Speech

Costly capital and the risk of rare disasters

Speech given by

Ben Broadbent, External Member of the Monetary Policy Committee

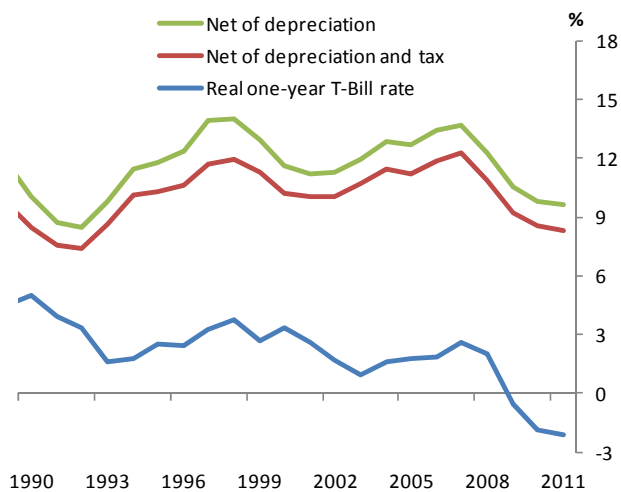At Bloomberg, London

28 May 2012

In my economics textbook is says the following: "Cuts in interest rates lower the cost of borrowing which results in higher investment and the purchase of consumer durables".

Chart 1: Rates of return for non-oil PNFCs

Note: Assumes equal tax rates for UKCS and non-oil PNFCs.
Source: ONS and Bank of England calculation

If this is how it works someone forgot to tell many of the companies I see. The risk-free interest rate, as measured by the yield on short-term indexed gilts, has fallen steeply since the onset of the financial crisis, and is now firmly in negative territory (Chart 1). Yet on a recent Agency visit many companies told me that their hurdle rates of return had <u>risen</u>. Prior to the crisis finance directors would approve new investments that looked likely to pay for themselves (not including depreciation) over a period of six years – equivalent to an expected net rate of return of around 9%. Now, it seems, the payback period has shortened to around four years, a required net rate of return of 14%[1].

This is hardly a large sample. And it's quite possible that managers' opinions about hurdle rates aren't worth much anyway. Perhaps finance directors know that managers tend to over-estimate profitability and adjust their targets accordingly.

But, for what it's worth, these numbers are in the range of average returns on existing capital for non-financial firms (Chart 1 again). More importantly – because this isn't just anecdotal – you also get the impression of an unusually wide spread between risky and risk-free yields from securities markets. The green line in Chart 2 is the ratio of profits to assets, the latter valued at market prices, for UK-quoted companies[2]. Instead of declining, that measure of yield has actually gone up since the recession, and even in absolute terms (let alone relative to risk-free rates) is currently more than 100bp higher than it was during the three years leading up to the crisis. The overall cost of capital in securities markets is this rate plus the expected long-run growth rate of corporate earnings. We don't have data for these expectations, but if, instead, we use Consensus forecasts for long-run UK GDP growth, we get the dotted red line[3].

.

---

[1] I've assume a depreciation rate of 6.5%, in line with national accounts estimates for the non-financial sector.
[2] Profits are net of taxes and depreciation, the denominator is equity and debt valued at market prices. Under Modigliani and Miller (1958) this is the same as the return on unlevered equity.
[3] This probably understates the true marginal cost. A part of UK-quoted companies' earnings come from emerging economies, whose expected growth is faster than that of the UK economy. In addition, new issuance tends to occur at a discount to existing securities. Recently, according to data from Dealogic, this discount has ranged between 5%-10%.

Chart 2: Risk premium has widened sharply
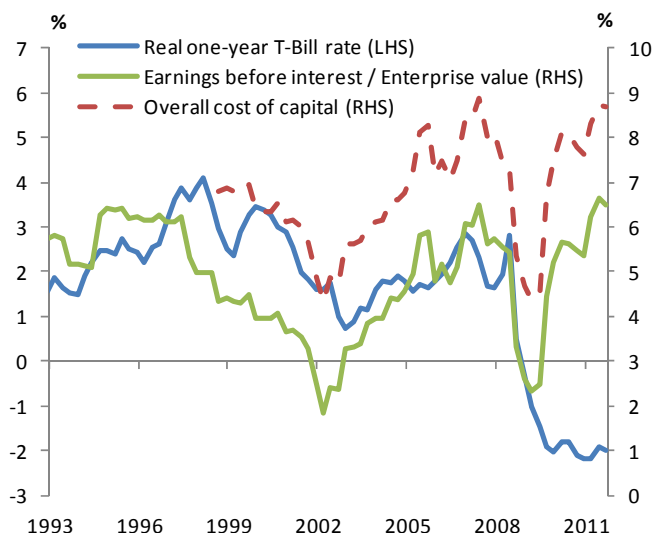
Note: Ratio of earnings before interest to enterprise value calculated for all UK listed companies, as defined by Datastream code TOTMKUK; enterprise value sums the market values of firms' equities and outstanding debt.
Source: Consensus Economics, Thomson Reuters Datastream and Bank of England calculations

Chart 3: New bank loans have apparently got cheaper
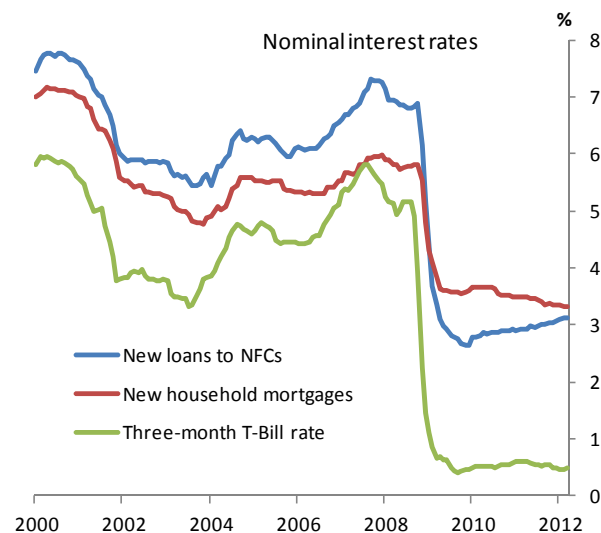
Source: Bank of England

One thing that has probably helped to push up required returns is a contraction in the supply of credit. Like Bank rate, interest rates on new bank loans have declined (Chart 3). But this ignores the impact of non-price factors, including outright rationing of loans. As we shall see below, this implies that the true, effective cost of credit is materially higher than the quoted interest rate on new lending.

That said, what's striking about Chart 2 is that the companies to which it applies are not, by definition, restricted to raising money from banks. They can also sell securities. Yet their cost of finance has apparently risen as well.

What I will suggest in this speech, therefore, is that, even if the origins of our present predicament lie in the banking crisis of 2008, and in the subsequent need to repair banks' balance sheets, we are now suffering from a more general rise in the premium demanded for all risky investments, however they're financed.

In fact, I will argue, the pattern in Chart 2 is exactly what you'd expect if investors' fears about downside risks in particular began to intensify – if their impression of "the worst that could happen" gets that much worse (what I have in mind here is the possibility of extreme outcomes in the euro area). And the investments most vulnerable to such a shift – where you'd expect to find the sharpest increase in required returns – are those that have some element of irreversibility. This will include many projects (spending on intangibles, for example) that are necessary to improve productivity. Thus high risk premia may be inhibiting not just demand but the economy's supply capacity as well.

Here's the plan: I will start with some remarks about credit rationing, providing some evidence that bank debt is more expensive than interest rates alone would imply; we then turn to a simple model of asset pricing that allows for "rare disasters" – as we shall see, small increases in the perceived likelihood of extreme outcomes can have powerful effects on yields, even if they're still very unlikely to occur; I will then explain why these effects are amplified in the case of sunk-cost projects and why, therefore, these downside risks may be important for productivity.

Credit rationing

If the quoted interest rate were the true marginal price of debt, then the credit supply curve facing an individual borrower would be a flat line ("S" in Chart 4). It would then make sense to carry out all investment projects – ranked according to prospective return along the "D" line – until the marginal project that yields the same as this interest rate.

Last week, however, my morning newspaper carried an interesting report. It said that a promise by a newly launched supermarket bank to undercut rivals' loan deals had been criticised by a watchdog "because it could damage borrowers' credit ratings". The reason given was that lenders consider the number of loan applications as an indicator of individual credit risk. So an additional application could increase the cost of other debts, now or in the future. And instead of the low, flat supply curve in Chart 4, the individual borrower apparently faces a higher, upward sloping line (S_c).

I have heard similar things from some businesses[4]. Their banks may be happy to roll over existing loan deals at relatively low interest rates, but only – so these managers believe – if the company's financial health is maintained. This might mean keeping debt within certain limits. It might mean holding some minimum amount of cash. But the effect is the same: credit supply for new investments is harder to come by and the true marginal cost of debt – the amount firms are actually willing to pay in order to reduce it – is higher than the interest rate.

Note that, facing such a curve, borrowers would have an incentive to cut spending – possibly to levels below their current income – in order to repair balance sheets. Indeed they might effectively be forced to do so. So if the cost line shifts upwards (to S_c') as depicted in the Chart 4 – a crude characterisation of what a credit tightening entails – you'd expect to see weaker investment, a higher rate of return on marginal projects and larger surpluses in the non-financial economy.

---

[4] The newspaper story also brings to mind exactly the sort of asymmetric-information world, as described originally by Stiglitz and Weiss (1981), in which credit rationing can occur, i.e. in which the supply curve in Chart 4 becomes vertical at some point. The business-cycle implications of these asymmetric information problems in debt contracts are explored by Bernanke and Gertler (1989) and by Kiyotaki and Moore (1997).

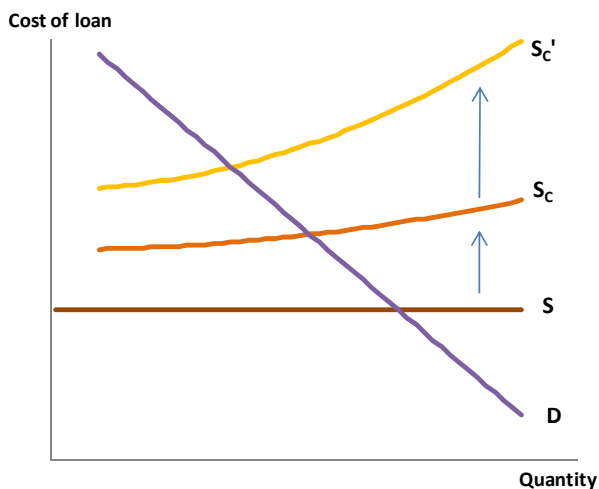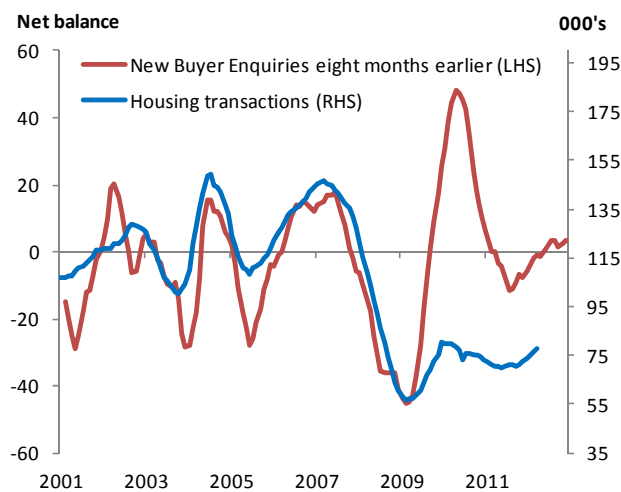**Chart 4: Quoted interest rate may understate true cost of debt**

Cost of loan

S_c'

S_c

S

D

Quantity

Chart 5: Housing market activity no longer demand driven

Net balance

000's

— New Buyer Enquiries eight months earlier (LHS)
— Housing transactions (RHS)

Source: Land Registry, Royal Institution of Chartered Surveyors and Bank of England calculations

We are all aware of the complaints from small business about the availability of credit. There are also clear signs of rationing in mortgage markets. Chart 5 shows the balance on New Buyer Enquiries in the RICS housing-market survey, an indicator of the desire to move house (and the associated demand for mortgage debt) against the number of transactions three quarters later. Until the crisis, the RICS balance predicted pretty well movements in both mortgage approvals and the number of transactions: activity in the housing market looked to be demand driven. That relationship broke down decisively after 2008, however. Buyer interest rose sharply towards the end of that year, as quoted mortgage interest began to fall. But activity went in the opposite direction, to levels consistent with average tenure times well over 20 years. This suggests that the market was – and continues to be – constrained not by a lack of demand but a contraction in the supply of finance.

This evidence tells us there is rationing, but not what it's worth in interest-rate terms (i.e. the rate rationed borrowers would actually be prepared to pay for debt). But the behaviour of larger firms, most of which have the option of selling bonds and equities, and are not limited to bank debt, suggests the effect is material. Chart 6 plots the proportion of their external finance accounted for by securities issuance as opposed to new loans from banks. The red line plots the difference in their cost (the gap between the earnings yield and quoted interest rates). It's drawn on an inverted scale, so a drop means bank debt is, on the face of it, getting relatively cheaper. All else equal, you would expect that to encourage a shift towards bank finance and, more generally, the two lines to move together over time.

That looks roughly true prior to the financial crisis. But it's clearly not the case since: despite the steep fall in interest rates, both in absolute terms and, to a greater extent, relative to yields on other forms of finance, firms have been shifting away from bank debt (you can see this too in the data for the aggregate non-financial corporate sector in Chart 7). If firms that have the option are choosing to pay down bank debt by issuing securities that are, apparently, much more expensive, this indicates that the interest rate
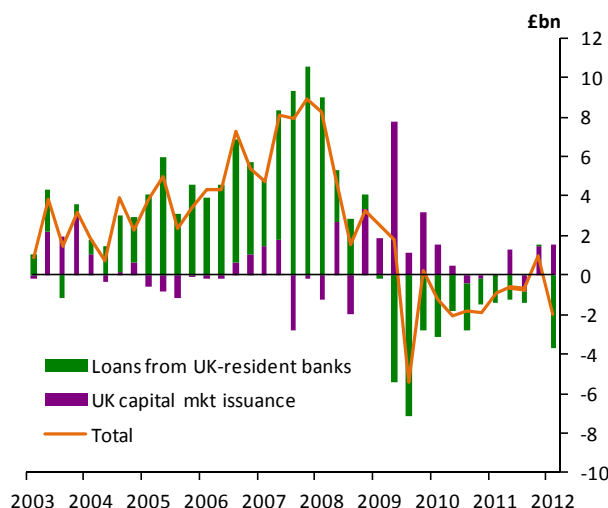
significantly understates the true cost of the debt. Chart 6 suggests the effect may be worth several percentage points.

Chart 6: Steep fall in quoted interest rates has not encouraged more borrowing from banks
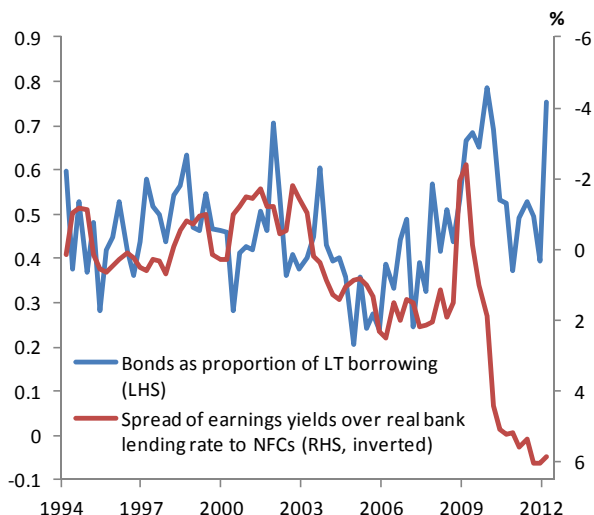
Note: 'Earnings yield' calculated as in Chart 2.
Source: Dealogic, Worldscope and Bank of England

Chart 7: NFCs issued securities, paid down debt in 2009

Source: Bank of England

Risk premia and "rare disasters"

One should hardly be surprised, after a once-in-a-century banking crisis, to observe shortages of credit. Whether they're sufficient to explain the continuing weakness of output and private-sector productivity growth is another question, however.

One of the things that struck me about the companies reporting higher hurdle rates is that only a minority also said they had problems with meeting banking obligations.

More significantly, we know that most business investment is done by large firms, companies that are generally able (if they so choose) to issue securities and bypass the banking system. Yet that category of spending also fell very sharply after the crisis. And, as we've already seen, even if those firms were indeed substituting securities finance for bank debt, they were doing so at a significantly higher cost than before the downturn – this despite a sharp fall in risk-free interest rates.

All this suggests that, even if the crisis originated in the banking system there is now a higher hurdle for risky investment – including, or even especially (I will later argue) the sorts of projects needed to improve productivity – on a more general basis. Specifically, what seems to fit best the facts in Chart 2 is not some symmetric, two-sided increase in risk but a rise in the perceived probability of an extremely bad economic outcome.

To illustrate the point I've used the simple model developed by the economist Robert Barro in his work on "rare disasters"[5]. That work – itself inspired by an older idea by Rietz (1988) – was designed to account for two stylised facts that more basic asset-pricing models have found hard to explain: why it is that risky assets have yielded so much more, over time, than risk-free debt, and why risk-free rates are themselves so low[6]. The Barro/Rietz insight is that you can resolve both puzzles if you allow for a big downside skew in the distribution of output, and that the world is indeed characterised by such "rare disasters". The possibility of such outcomes significantly increases the insurance value of risk-free assets (instruments that pay out come what may) so lowering their average yield. At the same time, it raises the required return on risky assets.

Not surprisingly these effects become more apparent as the perceived likelihood of a (still) rare disaster goes up. Chart 8(a) simulates such an increase. It assumes that the "disaster", were it to occur, is big enough to reduce GDP by an average of 15%[7] and that the probability of its occurring is initially thought to be 10%. These numbers are somewhat arbitrary and you get similar results if you were to assume a slightly higher initial probability but a smaller hit to GDP. The point of the simulation is that, from whatever starting level, the perceived likelihood of an extreme, discrete outcome need only rise a little to have significant effects on markets. As simulated here, a rise of 5% points or so in the perceived likelihood is sufficient to push risk-free interest rates below zero while at the same time increasing the expected return on equity (i.e. the hurdle rate for risky investments). To my mind, Chart 8(a) resembles quite closely the pattern of yields we've actually seen in financial markets in recent years.

In principle, there are other ways you could account for this pattern, Lower expectations of long-run growth, partly via the response of easier monetary policy, will have reduced yields on all assets. Higher uncertainty (of the conventional, two-sided sort) would raise the risk premium.

But it's hard to see how these effects can be big enough to explain the data. Judging by the sensitivity in Chart 8(b), long-run growth expectations would have to have dropped several percentage points for that alone to account for the decline in risk-free interest rates. Yet, as measured by consensus forecasts for 10-year-ahead GDP, those long-run expectations have declined only slightly (Chart 9). Similarly, the rises in pure (two-sided) uncertainty you need to account for the actual widening in the risk premium look implausibly large (Chart 8(c)) – 8% points or more, compared with a standard deviation of actual GDP growth that, in the long run of historical data (Chart 10), has never got close to that[8].

---

[5] Barro (2006, 2009 and 2011).

[6] Mehra and Prescott (1985).

[7] The impact of the "disaster" is itself stochastic, assumed to be uniformly distributed on [5%,25%]

[8] Pure unpredictability – the expected size of forecast errors – is likely to be smaller (and cannot be bigger than) the standard deviation of output itself as optimal forecasts will probably entail more than simply predicting that the economy will every year grow in line with its long-run average. That said, it should also be recognised that in this model, the only source of uncertainty, apart from the possibility of rare disasters, concerns purely temporary disturbances to the rate of growth. Bonsal and Yaron (2004) show that introducing very persistent shocks to output growth can help explain the equity risk premium, though to do that their model needs a great deal of persistence in shocks to growth and also the assistance of a very high degree of risk aversion.

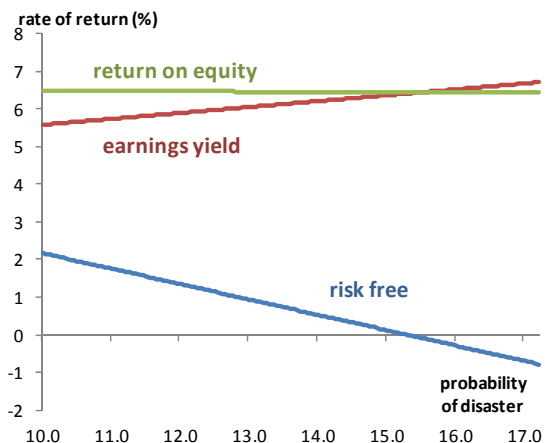**Chart 8a: Sensitivity of yields to perceived "disaster" risks**

rate of return (%)

return on equity

earnings yield

risk free

probability of disaster

10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0

Chart 8b: Sensitivity of yields to expected long- run growth

rate of return (%)

earnings yield

return on equity

risk free rate

expected long-run output growth (%)

3.0 2.0 1.0 0.0 -1.0 -2.0 -3.0 -4.0
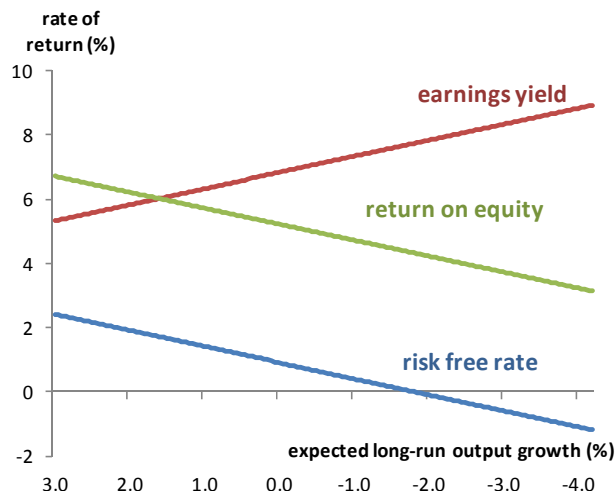
Chart 8c: Sensitivity of yields to degree of uncertainty

rate of return (%)

return on equity

earnings yield

risk free

output growth volatility

2.1 3.1 4.0 5.0 6.0 7.0 8.0 9.0
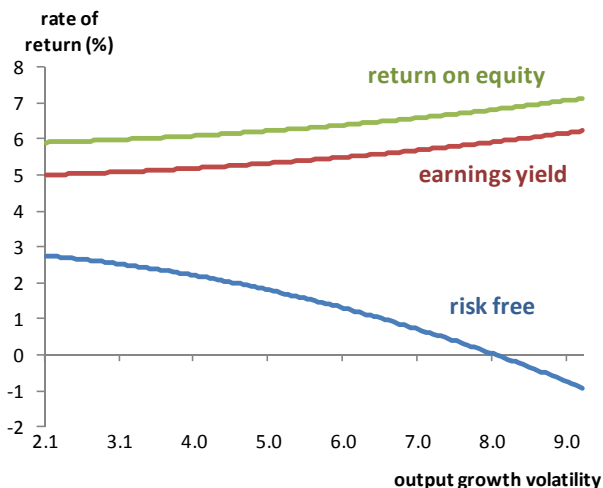
Chart 9: Long-term growth expectations weaker, but not by much

% pts

World GDP

UK

1999 2001 2003 2005 2007 2009 2011

Date forecast was made
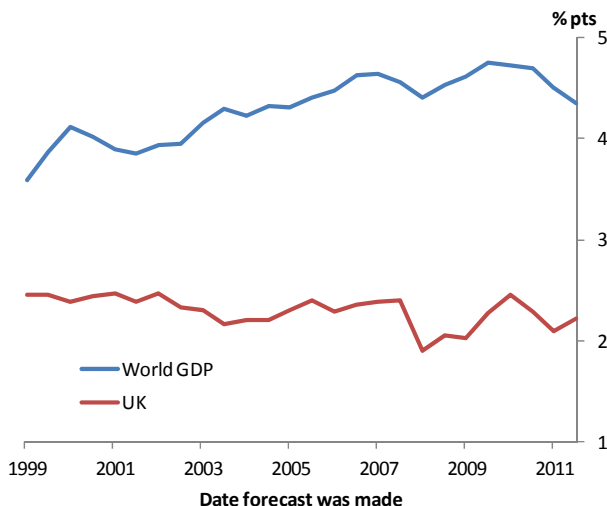
Note: Rolling consensus forecasts for average growth over next 10 years.
Source: Consensus Economics

So it looks to me as though a higher downward-skew in the distribution of outcomes – a higher risk of a rare but very bad economic shock – does the better job of explaining how financial markets have behaved. And we have, in the shape of the on-going financial crisis and the possibility of serious disruption in the euro area, a very plausible candidate for such a risk.

That is not to say we know either what form the worst-case outcome would take, or what probability to attach to it. I'm not sure it's even knowable. That's why the MPC decided last autumn explicitly to exclude these risks from its fancharts. But there is less doubt that it could have serious implications for the UK or that it's already come to have a very significant impact on financial markets. Chart 11 plots the rolling correlation

between daily movements in the UK equity prices and the spread between euro-periphery and German government bond yields. Pretty much unrelated prior to the financial crisis, the two series have since been tightly correlated.
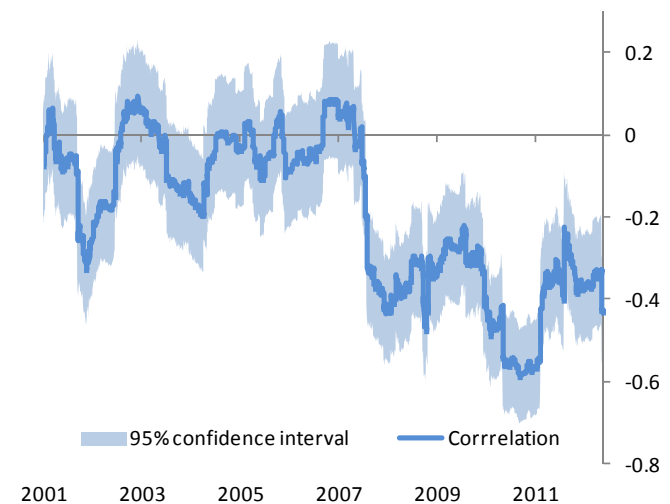
Chart 10: Rolling 25-year standard deviation of annual UK GDP growth
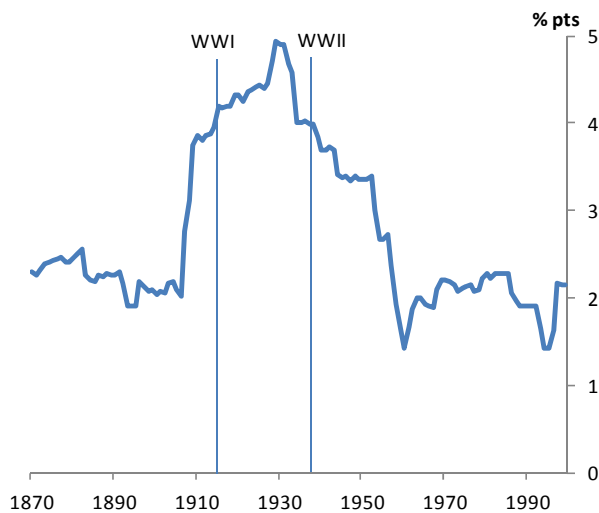
Note: Centred 25-year rolling windows are used. WWI and WWII stand for the start of the First and Second World Wars, respectively.
Source: Bank of England

Chart 11: UK equities more closely correlated with Euro Area sovereign spreads

Note: Correlation is between first differences of sovereign spreads and the FTSE all share index; Euro area sovereign spread calculated as the difference between 10-year German bond yield and a weighted-average 10-year yield for Greece, Ireland, Italy, Portugal and Spain.
Source: Thomson Reuters Datastream and Bank of England calculations

Disaster risk and irreversible investment

I want to make two other points.

The first is brief and involves the distinction between credit supply and credit demand. What I've argued so far is that, although UK bank deleveraging remains important – it's still adding to financing costs for borrowers dependent on the banks – the evidence suggests that an independent hurdle has emerged in the form of higher risk premia, plausibly associated with events in the euro area. This is raising the bar for all investments, including those financed in securities markets.

Were the worst outcomes to occur, however, they would clearly be transmitted via, and amplified by, the banking system. UK banks have significant exposure to the rest of Europe[9]. And, like those for the wider market, banks' funding costs have become much more sensitive to movements in euro-area sovereign spreads. This suggests that pressures on UK banks emanate partly from precisely the same risks that are affecting non-financial companies. This makes it harder to distinguish the influences of "credit supply" and "credit demand".

---

[9] See, for example, the Bank's latest Financial Stability Report (December 2011).

The second point concerns the distinction between reversible and irreversible investments. The model simulations above applied to the first, investments that a firm could exit costlessly. If it involved physical plant, for example, then the assumption would be that firms could lease such equipment or re-sell it in second-hand markets. In reality, many investments are not like that: they involve sunk costs. Big FDI projects, in-firm training, R&D, the adoption of new technologies, even simple managerial reorganisations – these are all things that can improve productivity but have risky returns and cannot be easily reversed after the event.

This matters because economists have long recognised that sunk-cost investments are particularly vulnerable to increases in uncertainty, fears of bad outcomes in particular. If things turn out well, you can always go ahead with the project when they do so; but if things turn out badly, a sunk-cost investment will have proved a big mistake. So if the risk of a rare but very bad event grows – if the worst-case scenario suddenly looks that much worse – you have a powerful incentive to delay such projects: the "option value" of waiting goes up and the required rate of return along with it[10]. Thus the equivalent to Chart 8(a), which plotted the sensitivity of expected returns to "disaster" risk, would look like Chart 12, and the effects of such risks on risky investment is thereby amplified.

How important is this effect? Many intangible investments are, by their nature, hard to measure, and not included in conventional statistics on business investment. But Marrano and Haskel (2006) estimated that, in 2004, and at least in gross terms[11], they were the same size, both worth 11% of GDP. And while not all intangible investment is irreversible, one suspects that, with a scarcer supply of leasing finance (Chart 13), even some physical investments are harder to exit than before the crisis.

---

[10] The canonical reference is Dixit and Pindyck (1994)..
[11] Intangible capital is likely to depreciate faster and is therefore probably smaller than measured business investment in net terms.

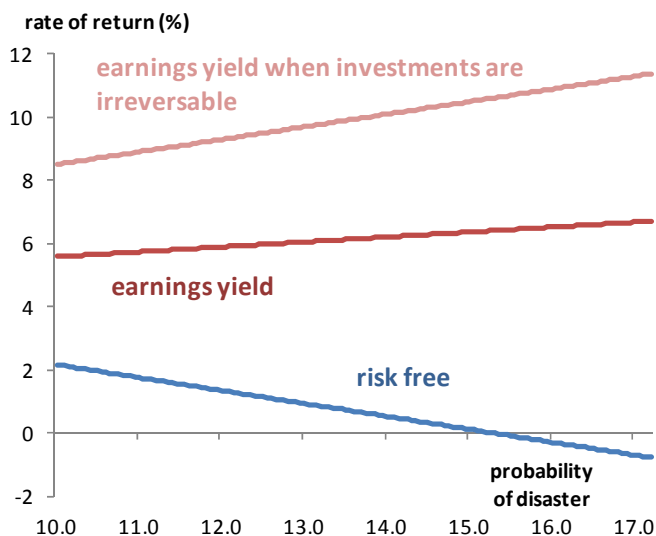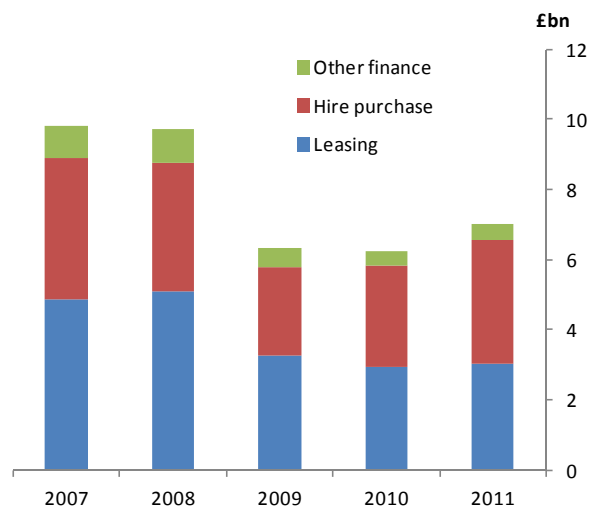**Chart 12: Sunk-cost projects more sensitive to risk of bad event**

rate of return (%)

earnings yield when investments are irreversable

earnings yield

risk free

probability of disaster

Chart 13: Harder to find leasing finance for equipment

£bn

- Other finance
- Hire purchase
- Leasing

2007 2008 2009 2010 2011

Note: Includes financing for both plants and machinery and business equipment
Source: Finance & Leasing Association

Summary and conclusion: euro risk still a hurdle to recovery

In a speech last year, I suggested that low capital mobility had contributed to weak growth of productivity and output. Following big shifts in relative prices, most obviously between traded and non-traded output, it was likely that some activities had become much more profitable (all else equal), others less so. Failure to move resources from one to the other would lower aggregate productivity. I also suggested that low capital mobility was connected with deleveraging: banks were "forbearing" on existing finance for activities that had become unprofitable while failing to fund the newly profitable projects.

But the truth is that, although there are still signs of tight credit, finance looks expensive even for firms that can bypass the banks. Together with the big drop in risk-free interest rates this suggests that the distribution of economic outcomes driving financial markets has a marked downwards skew – that fears have increased of a rare but bad economic outcome. Such an event could remain very unlikely yet, if severe enough, still have a powerfully inhibiting effect on new investment projects, particularly those that are difficult to exit. As the May Inflation Report put it "the possibility of extreme outcomes crystallising [in the euro area] will continue to weigh on UK activity...**even if those outcomes do not actually occur**" (my emphasis). What I'm arguing in this piece is that these heightened fears may already have been affecting the growth of UK activity, investment and productivity for some time.

It would be nice to think that these worries are unfounded – that "the only thing we should fear", to quote Roosevelt, "is fear itself". Unfortunately, I doubt that's the case. Markets and businesses possess "animal spirits" and can over-react to events. They may have done so again. But there's probably a premium on risky investments because there is genuine economic risk.

I don't mean, by any of this, to add to the prevailing gloom. We should remember that we have been through similar episodes before – as recently as the mid-1970s, risk premia rose to levels that were probably higher than they are now (I don't think it's a coincidence that productivity growth also slowed sharply at that time). Equity prices are still higher than last summer's lows, investment is still happening and, thanks in part to the ECB's LTRO operations, banks have managed to attract far more funding in the first few months of 2012 than they did a year ago.

In addition, one important implication of this thesis is that, if fears of downside risks were to recede, this could have pretty powerful effects on output – potential as well as actual – in a <u>positive</u> direction[12].

Nor is domestic policy powerless to affect things in the interim. Indeed, I strongly believe that the dramatic easing in monetary policy after 2008, here and in other parts of the world, was crucial in helping to prevent what might have been a much deeper downturn. And, were the (still unlikely) worst-case risks in the euro area actually to be realised, then our own monetary policy would again play its part in mitigating the impact.

But, to some extent at least, that expectation is already there: markets should, and presumably do, know that, because such a downturn would threaten to push inflation to dangerously low levels, it would also be met with further monetary easing. To a degree, therefore, that response is already factored into market yields and the prevailing cost of capital.

One should therefore recognise that, while they are both necessary and effective, these domestic interventions have their limits. It remains the case that, for the time being at least, the most important policy decisions affecting the UK are being taken in other parts of the continent.
.

---

[12] Bernanke (1983a) points out that the arrival of bad news can actually have a cathartically positive effect on irreversible investments (on the basis that people realise things can only better). Bloom (2009) simulates the effects of temporary uncertainty shocks on investment and labour productivity when firms face fixed (and sunk) adjustment costs. His shocks are symmetric – more uncertainty adds to upside and downside risks – but they nonetheless have powerful effects on investment and output. Equally, once uncertainty recedes, Bloom's simulations predict rapid rebounds in both.

References

Barro, R. J., 2006, "Rare Disasters and Asset Markets in the Twentieth Century", Quarterly Journal of Economics, Vol. 121, No.3, pg. 823-866

Barro, R. J., 2009, "Rare Disasters, Asset Prices, and Welfare Costs", American Economic Review, vol. 99, no.1, pg. 243-264

Barro, R. J. and J. Tao, 2011, "On the Size and Distribution of Macroeconomic Disasters," Econometrica, Econometric Society, vol. 79, no. 5, pg. 1567-1589

Bernanke, B. S., 1983a, "Irreversibility, Uncertainty, and Cyclical Investment," Quarterly Journal of Economics, MIT Press, vol. 98, no. 1, pg. 85-106

Bernanke, B. S., 1983b, "Nonmonetary Effects of the Financial Crisis in Propagation of the Great Depression", American Economic Review, American Economic Association, vol. 73, no. 3, pg. 257-76

Bernanke, B. S. and M. Gertler, 1989. "Agency Costs, Collateral, and Business Fluctuations", American Economic Review, vol. 79, no.1, pg. 14-31.

Bloom, N., 2009, "The Impact of Uncertainty Shocks", Econometrica, Vol. 77, No. 3, pg. 623-685

Bonsal, R. And A. Yaron, 2004, "Risk for the Long Run: a Potential Resolution of Asset Pricing Puzzles", Journal of Finance, Vol 59, No. 4, pg. 1481-1509

Dixit A., and R. Pindyck, 1994, "Investment under Uncertainty", Princeton University Press

Friedman, M and A. J. Schwartz, 1963**,** "A Monetary History of the United States, 1867-1960", Princeton University Press

Kiyotaki, N. and J. Moore, 1997, "Credit Cycles", Journal of Political Economy, vol. 105, no. 2

Marrano, M. G. and J. Haskel, 2006, "How much Does the UK Invest in Intangible Assets", Queen Mary University of London, Working Paper No. 578.

Mehra, R. & E. Prescott, 1985, "The equity premium: A puzzle," Journal of Monetary Economics, Elsevier, vol. 15, no. 2, pg. 145-161

Modigliani, F. and M. Miller, 1958, "The Cost of Capital, Corporation Finance and the Theory of Investment". American Economic Review, vol. 48, no. 3, pg. 261–297

Stiglitz, J. and A. Weiss, 1981, "Credit Rationing in Markets with Imperfect Information", American Economic Review, American Economic Association, vol. 71, no. 3, pg. 393-410

Reitz, T. A, 1988, "The Equity Risk Premium: a Solution", Journal of Monetary Economics, No. 22, pg. 117- 130