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Revised

Why the long-term interest rate matters

CEPR Regulatory Reform Forum on "A long-term environment of low nominal interest rates: what are the consequences for the financial sector?"

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This note draws on work with Jagjit Chadha and Fabrizio Zampolli. Views expressed are my own. They are not necessarily those of the BIS. Email: philip.turner@bis.org.

The title of this conference is: “A long-term environment of low nominal interest rates: what are the consequences for the financial sector?”. It does not specify which interest rate matters. It could mean the policy rate – the very short-term interest rate that central banks control. Giovanni Dell’Ariccia has just argued that the risk-taking channel of monetary policy transmission is driven by the policy rate. Many have argued along these lines, and it is indeed possible to make a logical case for this theory. But there is, however, one problem. It is that there is no evidence of any simple link between the US policy rate and the usual measures of volatility or risk appetite in financial markets in the years immediately before the recent crisis. Virtually all measures of risk premia and market volatility actually continued to fall right through the mid-2004 to mid-2006 period of tightening of monetary policy by the Federal Reserve (see Graph 2 in Turner, 2010). Banks and others greatly increased their risk-taking over this period – and higher policy rates did not dissuade them. And they continued to do so for a further year, even after the Federal funds rate had reached its local peak of 5¼%. Many of the riskiest sub-prime mortgages were written when the policy rate was near this peak. So a 400+ basis points rise in the Federal funds rate, which did ultimately lower real aggregate demand significantly, did not curb excessive risk-taking by the financial industry.

Or the title of the conference could mean the long-term interest rate. In my view, it is the long-term interest rate (or the slope of the yield curve) that is key for financial stability (Turner, 2013). In the absence of sovereign default risk, the long-term interest rate on government bonds defines the credit risk-free maturity transformation over time. It provides the basic discount rate, and is thus central to the pricing of all long-term assets. When the long-term rate is “too low”, the prices of long-term assets can rise “too high”. In particular, it influences the market value of assets that potential borrowers have as collateral for getting new loans. José-Luis Peydró rightly stressed this morning the importance of collateral valuation for risk-taking behaviour. 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. Many economists have underlined this point. It is the term spread, for instance, that is key in Adrian and Shin’s very influential work. Markus Brunnermeier has also written lucidly about the key importance of maturity transformation.

Hence the focus of my remarks will be on central bank policies aimed at the long-term yield on government bonds – and not about the determination of the policy rate.

Government debt/GDP ratios have risen sharply in almost all advanced economies. By buying a sizeable proportion of long-term government bonds, central banks in the United States, the United Kingdom and Japan have in effect monetised part of this increased debt. So a key question hanging over monetary policy over the next decade will be: "How far should central banks continue to manipulate the government bond yield curve?".

There are two schools of thought about this question. One might be called "Old Keynes". In both the *Treatise on Money* and the *General Theory*, Keynes argued that the authorities should be ready to alter the maturity of their debt issuance in order to influence the long-term interest rate. He complained in 1930 that: "Central banks are always too nervous about buying long-term paper". Because of *imperfect and uncertain substitutability* across maturities, changes in short rates do not feed through to long rates in a stable and predictable way. Hence he argued it would be better for central banks to supplement changes in the policy rate with operations in government debt markets. Both James Tobin and Milton Friedman shared Keynes's view that significant portfolio rebalancing effects made central bank open market operations in bond markets an effective tool of monetary policy.

The alternative school of thought is represented by the standard "New Keynesian" model – at least in its standard form. Portfolio balance effects are absent in this model. Because of highly elastic arbitrage across the yield curve, these models assume, the relative supplies of short-dated and long-dated debt play no significant role in shaping the yield curve.

Since the start of the crisis, several studies have demonstrated the quantitative importance of central bank purchases of government bonds and related assets. Event studies have generally confirmed that central bank actions have, on announcement, significantly lowered long-term interest rates. One recent study published in the *Economic Journal* found that the purchases of Treasuries by the Federal Reserve contributed to reducing the long-term rate by about 80 basis points in the first two large-scale purchasing programmes.

These studies, however, do not necessarily prove the case for "old Keynes" against the New Keynesian view. This is because they are based on the difficult financial market conditions prevailing in the post-crisis period. Capital constraints

on banks and other financial firms, worries about the creditworthiness of wholesale market counterparties uncertainty about future regulations … all such crisis-related elements would inhibit arbitrage by the private sector. The standard New Keynesian model would not apply in such disturbed circumstances – but may again apply in normal conditions.

So to explore this a bit further Jagjit Chadha, Fabrizio Zampolli and I decided to investigate the empirical relevance of the maturity effects of US Federal debt **over a pre-crisis sample** from 1976 to 2008 (Chadha et al, 2013).

Specifically, we examined the determinants of 5-year forward 10-year yields, an interest rate which should be less influenced by the business cycle and monetary policy than the contemporary 10-year yield. Note also that we used as far as possible expectations of future variables, not the current readings.

Five-year forward 10-year rate — Table 1

	1976H1-2008H1					1986H1-2008H1	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Inflation expectation	1.048***	0.999***	1.029***	1.138***	1.006***	1.018***	0.942***
	(0.070)	(0.068)	(0.082)	(0.156)	(0.132)	(0.074)	(0.087)
5-year ahead debt	0.017***	0.021***	0.017**	0.015	0.018**	0.021***	0.017**
	(0.006)	(0.005)	(0.007)	(0.010)	(0.008)	(0.005)	(0.008)
Average maturity	0.121***	0.129***	0.120***	0.132***	0.111***	0.118***	0.116***
	(0.013)	(0.012)	(0.012)	(0.015)	(0.010)	(0.016)	(0.017)
Tbill volatility (t<86H2)	2.997***	2.973***	2.296***				
	(0.250)	(0.257)	(0.442)				
Dividend yield (t<86H2)	-0.934***	-0.802***					
	(0.247)	(0.290)					
Trend growth (t<86H2)	-0.862***						
	(0.289)						
Trend growth					-0.231		-0.140
					(0.280)		(0.250)
Dividend yield					-0.019		0.110
					(0.114)		(0.091)
Tbill volatility					2.232***		0.601
					(0.450)		(0.856)
Observations	56	56	56	56	56	45	45
Adj R2	0.958	0.955	0.948	0.916	0.945	0.910	0.906

Notes: Newey-West standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. (t<86H2) indicates that a variable is multiplied by a dummy that takes the value of one before 1986H2 and zero thereafter. The regression includes a break dummy (t>=86H2).

The main novelty of our work is the inclusion of a variable for the average maturity of US Treasuries held outside the central bank: this is shown as m (in months) in Table 2. This variable proved to be highly significant. It suggested a sizable effect: shortening the average maturity of total outstanding Federal debt held outside the Federal Reserve by one month lowers the long-term yield by 12-13 basis points. Table 1 above summarises the main regression results.

The estimates of the other relevant coefficients are also significant, and seem of reasonable magnitude:

- A one percentage rise in long-horizon inflation expectations (π in Table 2) adds about one percentage point to the 10-year yield.
- A one percentage point rise in the government debt-to-GDP (d%y in Table 2) ratio five-year ahead is associated with about 2 basis points increase in the forward rate, a finding that is very close to what found by Laubach (2009).
- Greater volatility in the short-term rate drives up the long-term rate.
- Greater risk aversion (as proxied by the dividend yield) drives down long-term interest rates.

These results should be regarded as preliminary. They assume, for instance, that the decisions on the maturity of debt issued are independent of prevailing interest rates. If they are not independent, the coefficient on the average maturity term could be biased. We are exploring this endogeneity question further: economists need to analyse much more carefully how government debt managers react to macroeconomic developments, notably the pattern of interest rates.

This equation suggests that, given current fiscal conditions, the long-term interest rate should be much higher. Table 2 summarises recent readings of the key variables. The 5-years forward 10-year yield has fallen from a range of 5 to 5½% in the pre-crisis years to 3 to 3½% since the beginning of 2012. Despite a severe recession and much talk of deflation risks, inflation expectations have fallen only slightly (if at all). The near-zero policy rate and forward guidance has reduced the volatility of the short-term interest rate, but this was already low.

Recent values for key variables — Table 2

	5F10Y	π	d%y	m
2006	5.1	2.2	37.8	58
2007	5.3	2.1	33.1	58
2008	5.5	2.1	38.7	49
2009	5.3	2.1	66.0	48
2010	4.2	2.0	67.3	56
2011 H1	5.7	1.9	75.0	57
2011 H2	4.4	2.1	67.2	60
2012 H1	3.6	2.1	68.5	58
2012 H2	3.1	2.0	68.0	55
2013 latest	3.0	1.9	73.1	

These variables are defined in the text.

Given the significant rise both the expected future level of Federal government debt (that is, d%y) and the average maturity of debt held outside the Federal Reserve between 2008 and the present, the 5-year forward 10-year yield should have risen to more than 5% … it is actually down to 3%. Graph 1 shows the performance of the equation over 20 years.

One reason for the overprediction of the long-term rate is that several new, non-monetary factors seem to have increased the demand for government bonds:

- 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. This is coming from the post-crisis decline in unsecured interbank lending and higher swap margin requirements.

We must recognise these influences, which could last many years, are very difficult to quantify. Some of the effects could be temporary. As balance sheet adjustments of banks and others run their course, some effects could well reverse.

Another way of expressing the same point is to note that the term premium is holding 10-year US Treasuries, which has been declining over the past decade, has actually been negative since mid-2011. A few weeks after this conference, however, hints from the Federal Reserve that they would soon reduce their bond purchases triggered an unexpectedly sharp rise in long-term rates. Graph 2 shows how the term premium has evolved over 20 years.

Could a negative term premium become a systemic concern if sustained for very long? The answer is yes. Households individually (and via their unregulated collective savings vehicles) may become less willing to commit their savings to longer-term instruments. They could earn more by investing in, and rolling over, short-dated papers. But prudent borrowers will want to finance fixed capital formation (that is, in long-term physical assets) with long-term debt rather than short-term debt. Hence the financial system will be called upon, one way or the other, to bridge the wider gap between savers' preference for short-term assets and borrowers' preference for long-term debt. That is, financial intermediation will have to provide greater maturity transformation. Exactly which bits of the financial system are doing maturity transformation now, we do not really know. There is not even an agreed, simple metric for measuring how much a particular bank or insurance company is doing. Nor do we really know which bits should do it.

But we do know that the severity of the recent financial crisis owed much to excessive maturity transformation by firms that were ill equipped for such a function. Some financial products masked true maturity risks. Many investors, knowingly or not, took highly leveraged positions in long-term assets with short-term finance. We also know that the size of the term premium in the market yield curve is the market signal which conditions decisions about maturity transformation. Central banks will have to think very carefully about this when they deliberate about monetary policy and about the signals they send markets. There will be many years ahead when central banks will have (unwarranted) government bonds on their balance sheet. Central bank sales or purchases of government bonds could be viewed as a second policy instrument. Policies of Quantitative Tightening could moderate any increase in the policy rate. Indeed, the FOMC minutes in April 2011 reveal that participants noted that

> "for any given degree of policy tightening, more-gradual sales that commenced later in the normalisation process would allow for an earlier increase of the federal funds rate target from its effective lower bound than would be the case if asset sales commenced earlier and at a more rapid pace".

When and how this normalisation process will be undertaken could have a significant impact on both the level and the volatility of long-term interest rates.

Some argue that instrument uncertainty means that using both instruments could increase policy effectiveness. Remember the *Radcliffe Report* on the UK monetary system? They argued that uncertainty about how and when a 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. Almost a decade later, their reasoning found rigorous theoretical support. Brainard (1967) showed that uncertainty meant that, even with a single target, using all the instruments available would be better than just using a single instrument. Alan Blinder (2013) has argued that balance sheet policies could become a permanent part of the repertoire of central banks in the future.

Central banks no longer have the single target of price stability. They are also charged with financial stability, however difficult this is to define. Nor do they have a single instrument. Balance sheet policy aimed at the long-term interest rate is a strong candidate for a financial-stability-oriented instrument. Governor Stein of the Federal Reserve recognised this in a recent speech: "[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".

Conclusion

The argument in this note is briefly summarised:

1. The crisis has changed monetary policy frameworks … the central bank balance sheet has become a second instrument of monetary policy.
2. Preliminary econometric analysis suggests that central bank operations in government debt markets can influence the long-term interest rate even when market conditions are normal, and not stressed.
3. It is the long-term interest rate (or the shape of the yield curve) – rather than the policy rate – that is key for financial stability. A long-term interest rate so low that the term premium is negative encourages riskier forms of maturity transformation. And unusually low volatility in bond markets makes leverage too tempting.

The econometric analysis also suggests that long-term rates were, at the time of the conference, well below where historical macroeconomic relationships suggest they should be given large and rising government debt. I argued at the conference that, even in the absence of a macroeconomic shock such as higher inflation, long-term rates would rise.

The jump in long-term interest rates during June and early July 2013 (that is, the month that followed this conference) served as a timely reminder to investors that long-term rates could rise as well as fall, even if the policy rate is held constant. The re-establishment of two-way risk should help to limit leverage in the bond market, and so reduce the risk of market disruption when policy rates eventually rise. The rise in long-term rates that took place reduced, but did not eliminate, the gap between actual and predicted long-term rates.

References

Blinder, Alan (2013): “Exit to what? The *Status Quo Ante* or Some New Normal? ICMB conference, Geneva, 3 May.

Brainard, William (1967): “Uncertainty and the effectiveness of policy.” *Cowles Foundation Paper* 257.

Chadha, Jagjit S, Philip Turner and Fabrizio Zampolli (2013): “The interest rate effects of government debt maturity”, *BIS Working Paper* no 415. June. www.bis.org/publ/work415.htm

Laubach, Thomas (2009): “New evidence on interest rate effects of budget deficits and debt”, *Journal of the European Economic Association* 7(4), pp 858–885.

Stein, Jeremy C (2013): “Overheating in credit markets: origins, measurement and policy responses”. Speech at the "Restoring household financial stability after the Great Recession: why household balance sheets matter". Research symposium sponsored by the Federal Reserve Bank of St Louis, St Louis, Missouri, 7 February.

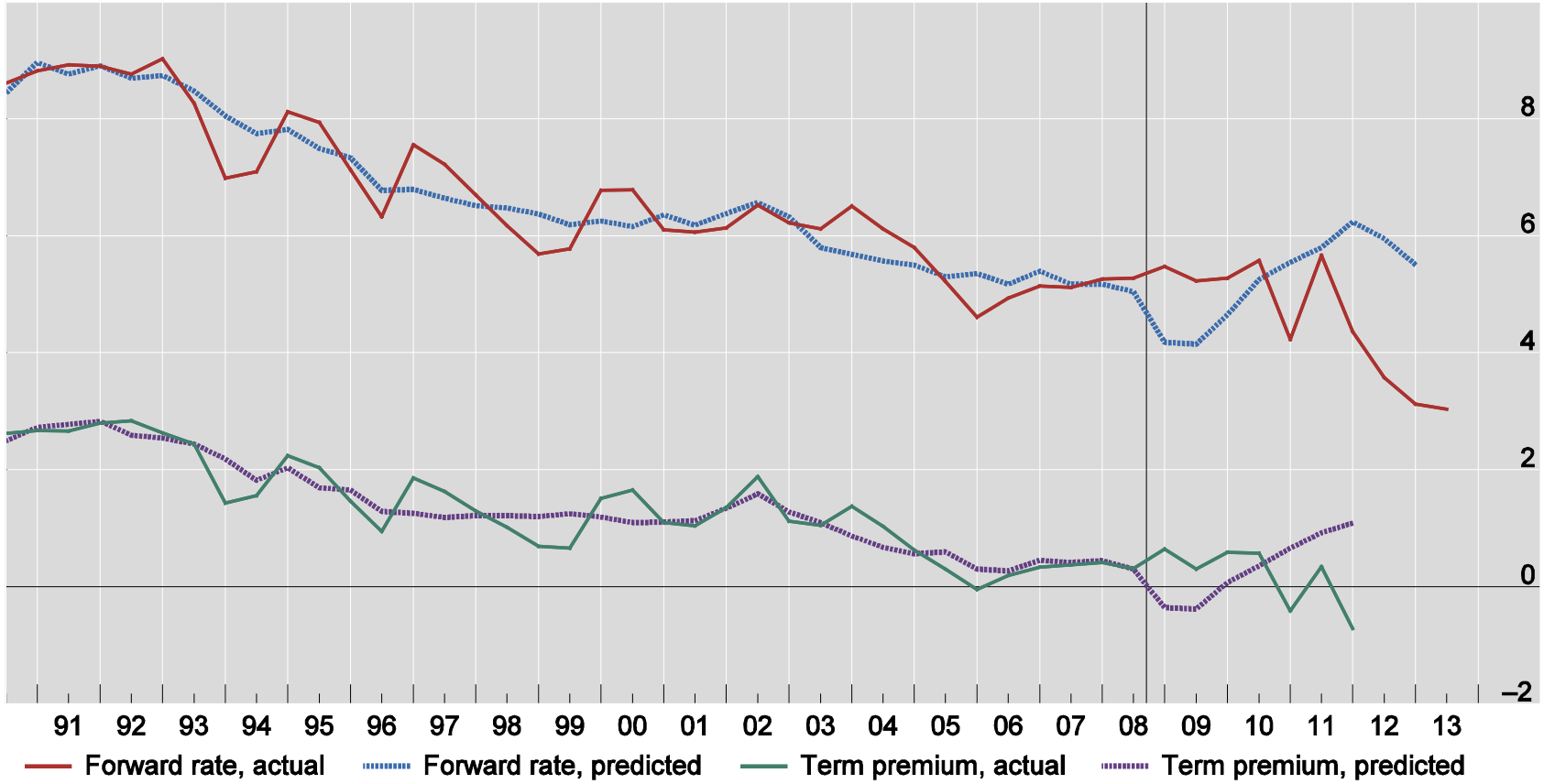
Turner, Philip (2010): “Central banks and the financial crisis” in *BIS Papers* no 51. March. www.bis.org/publ/bppdf/bispap51e.pdf

Turner, Philip (2013): “The benign neglect of the long-term interest rate”. *BIS Working Paper* no 403. February. www.bis.org/publ/work403.htm

Graph 1

Actual and predicted values

In per cent



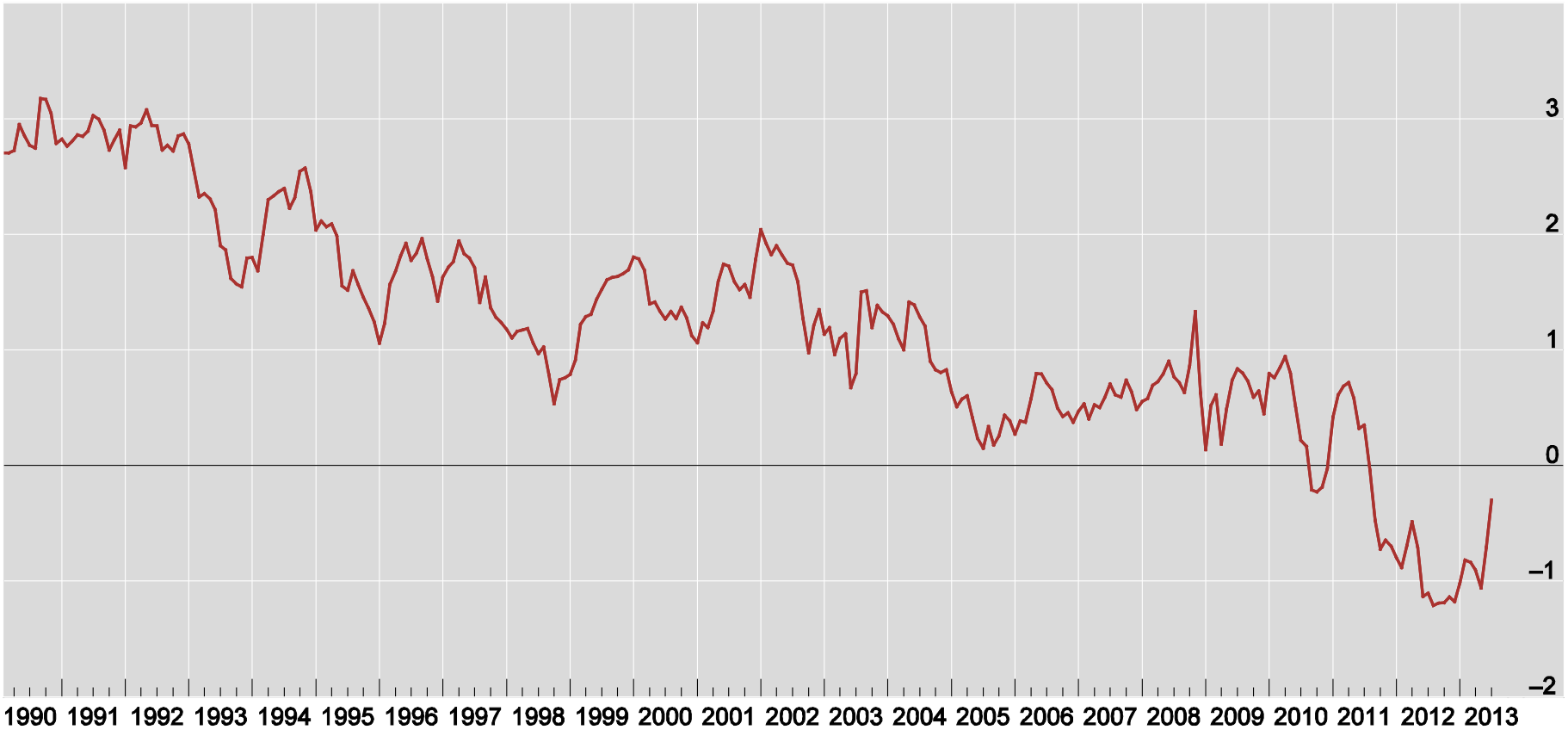
[1] Predicted values are from a regression of the five-year forward 10-year rate (top two lines) or 10-year term premium (two bottom lines) on average maturity of federal debt held outside the Federal Reserve and other regressors. Value to the right of the vertical line are out-of-sample predictions.

Source: Chadha, Turner and Zampolli (2013), BIS Working Paper, forthcoming

Graph 2

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.