BANK OF ENGLAND

Speech

Monetary policy expectations and long term interest rates

Speech given by

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19 May 2016

I would like to thank Rodrigo Guimaraes for his substantial contribution to this speech. Many of the ideas are based on his earlier and current research. I would also like to thank Bank of England colleagues for detailed and helpful comments.

1. Introduction

My talk today is about long-term interest rates.[1] Long-term interest rates play an important role in monetary policy. They are a key part of the transmission mechanism, via which monetary policy affects the wider economy. And they contain useful information about expected future policy rates and expected future inflation.

I will decompose long-term interest rates into real and nominal components, as well as expectations and risk premia components, with particular emphasis on the UK experience.

I will argue that the most important factor behind the fall in long-term interest rates since the financial crisis has been a downward revision in the expected path of policy rates, with inflation expectations relatively stable, thus reflecting lower expected future real rates. The fall in term premia accounts for a relatively small part of the decline in long-term interest rates.

I will argue that the reason expected future real rates are low is that monetary policy has responded, and is expected to continue to respond, appropriately to persistent forces weighing on demand and inflation. Interest rates are low because that is what the economy needs in order to keep inflation expectations anchored.

The natural rate of interest is expected to remain low for many years. Candidate explanations for a persistently low natural rate of interest across a wide range of countries include debt deleveraging, demographic shifts and changes in the distribution of income, which I discussed earlier in the year. The expectations-driven decline in long-term interest rates is apparent across a wide range of countries, suggesting that these forces are global, not unique to the UK.

Viewed in this light, there is nothing anomalous about the low level of long-term interest rates, nor is there any evidence that government bond yields are "distorted" by central banks' asset purchases. None of this should be taken to imply that low long-term interest will not change. They are based on expectations of future policy, which have changed, and will continue to change, as the economy evolves.

I will also present some thoughts on the near-term economic outlook, and the associated challenges for monetary policy.

[1] My colleagues on the MPC have recently addressed related issues; see, for example, Shafik (2015) and Broadbent (2014).

2. Why do Central Banks care about yield curves?

Setting conventional monetary policy means setting the policy rate, called Bank Rate, at the appropriate level to ensure that inflation is close to its 2% target.

Even though Bank Rate has been the main tool of monetary policy, it directly affects only a small part of the economy: Bank Rate is the interest paid on reserves that banks hold at the Bank of England.

The real impact of monetary policy is indirect: Bank Rate affects many other interest rates, which have a much larger economic impact. For households, it is the interest rates on deposits, mortgages, personal loans, credit cards and car loans that matter. For businesses, it is the interest rates on deposits, business loans and corporate bonds that matter. For the government, it is the interest rate on government bonds, or gilts, that matters.

Bank Rate is an overnight rate, a rate paid on a deposit made today that you can get back tomorrow. But most of the rates that I just listed that directly affect economic activity are not overnight interest rates, they apply over longer time periods. For example, the bulk of new mortgages have a rate that is fixed for 2 or 3 years, corporate bonds have rates that are fixed for around 14 years (but just 5-7 years before the crisis). The government on average borrows at rates fixed for around 15 years, and issues some bonds with rates that are fixed for over 50 years.

The interest rates that matter for many parts of the economy are longer term than just overnight. In today's talk I want to delve into what drives those longer-term interest rates. The range of interest rates from short to long term is described by the yield curve, which is simply a list of interest rates over different time horizons that apply at a particular point in time. I will focus primarily on the yield curve on government debt. Other interest rates are typically described as a spread, or margin, above or below the government yield curve.

As I will discuss, a crucial way in which policy affects these longer term rates and spreads is by affecting the expectations of future policy. Indeed, as summarised in Woodford (2003), the prevailing academic consensus before the crisis was that expectations of future policy were what mattered most, far more than just setting overnight rates. This consensus lay behind the global drive toward greater transparency from central banks and the adoption of inflation targets by a large (and increasing) number of countries.

Yield curves matter for monetary policy in two respects. First, as I have just explained, they are a key part of how monetary policy gets transmitted to the rest of the economy. Second, yield curves contain useful information about what market participants expect in the future.[2] Monetary policy responds to economic developments, and in turn aims to influence the economy to achieve the inflation target. Yield curves, as I

[2] See Bank of England (1999) and Woodford (2003) for a discussion of the role of market rates in the transmission mechanism of monetary policy, and Bernanke (2004) for discussion of the information value for policymakers.

will explain, contain information about the path for policy rates and inflation that market participants expect to prevail in the future. This can tell us, for example, whether market participants are optimistic or pessimistic about future economic developments, and it can also tell us whether market participants expect the central bank to be successful in meeting its inflation target.

3. Yield curves: what do the data say?

To describe the evolution of long-term interest rates over time, it is useful to introduce the concept of forward rates. For those unfamiliar with the concept, consider a one-year loan and a two-year loan. The two-year loan can be thought of as a one-year loan, which is then renewed after a year with another one-year loan. The rate for the second year of the two-year loan, which is implicit in the two year loan rate, is called the forward rate. We can calculate forward rates at all horizons.

The benefit of doing this is that any long-term interest rate can then be decomposed into a sum of forward rates. This is a useful descriptive device, because it allows us to distinguish whether long term interest rates change because of a change in the near-term forward rates, or the longer-term forward rates, or both.

A second calculation that will turn out to be useful is to split nominal yield curves into an inflation component and a real yield component. The existence of inflation-linked bonds allows us to measure the yield curve for each component separately. The inflation component of the yield curve, also known as "break-even inflation", is the component of the return on nominal bonds that investors demand for taking inflation risk.[3] There is yet a third split, which I will return to later, into expectations of future short rates and a risk premia component.

With those tools in hand, we can now examine the history of long-term yields (or long-term interest rates, which is the same thing).

Figure 1 shows the evolution of 10 year government bond yields in in the UK since 1972. Long term interest rates rose sharply from 6% to 16% in the 1970s, generally stayed above 10% until the early 1980s, and have come down gradually and significantly since then, with the exception of a brief spike in the early 1990s. Currently, the 10 year yield is about 1.5%.

Figure 2 decomposes long-term rates into an inflation and real yield component. The decomposition starts only in the early 1980s, when index-linked government bonds were first issued in the UK.

[3] Note that break-even inflation rate in the UK is measured in terms of the RPI inflation, because that is the inflation measure index-linked bonds are indexed too. The measure of inflation that the MPC targets, on the other hand, is CPI inflation. There is a large and time-varying wedge between the two measures, reflecting differences in coverage and methodology. See, for example, Liu et al (2015).

Initially, long-term interest rates were high because the inflation component was high, and up to Bank of England independence in 1997 the decline in long-term interest rates was primarily due to a decline in the inflation component. Between 1997 and 1999, both the inflation and real yield component fell back. After 1999, the inflation component has been broadly stable and the entire decline in long term interest rates since then has been due to the real component.

This evolution is consistent with a narrative, familiar to many, of the UK struggling with high and variable inflation in the 1970s through early 1990s, suffering from a lack of a consistent framework for monetary policy. This was brought under control only from 1992 with the introduction of inflation targeting, and further solidified in 1997 with Bank of England operational independence. [4]

Monetary policy went from being a source of disturbances to the economy, to being an inflation-stabilising force.

But stabilising inflation did not result in stable long-term rates. The real component of long-term rates kept falling, gently initially, then more sharply after the financial crisis.

Figure 3 shows the evolution of Bank Rate since 2005, as well as a series of forward curves at different dates. In response to the financial crisis, Bank Rate was cut from 5.5% in 2008 to 0.5% by March 2009.

Short-term forwards, which follow Bank Rate closely, fell sharply, but still implied a return to pre-crisis levels over the subsequent years. In other words, initially, long term rates fell largely because the short-term rates fell.

As we progressed through the post-crisis years, two further developments emerged: forwards remained low over increasingly long horizons, and longer term forwards were much less steep. We might call the pattern a "lying down" of the forwards.

Figure 4 presents a different way to make the same point: initially, most of the fall in long-term interest rates was due to the near-term forwards, here summarised by the 5 year rate (the average of forward rates up to the 5 year horizon). Thereafter, the longer-term forwards also started to decline, as summarised by the average forwards between years 5 and 10, called the 5 year, 5 year rate.

4. UK vs US

To get a sense of the extent to which UK interest rates were driven by domestic or international factors, it is useful to compare the evolution of UK and US long-term interest rates, shown in Figure 5.

[4] See Nelson (2000) for a description of the evolution of monetary policy in the UK from 1972 to 1997.

The pattern that emerges is “similar but not the same”. In the 1970s, US long-term yields rose more gently, as the US’s inflation experience in the 1970s was not quite as bad as the UK’s. Both countries reached similar levels of long-term yields in the in the early 1980s. Since then, the declines have been of a similar magnitude.

Figure 6 compares short-term interest rates, in this case the 1 year rate which tends to follow the policy rate fairly closely. Here too we see a pattern of “similar but not the same”. Both countries experienced very high short-term interest rates in the early 1980s as monetary policy aimed to reduce inflation sharply. UK rates spiked to similar levels again in the early 1990s, but this was associated with the UK’s membership and subsequent exit of the European Exchange Rate Mechanism, so the US did not have the same experience.

More recently, we can see that US rates came down slightly earlier in the financial crisis, as the US economy started its slowdown slightly before the UK, but short-term interest rates soon reached similar levels.

With short-term interest rates clearly responding to some specific domestic developments, but long-term rates seemingly more correlated, a view has sometimes been expressed that short-term rates are under the central bank’s control but long-term rates are driven by other “global factors” beyond the control of central banks. This is reinforced by findings such as those in figure 7, showing that 10 year rates have a higher correlation than 2 year rates.

I think that is somewhat misleading. A more apt description is that central banks in the UK and US are both responding to domestic circumstances, which tend to be somewhat but not perfectly correlated.

As shown in figure 8, the correlation of 2 year *forward* rates is more often than not higher than the correlation of 10 year forward rates. So the high correlation of long-term interest rates is also driven by the forward rates that prevail at shorter horizons, over the first few years of the yield curve.

To be more precise about what drives short-term and longer-term forward rates, we need some more tools and some theory, to which I turn next.[5]

5. Robust and sensible decompositions

Economic theory tells us that forward rates are driven by two components: expectations of future short rates, and risk premia, also referred to as term premia, the premium demanded by investors for holding “term risk”. In order to distinguish the two, we need a model.

[5] Using a model to decompose yields into expectations and term premia, as explained in the next section, we find that the correlation of the 10 year rate is just as much about the expectations component as about the term premium component. In other words, it is not the case that the high correlation is driven only by risk premia.

It is often instructive to start with the simplest first. The two rather extreme assumptions that allow a decomposition of forward rates into expectations and risk premia are the "Expectations Hypothesis" and the "Random Walk Hypothesis", both shown in figure 9.

The "Expectations Hypothesis" simply states that forwards are entirely driven by expectations, i.e. that there are no risk premia. So observed forward rates are taken to be the expectations of future rates.

The "Random Walk Hypothesis" takes the opposite approach. It assumes that expectations of future short rates are the current (or spot) short rate. Any deviation of forward rates from that flat expected path must therefore be due to risk premia.

The advantage of these two approaches, which we might call "0% premia" and "100% premia" is that they are robust, they always give the same decomposition of the yield curve. But are they sensible?

Nobody actually believes that risk premia are zero at all times on all assets.[6] This is a simplification used by economists who want to make their models tractable by making them linear, which precludes the existence of risk premia.

What about the assumption of a random walk? A simple clue as to whether this is sensible is given by figure 10, which shows the paths of interest rates that are expected by professional forecasters at different points in time. If forecasters believed in a random walk, this picture should show only horizontal lines. But it does not.[7]

If we accept that neither of these two extreme assumptions is sensible, how do we progress? We need a model that allows for non-trivial risk premia, i.e. somewhere in between 0% and 100%.

A standard class of models used in the academic literature and in central banks is the affine dynamic term structure model (ADTSM). This model specifies a familiar VAR process for yields, which describes the expectations component, and a similar process for the risk-adjustment.[8]

The problem with this class of models, as with many highly parametrized economic models estimated from persistent time series data, is that their estimation is not robust. As shown in Guimarães (2016), changing

[6] See Cochrane (2011) for a summary of the consensus for a large role for time-varying risk premia in explaining asset price movements. There is a long literature documenting the failure of the "Expectation Hypothesis" with significant time-varying risk in bond markets, see Piazzesi (2009) for a summary focusing on ADTSM, the class of models we use below.
[7] A similar picture arises for the US, using the Survey of Professional Forecasters, or the FOMC's own projections (made available since 2012).
[8] A full specification of an ADTSM involves specifying the determinants (factors) of the risk-free rate, how risk premia depend on these factors and how these factors evolve. The Gaussian ADTSM is the simplest class of such models, where the factors are assumed to evolve according to a standard VAR, and the prices of risk are linear on the factors, so the risk-adjusted dynamics also evolve according to a VAR, though with different parameters for the drift (mean and persistence). See Guimarães (2016) for more details.

the sample period or the number of factors can change the results wildly, with important consequences for not just the size but even the sign of risk premia. Figure 11 shows the range of 10 year spot term premia obtained by this class of models.[9]

One proposed improvement (suggested by Kim & Orphanides (2005, 2012)),[10] is to put some weight on surveys of forecasters. Even without assuming that forecasters are right, or that surveys are in any way a clean measure of market participants' expectations, putting some weight on surveys has been shown (Guimarães (2016)) to drastically improve the robustness with which risk premia can be estimated from yields, shown in figure 12.[11]

6. Analysing risk premia and monetary policy expectations since the crisis

A robust and plausible decomposition of long-term interest rates into a risk premium component and an expectations component allows us to examine the impact of monetary policy since the start of the financial crisis, including the impact of unconventional monetary policy.

First, let us recall that monetary policy always works by affecting a wide range of interest rates and risk premia. Expectations of future policy rates have an impact on longer term interest rates. But the expectation of better economic outcomes as a result of monetary stimulus also changes the distribution of risk, and therefore can reasonably be expected to affect risk premia on a wide range of assets, including government bonds.[12] Note also that there is not necessarily a sharp conceptual distinction between the transmission of monetary stimulus executed by a reduction in the policy rate, compared to the one executed via the purchases of government bonds. It is only a few decades ago that monetary policy in the UK and elsewhere was routinely executed by purchasing assets as the primary instrument, with changes in various interest rates as an intermediate target. Carrying out monetary stimulus via asset purchases from 2009 was more remarkable for its sheer speed and size than its change of tools.[13]

[9] The figures show a total of 72 estimates which result from combinations of number of factors (3, 4 and 5 factors driving the interest rate and risk premia) and 24 different data samples for each (8 samples starting in Jan 72, 77, 82, 87, 92, 97, 02, 07 and ending in Dec 2015 and 16 samples starting in Jan 72 but ending in Dec 00, 01, 02,…,14,15). These are estimated using the 3-step regression approach proposed by Adrian et al (2013). The addition of surveys using this method is explained in Guimarães (2016). Guimarães (2016) also shows that the estimation method is not particularly important, what matters is including surveys or not (i.e. same results when estimating the models by Maximum Likelihood with different assumptions about factors).

[10] See Kim & Wright (2005) for an early application to US data (model estimates continuously updated by Fed staff) and Joyce et al (2010) for an early application to the government yield curve in the UK.

[11] Importantly, Guimarães (2016) shows that this is purely a statistical identification problem (estimation of parameters), not about changing the information contained in bond prices to fit surveys, and that assuming survey forecasts are more or less noisy is not important (i.e. the results are insensitive to increasing the assumed volatility of errors of survey forecasts).

[12] For evidence and theory of risk premia effects of conventional monetary policy see among others Bernanke & Kuttner (2005), Gurkaynak et al (2005), Palomino (2012), Bekaert et al (2013), Hanson & Stein (2015), Fawley & Neely (2014), Gertler & Karadi (2015), Buraschi & Whelan (2015), Boyarchenko et al (2016)), Cesa-Bianchi et al (2016), Gorodnicheno &Weber (2016) and Schmeling & Wagner (2016).

[13] Since 2007, the Bank of England expanded its balance sheet nearly five-fold, or by 20 percentage points of GDP. The Bank of England (http://www.bankofengland.co.uk/education/Documents/resources/postcards/qecomp.pdf) still describes QE as injecting money in the economy. See also Mervyn King's 2009 Mansion House speech. Bernanke & Reinhart (2004), before the financial crisis, argued QE could be seen as a continuation of standard open market operations, simply as "switching its focus from the price of reserves to the quantity or growth of reserves" (pg 87).

In March 2009, the MPC cut Bank Rate to 0.5% and announced that this was, at the time, seen to be the effective lower bound on interest rates. In other words, any further reduction of Bank Rate was seen as potentially counterproductive, as the adverse impact on the balance sheets of certain lenders might more than offset the stimulative impact via a range of interest rates and possibly the exchange rate.[14]

Because the monetary stimulus provided by a 0.5% policy rate was judged to be insufficient at the time, the Bank also announced it would start a programme of asset purchases (also known as "quantitative easing", or QE), and the purchases were primarily of government bonds.[15]

We can now look at the evolution of interest rate expectations and risk premia since the start of the financial crisis, including over the period when asset purchases were carried out.

First, by simple inspection of the time series in Fig 13, we can see that risk premia in UK long-term interest rates were generally rising in the period when asset purchases began. Risk premia did not stabilise until 2010, when asset purchase programmes were well underway. And risk premia did not start falling until summer of 2011, and fell further from 2014 when UK asset purchases had already ended. The US showed a similar pattern, as can be seen in Figure 14.

Expectations, on the other hand, fell throughout this period, in a way that I described earlier as "lying down". Initially, it was near-term expectations of future policy rates that fell, but policy rates were expected to rise back to the pre-crisis levels fairly swiftly. Then, the point at which rates were expected to rise started being pushed out further in time, and the pace at which rates were expected to rise thereafter was being revised down.

Figure 15 summarises the evolution of term premia and expectations over the entire period from 2007 to 2016. It shows that well over half of the movement in yields was accounted for by changes in expectations, not changes in risk premia. At short horizons, 100% of movement was accounted for by expectations. But even at the 10 year horizon, more than 80% of the movement in the UK yield curve was due to expectations (just under 70% in the US).

So far, we have just described what happened on average over the period, without trying to pin down specific causality from the asset purchase programme to yields. But I am already finding it hard to tell a convincing story of asset purchases working primarily through term premia when term premia moved the wrong way initially, and when movements in the yield curve were primarily due to changes in the expectations of future short-term rates.

[14] Since then, lender balance sheets have improved, and the MPC announced in February 2015 that interest rates could be cut further if necessary.
[15] In the US, Fed funds (policy rate) reached the ELB in December 2008, establishing a band of 0% to 0.25% for its target rate, and purchases of mortgage backed securities began in November 2008 and government bonds in March 2009.

Moreover, let us consider for a moment the broad thrust of the argument that asset purchases reduced term premia primarily by removing bond supply or interest rate risk from the private sector.[16] As pointed out by Greenwood et al (2016), net supply of government bonds in the US *increased* over the post-crisis period, as the issuance requirements to fund the deficit rose much more sharply than the Fed's purchases. A similar pattern was observed in the UK, where net issuance of government bonds was far larger than the amounts bought by the Bank of England[17]. To explain why long-term interest rates declined throughout the post-crisis period, we have to resort to interest rate expectations, we cannot plausibly invoke the mechanical impact of asset purchases.

One approach often used to assess the impact of asset purchases on yields is to carry out an event study, for example by only looking at the movement in yield curves on the day of significant announcements related to asset purchases. That isolates the effect of asset purchases on the yield curve from the effect of other changes in the economy.

Figure 16 shows that the results still stand: even at longer maturities, roughly 60% of the movement in the yield curve is due to changes in expectations. And at shorter maturities, the share due to expectations is even larger. Results are similar for the US (just under 50%), as shown in figure 16.

However, I am only showing these event study results for comparability to many other studies in the literature. I would like to emphasise that I do not find event studies convincing for the purpose of analysing the impact of central bank asset purchases. These studies do not allow for the fact that some part of asset purchase announcements were anticipated by financial markets, nor do they allow for a gradual impact over time as market participants adjust their positions or learn about the new policy. Finally, event studies over-emphasise temporary effects that could be driven by low market liquidity and fade quickly.[18]

The picture that emerges is one where asset purchases have an effect on term premia, but also work by changing expectations of the future path of policy and future economic outcomes. This should not be too surprising[19]. Asset purchases were a powerful signal about central banks' reaction functions: central banks demonstrated they were willing and able to provide further stimulus even when the policy rate had reached

[16] For an overview of the various papers investigating the portfolio balance channel, see e.g. Joyce et al (2012).
[17] Since the start of the 2009 fiscal year, which coincided approximately with the start of UK asset purchases, net issuance of gilts has been GBP 800bn, while asset purchases have only been GBP 375bn. As in the US, it is very hard to reconcile net issuance with term premia dynamics: the period of decrease in net issuance (early 2009) corresponds to stable long term forwards and higher term premia estimates, while term premia fell most at the end of the sample, when there was large net issuance. This either suggests these effects are small or that they are temporary, matching the fact there were large fall in yields on announcement days even though over the whole of US QE1 period yields increased, which is what Wright (2012) finds.
[18] For a detailed treatment of the potential flaws in event studies, see Gurkaynak & Wright (2013). Greenwood et al (2016) emphasise the possibility of slow adjustment, and temporary effects due to lack of liquidity.
[19] Not too surprising, but stands in contrast with some papers in the literature that ascribe most of the effect of QE as working via term premia. See Williams (2014) for a review of the large number of studies on the impact of QE. Studies include the impact on the government yield curve (e.g. Doh (2010), Gagnon et al (2011), Bauer & Rudebusch (2014), Cahill et al (2013), Christensen & Rudebusch (2012), D'Amico & King (2013), Joyce et al (2010, 2011), Krishnamurthy & Vissing-Jorgensen (2011), Buraschi & Whelan (2015b)), on different asset classes (e.g. Bauer & Neely (2014), Glick & Leduc (2012), Gilchrist & Zakrajsek (2013), Hattori et al (2016)), on expectations (e.g. Carvalho et al (2011), Altavilla & Giannone (2015)) and on the macroeconomy (e.g. Bridges & Thomas (2012), Baumeister & Benati (2013), Kapetanios et al (2012), Weale & Wieladeck (2016)). We discuss these in Guimarães & Vlieghe (2016).

its effective lower bound[20]. Moreover, by carrying out further asset purchases even when the policy rate had been at its effective lower bound for several years, the action was also a signal that either the economy was even weaker than previously thought, or that low interest rates were providing less of a stimulus than previously thought (i.e. the natural rate was lower). Both mechanisms are likely to have contributed to a downward revision of the expected future rate path.

Why is it important to assign the impact of asset purchases to expectations or to term premia? Because it enhances our understanding of how the policy has worked in the past, and therefore how it might work in the future, should we need to use it again. It also sheds light on the likely impact of unwinding asset purchases one day.

Relatedly, if one thought that asset purchases work primarily through term premia, this might give credence to the idea that central bank bond purchases are "distorting" long-term interest rates. But, as the data show, most of the fall in long-term interest rates was not due to risk premia, but due to expectations of the future path of policy rates. Estimates of UK term premia are only slightly lower than their average levels in the decade before 2007, and most of the reduction has happened after QE had ended, with a reduction measured in tens of basis points, not hundreds of basis points.

Turning then to the expectations of the future path of policy rates, what do these say about how monetary policy behaved and is expected to behave?

We know from surveys and from formal models[21] that the relative stability of break-even inflation since the late 1990s is due to the stability of the expectations component of break-even inflation. This is important for our interpretation of the expectation of future short-term interest rates.

The fact that inflation expectations have been broadly stable suggests that monetary policy has been appropriately responding to persistent forces weighing on demand and inflation.[22] If inflation expectations had been declining, that would be indicative of monetary policy providing insufficient stimulus. If inflation expectations had been increasing, it would indicate too much monetary stimulus. But yield curve patterns suggest that market participants on average consider that the monetary stimulus in the UK has been "about right" to achieve the inflation target, and will continue to be "about right".

[20] Bernanke (2015) provides a detailed account of policy at the Fed during the crisis periods. He stresses how, even though there were doubts about how it would work and potential side effects, decisions on QE programmes were often driven more by the desire to send a clear signal about the FOMC's commitment to provide monetary easing (see pages 420-21 describing the decision to extend MBS purchases and start buying treasuries announced on March 18 2009, or page 484 for the decision to reinvest maturing MBS) than the specific mechanisms through which the policy might work.
[21] See Joyce et al (2010) and Guimarães (2016).
[22] For the initial deflation scare, see Smith (2012) for evidence from inflation options in the UK, and Guimarães (2012) for discussion of survey evidence and estimates of model-implied inflation risk premia and expectations consistent with a large deflation scare at the time of the Lehman collapse. See also Garcia & Werner (2011) for similar Euro-area evidence and Christensen et al (2012) for the US.

The interest rate that is appropriate in order to keep inflation close to target is referred to as the natural interest rate. The evolution of policy since the crisis and the expected future path of policy show that the MPC has been tracking the natural rate, and is expected to continue tracking the natural rate.[23]

Of course the expected path of future policy changes frequently as it adapts to new information about the economy and the MPC's reaction function. But the key point is that the expected path of interest rates is in line with the expected path of the natural rate: the MPC is not expected to overheat the economy or to stifle it. Rates are expected to be low because that is what the economy is thought to require in order to return inflation to target and keep it there.

That leaves us with the question of why the expected path of the natural rate is so low. Earlier this year I offered my own views on this, namely persistent effects from debt deleveraging, demographic shifts and changes in the distribution of income have created an environment where a given level of growth might be consistent with substantially lower interest rates than in the past. This environment might persist for years, even decades.[24]

7. Other countries

What about countries other than the US and the UK? The same decomposition between the expected path of interest rates and term premia can be estimated for a range of countries using the Consensus Forecasts survey of professional forecasters.

Using this decomposition, we see from figure 17 that there was no systematic movement in risk premia across a wide range of countries in the post-crisis period. For some, risk premia went up, for others, they fell, and for some they were unchanged.

What all countries did have in common, however, is a substantial fall in the expected path of future interest rates, shown in figure 18. The path of future policy rates was revised down by several percentage points on average.

Note that this sample includes countries that carried out asset purchases as well as those who did not. And it includes countries that reached their effective lower bound on interest rates as well as those who did not.

I interpret this pattern as significant further support for the idea that what is driving long-term interest rates lower is not asset purchases or otherwise distortive monetary policies, but rather global economic circumstances that are expected to require very low policy rates for many years. Without such low policy

[23] See Woodford (2003) for textbook description of desirability of tracking the natural rate as optimal policy. See Barsky et al (2014), Curdia (2015), and Curdia et al (2015) for US estimates of the natural rate, and Bank Underground blog post by Goldby et al (2015) for the UK.
[24] See Vlieghe (2016) for general discussion and references.

rates, we risk an unanchoring of inflation expectations to the downside, which in turn makes any level of policy rates less stimulative by increasing real interest rates, and can create a vicious cycle of growth and inflation disappointments, as seen in Japan since the early 1990s.[25]

8. Current UK outlook

Before concluding, I will make a few comments on the current outlook for the UK economy and recent data developments.

Despite repeated forecasts of stabilisation, UK GDP growth has continued to slow, from around 3% in 2014, to around 2% in 2015, to less than 2% in 2016 so far. This slowing has taken place against a background of persistently disappointing global growth, domestic fiscal consolidation, weaker than expected productivity growth, and, more recently, uncertainty about the upcoming referendum on the UK's membership of the EU. Inflation pressures remain subdued, although the inflation data have, on balance, not continued to surprise us to the downside over the past few months. Headline inflation is well below target at 0.3% on the most recent data, although most of that reflects past falls in energy and food prices, an effect which is expected to fade. Core inflation remains subdued at 1.2%. Wage inflation at around 2% continues to be weak despite the past declines in the unemployment rate to just above 5%.

The upcoming referendum on the UK's membership of the EU poses particular challenges for monetary policy.

First, it makes the data less informative than usual about the underlying state of the economy. Uncertainty ahead of such a major event is bound to lead some firms and households to postpone important spending decision until after the event. Should the vote be to remain in the EU, I would expect to see an improvement in growth as the delayed spending is actually carried out.

The challenge for the Committee is that we do not know how much of the slowing in growth is due to the referendum, an effect which should be short-lived, and how much of it reflects a more fundamental loss of underlying momentum, which might be more persistent.

The loss of UK growth momentum and absence of a meaningful pick-up in inflationary pressures has been a rather gradual process over the past few years, but, cumulatively, it adds up to a significant downward revision in growth and inflation, to which monetary policy has not responded so far. Instead, a significant downward move in the market path of interest rates over the past two years has provided the stimulus the economy needs to return inflation to the target over the forecast horizon.

[25] As discussed in, e.g. Bernanke (2003, 2015) and Ahearne et al (2002).

Following a vote to remain, I would like to see convincing evidence of an improvement in the economic outlook, in line with the forecasts in the May Inflation Report. If such improvement is not apparent soon, this will reduce my confidence that inflation is likely to return to the target within an acceptable time horizon without additional monetary stimulus.

If the vote is to leave, the MPC will be faced with an entirely different set of policy challenges. Given significant uncertainty about the future of the UK's trading relationships, a meaningful drop in domestic demand and in the exchange rate is possible. For some time, the productive potential of the UK economy might also decline as the economy adjusts to new trading relationships and investment patterns. The UK is therefore likely to experience lower growth, and higher inflation for a period as a weaker exchange rate pushes up import prices.

The response of monetary policy will depend on the relative magnitudes of the adjustment in demand, supply and the exchange rate. In any case, the MPC will take whatever action is needed to ensure inflation expectations remain anchored, and to return inflation to the target over an appropriate horizon.

9. Conclusion

Long-term interest rates play an important role in monetary policy. They are a key part of the transmission mechanism, via which monetary policy affects the wider economy. And they contain useful information about expected future policy rates and expected future inflation.

I have decomposed long-term interest rates into real and nominal components, as well as expectations and risk premia components, with particular emphasis on the UK experience.

I have argued that the most important factor behind the fall in long-term interest rates since the financial crisis has been a downward revision in the expected path of policy rates, with inflation expectations relatively stable, thus reflecting lower expected future real rates. The fall in term premia accounts for a relatively small part of the decline in long-term interest rates. In this respect, the evolution of the yield curve since the crisis is still consistent with the notion that central banks' main effect on the economy is through expectations. As summarized by Woodford, "Not only do expectations about policy matter, but, […] very little else matters".[26] I have argued that the reason why expected future real rates are low is that monetary policy has responded, and is expected to continue to respond, appropriately to persistent forces weighing on demand and inflation. Interest rates are low because that is what the economy needs in order to keep inflation expectations anchored. The natural rate of interest is expected to remain low for many years.

[26] See Woodford (2003), p15. Woodford's argument is that the control of overnight rates per se is of negligible importance for the economy compared to expectations of future policy, i.e. if changing overnight rates were thought to be unrelated to future overnight interest rates they would have very little effect on the economy.

Viewed in this light, there is nothing anomalous about the low level of long-term interest rates, nor is there any evidence that government bond yields are “distorted” by central banks’ asset purchases. None of this should be taken to imply that long-term interest rates will not change. They reflect expectations of future policy, which have changed, and will continue to change, as the economy evolves.

The expectations-driven decline in long-term interest rates is apparent across a wide range of countries, suggesting that the disinflationary forces are global, not unique to the UK. Candidate explanations for a persistently low natural rate of interest across a wide range of countries include debt deleveraging, demographic shifts and changes in the distribution of income, which I discussed earlier in the year.

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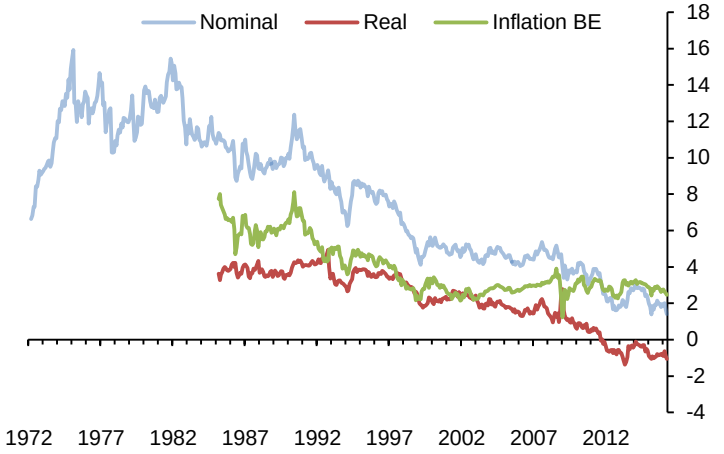
Figure 1: Nominal 10 year zero-coupon spot yield on UK government bonds

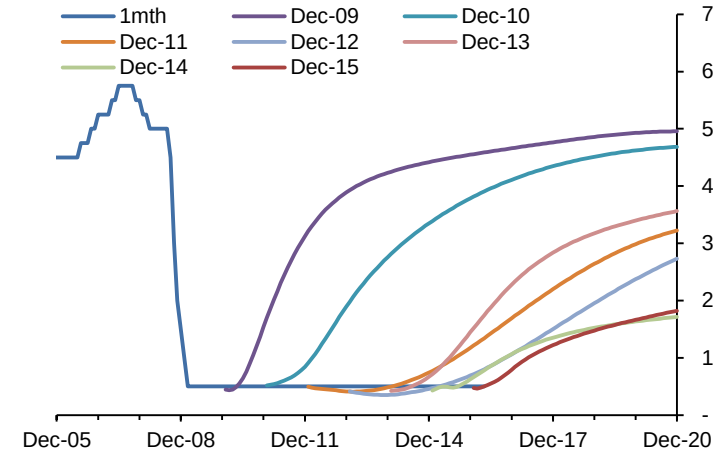
Source: Bank of England

Figure 2: Real and inflation breakeven 10 year zero-coupon spot yields on UK government bonds



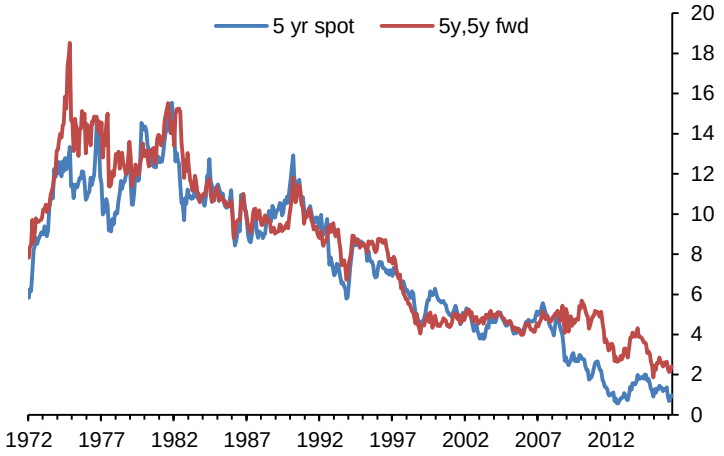
Source: Bank of England

Figure 3: History of Bank rate and OIS instantaneous forward curves



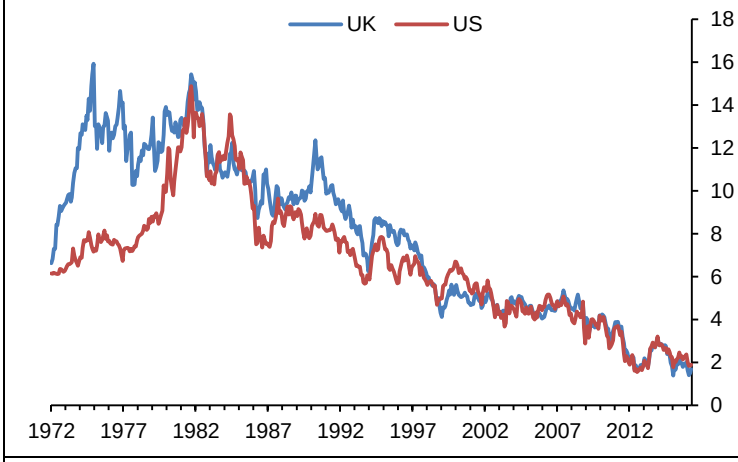
Source: Bank of England

Figure 4: Nominal 5 year zero-coupon spot and 5 year,5 year forward yields on UK government bonds



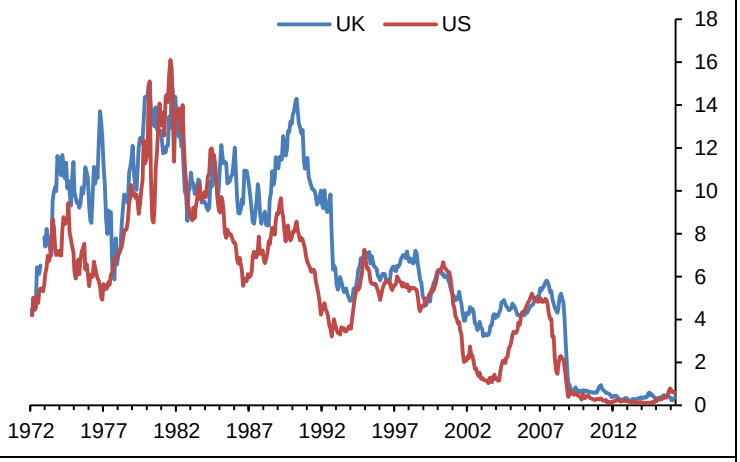
Source: Bank of England

Figure 5: Nominal US and UK 10 year zero-coupon spot yields on government bonds



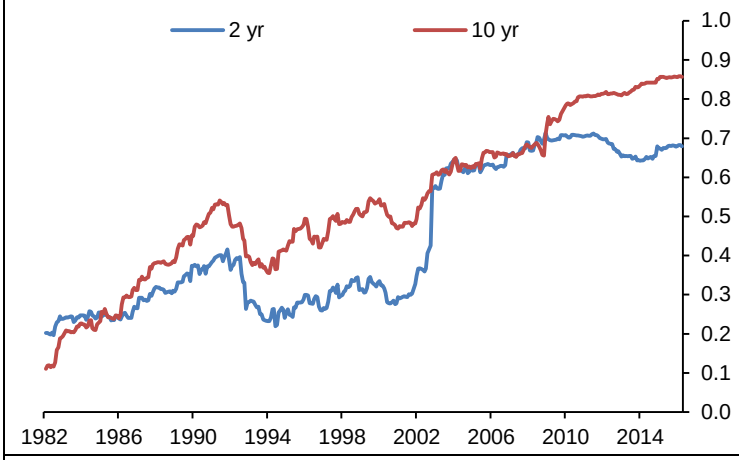
Source: Bank of England, Federal Reserve Board

Figure 6: Nominal US and UK 1 year zero-coupon spot yields on government bonds



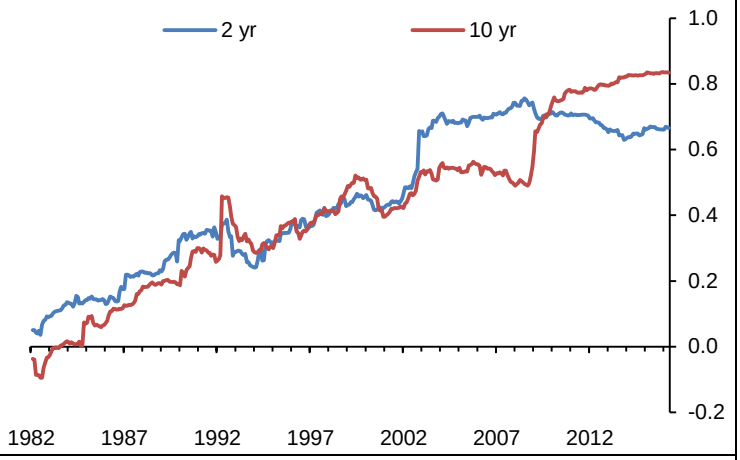
Source: Bank of England, Federal Reserve Board

Figure 7: Correlation between UK and US zero-coupon spot rates, 2 year and 10 year maturities



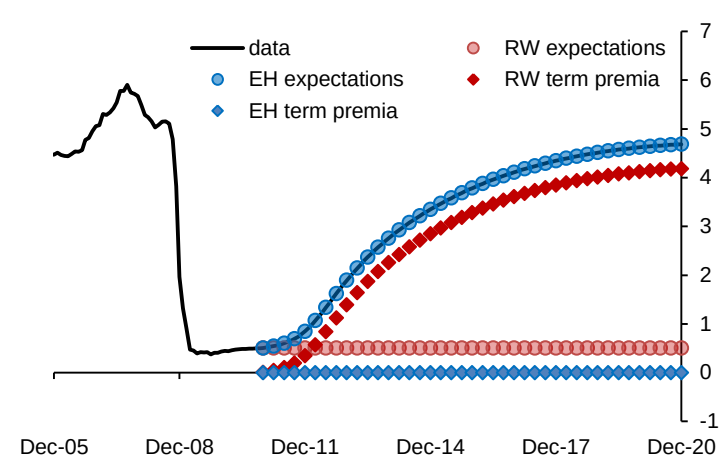
Source: Bank of England, Federal Reserve Board, author calculations

Figure 8: Correlation between UK and US (instantaneous) forward rates, 2 year and 10 year horizons



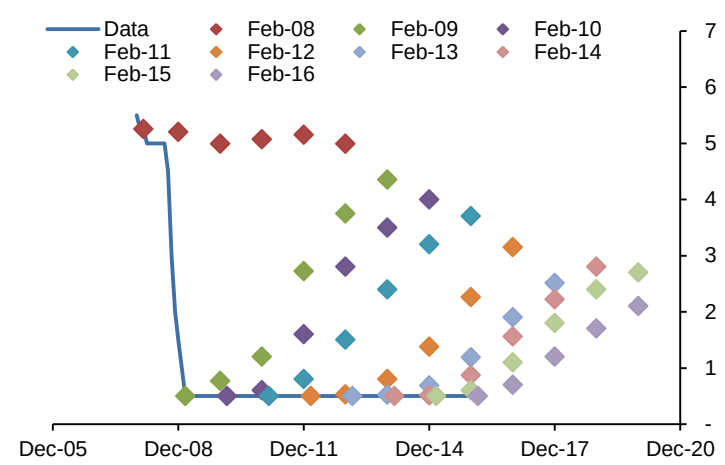
Source: Bank of England, Federal Reserve Board, author calculations

Figure 9: Example of "Random Walk Hypothesis"and "Expectations Hypothesis" (with Dec'10 forward curve)



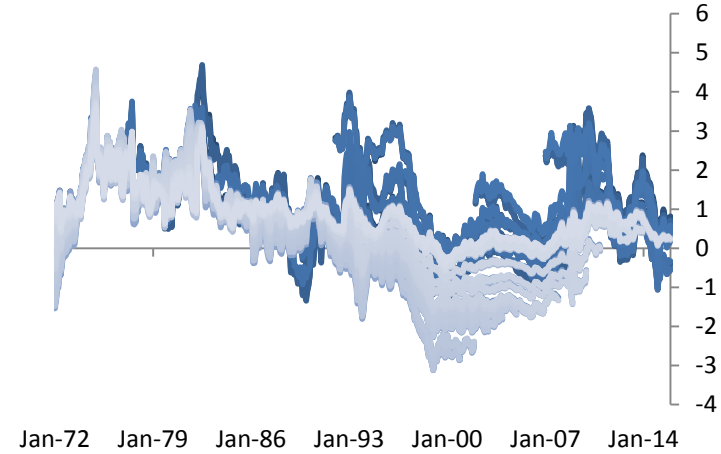
Source: Bank of England, author calculations

Figure 10: Bank rate forecasts from HMT survey of private professional forecasters



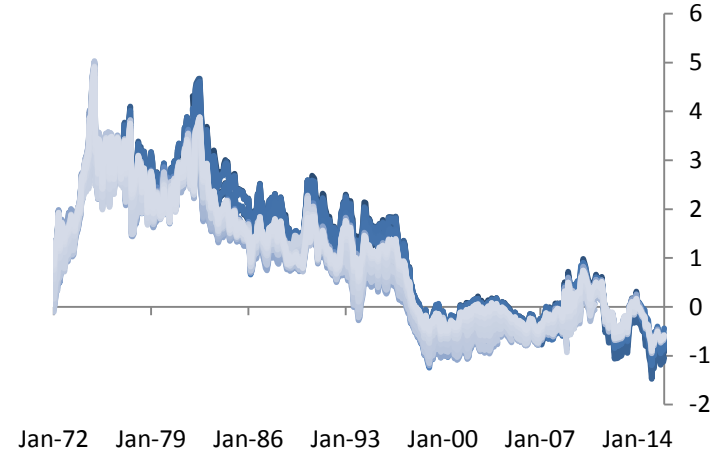
Source: Bank of England, HMT

Figure 11: Range of nominal 10 year spot term premia from 72[1] unrestricted model estimates of ADTSM



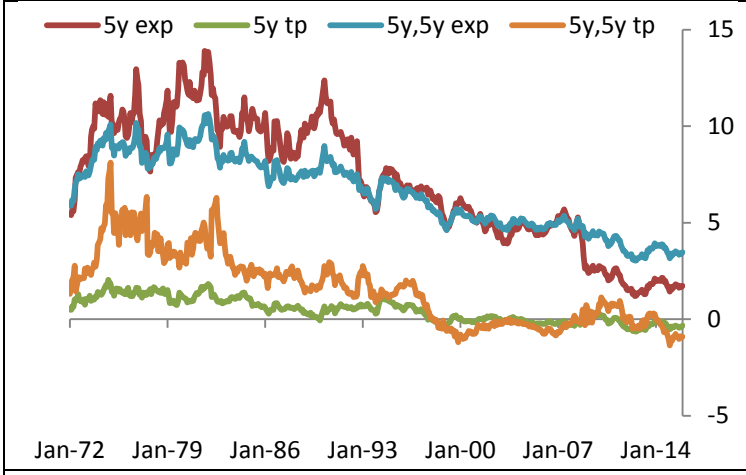
Source: Guimarães & Vlieghe (2016), [1]:combination of different number of factors (3) and samples (24)

Figure 12: Range of nominal 10 year spot term premia from 72[1] model estimates of ADTSM including survey forecasts



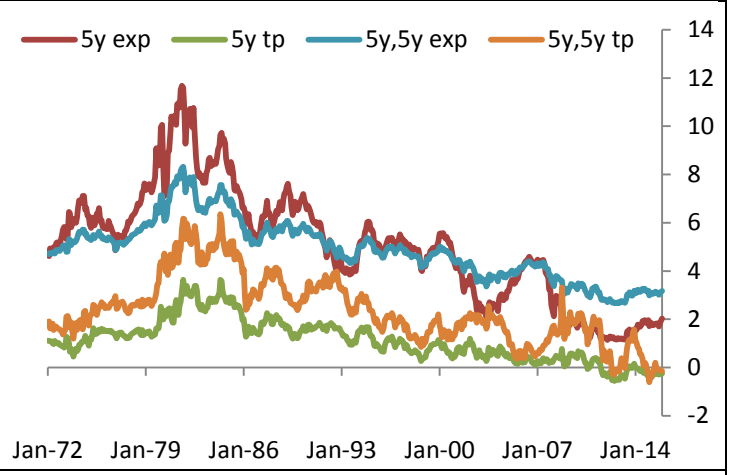
Source: Guimarães & Vlieghe (2016), [1]:combination of different number of factors (3) and samples (24)

Figure 13: Decomposition of UK 10 year nominal spot rate into expectations and term premia (5year and 5year,5year)



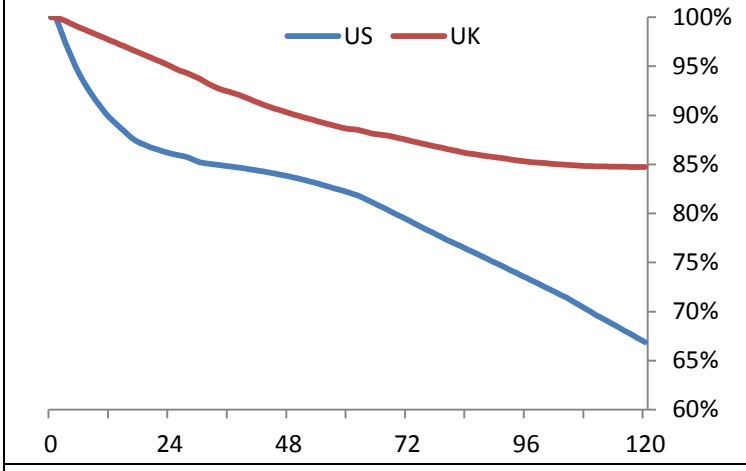
Source: Guimarães & Vlieghe (2016)

Figure 14: Decomposition of US 10 year nominal spot rate into expectations and term premia (5year and 5year,5year)



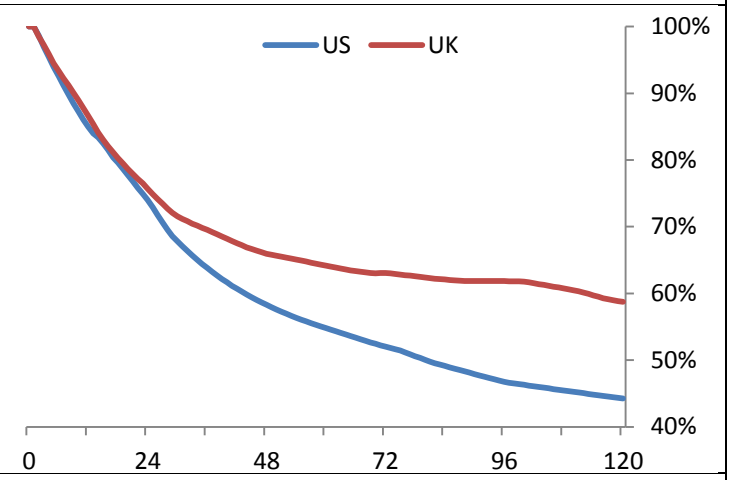
Source: Guimarães & Vlieghe (2016)

Figure 15: Share of change in yield curve from Jan 2007 to March 2016 due to change in expectations (by maturity)



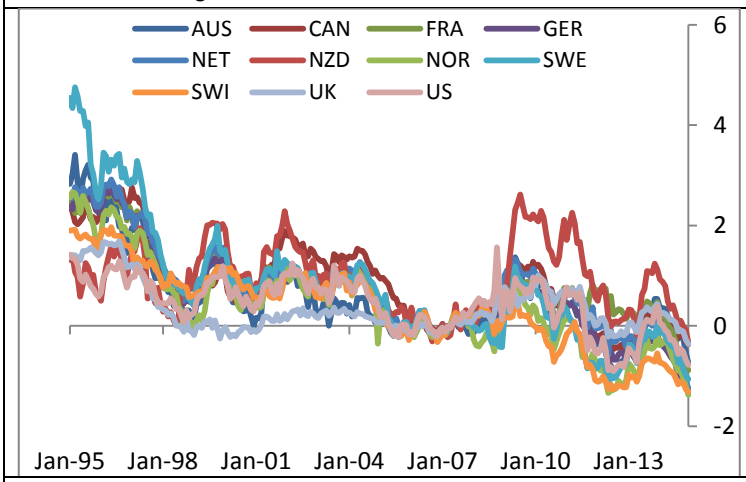
Source: Guimarães & Vlieghe (2016)

Figure 16: Share of 1-day change in yield curve in response to QE announcements



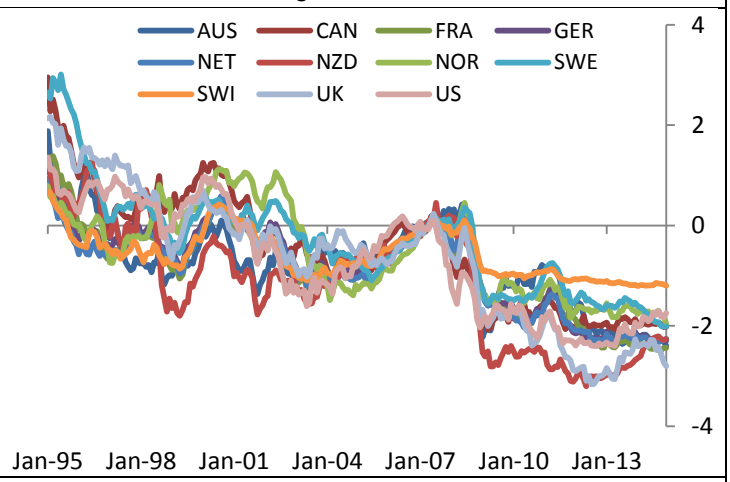
Source: Guimarães & Vlieghe (2016)

Figure 17: Change in 10 year spot term premia relative to 2007 H1 average



Source: Guimarães & Vlieghe (2016)

Figure 18: Change in 10 year spot expected short rate relative to 2007 H1 average



Source: Guimarães & Vlieghe (2016)