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Rising Long-Term Interest Rates: Is the European Bond Market Overshooting?

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POLICY DEPARTMENT A: ECONOMIC AND SCIENTIFIC POLICY

Rising long-term interest rates: Is the European bond market overshooting?

IN-DEPTH ANALYSIS

Abstract

Rather than chronicle recent developments in European long-term interest rates as such, this paper assesses the impact of increases in those interest rates on economic performance and inflation. That puts us in a position to evaluate the economic pressures for further rises in those rates, the first question posed in this assignment, and the scope for overshooting (the second question), and then make some illustrative predictions of future interest rates in the euro area. We find a wide range of effects from rising interest rates, mostly small and mostly negative, focused on investment spending, debt service costs and shrinking fiscal space. There are also countervailing positive effects, which render the net negative effects on spending and the real costs of borrowing relatively small. The illustrative projections, based on techniques derived from an analysis of how financial markets work, agree with that conclusion. Forecasts of long rates for the near future, and of short rates further out, both show a weak tendency to rise further. But they both remain small by historical standards. The recommendation for the ECB is therefore not to react by undertaking any major policy changes till the emerging European recovery is on a firmer basis and capable of overcoming increases in the cost of borrowing and shrinking fiscal space. There is also an implication that worries about rising/overshooting interest rates often reflect the fact that inflation risks are unequally distributed: larger in some places, but offset by their absence elsewhere. That is a matter for domestic policy, not ECB policy (concerned as it is with average European outcomes, not with outcomes in a particular economy).

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EXECUTIVE SUMMARY

- Low interest rate policies are a form of policymaking in which market interest rates are reduced differentially at different maturities – lowering them at the maturities that affect investment and household consumption decisions. It is intended to stimulate spending by increasing liquidity, pushing up asset prices, producing wealth effects, lowering borrowing costs, and hence stimulating aggregate demand.
- A popular view in the markets, and among economists and financial commentators, isthat the gradual and tentative rise in longer-term interest rates in Europe and the US will now lead to a return to normal monetary policies and normal monetary conditions after a decade or more of quantitative easing (QE) and low (and often negative) interest rates.
- We test the idea that the slow and uncertain increases in interest rates also signal a return to the status quo ante. We find this proposition is unlikely to hold at this stage, principally because of the distinction between market determined interest rates vs. policy rates.
- This distinction turns on the fact that market rates will revert to a real equilibrium value that depends on potential output, inflation expectations, the path of (expected) short term rates, various forms of real and nominal risk premia, the availability of good quality "safe" assets, and a liquidity premium. These equilibrium values have been declining in recent years, so a return to the exact status quo ante is unrealistic. Part of the "new normal" will be lower interest rates on average.
- There is also a distinction between short term interest rates and long-term interest rates; the difference between the two being made up of the market's view of inflation and default risks, and the term premium demanded for being tied into holding long dated assets.
- In the light of this, rather than detail the recent evolution of European long-term interest rates as such, we assess the impact of increases in long-term interest rates on economic performance and inflation. That allows us to evaluate the economic pressures for further rises in those rates, and the scope for overshooting, and then make some illustrative predictions of future interest rates in the euro area.
- We find a range of effects, mostly small and negative, focused on investment spending, debt service costs and shrinking fiscal space. There are some countervailing positive effects, rendering the *net* effects on spending and real costs of borrowing fairly small. The illustrative projections, based on techniques derived from an analysis of how financial markets work, support that conclusion.
- Forecasts of long rates for the near future, and of short rates further out, both show a weak tendency to rise further. But they both remain small by historical standards.
- The recommendation to the ECB is therefore not to react by making major policy changes till the emerging economic recovery is on a firmer basis and capable of overcoming increases in the cost of borrowing and shrinking fiscal space. There is also an implication that concerns about rising/overshooting interest rates often reflect the fact that inflation risks are unequally distributed. That is not a matter for the ECB, but local policymakers.

1. THE STARTING POINT: LOW INTEREST RATE POLICIES

It is a popular view in the markets, and among economists and financial commentators, that the gradual and tentative rise in longer-term interest rates in Europe and the US will lead a return to normal monetary policies and normal monetary conditions after a decade or more of quantitative easing and low (and often negative) interest rates. But whether these slow and uncertain increases in interest rates really signal a return to the status quo ante is more doubtful at this stage.

Low interest policies are based on the idea that central banks can stimulate an economy, even when conventional monetary policy has become ineffective, by intervening to change long-term *market* rates. Market interest rates differ from short term policy rates by a wedge that depends on the market's assessment of inflation and default risks, and the term premium which reflects the cost of being tied in to holding longer dated assets. The fact that this wedge has varied over time suggests that the market's view may have differed from the policy view.

In that context, Constancio (2016) notes that market interest rates will possess a natural equilibrium value, and the function of policy is to guide the current rates to that equilibrium. Market variations then reflect different assessments/movements around an equilibrium value that depends on changes in potential output, expectations of inflation, the path of short-term (policy) rates, various risk premia, the availability of safe assets and possibly liquidity premia. Several recent studies have shown equilibrium interest rates in the euro area and US to have declined (figure 4). Given that, we cannot expect to return to the status quo ante exactly.

As a result, rather than detail the recent developments in European long-term interest rates as such, this paper assesses the impact of increases in those interest rates on economic performance and inflation by topic listed in the previous paragraph. That allows us to evaluate the economic pressures for further rises in those rates, and the scope for overshooting, and then to make some illustrative predictions of future interest rates in the euro area.

We find a wide range of effects from rising interest rates, mostly small and mostly negative, focused on investment spending, debt service costs and shrinking fiscal space. There are also countervailing positive effects, which render the net negative effects on spending and real borrowing costs relatively small. The illustrative projections, based on techniques derived from an analysis of how financial markets work, agree with that conclusion. Forecasts of long rates for the near future, and of short rates further out, both show a weak tendency to rise further. But both remain small by historical standards.

2. THE IMPACT OF INTEREST RATE POLICY

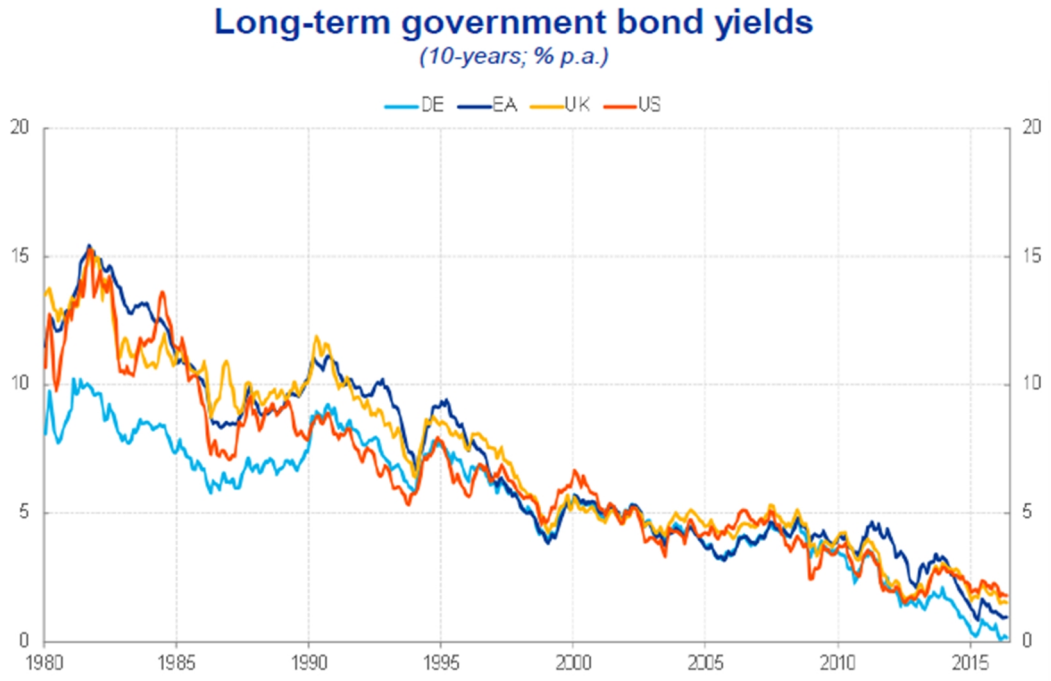
We have experienced several asset purchase programmes in recent years: principally in the US (to 2014), UK (to 2014), Japan (restarted in 2013), and in the euro-area (since 2015). Any assessment of how effective or successful these programmes have been must include an analysis of their impact on the targets of economic policy.

2.1 Low interest rate policies

The basis of low interest rate policies is the idea that financial markets are neither perfect nor complete. Arbitrage therefore tends to work imperfectly, depending on expected future interest rates and the preferences for short-term over long-term assets.

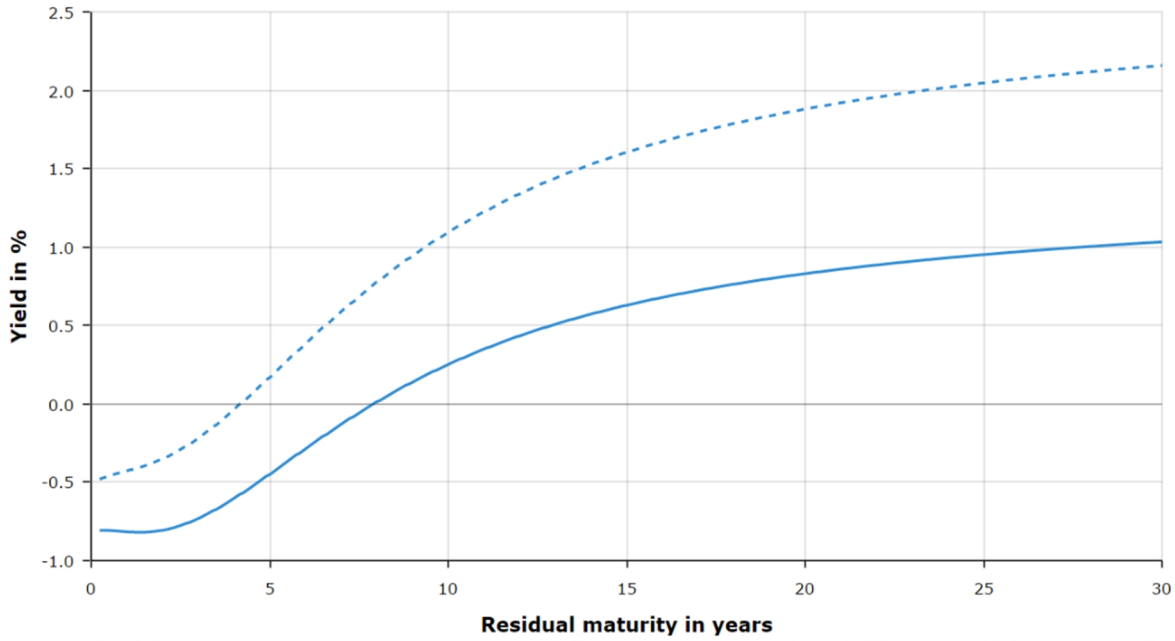
In such circumstances, monetary authorities can purchase sufficient quantities of long dated Treasury securities, or mortgage-backed securities or corporate bonds, to raise bond prices and lower interest rates at that maturity. These effects then extend to other longer-term assets as investors who just sold securities to the central bank, invest in substitutes that are closer to the asset just sold than cash to maintain their preferred portfolio balance. This adds further downward pressure on interest rates along the yield curve or in neighbouring markets.

Figure 1: Long-term government bond yields: Euro-area, Germany, UK, US



Source: ECB, Deutsche Bundesbank, Bank of England and Federal Reserve Board.
Latest observation: May 2016

Figure 2: The yield curve at different maturities in the euro area (April 2017)



Dashed lines indicate the spot rate based on all government bonds; solid lines on AAA-rated bonds only.

Source: ECB

Using this portfolio rebalancing or "ripple" effect, the central bank is able to influence the spread of long-term interest rates over policy rates (term premium) *and* the return on risky assets over risk-free assets (risk premium). It can therefore steer the interest rates most relevant to consumption and investment spending.

2.2 Impacts in the US and UK

The policy process above is an example of the low interest rate policies implemented by the US and UK after the financial crisis. The data confirms the impact of this policy channel. In the US, before 2008, the average term premium for securities with a 10 year over a 9-year term was 200 basis points. That premium dropped by 75 basis points with the low interest policies. In the UK, QE reduced the spread of corporate bonds over gilts by 200 basis points (investment-grade, non-financial bonds), and reduced the yield on 10-year gilts from 5% to 2% (Miles, 2012). The ripple effect on nearby markets and other maturities was strong.

How much did those changes translate into gains in output and employment? A range of estimates for the US, reported in Williams (2011), suggest that these QE policies reduced interest rates by between 0.15% and 0.3% points in this period – corresponding to having increased GDP by similar amounts. That is valuable, but not large. There was no perceptible impact on inflation before the programme ended.

In the UK, low interest rates are estimated to have added 3% to the level of GDP over the 6 years since 2009 compared to what would have happened otherwise, with negligible effects on inflation [0.1% or less][1]. Thus, real output was higher by ½% on average each year; an extra 0.4% on the growth rate. However, unemployment typically follows output with a delay of one to two years. Hence low interest rates take two years or so to achieve full effect.

[1] Kapetanios *et al* (2012); Joyce et al (2012); Bank of England (2012).

2.3 Lessons learned from the US

The US Federal Reserve conducted three rounds of Quantitative Easing. The first (QE1, 2008-2010) involved asset purchases of $2.1tn; the second (QE2, 2010-12) added $2.05tn assets at the rate of $30bn a month; and the third (QE3, 2012-14) bought assets at $85bn a month before being tapered to $65bn, then $50bn a month, was terminated in late 2014. In total, the three QE programmes amounted to $4.5tn or 25% of GDP. This is larger than the programme for the euro area which at €80bn per month amounts to 16% of euro-area GDP.

Financial Effects: Early estimates suggested that QE had reduced long term market interest rates by 30 to 100 basis points, depending on the type of security (Gagnon *et al*, 2011). Subsequent studies of QE1 and QE2 found similar results (Williams 2011), as did the corresponding studies undertaken for the UK. But later studies from the QE2-QE3 era (Chen *et al*, 2012) reduced these interest rate reductions to 30-40 basis points, or 4-9 basis points per $100bn of assets purchased.

There are several explanations for this weakening impact. First, there may be "QE fatigue" as the supply of good quality assets ready for purchase began to fall. There have been instances of that. The Bank of England failed to meet its purchases target in 2016, and the ECB was mooted to have failed to fill its quota for certain national bonds and had to buy German bonds instead. Second, repeated applications of QE inevitably create expectations of inflation which undermine the downward pressure on interest rates further along the yield curve. Third, adherence to the zero lower bound means that interest rate reductions, per unit of QE, will be smaller the lower are market interest rates at the start.

A second risk is that QE impacts other variables – most importantly risk premia, as opposed to term premia. To the extent that QE reduces the risk premia in corporate bonds, or in bank borrowing, or on bank loans, or in poorly performing economics, it will impact on the cost of borrowing and the progress of the economy – over and above what can be achieved by manipulating market-wide interest rates. Many say that this is a major advantage of QE (Gagnon et al, 2011), and that QE operations should be matched to the specific interest rates you wish to reduce (LeRoy and Lucotte, 2016; Hughes Hallett, 2016).

This raises the question: which assets should the ECB buy? Evidently it should buy beyond government bonds, to include corporate bonds and bonds of the distressed governments if it wishes to have the maximum effect in lowering commercial borrowing costs, and in particular real interest rates in regions or sectors where risk premia are strongest.

A third risk is that, by reducing market interest rates, QE will cause an economy's exchange rate to depreciate. On one hand, this is useful as it boosts net exports (so long as other economies do not use QE at the same time) and adds to the recovery. On the other hand, it is unhelpful because it may induce a capital outflow which will lower asset prices and raise interest rates again. These two effects tend to offset each other.

Macroeconomic Effects: Early estimates of the output and price effects of QE operations in the US were optimistic: the drop in long term interest rates of ½% point in QE1 was thought to raise GDP by 3% in the short run, and prices by 1%, all else equal. Later estimates from the QE2 period reduced those figures to GDP increases of 0.4%-0.5% a year over 5 years, with a minimal upward impact on prices (Chen *et al* 2012), driven by a smaller fall in interest rates (about 0.2% points) spread over a longer period.

Second, longer periods of commitment to low interest rates seem to increase the gains in GDP; but at a cost of extra inflation. That introduces a trade-off and a need for careful timing. Signaling policy intent (forward guidance), and a clear exit strategy, appears to be crucial for lowering the risk of unsuccessful QE policies.

2.4 Low interest rates in the euro area

Do the results in the euro area match those in the US or UK? The ECB's asset purchasing programme appears to have had a more limited impact on the euro-area economy, with output growth averaging at 0.3% and inflation -0.05% from 2014 through 2015. This may be because the Euro programme is smaller; or because long interest rates fell by less (½% on average), having started from a lower level**.**

By 2016 the effects had become larger. Output growth reached 1.5%, unemployment was lower (10.5%) and the trade surplus rose to 2% of GDP on the back of a 25% fall in the Euro. But whether these results are due to QE is unclear. More likely they were driven by the exchange rate depreciations set in motion by QE. That may explain the temporary uptick in inflation: 0.2% in 2015, to 0.5%-1.1% in 2016, and projected rates of 1.5-1.7% for 2017 to 2019. All these figures fall short of the ECB's 2% inflation target.

At this point, a few comments need to be made to show that raising interest rates would now have a damaging but *limited* impact on the real economy. The first is that monetary policy has had to act alone; it has not been able to take advantage of fiscal expansions at the same time or exploit lower borrowing costs directly or refinance past debt. Only Italy seems have done that systematically to be rewarded with small gains in *relative* performance (section 6).

Second, low levels of private sector lending seem to have been a problem everywhere despite low interest rates. In surveys, 85% of the banks report that low interest rate programmes have had no effect on lending. That suggests difficulties with the transmission between liquidity provision and credit uptake. Investment spending is still below its 2008 peak; *real* interest rates remain high; and risk averse small businesses and consumers prefer to pay down debt rather than borrow. Rising interest rates would make this situation worse.

Third, also important, non-performing loans have increased and now average 9% of GDP, and reach 20% in some places, which makes the banks reluctant to lend however attractive or unattractive the interest rate. If this is true, rising interest rates would (initially at least) make little difference to economic performance or recovery. Nonetheless, there is no sense in making a difficult situation worse – particularly for those who are slow to recover.

3. INFLATION, INTEREST RATES, ASSET BUBBLES AND SAVINGS

3.1 Threats to economic performance

Section 2.4 has made it clear that the improvements in output growth and jobs, per unit of assets purchased, have been modest. Part of the reason is the small size of the ECB programme (as a proportion of GDP) compared to programmes elsewhere. And with the reduction in the size of the programme from €80bn to €60bn assets purchased per month, this sense of not having achieved very much for large expansions in the ECB's balance sheet can only get deeper. That could lead to disagreement over the trade-off between the risk of creating increases in inflation for small gains in output and employment. The root of this difficulty is weak transmissions between credit provision and investment or consumption spending.

A more serious risk is that QE fatigue could reduce the gains in economic performance *per unit* of assets bought, or per unit of extra inflation created. This would risk extending the disagreements over the direction of policy and ultimately undermine the credibility of the QE programme as a whole – which depends on expectations of success to trigger demand for new loans, investment and spending.

3.2 Interest rates and inflation forecasts

The argument that asset purchases increase money holdings and ultimately increase inflation or inflation expectations is well taken – especially since there is no publicly articulated exit strategy for the euro area.

A carefully formulated, tested and announced exit strategy is the standard way to deflect this tendency to raise inflation expectations since it signals that the expansion in monetary aggregates is temporary and will reverse. Given its absence, it is remarkable that so little inflation has emerged in the US, UK, Japanese or Euro QE programmes – except perhaps in the euro area where inflation had reached 1.1% by the end of 2016. However three points about that increase: i) it still falls short of the 2% Euro-wide target, the mandated ECB target; ii) it is unclear if this inflation was the result of QE *per se* (more likely it was caused by the Euro depreciations in 2016 and loose/expansive wage bargains in Germany compared to other Euro economies); iii) this extra inflation is distributed very unevenly, 0.8% in the average Euro economy in 2016, but 1.7% in Germany (1.5% in France, 1.0% in Italy, 0.9% in Spain, 0.2% in Greece, 0.1% in Ireland)[2]. These observations are reinforced by inflation outcomes since then. Euro area inflation touched 2.0% in February 2017; but then fell back to 1.6% in March, to 1.5% in April, and is forecast (by the ECB) to remain in the 1.4%-1.8% range until 2022. Likewise, inflation in Germany briefly reached 2.2% in February 2017, but fell back to 1.5% in March and 2% in April. In Italy, it fell to 1.4% in March after a February peak of 1.6%; in Spain from 3% to 2%; and in France it has remained unchanged at 1.4%.

Hence a more nuanced view is that this new inflation is a German, not a Euro problem. It is likely to be temporary phase due to the Euro's depreciation. It is also likely to be temporary because, if energy and fresh food prices are taken out, core Euro inflation has remained unchanged at 0.9% over the same period despite temporary spikes in energy and fresh food prices. Core inflation then retreated to 0.7% by March, and has remained around 0.8% since. This shows there is little systematic, internally generated pressures for Euro inflation. At this point, core inflation remains subdued; not driven by QE or an emerging Euro-area recovery. But it is badly distributed.

[2] These figures are for December 2016 (Datastream).

Hence the risk of inflation, the main driver of interest rate rises and interest rate expectations (Taylor rule style), is projected to remain small, although theoretically possible. A secondary mechanism here is that longer term interest rates are an average of current and future expected short run (policy) rates: section 5. Therefore, if inflation is not expected to rise over the five years to 2022, long interest rates should not be expected to rise either. The third mechanism is imported inflation. The main drivers would be energy prices which showed a tendency to rise in late 2016 into early 2017, but which have fallen again since then. And food prices which have not shown a tendency to move one way or the other.

Inflation is likely to remain low, but volatile with mild periods of overshooting; and interest rates correspondingly uncertain but with limited movement in both nominal and real terms.

3.3 Impact of low interest rates on savings

The level of savings depends, but only in part, on the ECB's short run policy rate. Available estimates show that the ECB's asset purchases have pushed the prices of equities and similar assets up by as much as bond prices. This implies the ripple effect is strong, and that most of the impact of low interest rates on consumption and savings has come through *wealth effects* – not savings effects.

Traditionally the two big influences on savings and consumption spending have been the loss of jobs (so reduced earnings) and expectations of inflation. QE has limited both – meaning that savings deposits are healthier and more secure than they would have been before QE. On the other hand, lower interest rates reduce both interest income and interest payments on mortgages and on personal or small business loans. Since savings deposits are at short-term rates, but QE operates at long rates, the ***net*** effect of that is that income gains from saving under QE are small but positive, meaning households gain a little in income (as earnings, thus deposits, are higher even if the yield on past savings is lower) – but have little incentive to save except as a precautionary measure. This is confirmed by Bank of England (2012, Table 1). These small *retained* income gains are at risk with rising interest rates.

More important are the direct effects. Rising asset prices (falling interest payments) will boost dividend payments and reduce defaults/bankruptcies. Thus, the larger the share of assets in household or corporate portfolios, the greater are the gains from low interest rates and the greater the boost to the economy from increased consumption or investment. However, in individual cases it will depend on whether the individual is a *net* asset holder (those later in the life cycle) or a *net* liability holder (those early in the life cycle). So, even if low interest rates have brought gains for the economy as a whole, there will be rising intergenerational transfers (from old to young in this case) and increasing inequalities behind the scenes.

These transfers and shifts in wealth inequality can be large numerically, dwarfing the small savings rate effect. For the UK, the gains in net wealth from QE are estimated to have been 13 times larger for the rich than the poor; and 26 times larger for the older generation (they disproportionately own the assets, even if their net savings income is smaller) than the younger generation [Hughes Hallett, 2016].

If we now reverse the path of interest rates, we get the opposite pattern of events – although the contribution from improved savings is likely to remain small. The main impact is to reduce the role of wealth effects on spending and investment; with small losses in *net* incomes from savings, but a greater incentive to save. Hence lower earnings, investment, employment and inflation, and a smaller tendency for asset prices to rise. That implies less wealth inequality (good for the poor or young) and fewer transfers to the old. This may be bad for the economy in aggregate; but the effects are largely redistributive, with effects on wealth holdings rather than savings.

There will still be regions or sectors where asset bubbles may emerge (certain regions of the German housing market for example), but the ECB policies should be directed at the Euro average rather than individual regions. In that case, asset bubbles become a possible but decreasing risk. The main reason for this view is that, if grounds for risk aversion or the need to deleverage debt persist, or banking regulations tighten, there will be no appetite for large asset positions. It would be too risky. An articulated exit strategy would underline those risks.

3.4 A Threat of financial instability

a) Reduced default rates among firms means less creative destruction as the recession eases, leaving a trail of unreformed firms and nonperforming loans. If the recovery is slow or interest rates rise, the financing of zombie firms may be withdrawn, a risk to future stability. Similarly, structural reforms are likely to be postponed.

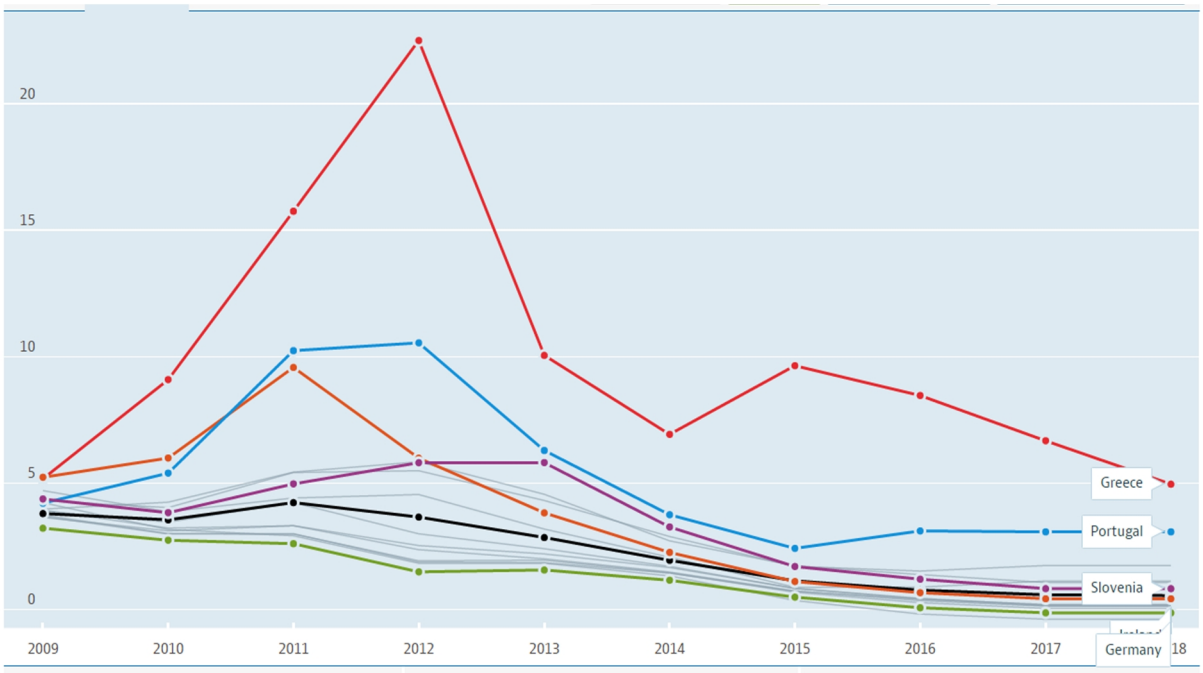
b) If non-performing loans are a significant portion of banks' loan book, the banks will be reluctant to make new loans, causing losses (if not a breakdown) in the transmission from extra liquidity to new loans and spending.

c) Mortgage and other lending declines because the ECB takes so many bonds off the market that banks and firms cannot retain enough high-quality bonds to act as collateral for their loans. This would damage investment spending, especially investments in new technology or productivity enhancements.

d) Investors, specifically insurance or pension companies, undertake riskier investments just when interest rates start rising. Likewise, speculation on higher asset prices creates a serious risk of an asset bubble (especially in housing). Prudential regulation and higher capital ratios are needed to counter this effect.

e) Low interest rates may have rescued average or stronger regions and sectors where there are higher yields and security, leaving the weaker with financial instability, stagnation and higher interest rates. The risk here is that risk premia and interest rate spreads do not reduce. On the other hand, they are already small (Greece and Portugal excepted) and have fallen steadily since 2012 (figure 3).

Figure 3: Interest Rate spreads, by country up to 2018



Source: ECB

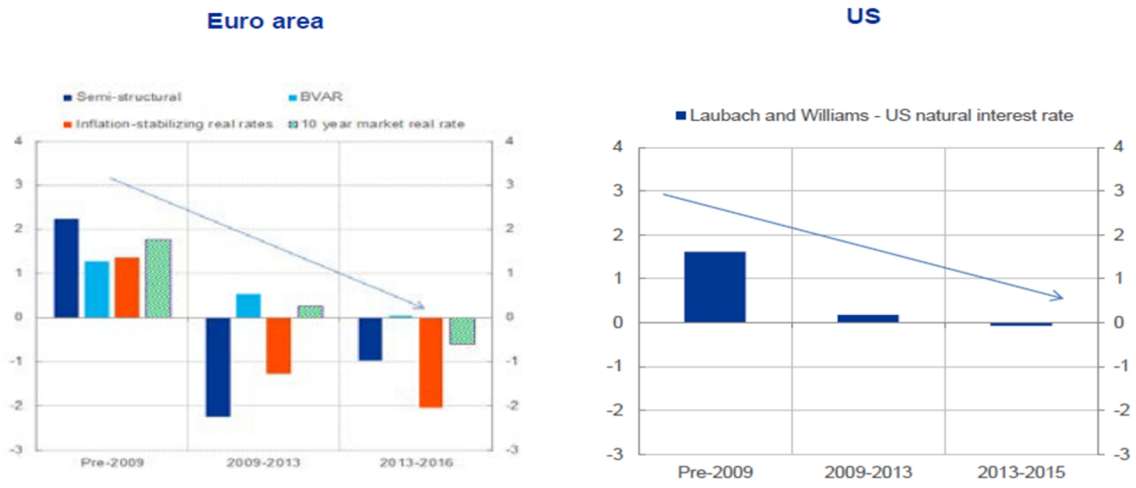
4. QUALIFICATIONS/ADDITIONS TO SECTIONS 2 AND 3

Market Rates: In this paper, we are dealing with longer term market rates not policy rates, and as such the rates which consumers, businesses, and the public sector (governments) will have to face for new borrowing or for refinancing – that is for mortgages, durables, private investment, (public sector) deficit borrowing and public investment projects. If market rates rise, or are expected to rise, borrowing for all those purposes will become more expensive – restricting fiscal space and spending on those items compared to what might otherwise have been (but not by much since interest rates have been artificially low for a decade or more, and because the recovery in growth creates countervailing incentives to invest).

A more serious qualification is that rising interest rates imply lower bond prices (corporate bonds in particular), hence lower quality/less valuable collateral and rising private and public financing costs (indeed some past loans could be called in). That could imply a larger negative impact on economic performance in the future.

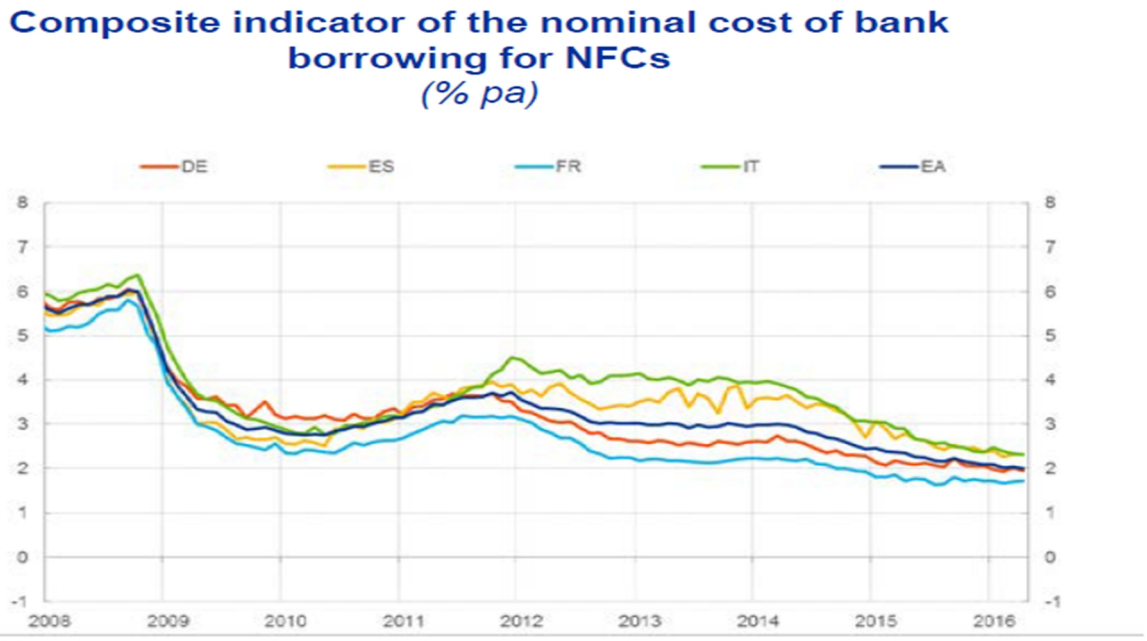
Real Interest Rates: The real cost of borrowing is of course given by ***real*** interest rates. Rising nominal rates will be offset by increases in (expected) inflation if the latter are of comparable size. So far, the latter have been larger. Hence borrowing costs, while lower than pre-crisis levels in 2008 (figure 4), are still negative if a bit higher than at the bottom of that crisis. If nominal interest rates rise as predicted (section 5) and inflation rates continue to be roughly constant as predicted (section 3.2), we can expect few changes in real rates of interest or real borrowing costs – perhaps small rises in the immediate future as inflation adjusts faster than nominal interest rates. But this is likely to be a marginal change (figure 5); the inflation risk premium is and has been pretty much the same as the term premium in the most recent adjustments (figure 6).

Figure 4: The development of real interest rates in the euro area and the US



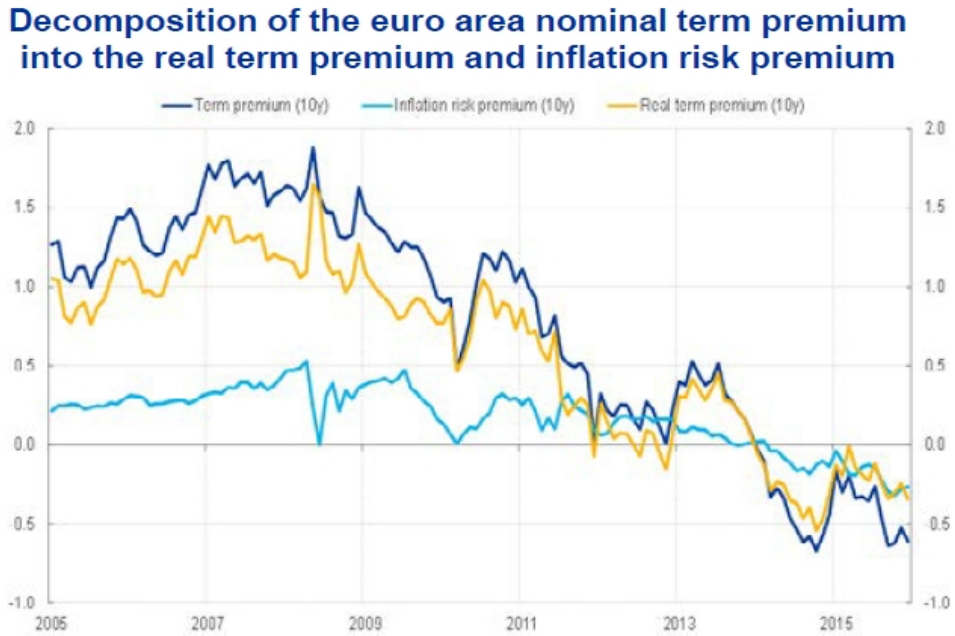
Source: ECB calculations, and San Francisco FED.
Notes: The semi-structural model is very much aligned with the approach of Messonnier and Renne (2007). The BVAR is a bayesian vector auto regression with minimal restriction that forecasts a five-year ahead forecast of the short-term real interest rate. The inflation-stabilizing real rate is the real interest rate that would be required to stabilise inflation in the euro area at below but close to 2% over the medium-term. It is based on the model by Christiano, Motto and Rostagno (2014). For the US, the natural real rate is based on the publically available data series from the model by Laubach and Williams (2003).
Latest observation: 2016 Q1 for the euro are estimates and 2015Q4 for the US.

Figure 5:



Source: ECB.
Notes: The indicator for the total cost of lending is calculated by aggregating short and long-term rates using a 24-month moving average of new business volumes. The cross-country standard deviation is calculated over a fixed sample of 12 euro area countries.
Latest observation: April 2016.

Figure 6:



Source: Bloomberg and ECB calculations.
Notes: Both the nominal term premium and the inflation risk premium are based on affine term structure models. The real term premium is computed as the difference of the nominal term premium and the inflation risk premium.
Latest observation: May 2016.

Risk Premia/Interest Rate Spreads: If there are negative effects on investment, public or private, or financing and borrowing costs as a result of rising interest rates, the impact on economic performance will become exaggerated if increases in inflation or default risk premia or term premia come into play at the same time. That would damage those with greater than average public or private debt most in need of improvements in performance, and damage

overall outcomes for the euro-zone itself. However, this does not appear to be a material risk at this stage: inflation risks in the euro-zone and the real or nominal term premia appear to have been on a declining trend since 2009, small and of roughly equal size (figure 6). There is little evidence to suggest additional risks from this source: if anything, real borrowing costs could get marginally smaller from this source.

Risk Aversion: The experience of low interest policies in Europe has shown businesses and consumers to have been reluctant to invest or spend on a scale needed to trigger a recovery. In the euro area, this happened because businesses, consumers and banks paid off past debt at a time when no other stimulus was available to counteract deleveraging. In addition, the ECB faced austerity policies on top of deleveraging. Second, rising interest rates in the US are signals of recovery. But low market rates in the euro area signal low expectations for recovery, reflecting damaged transmissions from cheap credit to higher spending.

Incomplete Pass-through: The impact of a policy change comes in two parts: i) the change in *market* rates per unit change in the policy rate (the pass-through); ii) the change in the economic variables that we aim to influence, per unit change in market rates (the transmission). It appears both have fallen. Before 2007, each 1% change in the policy rate was matched by a 1% change in market rates. Since then, market rates have changed by much less. This happens when investors prefer to invest their funds in equities, meaning banks need to offer higher interest rates to retain the funds to lend. So, market rates fall by less than the policy rate when the latter is reduced. Or investors or firms may prefer to hoard excess funds rather than deposit them in banks whose financial health they distrust.

Global Cycles: The argument here is that financial integration world-wide means that assets of all kinds, risky or not, have developed common components in prices or yields. Given free capital flows, that means that credit flows in different economies show similar pro-cyclical patterns and volatilities. This can be seen in the data (Rey 2013,2015). As a result, there are strong global cycles which lead to excess credit growth in boom periods and credit collapse in recessions. This tendency is further strengthened if national cycles become synchronised through globalisation in trade and finance. The implication is that, unless we have the means to control credit growth outside Europe, world financial cycles will constrain monetary policy at home. Put differently, arbitrage from higher US interest rates may raise interest rates in Europe in the short term – but the corresponding capital flows to the US will lower the Euro/$ exchange rate. The *net* impact on output is likely to be small, but there may be additional financial instability issues to contend with.

5. LINKS BETWEEN SHORT AND LONG-TERM INTEREST RATES

Long interest rates follow the market's forecasts of future short-term rates. To see this, start with bond prices represented as the net present value of the future repayments of principle (face value) and interest. For simplicity, we first consider only two types of bonds to make the linkage between interest rates at different maturities clear. Generalisations then follow.

Suppose we take a one year bond that promises to repay €100 in one year's time, and a two-year bond that will repay €100 in two years. Both will attract interest payments of course, but at different interest rates. The price of a one year bond must be equal to the net present value (or yield) of that bond held until maturity[3], €100 in this case. Thus

$$P_{1t}(1 + i_{1t}) = €100, \text{ or } P_{1t} = €100/(1 + i_{1t})$$

where P_{1t} is the current price of the one bond and i_{1t} is the interest rate payable. Likewise, the price of a two-year bond in year *t* will be the present value of €100 paid in two years:

$$P_{2t}(1 + i_{1t})(1 + i^e_{1t+1}) = €100, \text{ or } P_{2t} = €100/(1 + i_{1t})(1 + i^e_{1t+1})$$

where "e" denotes the expected value of the one year interest rate next year.

But arbitrage in the financial markets will also ensure that the price (or yield) of a two-year bond held for one year but then sold, equals the price (yield) of a one year bond held until maturity – since, if it did not, all holders of two year bonds could profit by buying/selling their entire stock to sell/buy one year bonds. Hence the current price of a two-year bond held for one year must be equal to the expected price of a one year bond bought next year:

$$P_{2t}(1 + i_{1t}) = P^e_{1t+1}, \text{ or } P_{2t} = P^e_{1t+1}/(1 + i_{1t}) = €100/[(1 + i_{1t})(1 + i^e_{1t+1})] \quad (1)$$

Now we switch from comparative prices to yields, the earnings that investors would realise by holding bonds of different maturities. The yield on a bond is the *constant* rate of interest that would make repayments equal to the price today (i.e. the rate an investor would earn by holding a certain bond to maturity). We have the choice between holding one two-year bond vs. a two 1-year bonds in sequence. Since the price (net present value) of the two options will be equal in terms of yields (rates of return), we have:

$$\frac{€1}{(1+i_2)^2} = \frac{€1}{(1+i_{1t})(1+i^e_{1t+1})}, \text{ which implies } (1 + i_2)^2 = (1 + i_{1t})(1 + i^e_{1t+1}). \quad (2)$$

Expanding, this arbitrage condition implies the following relationship between two-year and one year interest rates:

$$1 + 2i_{2t} + i^2_{2t} = 1 + i_{1t} + i^e_{1t+1} + i_1 i^e_{1t+1} \quad (3)$$

Or, neglecting the "second order small" elements (interest rates are small; *i*=5% is 0.05)

$$i_{2t} \approx ½(i_{1t} + i^e_{1t+1}). \quad (4)$$

This relationship implies long-term interest rates will be the average of the current short-term interest rate and that expected (forecast) by the financial markets for the next period.

Alternatively, we can write the market's current short-term interest rate forecast as

$$i^e_{1t+1} \cong 2i_{2t} - i_{1t}. \quad (5)$$

The obvious analogue for longer maturities, *n*-year bonds say, arises from a comparison of the yields from an *n*-year bond with a sequence of shorter bonds held either as an *n*-1 bond

[3] Since arbitrage will ensure that at a price higher than this no-one will buy, but at a lower price everybody will buy.

and then a 1-year bond say; or as a sequence of *n* 1-year bonds. The comparison with a (*n*-1)-year bond and a 1-year bond is probably not useful because it involves a sequence of forecasts of multiyear interest rates, $i^e_{1,t+1} \ldots\ldots i^e_{n-1,t+n-1}$, which is typically not available or reliable so far into the future. However, comparisons *n* 1-year bonds held in sequence for one year each is easy to deal with. We return to the arbitrage condition in the case of *n>2*,

$$(1+i_{n,t})^n = \left(1+i_{1,t}\right)(1+i^e_{1.t+1}) \ldots\ldots\ldots (1+i^e_{1,t+n}) \qquad (6).$$

Expanding these terms, we get

$$1+ni_{n,t}+\binom{n}{2} i^2_{n,t} \ldots\ldots\ldots + ni^{n-1}_{n,t} + i^n_{n,t} = 1+\sum_{j=0}^{n} i^e_{1,t+j} + \sum_{k=0}^{n}\sum_{j=0}^{n} i^e_{1,t+k} i^e_{1,t+j} \ldots \qquad (7)$$

Applying the "second order small" approximation as before, we ignore quadratic and product terms. We end up with

$$ni_{n,t} \approx \sum_{j=0}^{n} i^e_{1,t+j} \quad \text{or} \quad i^e_{1,t+1} \approx ni_{n,t} - \sum_{j=0}^{n-1} i^e_{1,t+j} \qquad (8)$$

where $i^e_{1,t+j} = i_{1,t}$ if $j = 0$.

Thus, if we have expectations, official forecasts, information from the futures markets for government debt, or calculated/simulated values of short term interest rates in the scenarios whose implications we need to examine, we can project ("forecast") the long-term interest rates that would apply at the same time: the first formula in (8), which allows us to answer the second question posed for this paper. Alternatively, we can use yield curve data from the existing markets at *t* to project short term rates for various dates in the future: the second equation in (8).

Such projections are easy to compute and compare to market rates, as a check on the mutual consistency of, or for possible overshooting in, Euro interest rates. For example, for 10-year rates (*n=10*) we have [recursively substituting out earlier expectations by (5) and equivalent expressions for *n*≥ 3]:

$$10i_{1\ ,t} \approx \sum_{j=0}^{1} i^e_{1,t+j} \quad \text{or} \quad i^e_{1,t+1} \approx 10i_{1\ ,t} - \sum_{j=0}^{1} i^e_{1,t+j} = 10i_{1\ ,t} - 9i_{9,t} \qquad (9).$$

Projections of short and long Euro interest rates. We turn to the data in figure 2:

i) Consider first the case of AAA rated Euro economies. In April 2017, their average 10-year interest rate was approximately 0.4%; and a 9-year rate of 0.25%. This would imply, by (9), the 1-year rate in operation ten years from now should be $i^e_{1,t+1} \approx 1.75\%$. This represents a considerable increase: 2.5 percentage points. But not an unreasonable value, and it is entirely consistent with the "new normal" hypothesis in the introduction. On the other hand, it is lower than the usual pre-crisis values we used to see.

   By contrast, if we assume the current low interest rate policy were to continue for a few years more, $i_{1\ ,t}$ would be *-0.8%,* which it is not; a thoroughly unreasonable number that would need to rise *1.2ppts*. Alternatively, this exercise is telling us that to assume that current low rates will continue is not realistic or tenable. But if we assume short or policy rates will rise from their current values of $i^e_{1,t} \approx -0.8\%$ to $i^e_{1,t+3} \approx 3\%$ over 2½ years as projected in the US, and then stay at that level for the remaining 7½ years, this will produce an average short rate of 2.4% for $i_{1\ ,t}$, which is reasonable and a good illustration of the new normal.

ii) Now consider the whole euro area, not just the AAA rated part. Data from figure 2 imply, via (9) as before, a projection of the 1-year rate ten years from now of $i^e_{1,t+1} \approx 2\%$ - again a very reasonable number for the new normal, but a significant rise over the current value of $i^e_{1,t} \approx -0.4\%$. Similarly, if we assume short or policy rates rise from $i^e_{1,t} \approx -0.8\%$ to

$i^{e}_{1,t+3} \approx 3\%$ over 2½ years and then stay there as before, $i_{1\ ,t}$ should be around 2.4%. It is not, so we should expect further rises in the long rates.

iii) The UK, using data from the Financial Times (13 May), has a projected $i^{e}_{1,t+1} \approx 1.17\%$ which implies no change, but a current 10-year rate of $i_{1\ ,t} \approx 2.3\%$; essentially same story again.

6. COORDINATION

As an aside, if policy transmissions are weak or ineffective, or if monetary policies are forced to operate alone because fiscal deficits/debt are already too large, interest rates will tend to adjust by too much to compensate – in this case upwards (but downwards in recessions). It would then be useful to coordinate with other policies to offset the effects of deleveraging, inflation, tighter bank regulation or financial instability which impose an extra burden on interest rates. A natural partner is expansionary fiscal policies. It is important to note, they can be used *without* Euro-bonds or inter-country loans/transfers at the European level.

The key point is that even countries with large fiscal imbalances could contribute a supporting fiscal policy by exploiting the fall in borrowing rates that QE has made possible. Refinancing debt would enable the average euro-area country to increase spending or reduce taxes by 0.45% of GDP after a fall of ½% in interest rates, without increasing its debt or deficit ratios. For France, the contribution might be 0.5% of GDP; for Germany 0.4% and so on. The contribution from high debt countries could be higher, depending on how much the local risk premia have been lowered. For Italy, the contribution could be 0.7% or more. Italy and Portugal have already exercised this option; whereas, reversing the argument, half of the improvement in Germany's deficit ratio since 2014 represents a EU fiscal stimulus withdrawn.

This proposal can be made systematic by introducing GDP-linked bonds. With these bonds, interest payments are adjusted down according to an agreed formula whenever GDP growth is below trend/potential output; and up when GDP growth rises above trend (potential) output. That makes the adjustments symmetric, with no systematic bias or loss of discipline because it forces governments to "save for a rainy day" in good times. It also means the interest rates applied to determine repayments varies up and down as growth varies above or below trend – expanding the fiscal space available for new fiscal interventions in bad times, but requiring debt to be paid down in good times.[4]

[4] The Bank of Japan uses a similar technique to get the effects of QE without creating the costs or risks of expanded balance sheets.

7. CONCLUSIONS

That low interest rates risk creating financial instability while, at the same time, stimulating recovery is well understood. The most popular concerns are the reappearance of inflation, a lack of savings, asset price bubbles and volatility in the currency markets.

This paper took a wide view of rising interest rates. We find a range of effects, mostly small and mostly negative, focused on investment spending, debt service costs and shrinking fiscal space. There are also countervailing positive effects, so the *net* negative effects on spending and borrowing costs are relatively small. The illustrative projections, based on techniques drawn from financial markets theory, agree with that conclusion. Forecasts of long rates for the near future, and of short rates further out, both show a tendency to rise further but little evidence of overshooting. Both remain small by historical standards.

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