A comparison of long bond yields in the United Kingdom, the United States, and Germany

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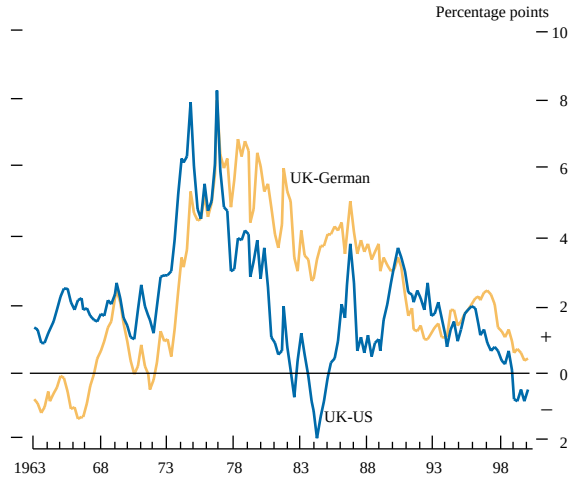
Long-dated gilt yields are currently well below the comparable German and US government bond yields for the first time in many years. This article considers what factors are likely to have contributed to these changes in nominal rates of return. We conclude that much of the decline in long gilt yields can be attributed to a decline in UK inflation expectations since the mid-1970s. However, we find evidence to suggest that gilt yields have more recently also fallen in response to a significant reduction in net gilt issuance combined with an increase in demand for gilts from UK institutional investors.

Introduction

For most of the past 30 years, investors have demanded a higher nominal rate of return on UK government bonds (gilts) than on either German or US government bonds (Bunds and Treasuries respectively). As can be seen from Chart 1, the gilt-Treasury and gilt-Bund spreads reached a peak of around 8 percentage points in 1976 (using quarterly data). Since then, however, the size of this yield premium on gilts has declined steadily; in February 2000, the redemption yield on the 5¾% Treasury Stock 2009 (the current benchmark ten-year gilt) fell below the comparable German Bund yield. Furthermore, longer-maturity gilt yields are now well below comparable Bund and US Treasury yields (see Chart 2).

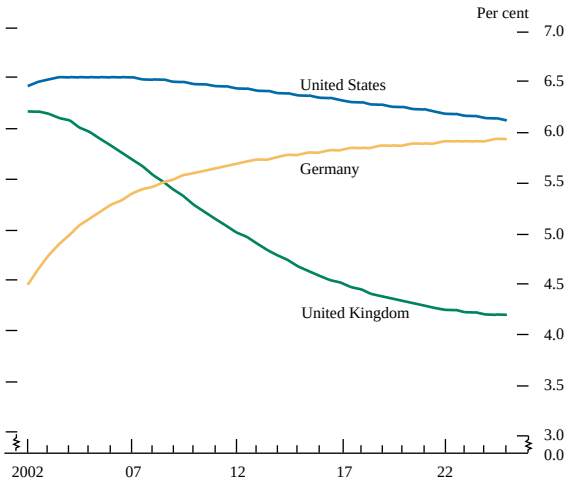
Chart 1
Ten-year yield differentials(a)



(a) Using redemption yields.

This article begins by outlining the main determinants, according to economic theory, of these changes in relative bond yields. It then goes on to discuss what other UK-specific factors may have influenced the bond yield differentials in recent years.

Chart 2
Par yield curves, as at 1 March 2000(a)



(a) Curves derived using Svensson curve-fitting technique.

UIP, PPP and the Fisher equation

Three theoretical economic relationships can be used to illuminate movements in international bond yield differentials: uncovered interest rate parity (UIP); purchasing power parity (PPP); and the Fisher equation.

The UIP condition says that, in a world of freely floating exchange rates and perfect capital mobility, interest rates and exchange rates should be such that a rational investor will be indifferent between the choice of holding an interest-bearing asset denominated in his or her domestic currency and an alternative asset with the same characteristics denominated in a foreign currency. Expressed more formally, this implies that the difference between the one-period return on holding assets denominated in different currencies should be equal to the expected exchange rate movement between the two currencies over the period, plus any risk premium attached to the uncertainty of the exchange rate forecast. This can be written as:

$$i_t^* - i_t = s^e_{t+1} - s_t + \rho_t \qquad \textbf{(1)}$$

where i_t^* is the foreign one-period nominal interest rate; i_t is the domestic one-period nominal interest rate; s_t is the spot exchange rate (defined as the foreign currency price of domestic currency); s^e_{t+1} is the market's one step ahead forecast for the spot exchange rate made at time t;(1) and ρ_t is a risk premium. The implication of the UIP condition is that the bond yield differentials observed in Chart 1 reflect expected exchange rate movements between sterling, the US dollar and the Deutsche Mark over the life of the bonds, plus a risk premium.

Economic theory also suggests that differentials between the expected inflation rates in two countries should be the key factor affecting the expectation of any exchange rate movement between the two countries' currencies. This is known as the purchasing power parity (PPP) relationship:

$$\Pi^{e*}_{t+1} - \Pi^{e}_{t+1} = s^e_{t+1} - s_t \qquad \textbf{(2)}$$

where Π^{e*}_{t+1} is the market's forecast for the change in the foreign price level between periods t and $t+1$, and Π^{e}_{t+1} is the market's equivalent one step ahead forecast for domestic inflation. Combining the UIP and PPP conditions, we can see that most of the observed spreads between the yields on UK, US and German government bonds should be related to expected inflation rate differentials between the three countries over the life of the bonds. So the risk premium in **(1)** represents uncertainty surrounding future inflation differentials.

Finally, the Fisher equation (1930)(2) states that the nominal return (i) required by investors to induce them to purchase and hold a bond is made up of two components: the expected rate of inflation over the holding period for the bond (Π^e), and the real rate of return (r):

$$i_t = \Pi^{e}_{t+1} + r_t \qquad \textbf{(3)}$$

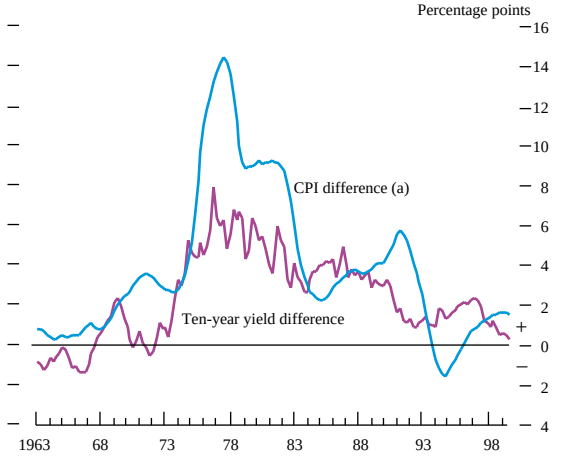
Clearly, if equations **(1)** and **(2)** hold, then the real rates of return in different currencies should be the same. However, there is strong evidence to suggest that PPP often does not hold, particularly in the short and medium term. This implies, therefore, that the nominal bond yield differentials that we observe between the United States, Germany and the United Kingdom may be affected by changes in relative real rates of return, as well as by changes in relative inflation expectations and changes in risk premia.

The role of inflation expectations

A possible explanation for the narrowing in the yield spreads between gilts and both Bunds and Treasuries over the past 25 years is that expected inflation has fallen more in the United Kingdom than in the United States and Germany. Inflation expectations are generally thought to be influenced by a combination of the following factors: the current rate of inflation; the economy's position in the business cycle; its historical inflation performance; and perceptions about the policy objectives of the monetary authority. The measure of inflation expectations that is relevant for nominal bonds is the expected change in the price level over the life of the bond—in this case, ten years. Unfortunately, as most survey measures of agents' inflation expectations focus on much shorter time horizons than this, typically only one or two years, they are not particularly appropriate benchmarks to use. We are therefore forced to consider alternative measures.

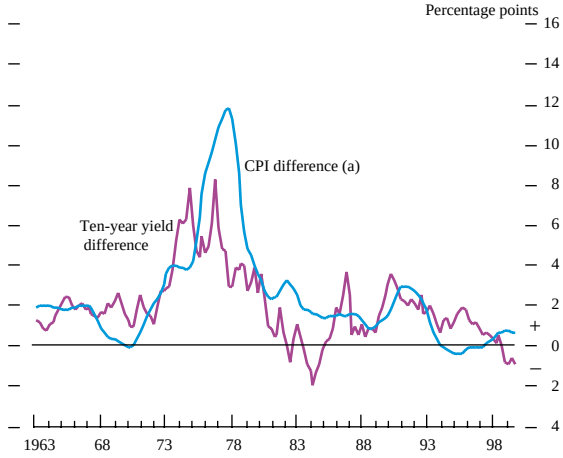
The simplest approach is to assume that an average of past inflation can be used as a rough proxy for the expectation of average annual inflation over the following ten years. Though this is a crude approach, Charts 3, 4, and 5 show that three-year backward-looking moving averages of inflation differentials between the United Kingdom, Germany and the United States go a long way towards explaining the relative bond yield differentials between these countries. Inflation differentials have declined with yield

Chart 3
UK-German bond yield and inflation differentials



(a) Using three-year backward-looking moving averages of headline consumer price inflation.

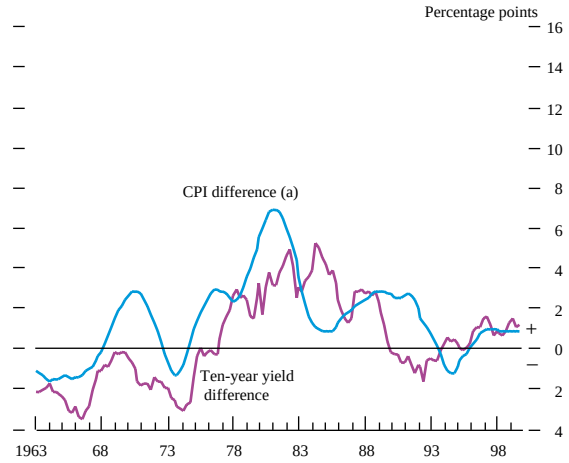
Chart 4
UK-US bond yield and inflation differentials



(a) Using three-year backward-looking moving averages of headline consumer price inflation.

(1) The exchange rates in **(1)** are expressed as logs.
(2) *The theory of interest*, New York, Macmillan.

Chart 5
US-German bond yield and inflation differentials



(a) Using three-year backward-looking moving averages of headline consumer price inflation.

spreads. In all three cases the correlation coefficients between the quarterly movements in bilateral inflation and bond yield differentials are at least 0.64. Hence it seems reasonable to conclude that the convergence of UK inflation towards the levels prevailing in Germany and the United States helps to explain much of the narrowing in the yield spread between UK nominal bonds and US and German nominal bonds.

An alternative, and possibly better, measure of ten-year average inflation expectations can be derived for those governments which issue both conventional bonds and index-linked bonds. By rearranging the Fisher equation, we can obtain a measure of inflation expectations from the difference between the nominal yields and real yields prevailing on conventional and index-linked government bonds. However, the German government does not issue index-linked debt and the United States began to do so only recently. Hence it is not yet possible to derive long time series of expected inflation differentials in this way.

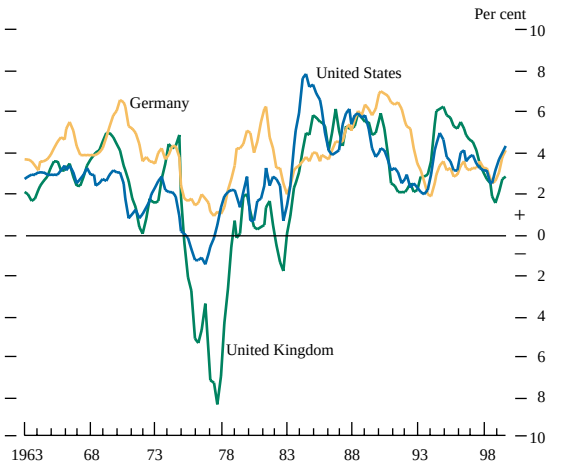
The discussion so far has focused exclusively on ten-year bond yields. The reason for this is that the German, UK and US governments have historically tended to issue bonds of this maturity and so long time series of yields are readily available. Issuance of government bonds with greater maturities has not been as common—Germany has issued relatively few bonds beyond ten years in duration. As a result, it is more difficult to assess the extent to which movements in inflation differentials can also explain changes in 20 or 30-year government bond yield differentials. However, both the UK and US governments have regularly issued bonds with maturities as long as 30 years. Furthermore, the correlation between quarterly movements in 10 and 20-year government bond yields in both the United States and the United Kingdom has been high over the past three decades, at almost 0.9. Although there have been episodes when the UK-US 10 and 20-year yield spreads diverged from one another, these have been relatively short-lived. Over most of the period, the UK-US 10 and 20-year yield spreads have moved broadly in line with each other. So it seems reasonable to conclude that changes in expected inflation differentials also help to explain a large proportion of the changes in government bond yield differentials at maturities greater than ten years.

The role of the real rate of interest

As noted above, another factor that might have contributed to the decline in the gilt-Bund and gilt-Treasury spreads since the 1970s is the possibility that the real rate of return on UK government debt has fallen, relative to the real rates of return on US and German government bonds. In a world with perfect capital mobility, freely floating exchange rates, and risk-neutral investors, both UIP and PPP should hold, implying that the real rates of return on bonds with identical characteristics issued by different governments should be the same. This might suggest that differential movements in real rates of return are unlikely. However, most empirical studies suggest that PPP does not hold in the short run and that the degree of international capital mobility has increased over the past three decades. Hence, if international capital mobility was more limited in the 1970s and early 1980s, the full equalisation of real rates of return on UK, US and German government bonds may have been impeded.(1) So, if real rates of return were higher in the United Kingdom than in the United States and Germany in the past, this development could also explain falling relative gilt yields.

In Chart 6, we plot the real yield on UK, US and German ten-year government debt, derived as the difference between the nominal yield and a three-year moving average of CPI inflation (used as a proxy for the average rate of inflation expected over the following ten years). This approximation (which assumes that there is no change in the relative prices of consumption baskets) suggests that real rates of return on UK, US and German government debt have diverged

Chart 6
Proxy ten-year real government bond yields(a)



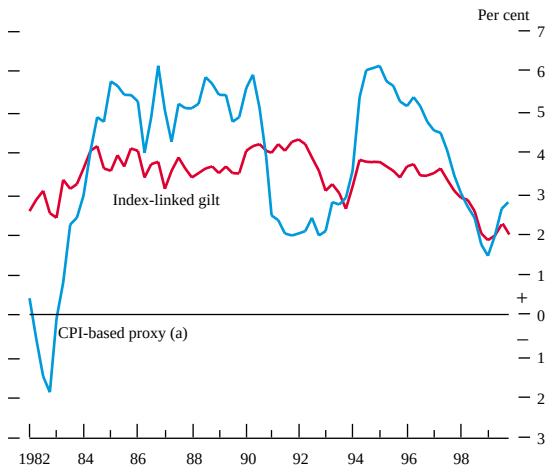
(a) Ten-year nominal redemption yield minus three-year moving average of headline CPI inflation.

(1) The United Kingdom abolished its exchange controls in October 1979.

markedly in the past, and often for considerable periods of time. Some divergence in these real rates should be expected, given the crude nature of our proxy for inflation expectations. In particular, although *ex ante* real returns should be equal if UIP and PPP hold, *ex post* real rates need not be equal if some unexpected event occurs. It is interesting to note, however, that the degree of divergence between these proxy measures of real rates appears to have diminished over the past 30 years. This appears consistent with an improvement in international capital mobility; but it could also be related to declines in differential international risk premia and reduced expectational errors. However, there is no clear sign that real rates of return in the United Kingdom in the 1960s and 1970s were higher than in Germany or the United States. Rather, Chart 6 suggests that the opposite may have been true—UK real rates appear to have been lower than in Germany and the United States. It is difficult to argue, therefore, that long-run convergence in real rates has contributed significantly to the decline in the United Kingdom's relative nominal yields.

The United Kingdom began issuing index-linked bonds in 1981. Chart 7 compares real zero coupon rates derived from UK index-linked gilts with the measure shown in Chart 6. As can be seen, the long-term real rate derived from the index-linked bonds is less variable than our CPI proxy measure. This suggests that long-term inflationary expectations may be slower to respond to current inflation outturns than implied by our three-year moving-average proxy. Nevertheless, index-linked bonds tend to confirm the indication from the proxy measures that real rates of return can differ between countries—at the beginning of April, the yield on the benchmark ten-year US index-linked bond was around 4%, while the equivalent yield on a ten-year index-linked gilt was around 2%. With the increases in international capital mobility observed in the past 20 years, such differences may reflect country-specific, institutional factors (or differences in the measurement of inflation between the United States and the United Kingdom).

Chart 7
Alternative measures of ten-year UK real gilt yields



(a) Ten-year nominal redemption yield minus three-year moving average of headline CPI inflation.

The role of risk premia effects

According to expressions **(1)**, **(2)** and **(3)**, differences between nominal yields will be determined by expected inflation differentials and a risk premium, where the risk premium will be related to uncertainty about future inflation differentials, about the exchange rate and about the real rate of interest. It is possible that risk premia effects may be able to explain some of the longer-term decline in bond yield spreads.

In order to gauge the size of any risk premia effects among major government bond markets, we need a model of government bond yields that will enable us to estimate the proportion of the yield spread determined by what we call 'bond market fundamentals' ($r + \prod^{e}$) and the proportion that is determined by risk premia effects (ρ). The model we use is based on a technique proposed by Campbell and Shiller (1987)[1] and involves estimating a vector auto-regression (VAR). From the model we can obtain a forecast of future short-term interest rates based on the estimated relationship between the variables in the VAR. Then, by invoking the pure expectations hypothesis (PEH) of the term structure of interest rates, we can obtain a measure of the theoretical long rate—the rate that would prevail in the absence of a risk premium. The pure expectations hypothesis refers to the idea that the entire term structure of interest rates reflects the market's current expectations of future short-term interest rates. According to this theory, if there were no risks attached to investing in bonds, an investor should be able to replicate the return available on a long bond by buying combinations of shorter-maturity bonds. We rely on the notion that PEH holds to derive our theoretical long rates. The difference between actual yields and the calculated theoretical rates derived from the model can then be used as a proxy for risk premia effects.

It should be noted, however, that this proxy for risk is an *ex post* measure. As such, it will include both risk premium elements and elements related to unanticipated shocks. We assume that the shock component is genuinely random and therefore that systematic movements reflect changes in risk premia. Furthermore, it is impossible to distinguish between the potential components of the measure, such as uncertainty about future exchange rates, future inflation rates, and future real rates of return.

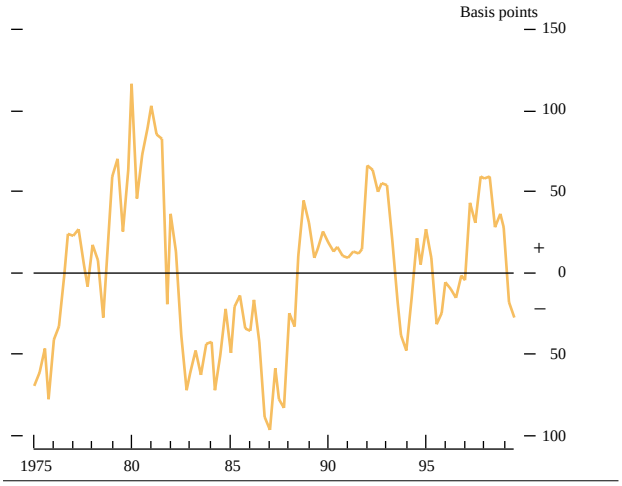
The system of equations used in our model was estimated with UK, US and German data. This framework allows us to calculate the actual and theoretical bond market spreads between these three markets. From the estimated econometric model, and after imposing the PEH condition,

(1) 'Cointegration and tests of present value models', *Journal of Political Economy*, Vol 95, pages 1,062–88.

we can monitor the changes in the bond spreads that are due to changes in financial market risk premia as defined above and the changes that are due to movements in the underlying, fundamental relationships between the markets. The estimated VAR includes the change in a short rate and a measure of the slope of the yield curve for the United States, the United Kingdom and Germany (see Clare and Lekkos (2000)[1] for a more detailed description of the methodology).

In Chart 8 we present the difference between the actual gilt-Bund yield spread and the theoretical gilt-Bund yield spread. Positive values in Chart 8 indicate that actual UK rates are higher relative to German rates than the PEH theory would predict them to be, and *vice versa*. We can discern three distinct periods: 1975 to 1982, 1983 to 1988, and from 1988 to the end of our sample. In the first and third of these periods, investors generally attached a positive risk premium to gilts relative to Bunds. Between 1982 and 1988 the situation was reversed, with investors attaching a higher risk premium to German government securities.

Chart 8
Difference between actual and theoretical £-DM spreads

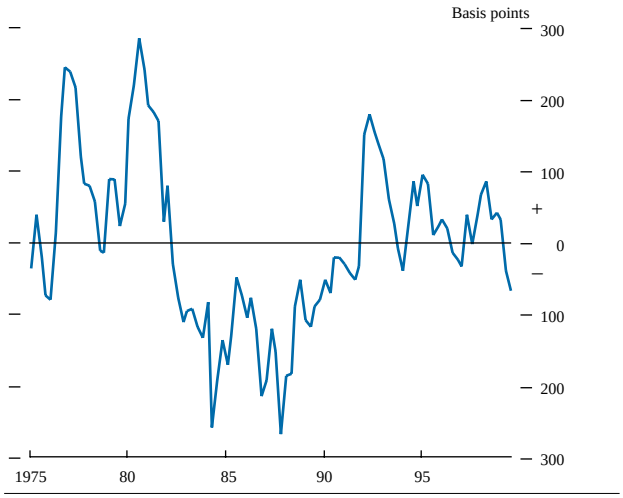


In June 1980, the relative premium on gilts peaked at more than 116 basis points. At this time the actual spread between gilts and Bunds was approximately 530 basis points. Thus our measure indicates that around a fifth of the spread might have been attributable to risk premia considerations. This, in turn, would imply that the rest of the spread was due to either expected inflation differentials or differences in the real rates of interest. Since 1988, the relative risk premium on gilts (over Bunds) has averaged around 20 basis points. However, it reached 57 basis points in June 1998, when the actual spread was around 110 basis points. This suggests that, at this time, a greater proportion of the observed spread was due to risk premia effects and less to expected inflation differentials and real interest rates.

Between 1982 and 1988 the risk premium was negative. In June 1987 the spread was -95 basis points, and the actual spread was around 350 basis points. The change in the sign of the risk premium may have reflected the impact of the Conservative government's monetary policy regime, which may have caused market agents to change the way in which they formed expectations about future short rates.

Chart 9 plots the difference between the actual and theoretical gilt-Treasury spreads. The chart is qualitatively similar to Chart 8, with positive risk premia at the beginning and end of the sample and a negative gilt premium in the middle of the sample. The key difference between the two charts is that the implied relative risk premium in Chart 9 is much larger than that in Chart 8. It is consequently more difficult to rationalise some of the model's results. In December 1980, for instance, the risk premium was 287 basis points while the actual spread between gilts and Treasuries was around 100 basis points, implying that expected inflation in the United Kingdom must have been lower than in the United States at the time. Given that actual UK inflation was around 3 percentage points higher than US inflation at the end of 1980, the model's results need to be interpreted with caution.

Chart 9
Difference between actual and theoretical £-$ spreads



Nevertheless, over the entire sample, Charts 8 and 9 do seem to indicate some decline in the risk premium attached to gilts, relative to Bunds and Treasuries. But the risk premium does not seem to have declined monotonically and could be said to time-vary around zero. If this is true (and our sample is too short to say definitively whether the premium cycles around zero) then risk premia are probably not the major contributory factor to the decline in the gilt-Bund and gilt-Treasury spreads over the past 25 years. A final point worth noting is that there has been a general increase in the relative importance of the risk premium as a component of the actual spreads, as rates of inflation between the respective economies have converged.

(1) Decomposing the relationship between international bond markets, *The Proceedings of the Autumn BIS Central Bank Economists' Meeting—International Financial Markets and the Implications for Monetary and Financial Stability*, The Bank for International Settlements, Basel, Switzerland, Vol 8, pages 196–213.

More recent changes in gilt-Bund and gilt-Treasury spreads

Chart 1 shows that the gilt-Bund and gilt-Treasury spreads have been declining since the mid-1970s. However, the decline in these spreads, or more specifically the decline in gilt yields, has received particular attention over the past two to three years. Since the beginning of 1997, UK-US and UK-German 20-year yield differentials(1) have declined by around 230 and 265 basis points respectively. Can changes in expected inflation rates, real rates, or risk premia account for this recent and dramatic decline?

Contemporaneous UK-US and UK-Germany twelve-month inflation differentials have declined by around 90 and 55 basis points since 1997. Furthermore, headline inflation rates in all three countries have been less than 4% since 1994. It is difficult, therefore, to rationalise the full extent of the decline in the 20-year yield spreads in terms of plausible changes in inflation expectations. Chart 6 offers weak evidence of a recent decline in UK real rates, while Charts 8 and 9 indicate similarly weak evidence of a decline in the relative risk premium attached to gilts. But it is possible that these changes have occurred as a result of other factors, ie changes unrelated to Fisher's equation.

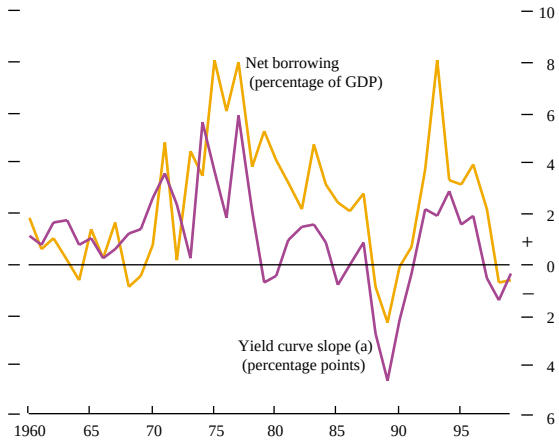
Recent gilt market specific factors

As Chart 2 shows, the UK yield curve is currently inverted. This inversion began in the second half of 1997 and has become more pronounced since. If this development were related to UK-specific factors then it will also have affected the current spreads between gilt yields and Bund and US Treasury yields.

There are a number of UK-specific supply and demand-side factors that may have influenced the shape of the gilt yield curve over the past few years. On the supply side, although all three countries have reduced their general government deficits, the improvement in the UK government's financial balance has been the most significant, changing by 9% of GDP since 1993, to a surplus of 0.7% of GDP in 1999. Net borrowing by the UK government has been negative since 1998 and the outstanding stock of gilts has, therefore, been contracting. In Chart 10 we plot net borrowing as a proportion of GDP and the spread between ten-year gilt yields and three-month interbank lending rates. We can see that there is generally a positive relationship between the two, and that the recent flattening of the UK yield curve, which began in 1996, coincides with a significant decline in net borrowing.

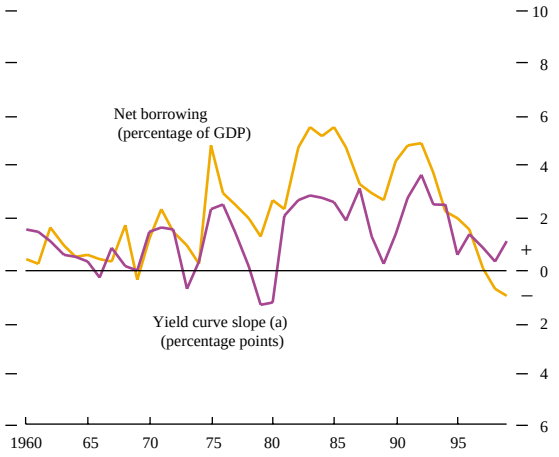
Similar relationships between net issuance and the slope of the yield curve can be observed in both the United States and Germany (see Charts 11a and 11b). However, the improvements in the US and German governments' fiscal positions have not been as large. Over the same six-year period, the US general government balance increased by

Chart 10
United Kingdom: government net borrowing and yield curve slope



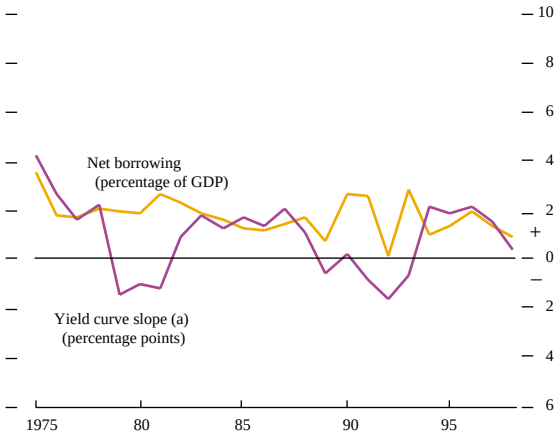
(a) Ten-year gilt yield minus three-month interbank lending rate.

Chart 11a
United States: government net borrowing and yield curve slope



(a) Ten-year gilt yield minus three-month interbank lending rate.

Chart 11b
Germany: government net borrowing and yield curve slope



(a) Ten-year gilt yield minus three-month interbank lending rate.

(1) 20-year bond yields derived using the Svensson curve-fitting technique.

6 percentage points to a surplus of 1% of GDP and the German balance improved by around 1½ percentage points to a deficit of 1½% of GDP. Hence, while the rate of gross new bond issuance has been falling in all three countries, the gilt market has experienced the largest relative adjustment since 1993. Furthermore, the outstanding stock of gilts is smaller than either the outstanding stock of US Treasuries or the stock of Bunds (both in gross terms and as a fraction of GDP). This might suggest that the relative impact of any given reduction in gross issuance would be larger in the gilt market than in either of the other two debt markets.

At the same time, the average maturity of UK pension funds has continued to increase. This has prompted pension fund managers to adjust the balance of their portfolios away from higher-risk equity investments in favour of less risky gilts (particularly long-dated gilts) in an attempt to match the expected return on their assets more closely with the known profile of their liabilities. In addition, over the past two or three years, many market participants have cited the Minimum Funding Requirement (MFR), applied under the Pensions Act 1995, as stimulating pension funds' demand for long-dated conventional gilts and making it less price-sensitive. Under the MFR, the liabilities of pension funds with a mature membership and obligations defined in nominal terms are discounted using 15-year gilt yields. This gives funds an incentive to hold long-dated gilts to reduce the regulatory risk of failing the funding requirement. These developments help to explain why the share of outstanding gilts held by pension funds has increased from around 18% in 1994 to more than 25% in 1998. Furthermore, the existence of these MFR benchmarks suggests that UK pension funds are unlikely to be indifferent between holding a 15-year gilt and holding any other 15-year fixed interest asset, regardless of whether it is denominated in sterling or a foreign currency. This may help to explain why the UIP and PEH conditions appear not to be holding at present.

Although the authorities in the United States and Germany do employ indirect and direct controls on the investment portfolios of their pension funds, there have not been any major changes to these rules in the past few years. Furthermore, anecdotal evidence from market participants suggests that MFR-type distortions at the long end of the yield curve are not generally viewed as influencing the shapes of the US and German yield curves.

The demand for gilts from life assurance companies has also increased strongly in recent years. This is related to two considerations. First, the decline in gilt yields has put pressure on insurance companies' solvency levels. This, in turn, has prompted some insurance firms to purchase more gilts in an attempt to improve their solvency. As with pension funds, the current regulatory regime (this time in the form of the Resilience Test) appears to provide the incentive for this self-reinforcing response to falling gilt yields. The second reason for insurance firms' increased demand for gilts relates to their past practices of selling policies with guaranteed minimum annuity rates. These minimum rates are now, in many cases, well above current market annuity rates, and the margin has widened as long gilt yields have fallen. This has prompted life assurance companies to make further purchases of gilts to limit the losses to which they are exposed. Again, this demand has been relatively price-inelastic. Consequently, the share of the outstanding gilt stock held by insurance companies has increased from 28% in 1994 to more than 35% in 1998.

The combination of this reduction in gilt supply and the simultaneous increase in demand by the two largest types of institutional holders of gilts may have contributed to the fall in yields at the long end of the UK yield curve. The timing of these demand and supply factors loosely fits with the timing of changes in the shape of the gilt yield curve, which began to flatten from 1996 onwards and became inverted by the second half of 1997.

These unusual supply and demand conditions suggest that the gilt market may have become more segmented than either the US Treasury market or the Bund market, with the prices of long-dated conventional gilts rising above the levels one might reasonably have expected to find on the basis of the UIP and PEH theories. We can attempt to obtain some idea of the degree of this gilt market 'overvaluation' by comparing the yields on gilts with those prevailing on other benchmark sterling-denominated debt instruments, such as the bonds issued by multinational financial institutions or the yields available in the swap market.

Given that the World Bank's (IBRD) debt is guaranteed by its member countries (one of which is the United Kingdom), the credit quality of gilts should be similar to that of IBRD bonds. To obtain an estimate of the degree of gilt market overvaluation, we can compare the spread between sterling-denominated IBRD bonds and gilts with the spread between US dollar-denominated IBRD debt and US Treasuries and the spread between euro-denominated IBRD debt and bunds. Unfortunately, however, because of the German government's limited debt issuance at maturities exceeding ten years, reliable estimates of the IBRD-bund spread can only be derived for the six to ten-year maturity range. This, therefore, also limits the comparisons we can make with developments in the gilt and Treasury markets.

Chart 12 presents these three spreads with respect to non-callable debt issued by the IBRD (where the spread is defined as IBRD bond yields minus government bond yields). If the six to ten-year duration gilts were 'overvalued' relative to Treasuries and Bunds, then we might expect the IBRD-gilt spread to be larger than either the IBRD-Treasury or IBRD-Bund spreads. As is shown, there was little difference between the three spreads until September 1998. However, the spread between UK gilts and IBRD debt widened rapidly after September 1998 to between 50 and 70 basis points, and has remained at this level since. In contrast, the IBRD-Bund yield spread has increased only marginally, to around 15 basis points, tentatively suggesting that UK gilts at this duration may be 'overvalued' relative to Bunds by around 35 to 55 basis

Chart 12
IBRD bond spreads

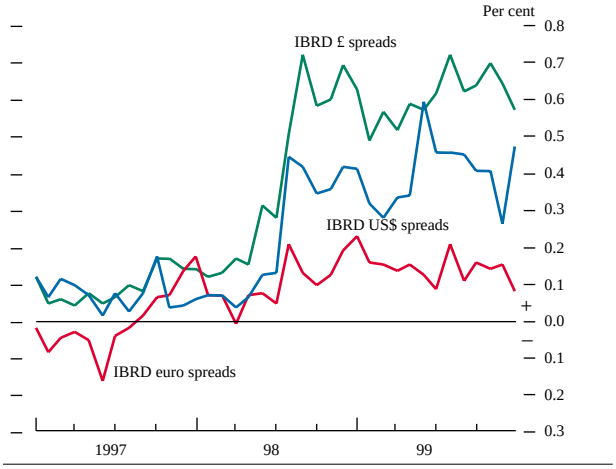
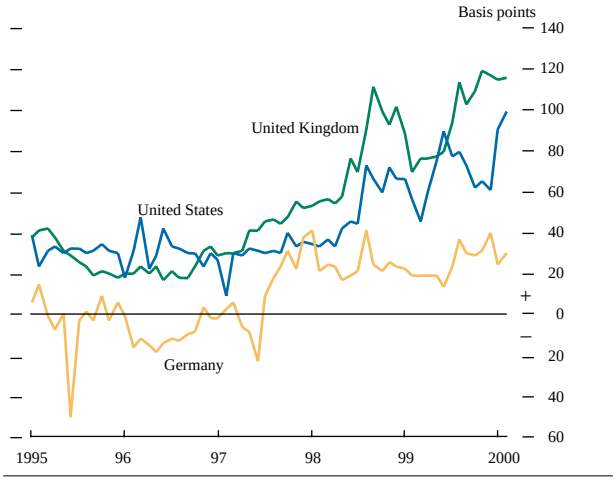


Chart 13
Ten-year swap spreads



points. But the rapid widening of the IBRD-gilt spread does not appear to be consistent with the MFR and gilt issuance developments noted above, which developed over a longer period. Also, the widening in this yield spread was not a UK-specific phenomenon. The spread between the yields on US dollar IBRD debt and US Treasuries follows a similar path to its sterling equivalent, although the US spread increases to around only 40 basis points. In both cases, the widening of these spreads coincided with the Russian debt crisis and the problems of the US hedge fund Long Term Capital Management.

An alternative approach is to use swap market yields as the benchmark against which to judge the value of gilts. However, here too it is difficult to get a reliable long-run time series of swap spreads at the 15-year maturity (where the MFR is likely to have been most influential). This is again because of the relative lack of long-duration Bunds, combined with the fact that the UK swap market becomes relatively illiquid beyond the ten-year maturity. Nevertheless, there is some evidence at the ten-year maturity of a gradual increase in gilt market 'overvaluation'. Since 1997, the swap-gilt yield spread has widened by a greater amount than either the swap-Bund spread or the swap-US Treasury spread (see Chart 13). This spread suggests that, at the end of 1999, ten-year gilt yields were 'overvalued' by around 60 basis points relative to US Treasuries and by almost 80 basis points relative to Bunds.

More recently, however, the US yield curve has inverted markedly, following announcements by the US authorities about their intentions to buy back the outstanding stock of government debt quicker than had previously been expected. As can be seen from the chart, this has led to a rapid widening in the ten-year swap-US Treasury spread, thereby closing most of the 'overvaluation' difference between the gilt and Treasury markets. This suggests that supply-related considerations in both the United Kingdom and the United States have had a larger influence on the shape of the yield curve than demand-related considerations.

Finally, it should be noted that 15-year gilt yields have fallen by around 290 basis points since the beginning of 1997, 65 basis points more than the decline in 10-year yields and 150 basis points more than the decline in 6-year yields. Given that the MFR benchmark relates to the 15-year gilt, both of the above estimates of gilt market 'overvaluation' may be underestimates. We might tentatively conclude, therefore, that around a third of the decrease in UK-US and UK-German bond yield differentials observed since the beginning of 1997 may have been related to reduced net issuance of gilts combined with the increase in demand for long-dated gilts from pension funds and life assurance companies.

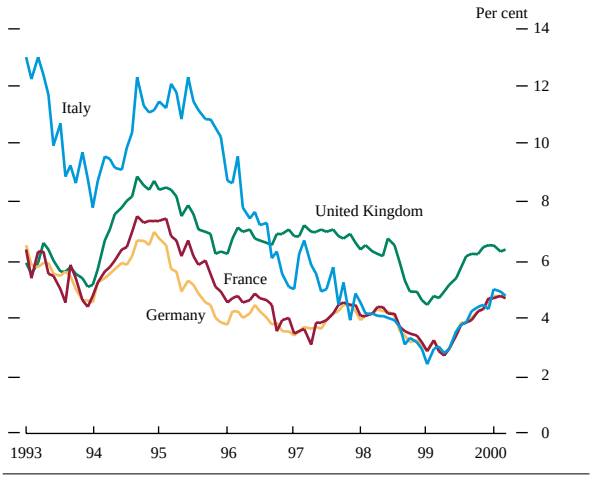
Expectations of European convergence

Another potential explanation for the convergence of UK long-term interest rates towards the level of German yields, particularly recently, relates to the possibility of the United Kingdom joining the European Economic and Monetary Union (EMU). There is only one official short-term interest rate for all EMU member countries, set by the European Central Bank. If financial markets believed that there was a realistic chance of the United Kingdom joining the euro area, then there would also be an associated expectation that UK short-term interest rates would converge on the levels prevailing in the euro area prior to entry.

As noted above, if there were no risk and liquidity premia effects, then the pure expectations theory of the term structure would hold, and forward interest rates would reflect forecasts of future short-term interest rates. In order to have convergence in implied short-term interest rates at all dates in the future, one also has to have convergence in long-term bond yields. So, if the perceived probability of UK participation in EMU had increased over the past five years, this would have added to the other factors discussed above leading to convergence in long bond yields.

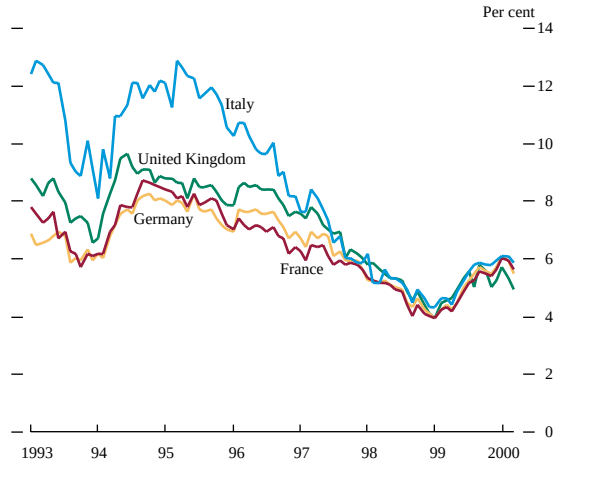
Chart 14 indicates that from the beginning of 1998 onwards there was full convergence in one year ahead implied six-month rates for Germany, France and Italy. This suggests that, by January 1998, there was a widely held expectation in the financial markets that these three

Chart 14
EMU convergence (implied six-month rates, one year ahead)



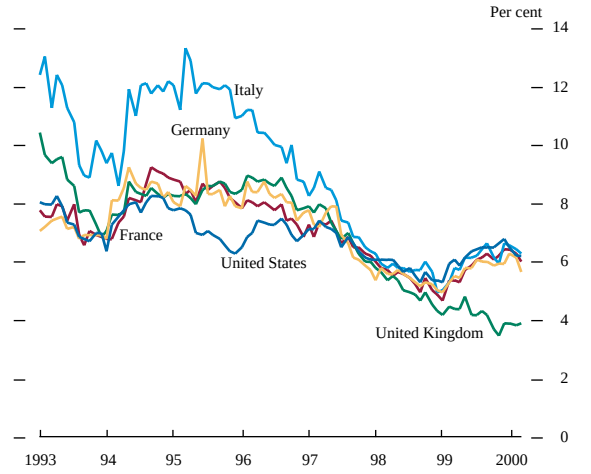
countries would all become members of EMU in January 1999. In contrast, UK one-year forward rates have remained more than 100 basis points above those in Germany and France since 1995, suggesting that the market believes there is little prospect of UK entry into EMU in the near term. At the five-year horizon, however, the perceived chance of UK participation in EMU appears to be much greater. As can be seen from Chart 15, UK five-year forward rates have closely mapped German and French rates since around 1995. This might suggest that the markets believe the United Kingdom will participate in EMU at some stage in the medium term.

Chart 15
EMU convergence (implied six-month rates, five years ahead)



However, this explanation clearly cannot be used to rationalise the convergence of UK and US long bond yields. Furthermore, forward interest rates in different countries may be aligned for reasons quite independent of the prospects for monetary union. As Chart 16 shows, ten-year forward rates from the United States, Germany, France and the United Kingdom have tracked each other reasonably closely since 1994. Interestingly, UK ten-year forward rate expectations fell below the levels prevailing in the other four countries from early 1998 onwards. This would appear to confirm the significance of the UK-specific factors noted above.

Chart 16
EMU convergence (implied six-month rates, ten years ahead)



Conclusions

We have considered some of the factors that may be behind the decline in the spreads between long-term gilt yields and yields on both Bunds and Treasuries. Much of the decline over the past 25 years or so appears to be attributable to a fall in inflation expectations in the United Kingdom relative to inflation expectations in Germany and the United States. We find little evidence to suggest a convergence of real rates of interest or a secular decline in relative, country-specific risk premia. While much of the decline in the yield spreads can be attributed to changes in relative inflation expectations, we also believe that the dramatic decline in these spreads over the past three years cannot be entirely due to this. Instead, we believe that some of the recent decline is due to gilt market specific factors. Around one third of the decrease in UK-US and UK-German bond yield differentials observed since the beginning of 1997 has been, we suggest, related to a significant reduction in net gilt issuance combined with an increase in the demand for long-dated gilts from pension funds and life assurance companies. The evidence from long gilt yields does not appear to be consistent with EMU-convergence stories. Indeed, US forward rates are closer to euro rates in ten years' time than are UK forward rates.