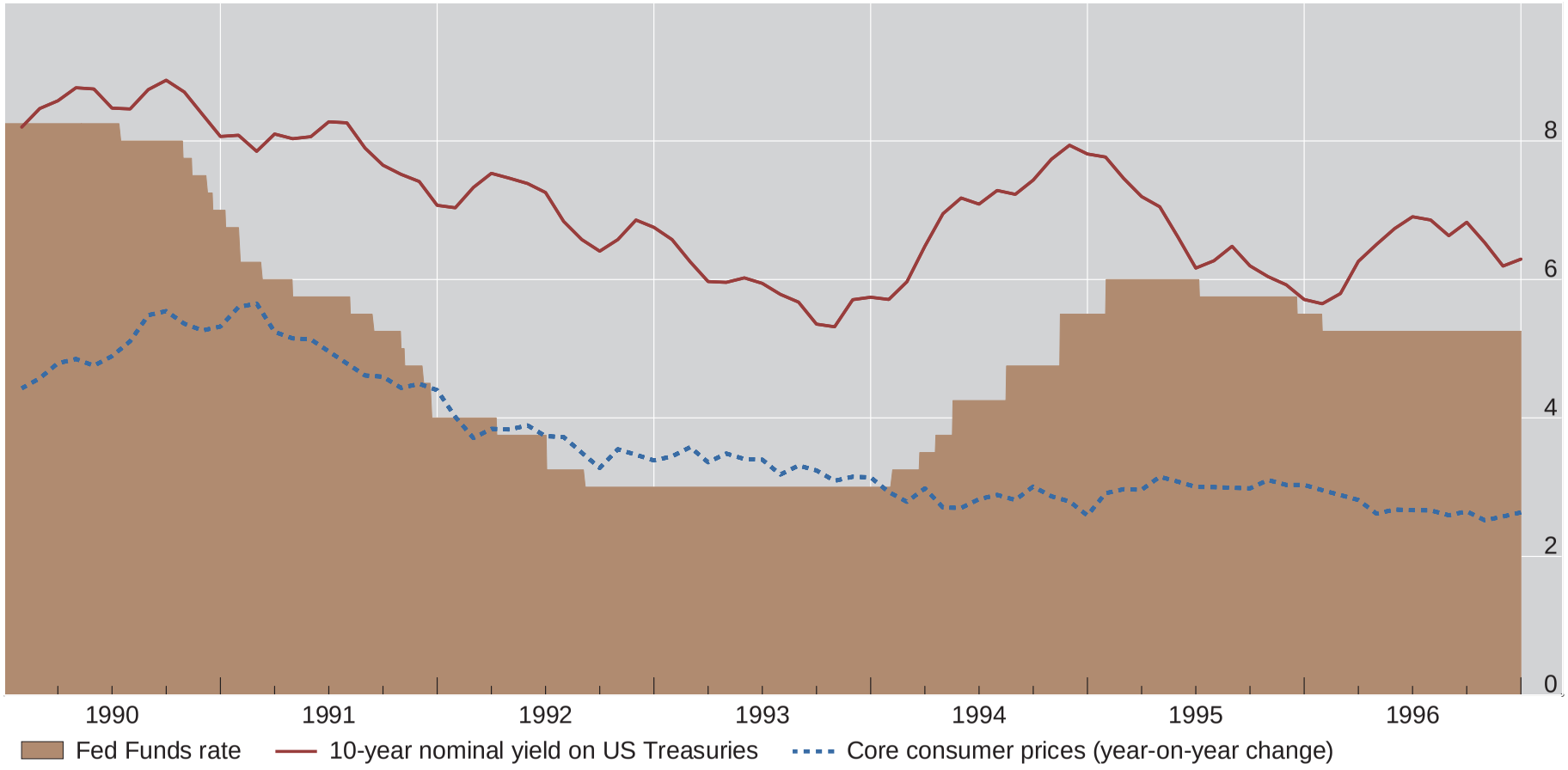
Quarterly averages, in per cent

Sources: National data; BIS calculations.

Graph 4

US 10-year nominal government bond yield, Fed funds, core inflation

In per cent

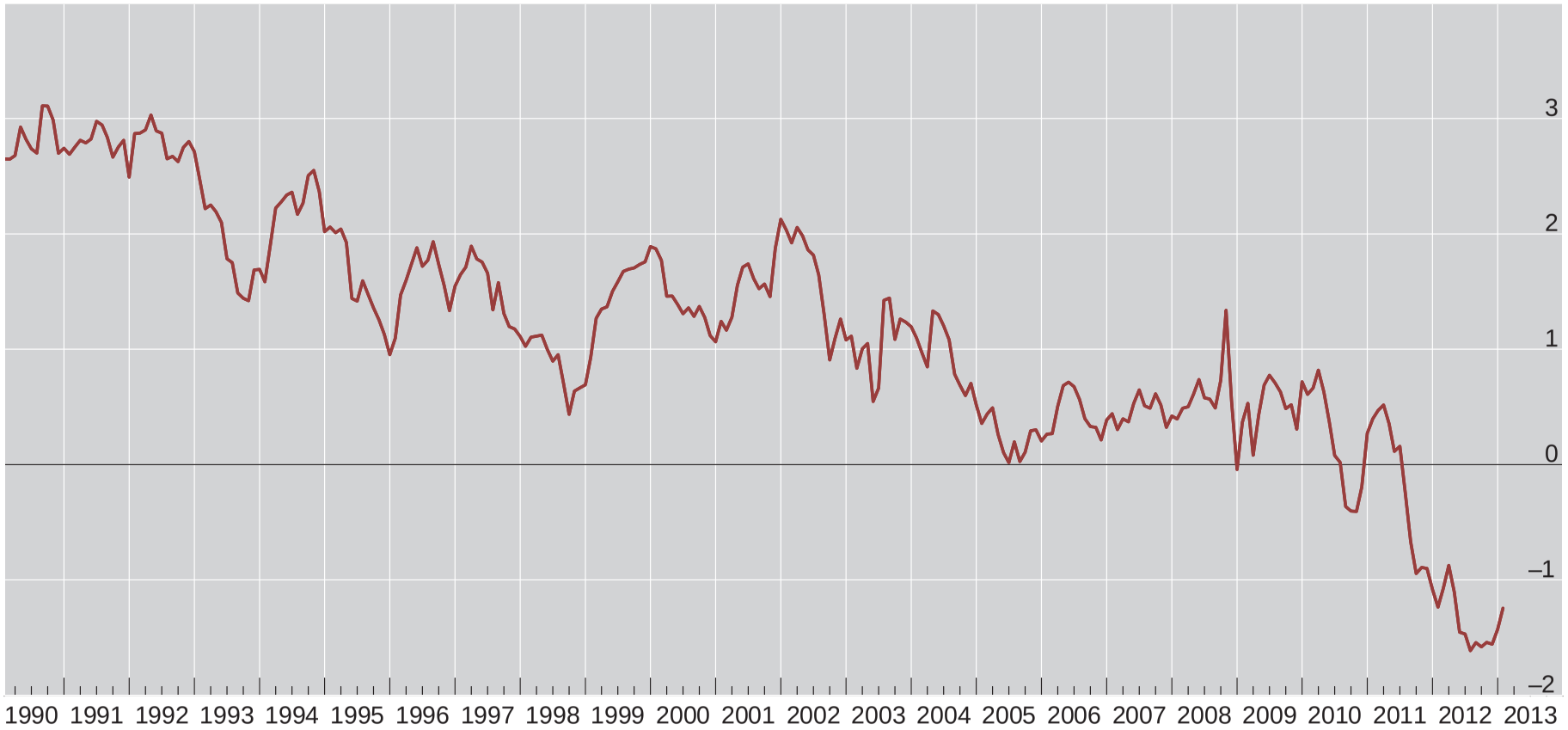


Sources: Bloomberg; Federal Reserve; U.S. Bureau of Labor Statistics.

Graph 5

The term premium in US 10-year nominal government bond yields[1]

In per cent



[1] Sum of inflation and real yield risk premia. These are calculated using the BIS's standard yield curve models.

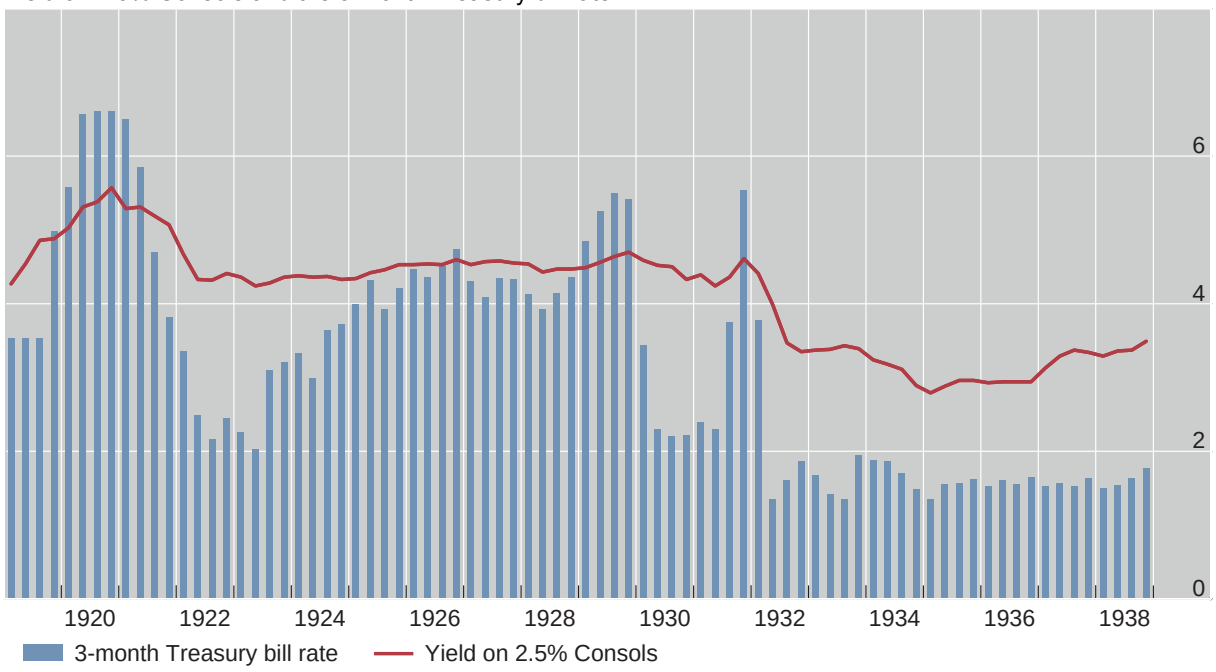
Sources: Bloomberg; national data; BIS calculations.

Graph 6

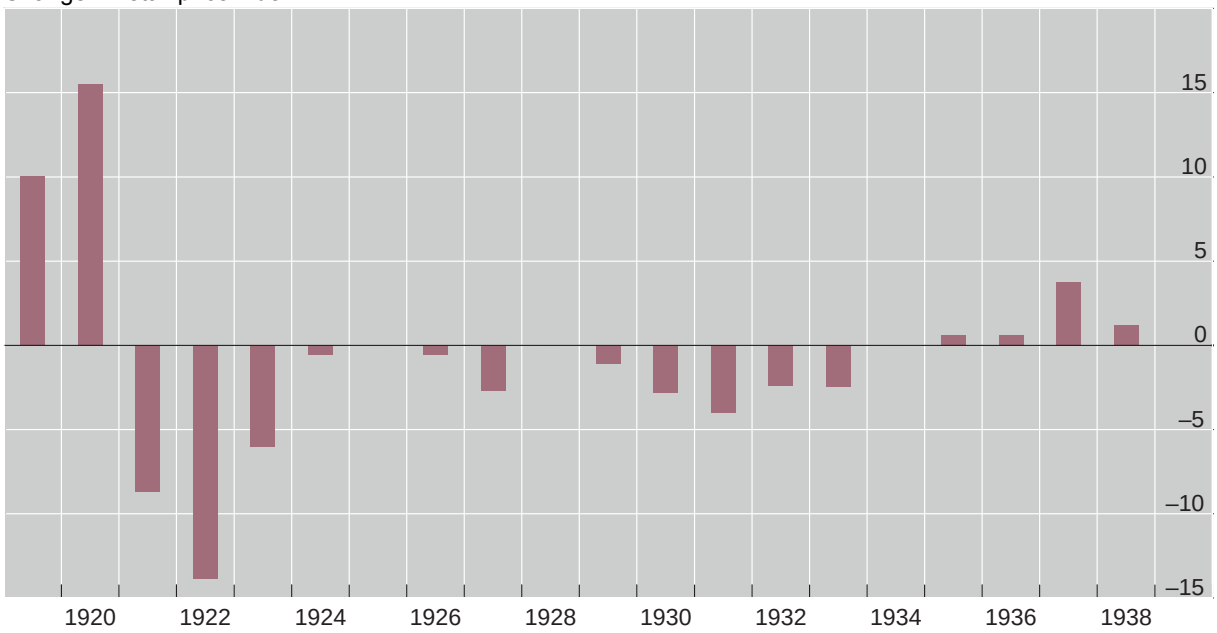
UK interest rates between 1919 and 1938

In per cent

Yield on 2.5% Consols and the 3-month Treasury bill rate



Change in retail price index



Sources: Howson (1975); national data.

Graph 7

10-year bond yields and inflation in emerging markets[1]

In per cent

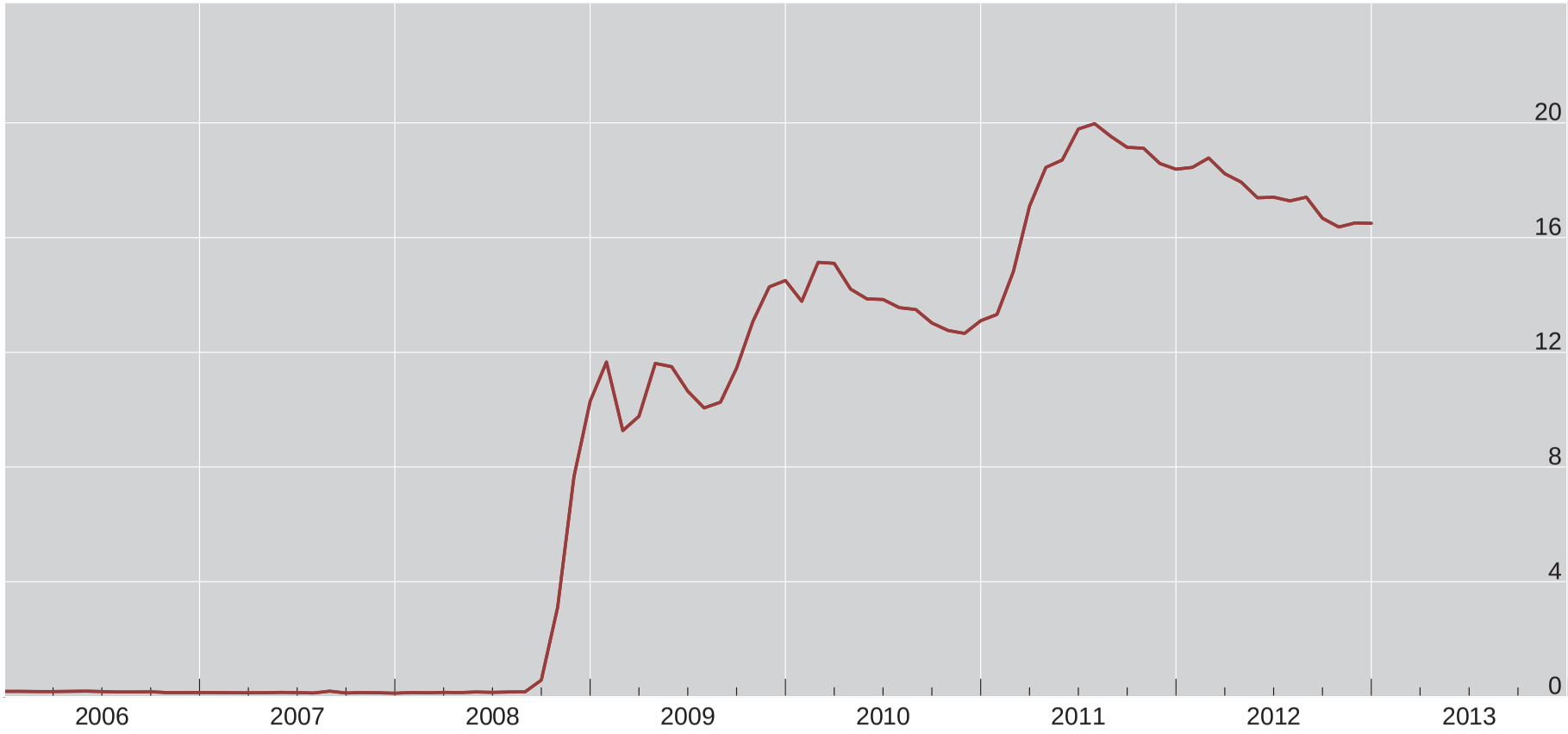
[1] Simple average of Brazil, Korea, Mexico, Malaysia, Poland, South Africa, Thailand and Turkey. [2] Year-on-year change.

Sources: Bloomberg; Datastream; national data.

Graph 8

Bank reserves deposited with the Federal Reserve

As a % of total bank deposits[1]



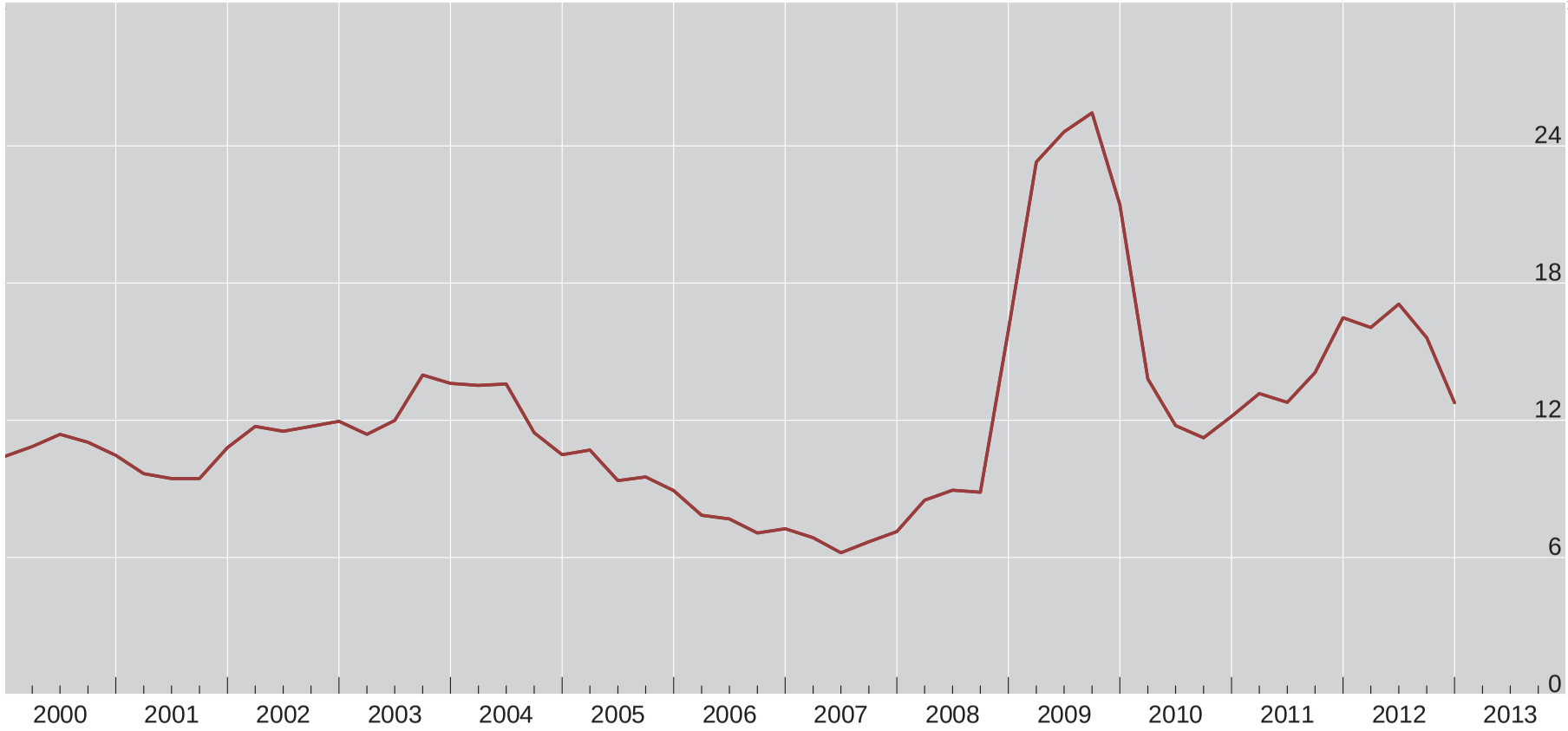
[1] Reserve balances of depository institutions with Federal Reserve banks as a percentage of total deposits of commercial banks in the United States.

Sources: Federal Reserve; BIS calculations.

Graph 9

Volatility of forward US long-term yields[1]

In basis points



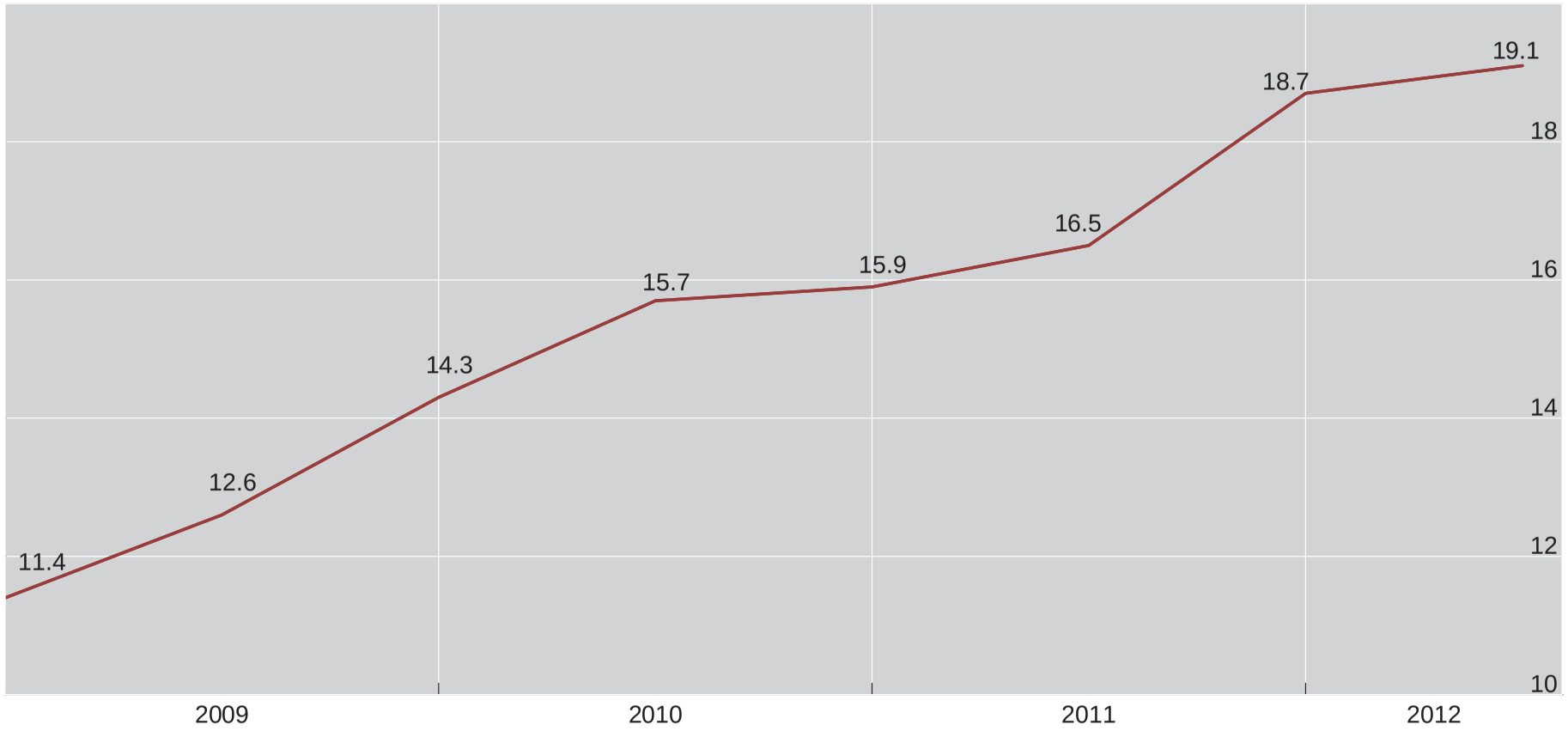
[1] Standard deviation over preceding 52 weeks of changes in weekly averages for 5-year 5 years ahead zero-coupon yields; calculated from 10-year and 5-year zero-coupon government bond yields.

Sources: National data; BIS calculations.

Graph 10

Share of sovereign exposures in total banking book exposures

In per cent



Notes:

(1) These data are based on a consistent sample of 30 large banks (i.e. those that are internationally active and have Tier 1 capital in excess of €3 billion).

(2) Exposures are post credit risk mitigation and after applying credit conversion factors where applicable. Sovereign exposures as defined in paragraph 229 of the Basel II framework.

Source: Basel Committee on Banking Supervision.

Chart 1

CENTRAL BANK HOLDINGS OF GOVERNMENT BONDS: THE EXIT POLICY