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Recent and Prospective Trends in Real Long-Term Interest Rates: Fiscal Policy and other Drivers

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ABSTRACT/RESUME

Recent and prospective trends in real long-term interest rates: fiscal policy and other drivers

This paper documents some features of recent trends in bond yields and discusses the drivers of these trends. This includes a discussion of the relationship between fiscal balances and interest rates -- with a summary of key empirical results from the literature provided in the Appendix. The main points to emerge from this analysis are as follows. *First*, cyclical and portfolio-allocation factors seem to have been the main driving forces behind the decline in long-term real interest rates over 2000-2003. However, in some European countries, declining (inflation, exchange-rate, and sovereign) risk premia suggest that the equilibrium real interest rate may now be somewhat lower. *Second*, the weight of recent evidence suggests a causal relationship from fiscal positions to long-term interest rates, at least for the United States. Thus, the actual and projected deterioration in US fiscal positions might have contributed to the recent rise in bond yields, although part of the fiscal-policy-related increase may still be yet to come. *Third*, there is evidence that US-denominated shocks have a greater influence on bond yields in Europe and Japan than vice versa, raising the risk that bond markets might push interest rates in Europe above the levels that would be justified by domestic determinants. However, there are some reasons why interest rate transmission from the United States to Europe may be milder than in 1994. *Finally*, the paper discusses the implications of substantial fixed-income portfolio losses for exposed financial institutions, as well as corporate balance sheets.

JEL classification: E43, E44, EG2, F42, G20
Keywords: Fiscal policy, long-term interest rates, international transmission

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Évolution récente et perspectives des taux d'intérêt à long terme réels : Politique budgétaire et autres moteurs

Ce document présente quelques caractéristiques des évolutions récentes des rendements obligataires et étudie les moteurs de ces évolutions. Cela comprend un débat sur la relation entre le solde budgétaire et les taux d'intérêt – avec un résumé des principaux résultats empiriques des études en la matière présentées à l'Appendice. Les points essentiels qui ressortent de cette analyse sont les suivants : *Premièrement*, que les facteurs conjoncturels et liés à l'allocation de portefeuille semblent avoir été les principaux moteurs de la baisse des taux d'intérêt à long terme réels entre 2000 et 2003. Dans certains pays européens, toutefois, la baisse des primes de risque (d'inflation, de change et souverain) semble indiquer que le taux d'intérêt réel d'équilibre se situe aujourd'hui un peu plus bas. *Deuxièmement*, les données récentes semblent pencher en faveur d'une relation de causalité entre les positions budgétaires et les taux d'intérêt à long terme, au moins pour les États-Unis. Ainsi, la dégradation effective et prévue des positions budgétaires aux États-Unis a pu contribuer à la hausse récente des taux d'intérêt, mais peut-être une partie de la hausse est encore à venir. *Troisièmement*, il est évident que les fluctuations des taux d'intérêt aux États-Unis ont plus de répercussion sur les rendements obligataires en Europe et au Japon que le contraire, ce qui pourrait entraîner en Europe une hausse des taux d'intérêt supérieure aux niveaux que justifieraient les déterminants intérieurs. Cependant on peut penser qu'une répercussion des taux d'intérêt américains en Europe sera plus faible qu'en 1994. *Enfin* le document s'interroge sur les conséquences des pertes en capital sur les portefeuilles obligataires des secteurs financiers vulnérables comme sur la situation financière des entreprises.

Classification JEL : E43, E44, EG2, F42, G20
Mots-clés : positions budgétaires, intérêt à long terme, transmission à l'échelon internationale

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RECENT AND PROSPECTIVE TRENDS IN REAL LONG-TERM INTEREST RATES: FISCAL POLICY AND OTHER DRIVERS

by

Anne-Marie Brook[1]

1. Introduction

1. Following a trough at unusually low levels, there has recently been a significant reversal in bond yields in the United States -- both nominal and real -- and rises, albeit smaller, in other economies. Looking forward, the main questions of interest are the extent to which this upward correction has yet to run its course and the effects it may have. Section II begins by documenting some key features of recent trends in bond yields before focusing more specifically on the drivers of these trends. This includes a discussion of the relationship between fiscal balances and interest rates -- with a summary of key empirical results from the literature provided in the Appendix. Section III considers the question of which financial institutions/sectors are most vulnerable to a sharp rise in interest rates.

2. The main points to emerge from this analysis are as follows:

- Cyclical and portfolio-allocation factors seem to have been the main driving forces behind the recent decline in long-term real interest rates. This suggests that once cyclical factors dissipate, real bond yields should revert to more historically normal levels. However, in some European countries, declining (inflation, exchange-rate, and sovereign) risk premia suggest that the equilibrium real interest rate may now be somewhat lower. A lower equilibrium real interest rate is less likely for the United States due to greater fiscal deterioration. Implied forward interest rates also suggest that US bond yields have further to rise than their European counterparts.

- Although the relationship between interest rates and fiscal balances is sometimes controversial and difficult to identify, the weight of recent evidence seems to be in favour of a causal relationship from fiscal positions to long-term interest rates, at least for the United States. There has been significantly less empirical analysis conducted for other countries although, on the basis of some international panel studies, and on theoretical grounds, one would expect similar relationships to hold. The actual and projected deterioration in US fiscal positions might contribute up to 110 basis points relative to where bond yields would have been otherwise. Although some of this may have already been priced in, perhaps by contributing to the recent rise

1. Anne-Marie Brook is an economist in the OECD Department of Economics. The author is grateful for valuable comments from Mike Kennedy, Jørgen Elmeskov, Michael Feiner and Jean-Philippe Cotis. She also thanks Catherine Lemoine and Laure Meuro for statistical assistance and Veronica Humi and Paula Simonin for secretarial assistance. The responsibility for all remaining errors and mistakes lies with the author. The views expressed here are those of the author and do not necessarily represent those of the OECD.

in bond yields, part of the increase may still be yet to come. Since the fiscal deterioration has been less severe in Canada and Europe, fiscal policy may have put less pressure on bond yields in those regions.

- There is evidence that movements in US long-term interest rates have a greater impact on bond yields in Europe and Japan than vice versa. This raises the risk that if the US bear market were to gather further speed, it could prompt a significant tightening in European financial conditions, as in 1994, even if growth prospects in Europe remain weak. However, relative to the US economy, many European economies have experienced less deterioration in their fiscal positions. This may limit the extent to which bond markets in Europe, by over-reacting to higher rates in the United States, might push interest rates in those markets above the levels that would be justified by domestic determinants. In addition, there is some evidence that the extent of the "one-sided transmission" may have become slightly less one-sided.

- A significant further rise in long-term interest rates would imply substantial fixed-income portfolio losses, raising concerns about the implications for exposed financial institutions, as well as corporate balance sheets. The Japanese financial system and some European banking and insurance sectors seem most vulnerable.

2. Recent and prospective developments in bond yields

3. After trending steadily downwards (Figure 1), nominal long-term interest rates[2] in most countries recently reached levels not seen for over 40 years.[3] Much of this decline can be attributed to lower inflation. The recent low point of *real* interest rates[4] has more recent precedents. This can be seen in Figure 2 which illustrates the main cyclical swings in real interest rates since the late 1980s. Measured from trough to trough, three interest rate cycles are identified: 1987-1993; 1993-1999; and 1999-2003.[5] A few observations emerge. First, given declining inflation, real interest rates have not fallen by as much as nominal interest rates. Second, in all G7 countries, average real interest rates in the 1999-2003 cycle appear to have been lower than in previous cycles. But only in a few countries (France, Italy and Japan) has there been a consecutive step-wise reduction in the average real interest rate over each of the last three cycles. Third, the recent rebound in bond yields appears to have taken US real interest rates to a level slightly higher than the average over the 1999-2003 cycle, whereas in other countries real interest rates remain unusually low by historical standards. Finally, long-term real interest rates typically rose by 200-300 basis points during previous rebounds (see Table 1 which documents the average rebound in real interest rates following each of the three troughs).

4. The remainder of this section discusses some of the possible determinants of these trends in real interest rates, with a distinction made between those factors that are primarily cyclical determinants (Sections 2.1 and 2.2), those that better explain the "equilibrium" interest rate (Sections 2.3 and 2.4), and those that stem from events from other countries (Section 2.5).

2. Unless otherwise defined, long-term interest rates are Government bond yields, generally of ten years duration.

3. Exceptions are Italy and France, where nominal bond yields were briefly lower in early 1999.

4. Real interest rates are *ex ante* with HP-filtered core inflation used as a proxy for inflation expectations.

5. Although interest rate cycles are broadly similar across G7 countries, these dates are indicative rather than exact for all countries. For example, in the United States and Japan there was a clear bond yield trough in 1987, whereas UK real bond yields reached their low point much later (in 1989).

2.1 Cyclical explanations

5. Between early-2000 and mid-2003, cyclical weakness pushed bond yields lower through three main channels. First, heightened uncertainty and lower expected profitability reduced the attractiveness of investment. In turn, this reduced the demand for investment funds and pushed interest rates down. Second, in response to world economic weakness and large negative output gaps, the stance of monetary policy in the major economies became very stimulatory. Expectations of continued low short-term rates were an important factor pushing down long-term rates and since monetary policy is expected to remain stimulatory for quite some time yet, this factor continues to keep bond yields at relatively low levels by historical standards. Third, worries about the possibility of deflation occurring outside of Japan was a reinforcing factor.[6] These factors caused yield curves to fall considerably, and in most cases also to flatten (see June 2003 yield curve in Figure 3).

6. Since mid-June a more positive outlook for the US recovery, and a shift in the weight of policy away from concern about a deflation scenario, are among the factors that have caused US yields to rise. Less dramatic rises have also occurred in other economies (Figure 3), although to some extent bond yields in Europe may have simply followed US yields rather than have taken their cue from domestic data.[7]

7. In previous cycles a substantial increase in real bond yields has typically occurred within a year of the trough (Table 1). But in current circumstances, following a period of over-investment, with unusually low inflation and significantly negative output gaps, it may take longer. On the other hand, as noted in Section II.D, the deterioration in cyclically-adjusted fiscal balances will go in the other direction, pushing interest rates up, so it is unclear what the net effect will be.

8. The term structure of interest rates suggests that most of the fall in bond yields over the past couple of years can be accounted for by lower expected near-term short rates. Implied forward 5-year rates, which may be thought of as a proxy for more "normal" interest rates, have been more stable. For the United States, Germany, Japan and the United Kingdom, Figure 4 (top panel) shows the implied 5-year bond yield five years forward and the actual 5-year bond yield. The difference between current and implied 5-year forward yields indicates how much markets expect 5-year bond yields to increase over the next five years (Figure 4, bottom panel). Although this indicator is sensitive to time-varying risk premia, it clearly signals that further rises are expected. A reversion to average term premia in the context of cyclical strengthening might boost the US 10-year rate by at least another 100 basis points over the next few years.[8] On top of the recent rise in the US 10-year bond yield, such an increase would take the total correction to around 230 basis points. This would be in line with the average run-up in real bond yields in previous recovery periods (Table 1). However, because the total rebound includes short-term cyclical and portfolio-related factors, it has often involved an overshoot of the longer-run trend.

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6. For a given level of short-term rates, lower inflation *per se* would tend to raise long-term real interest rates. However, provided the central bank is seen as having both the capacity and intent to maintain a small positive inflation rate, worries about the *possibility* of deflation would normally prompt expectations of lower short-term rates, therefore resulting in lower long-term bond yields also. Even if the zero lower bound on the policy rate were reached, it can be argued that a determined central bank should be able to use alternative instruments to keep inflation positive and expectations of short-term rates low. In July, Federal Reserve Governor Ben Bernanke outlined a number of concrete measures via which the FOMC could commit to keep short-term yields at a very low level for an extended period (*e.g.* see http://www.federalreserve.gov/boarddocs/speeches/2003/20030723/). However, Bernanke also pointed out that long-term interest rates would eventually rise as the outlook for inflation began to trend up again.

7. Section 2.5 discusses the tendency for US bond markets to lead interest rate changes in other markets.

8. Since the spread between the 10-year and 5-year interest rate is unusually high at present, 10-year bond yields are likely to rise by less than 5-year yields.

9. Figure 4 clearly distinguishes US bond yields as those having larger increases priced in than European and Japanese yields. In fact, the extent of the expected rebound in the United States appears not to have fallen back with the recent shift up in interest rates and remains at a very high level by historical standards. In contrast, the implied forward markets for Germany, the United Kingdom and Japan suggest more limited increases in bond yield in those countries. Another distinguishing feature for the US market is the contrast between the very large interest rate increases that market participants are expecting now and the smaller difference between the forward rate and the market rate during the bear market of 1994. One possible explanation is the use of a so-called "mini-max" strategy by the Federal Reserve for setting policy rates. This strategy involved minimising the probability of the worst-case outcome (deflation) by deliberately putting more emphasis on its avoidance than warranted by the most likely outlook for economic growth in the United States.

2.2 Portfolio reallocation effects

10. Another factor contributing to recent low bond yields may have been shifts out of equities during the equity-market correction, which brought with it an increased focus by investors on superficially less risky, fixed-income investments.[9] These portfolio reallocation effects most likely played a more significant role in the bond yield falls that occurred over recent years than in previous bull bond markets. Indeed, equity prices and bond yields were uncharacteristically synchronised after the downward stock market correction began in early 2000 (Figures 5 and 6).[10] In particular, previous bull markets for bonds (*i.e.* falling bond yields prior to month 0 in Figure 5) were accompanied by either rising or flat equity prices, with the exceptions of Germany during 1986/87 and Japan during the 1998 bull market. In contrast, the recent drop in bond yields was accompanied by falling equity prices in a large number of countries -- most notably in Europe and Japan.

11. More recently, most major stock-market indices have rebounded by around 30 per cent (Column C of Table 2) from the lows reached in 2002 (United States and Canada) or earlier this year (Europe and Japan).[11] Yet concerns about continued high price-earnings ratios (particularly in the United States) suggest that the risk of a large-scale portfolio shift out of fixed income investments and into equities may be limited. This tendency is reinforced by other safe-haven drivers such as lingering underlying geo-political uncertainties and concerns about corporate accounting practices and the adequacy of corporate governance. As long as these factors remain relevant, it is less likely that the bear market in bonds will be significantly exacerbated by a reversal of the earlier portfolio movements.[12]

2.3 Risk premia

12. With low and stable inflation well established, it is likely that markets now demand less of an inflation risk premium than in the past. This suggests that, *ceteris paribus,* real interest rates will, on

9. As noted in *OECD Economic Outlook* No. 72, this is the first recovery that began against a background of falling equity prices.

10. In both Figures, month 0 corresponds to the month in which 10-year bond yields reached their lowest point. These months are noted in parentheses below the title for each country.

11. Note that because such percentage changes are calculated off a low base, they may exaggerate the extent to which earlier losses have been regained. To illustrate, column D in Table 2 reports the proportion of the peak-to-trough fall that has been reversed. This suggests that although US and Canadian markets have reversed around 30 per cent of their losses, European markets have only reversed about 20 per cent, and Japan's recovery is the smallest at just 9 per cent.

12. However, the willingness of investors to take on more credit risk in return for higher yields is largely credited for driving corporate swap spreads significantly lower.

average, be lower over the next decade than they were over the 1980s and early 1990s. For euro-area countries this effect may have been reinforced by falling exchange-rate and sovereign-risk premia (particularly for Italy). In terms of the average interest rates depicted in Figure 2, this provides a possible explanation of why the level of real interest rates during the most recent cycle was lower than during the first cycle depicted.

13. In addition to this effect via risk premia, the need to bring inflation down over the late 1980s/early 1990s cycles called for policy rates to be kept higher than would otherwise have been the case. This is again likely to have kept long-term real rates above equilibrium levels, implying that average real rates over earlier cycles might give an exaggerated impression of equilibrium rates.

14. Potentially taking interest rates in the opposite direction, there is some risk of an eventual rise in risk premia in Japan unless the fiscal deterioration stabilises. [13]

2.4 Saving/investment balances and budget deficits

15. Abstracting from risk premia, the "equilibrium" real interest rate can be thought of as the price that equilibrates saving and investment when the economy is operating at full capacity and inflation is stable.[14] Key world economies operating below capacity, and perhaps fear of deflation, pushed real interest rates below equilibrium, with a correction towards equilibrium likely as these factors unwound. The question is whether the equilibrium interest rate itself may also have fallen. Disentangling the trend components of private saving and investment balances is outside of the scope of this paper – although it can be noted that both have tended to trend lower in recent years.[15] Of perhaps more obvious relevance to recent trends in bond yields, there has recently been a significant decline in public saving rates (Figure 7 and Box).

16. An impressionistic sense of the relationship between interest rates and the projected fiscal balance can be gained by examining the bi-variate relationship (Figure 10). The upper chart shows the relationship between the average projected fiscal balance over a six-year-ahead forecast horizon[16] and the

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13. There are two possibilities. One is that investors may attribute a higher probability to an eventual default on Japanese Government Bonds (JGBs). Alternatively, investors could increasingly see the danger of the government reducing the real burden of public debt on the budget by a period of unexpected inflation. Either outcome would push up the risk premium on JGBs and could result in a large shift of funds offshore.

14. In addition, for small open economies, this definition would require that the exchange rate be at equilibrium.

15. Trend investment has weakened, due in part to a drop in the perceived rate of return on capital in the wake of re-evaluations of potential growth. Private saving rates in the major countries also seem to be trending lower (de Serres and Pelgrin, 2002), despite the unsustainability of publicly-funded pension systems in many countries, and the implied growing importance of private savings to meet the future needs of ageing populations.

16. The projections for the government fiscal balance serve as a proxy for information available to financial market participants about the likely future path of fiscal variables. Projections are OECD medium-term baseline projections as published in the *Economic Outlook* since 1999. Prior to 1999 they were produced on a more irregular basis; the data-base contains semi-annual projections starting in 1985H2 although there are a number of missing observations (1986H1, 1991H2, 1992H1, 1993H1 and 1995H2). The projections assume that: output gaps close within six years; unemployment rates return to their structural level; commodity prices remain broadly unchanged in real terms; monetary policies are directed at maintaining stable inflation; structural fiscal policies remain broadly unchanged. Due to the lag between finalisation and publication of the projections it is assumed that fiscal projections published in month t should correspond to market interest rates determined in month t-2. Relative to the OECD fiscal projections used by Reinhart and Sack (2000) and Chinn and Frankel (2003) this dataset is more forward-looking (six years

real long-term interest rate. The bottom panel replaces the real long-term interest rate with the spread between the ten-year and three-month interest rates,[17] and the correlations depicted in Figure 10 are summarised in Table 3.

Box. **Government fiscal positions**

Figures 7a illustrates the extent of recent deterioration in the fiscal positions of the G7 economies. In a number of them (the United States, Germany, France, and the United Kingdom) the gains of the late 1990s have been largely unwound.[1] Italy has also experienced a deterioration in recent years, although its relative position remains improved compared with a decade earlier, even after adjusting for the effects of inflation.[2] Japan began the move into deficit much earlier and remains in the most severe situation among G7 countries. In contrast, Canada stands out as having not only achieved a substantial structural improvement over the 1990s, but also as having been able to maintain most of those gains in recent years.

Revisions to successive OECD medium-term baseline projections since December 2000 show that in some respects the fiscal deterioration appears to have been unanticipated (Figure 8). Indeed, 2003 outcomes for some countries could well turn out to be worse than projected by the Secretariat in April (published in the June 2003 *Economic Outlook*). Part of the decline in recent years reflects unexpected weakness of the real economy, but part is also due to policy measures. Furthermore, revenues at the peak of the cycle included, to a greater extent than expected, what turned out to be transitory components, mainly in the form of significant capital gains tax revenues. Despite generally worsening fiscal positions in all countries, only Japan is expected to experience a substantial near-term increase in its debt-to-GDP ratio (Figure 9, top panel). For other countries, Figure 9 (bottom panel) suggests that relatively favourable debt dynamics will persist. However, this indicator assumes constant interest rates and is sensitive also to assumptions about trend growth rates and future taxation and spending policies. Thus, the range of possible alternative outcomes is broad, and the risks in some countries are not insignificant, given the context of population ageing.

1. Although for several European economies, the extent of the improvement in 2000 was inflated by the proceeds from the sale of third-generation mobile telephone licences.

2. The extent of improvement in the Italian fiscal position, as measured conventionally, is slightly misleading due to its failure to take into account inflation-driven changes in the real value of public debt (Eisner and Pieper, 1984). Thus, the fiscal positions shown in Figure 7b have been adjusted for the effects of inflation.

17. Despite the obvious limitations of bivariate analysis, the negative relationship between the interest rate variables and the fiscal position is sufficiently strong to show up in the charts for the United Kingdom and, to a lesser extent, the United States and Canada. For the continental European countries, other factors have obscured the effect.[18] In Japan, the fiscal deterioration has been dramatic and yet

ahead, rather than two years ahead). Note that the fiscal projections used in Figure 10 have not been adjusted for inflation. This is consistent with results that the inflation-adjustment makes little difference to estimated relationships between fiscal positions and interest rates (*e.g.* Knot and de Haan, 1995).

17. This approach follows that used by Canzoneri *et al.* (2002) and Reinhart and Sack (2000) for the United States. One problem with analysis based on the interest rate spread is that it may contain too much of a cyclical component. Laubach (2003) avoided this problem by using instead the level of interest rates expected to prevail 5 years ahead (i.e. implied forward rates). In practice, however, the 5-year forward rate is relatively similar to the 5 year market rate (Figure 4) and produces a relationship with the fiscal projections very similar to that with the 10-year real interest rate, as depicted in the top panel of Figure 10.

18. These factors may include exchange rate considerations (for France), unification (for Germany) and declining inflation and exchange rate risk premia (for Italy).

Japanese real bond rates have headed in a counter-intuitive direction (downwards). Some possible explanations include: a more pessimistic medium-term economic outlook than in other G7 countries; expectations of continuing very low short-term interest rates; a relatively illiquid market for Japanese Government bonds; flight-to-safety portfolio shifts from stock markets; and, perhaps most importantly, "excess" saving in the domestic economy as evidenced by Japan's large current account surpluses and rising net foreign asset position which underpin low interest rates via a negative risk premium for Japan.[19]

18. In the empirical literature, recent multivariate regression analysis generally supports the existence of a statistically significant negative relationship between fiscal positions and long-term interest rates. However, the empirical analysis has proved to be difficult and sometimes controversial, with widely varying estimation approaches and sometimes inconclusive results. Part of the problem has been the absence of a long time series during which structural influences on financial markets were more or less unchanged. Some of the relevant considerations in the empirical literature are as follows (see Appendix for a more detailed summary):

- Econometric challenges include issues of endogeneity, causation and the power of significance tests. Also, there are questions about the functional form of the relationship between fiscal policy and interest rates. For example, a given fiscal deterioration may have only a small impact on interest rates in the presence of low stocks of debt but a very large effect once debt reaches higher levels.

- The determination of long-term interest rates should depend on *expectations* of future fiscal policy rather than on concurrent budget positions or concurrent government debt. However, long-term datasets of fiscal projections are not available for most countries other than the United States.[20]

- Capital flows may mitigate the impact of fiscal policy on interest rates. Conversely, rising interest rates abroad might push interest rates up, regardless of the domestic fiscal position.

19. With these considerations in mind, the Appendix and Table 4 discuss and summarise a number of recent empirical studies for the United States. These suggest that a 1 per cent of GDP deterioration in the fiscal position may raise long-term interest rates by around 25 basis points. Similarly, a one percentage point increase in government debt is typically estimated to raise long-term interest rates by 1 to 5 basis points.

20. These magnitudes can be used to speculate on how much lower long-term interest rates might be, if it were not for the recent deterioration in fiscal positions. The far right-hand-side column in Table 5 provides some estimates of the impact that recent (or expected) fiscal deterioration could be expected to have on long-term interest rates (in basis points). The numbers suggest that recent fiscal policy deterioration in the United States might imply US bond rates around 110 basis points higher than they would otherwise be.[21] It is possible that these effects have already been fully priced in to bond yields, either by having prevented long-term interest rates from falling even lower and/or by contributing to the

19. See, for example, Goyal and McKinnon (2003).

20. Some economists have used near-term OECD projections for cross-country panel studies. The earlier discussion of simple bi-variate relationships (depicted in Figure 10) used OECD *medium-term* projections for the first time.

21. A wider range of possible outcomes is obtained using assumptions about increases in the US debt-to-GDP ratio, varying according to the extent to which the deterioration in the structural fiscal balance is expected to be permanent.

recent rise in bond yields. However, it could also be the case that part of this effect has not yet been reflected in bond yields. Furthermore, if structural deficits deteriorate further[22], fiscal policy may exert additional upward pressure on bond yields. For other regions, recent deterioration in the fiscal outlook for the OECD area suggests that *global* interest rates may be 30-60 basis points higher than otherwise. Since fiscal policy affects the equilibrium real interest rate, these effects are over and above any upward pressure from a return to more normal cyclical conditions.

21. A common approach to determining equilibrium interest rates is to assume that the cyclical determinants of interest rates average out over the cycle, in which case historical average interest rates can be considered as a "normal" level for bond yields. For the United States, Figure 2 shows that the average real long-term interest rate over the most recent trough-to-trough cycle was 2.9 per cent, significantly lower than the average recorded for the previous two cycles. Although Section 2.3 presented some possible reasons why the equilibrium real interest rate might have fallen since the 1980s, this may be offset by upward pressure from low rates of government saving. Thus, it cannot be ruled out that the equilibrium real interest rate in the United States remains closer to its previous average of around 3.7 per cent.

22. For France and Italy, the step-wise reduction in average interest rates may be partly attributable to the disappearance of inter-country exchange-rate and sovereign risk *premia* (discussed in Section 2.3). In the United Kingdom and Germany average real interest rates have been more constant, with the exception of relatively high rates in the United Kingdom during the mid-late 1990s.[23] Only in Canada and Italy, where fiscal positions have recorded the greatest improvement, might it be at all plausible to attribute the step-wise reduction in average interest rates to trends in saving rates. However, since private savings rates have declined in these two economies, permanently lower real interest rates are likely only if fiscal consolidation remains a dominant feature.

23. For Japan, Figure 2 suggests that long-term real interest rates have become progressively lower as the challenges facing the Japanese economy have become more apparent. Yet this trend is the opposite of that predicted by declining government saving. The full explanation for declining real interest rates in Japan is most likely more complex than for the other G7 economies (see paragraph 17).

2.5 Propagation of interest rate changes across borders

24. Bond yields are determined not only by domestic developments but also by international capital flows, and there is some evidence that the linkages among major bond markets have become stronger.[24] Prior to the bear market of 1987, the troughs in yields were scattered from August 1986 (France) to May 1987 (Japan, Germany and the United Kingdom).[25] By comparison, the timing of the bear market of 1994 was more tightly matched. This is consistent with investors' increased use of leverage in 1994, when

22. Given ongoing security challenges in Iraq there are significant upside risks to US defence expenditure.

23. This could be partly attributable to the newly independent Bank of England establishing its anti-inflation credibility.

24. Especially at the volatility level (Laopodis, 2002). Also see Dalsgaard *et al.* (2002).

25. Moreover, national experiences differed significantly. For example, although long-term interest rates in the United Kingdom rose over most of 1987, they then fell for most of the two following years, in contrast to the rising or stable trends in the other G7 countries.

highly-leveraged investors sold European and Japanese bonds in order to cover their losses in the US market.[26] Bond markets also moved in tandem during the bear market in bonds of 1999.

25. There is also evidence that US-denominated shocks have a greater influence on bond yields in Europe and Japan than vice versa.[27] In particular, US real interest-rate shocks have been found to evoke significant responses in European interest rates. This is consistent with the observation that since bond yields troughed in June of this year, long-term interest rates in Europe have risen along with their US counterparts, albeit to a lesser extent. Although still affected by US interest rates, Japanese bond yields seem to be relatively more independent than bond yields in Europe.

26. The predominantly unilateral nature of the international transmission raises a number of issues. The relatively greater fiscal deterioration in the United States, as well as the stronger signs of cyclical recovery there, may help to explain the recent rise in interest rates elsewhere in the world – particularly in Europe where domestic drivers of yields may be weaker. This raises concerns about a repeat of 1994, when tightening monetary policy in the US prompted very dramatic rises in bond yields in Europe. However, there are two reasons to believe that the 1994 experience will not be repeated, at least not to the same extent. First, in 1994, the extent of propagation from the US depended on adverse pre-conditions – most notably a relatively poor track record on inflation and fiscal balances (Figure 11). Since then, these indicators have generally improved; across the OECD area as a whole, average inflation rates have fallen, and there has been a significant improvement in fiscal positions (Figure 12).[28] For most European countries in particular, improved fiscal positions relative to those in the United States may suggest less reason than in 1994/95 to fear marked transmission from the US bond market. Second, there is some tentative evidence that, following European monetary union, the "one-sided transmission" may have become slightly less one-sided.[29]

27. The argument that there will be proportionately less propagation from the United States to Europe now, compared with 1994, is supported by the moderate nature of the recent back-up in bond yields in Europe relative to the United States. On the other hand, the possibility of more significant cross-border transmission should not be ruled out, and questions can be raised about the ease with which domestic economic policy would be able to offset the impact of higher foreign bond yields.[30]

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26. Borio and McCauley (1995) argue that the prevalence of investors borrowing short in one market to finance long positions in another set the 1994 episode apart from 1987, when leverage remained a domestic phenomenon.

27. Chinn and Frankel (2003), Laopodis (2002), Peiró (2002), Awad and Goodwin (1998), Christiansen and Pigott (1997).

28. Note, however, that most of the improvements in fiscal positions have come from the smaller countries. Thus, while the weighted average OECD-wide fiscal balance, at around -3 per cent of GDP, is less negative than the average balance in the ten years prior to 1994, it is being dragged down by larger-than-average deficits in Japan, the United States and the large European economies.

29. Consistent with the rest of the literature, Chinn and Frankel (2003) find that over the 1988 – 2002 period, US real long-term interest rates are driven almost entirely by own-dynamics, versus rates in Europe which are significantly influenced by US rates. However, over a more recent time period (since 1996) their results are more ambiguous, with the US interest rate responding to some extent (more than previously) to French, Italian and Spanish real rates.

30. There is no evidence of absolute or relative equalisation of real interest rates, which implies that domestic macroeconomic policy still has an important impact on long-term interest rates. Nevertheless, in the context of greater financial integration, the *degree* of domestic control over the long end of the yield curve must have diminished to some extent in many countries.

28. Given the unique factors at play in the Japanese bond market, it would seem less likely (compared with Europe) that Japanese bond yields will automatically rise in response to a rise in US yields. However, as long as Japan's public debt continues to grow, there is an increasing risk that investors will become concerned for the capital value of their loans, thereby raising risk premiums, as discussed in Section 2.3.

3. The vulnerability of the financial sector to a sharp rise in interest rates

29. With bond yields already having risen and the case being made in the previous section of the possibility that more is to come, the question arises as to the balance sheet implications of such changes. Indeed, the sharp rise in the yield curve in 1994 checked or reversed the rise in equity markets and prompted some of the largest fixed income portfolio losses in the post-war period. It should be noted that this section is not intended to take a view of the most likely outcome but rather to identify risks that may merit attention.

3.1 Banking institutions

30. The global financial system has come under pressure in recent years due to equity market declines and asset impairment stemming from deterioration in economic performance. Yet in many countries, particularly in the United States, the banking sector has been remarkably resilient. Relative to their US counterparts, European and Japanese financial institutions were more affected by falling stock prices through their higher exposure to equity markets. As a result, equity sub-indices for the insurance sector in Europe and the banking sector in Japan suffered more than those of the total markets (see the final four charts in Figure 13).

31. The recent turnaround in the bond market suggests some new risks. Housing market weakness, combined with a drop in mortgage refinancing in the United States, would remove one source of low risk revenue. Leveraged hedge funds may also be at risk from rising bond yields and could pose risks to regulated counterparties.

32. When *short-term* interest rates eventually rise, the timing of which depends on the scale of economic recovery, there may be some risks in the US mortgage-backed securities market, which has become a close substitute for government debt. An unexpected rise in interest rates can spark a rapid unwinding of "carry trade" positions, which profit from the spread between long-term and short-term interest rates, resulting in significant market volatility. Counter-parties include commercial banks, insurance companies and pension funds, all of which have extensive holdings of mortgage agency securities in addition to Treasury bonds.[31] Carry trades have been less common in non-US markets where the yield curve has been flatter.

31. Most bonds have positive convexity, indicating that the bond's price rises more rapidly as interest rates fall than it declines as they increase. However, in the mortgage-backed securities market, the pre-payment option on mortgages leads to negative convexity. As interest rates rise, the prevalence of pre-payment declines rapidly, leading to the lengthening of the duration of mortgage-backed securities and-sharper price losses. Anecdotes suggest that carry positions are largely unhedged (IMF, 2003), although even when positions are hedged (such as at the mortgage agencies) the market risks are simply transferred elsewhere. Also, hedging against negative convexity generally involves selling treasury securities as rates rise, which tends to amplify the upward movement in interest rates.

33. The biggest risks to banking institutions are in Japan, where any significant rise in bond yields could create significant turbulence, given the overall precarious condition of the financial sector.[32] In the banking sector, capital losses on bond holdings would result in a further depletion of capital reserves and an exacerbation of an already fragile financial system.[33]

3.2 Private pension funds and the life-insurance industry

34. The prevalence of significant funding gaps in pension plans poses risks for corporate sector performance in the face of sharp sell-offs in the bond market. Insurance firms are similarly exposed through their annuity products. Figure 15 illustrates the composition of assets in these two sectors for the G7 countries. The key issues include the following:

- The liabilities of life-insurance companies and pension plans -- annuities and promises to pay out on defined benefit pensions -- are typically of very long-term maturity. Yet with the issuance of 30-year bonds becoming less common, it has become increasingly difficult for institutions to avoid market interest rate risk.

- Movements in interest rates affect profitability in several ways. First, if interest rates rise, then firms make capital losses on their fixed income assets. Since bonds are often traded, and not always held to maturity, this can have important effects. Offsetting this, a rise in interest rates implies higher returns on new contributions.[34] It also increases the discount rate assumption used in actuarial projections, implying a lower present value of future pension liabilities. Quantifying the net risk would be very difficult given the considerable discretion companies have to vary the actuarial assumptions, discount rates and rate of return assumptions in their calculations. But since some companies did not reduce their discount rates as market rates fell, there is less potential for the valuation of liabilities to gain from a reversal in market rates.

- In the face of a sharp sell-off in fixed interest markets, the implications for pension funds and insurance companies depend partly on whether the losses are offset by equity market gains or exacerbated by losses. This is particularly true for the United Kingdom and the United States where shares comprise a large proportion of assets (Figure 15). Unfortunately, past experience suggests that it is difficult for equity markets to experience sustained gains at a time when bond yields are rising (Figure 6). An exception was 1998 when equity markets were generally rising. However, given current valuations, it is doubtful whether this experience will be repeated.

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32. The fact that JGBs are not widely held outside of Japan is likely to make this market particularly vulnerable to sudden shocks. Overall, the public sector holds 58 per cent of the existing stock of JGBs, while only around 3 per cent are held by foreign investors (Figure 14).

33. Of course, the severity of the consequences of interest rate rises would be mitigated if it were accompanied by a significant economic recovery and equity market gains. However, as noted earlier, rising bond yields are not typically accompanied by rising equity markets.

34. However, given that many pension funds have recently made overly optimistic assumptions about future investment returns, it is unlikely that this effect will dominate. In fact, if the outlook for investment returns remains less bullish than in the 1990s and investment return assumptions are reduced further, as is likely in a lot of cases, many companies will have to make substantial cash contributions to their pension funds. Balance sheets can be very sensitive to these assumptions. For example, according to an examination of US pension funds published by the actuarial firm Milliman USA the average rate of return assumed by 100 companies in 2002 was 8.9 per cent (http://www.milliman.com/eb/pension-fund-survey/). If the companies had instead assumed an average return of 7.9 per cent, the collective pretax earnings from those pension funds would have dropped from a gain of $3.3 billion to a loss of $5.7 billion (*New York Times,* April 17, 2003).

35. Insurance companies and pension funds in Germany may be particularly vulnerable, given the high proportion of their assets invested in loans (Figure 15). This exposes these institutions to a bear market *indirectly*, through the impact of higher long-term interest rates on macroeconomic activity, and the risk that higher real yields may create difficulties for some firms, given their relatively high levels of debt. Insurance companies are also exposed to potential declines in property prices, which could be prompted by higher interest rates.

36. In Japan, not only are more than half the financial assets of insurance companies and pension plans in fixed income securities, but significant double gearing between banks and life-insurance companies increases systemic concerns in the event of a sustained rise in bond yields. While some market participants in Japan may have actively sought exposure to JGBs in expectation of stable or declining yields, others may simply have had difficulty finding attractive alternatives.

37. Overall, a further exacerbation of the losses to pension funds and in the life insurance industry has the potential to create severe negative implications for vulnerable institutions, including banks. In turn, distress sales of equities by insurers and pension funds could also prompt a further downturn in stock markets. With regard to these concerns, Japan and, to a lesser extent, Germany would seem to be the most vulnerable, if there were to be significant rises in long-term interest rates in these countries.

3.3 Central banks and governments

38. Central banks are major participants in national bond markets (see Figure 14 for the United States and Japan), although the (often unrealised) capital losses to their reserves stemming from a significant bear market are generally of little macroeconomic concern. An exception may be the case of Japan, where there is, arguably, a risk of the greatest increase in interest rates, although perhaps not in the short term.[35] At the end of 2002, the Bank of Japan held more than 80 trillion yen worth of JGBs (worth approximately 16 per cent of GDP), up significantly on previous years. In the event of a significant rise in the nominal interest rate, the sale of bonds by the central bank to mop up excess liquidity would entail losses on a scale large enough to wipe out its capital base.[36]

39. Other public sector institutions in Japan are also significantly exposed to the bond market, particularly the Fiscal Loan Fund (which, at the end at 2002, held 13 per cent of Japanese Government Bonds); Postal Savings (13 per cent), Postal Insurance[37] (9 per cent) and social security funds (7 per cent). Finally, debt servicing capabilities in emerging markets could be adversely affected if a sustained bear market leads to a significant reversal of capital flows.

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35. As discussed earlier, the main risk to Japanese bond yields would be if the dynamics of Japan's growing public debt continue to deteriorate, putting upward pressures on the risk premium.

36. If the central bank were to require recapitalisation by the government, questions might reasonably be raised about its independence. However, as discussed by the BIS (2003), this risk should not necessarily act as a limitation on public policy, and concerns about independence could be mitigated in other ways.

37. The postal savings system holds about one third of total Japanese deposits and postal life insurance holds about 40 per cent of total Japanese life insurance (Fukao, 2003).

Appendix: The relationship between government fiscal balances and interest rates

40. In the empirical literature, estimating the impact of fiscal policy on real interest rates has proved to be difficult and sometimes controversial. However, there is increasing acceptance of a causal relationship between government fiscal positions and real interest rates. Many prominent macro-econometric models also embody a negative relationship between fiscal positions and interest rates.[38] Part of the problem for empirical studies has been the absence of a fairly long time series during which structural influences on financial markets were more or less unchanged. For example, the timing of financial market deregulation and the introduction of anti-inflation policies, both of which have important implications for interest rates, have varied across countries.

41. As background to the key findings in the literature (Table 4), the following points highlight some variations and technical considerations in the literature:

- First, there are variations in the relationship tested. The most common approach is to use some measure of the level of real interest rates as the dependent variable.[39] A related approach is to model the interest rate spread (long minus short), on the assumption that, provided Ricardian equivalence is not complete, expectations of future fiscal deficits (or increased debt loads) should steepen the term structure of real interest rates. A separate strand of literature has addressed the relationship between interest rates and fiscal variables by directly testing the hypothesis of Ricardian equivalence, although these studies are outside the scope of this paper.[40] Others have focused exclusively on the impact of fiscal policy on short-term interest rates. However, short-term rates are probably less useful for examining the effect of *long-run* fiscal policies, because the responsiveness of the short-term interest rate to short-term events may obscure a smaller response to more distant events. Indeed, Table 4 highlights some studies which have found insignificant (or perverse) effects on short-term interest rates.[41] Also there are questions about the functional form of the relationship between fiscal policy and interest rates, which may not be linear. A given fiscal deterioration is likely to have only a small impact on interest rates in the presence of low stocks of debt but a very large effect once debt reaches higher levels.

- Second, the determination of long-term interest rates should depend on *expectations* of future fiscal policy rather than on concurrent budget positions or concurrent government debt.[42] Thus it is preferable to use reliable independent projections of fiscal policy over long enough periods. The Congressional Budget Office (CBO) and the Office of Management and Budget (OMB) provide such projections for the United States. For other countries a long-term dataset is not available although some economists have used near-term OECD projections. This data availability issue is a key factor limiting the comparability of results for the United States, with those for other countries.

38. As noted by Gale and Orszag (2002).

39. While the ideal variable would be an actual market real rate, long time series are not available outside of the United Kingdom.

40. Tests of Ricardian equivalence typically involve estimating the significance of fiscal variables within a consumption function. Ricciuti (2003) reviews the Ricardian equivalence literature and finds that it is inconclusive. It is likely that that some form of Ricardian equivalence holds but that it is not complete (*e.g.* de Serres and Pelgrin, 2002).

41. *E.g.* Giannaros and Kolluri (1989) and Evans (1987a,b).

42. This point was first noted by Feldstein (1986).

- Third, there are a number of econometric issues. Fundamentally, since interest rates and government fiscal positions are endogenous, the direction of causation is not always certain.[43] In addition, each variable might also be determined jointly by a third factor, such as the cyclical position of the economy. There are also questions about the power of the tests. The number of available observations is typically small and for some countries the sample variability in interest rates and government budget positions is low, exacerbating the problem of precisely estimating coefficients. This problem can be mitigated to some extent by using cross-country panel data, although availability of consistent time series is an issue.

- Finally, the role of capital flows is important. If there is a high degree of capital mobility and the fiscal deficit of a country is small relative to world saving and to the stock of capital that is mobile in the short term, then there may not be any noticeable increase in that country's interest rates (other than via any risk premia effect).[44] However, if a country's fiscal deficit is large by global standards, or if its assets are not a perfect substitute for foreign assets, then an increase in the real interest rate would be necessary to induce the capital inflow. Conversely, rising interest rates abroad might push interest rates up, regardless of the domestic fiscal position.

42. With these considerations in mind, some of the key findings in the literature are summarised in Table 4. The first half of the table focuses on the effects of government *fiscal positions* on interest rates and the second half on the relationship between the corresponding *stock* variable (government debt) and interest rates. Starting with the top half, most empirical work conducted in the past ten years estimates the impact on US real long-term interest rates of a sustained 1 percentage point decrease in the US fiscal position to be in the range of 20-40 basis points[45], and the impact on the slope of the yield curve to be in the range of 10-60 basis points. In contrast, a number of earlier studies, especially those using data covering the 1970s period and those using short-term interest rates, have found fiscal positions to have an insignificant or even negative impact on interest rates.[46]

43. Considering the relationship between the *stock* variable (government debt) and interest rates, the empirical results again seem to depend to some extent on the time period sampled, with more conventional results reported for post-1980 samples. For example, Plosser (1987) finds that an increase in government debt has a negative impact on nominal and real interest rates for samples including the 1970s, but a small positive effect after the late 1970s. For more recent data periods, empirical estimates suggest that a one percentage point increase in (actual or projected) domestic government debt raises domestic long-term real

43. For example, Allsopp and Glyn (1999) propose a scenario in which the causality runs from high interest rates to high debt ratios. In their scenario an increased focus on inflation control in the 1980s led to high nominal and real interest rates, which increased the pressure on debt servicing and, together with the lack of offsetting fiscal restraint prior to the mid-1990s, helped to lock in higher fiscal deficits.

44. Compared with the Ricardian equivalence explanation as to why government budget deficits may not affect interest rates, other macroeconomic effects would, however, differ. Whereas under Ricardian equivalence, private (domestic) saving would increase, in the capital inflows scenario, the decrease in government saving would be offset by an inflow of foreign capital. The capital inflows would cause an appreciation of the real exchange rate and a deterioration of the current account, decreasing the ratio of net foreign assets to GDP. Thus, the welfare of future generations would be reduced.

45. An exception is Cebula (2000) who estimates that real bond yields rise by 86 basis points.

46. *E.g.* Evans (1987a and b). In addition to the time period, another factor that differentiates Evans (1987b) analysis (as well as that of Plosser (1987) who he follows) is his use of VAR forecast innovations to proxy for unexpected changes in fiscal policy. Elmendorf (1993) suggests that this methodology may produce an inferior measure of fiscal policy expectations than forecasts that incorporate non-quantitative information.

interest rates by something in the range of 1 to 6 basis points.[47] There is also some evidence that this relationship is non-linear, with significantly larger impacts on interest rates for countries with higher starting levels of debt.[48]

44. The extent to which the estimated coefficients on the deficit-to-GDP ratio are higher than the coefficients on the debt-to-GDP ratio may be economically plausible.[49] The coefficients would be the same only if increases in deficits are serially uncorrelated. Since they are not, a large deficit this year is likely to be followed by another large deficit next year, thereby suggesting a greater total increase in debt than implied by a one-year-only increase in the deficit. At the extreme, a 1 per cent of GDP deficit increase that was expected to be permanent would increase the steady-state debt-to-GDP ratio by (1+g)/g percentage points, where g is the growth rate of nominal GDP. Thus, for g=0.05, the coefficient on the deficit-to-GDP ratio would be around 20 times larger than the coefficient on the debt-to-GDP ratio. Laubach's results (summarised in Table 4, parts A and B) indicate that the former coefficient is only around five times higher, suggesting that investors perceive increases in deficit-to-GDP ratios to be highly persistent, but not permanent.

45. A related but slightly different approach has been taken by Ford and Laxton (1995) and Helbling and Westcott (1995) who estimate the impact of *world* public debt on *world* interest rates. In this case, a 1 percentage point increase in world public debt has a much larger impact on world interest rates (10–50 basis points) than for the single country variables discussed above. This result is consistent with the fact that on a global scale, upward pressure on domestic interest rates cannot be damped by capital inflows.[50]

46. As already mentioned, there are also differences in results for different geographical areas. While there has been considerably less analysis on the relationship between fiscal variables and interest rates for countries other than the United States, most panel studies have estimated coefficients of a smaller magnitude to those for the United States alone.[51] As with the US literature, single-country analyses for other countries have used varying estimation approaches and often obtained inconclusive results. Knot and de Haan (1995) found a statistically significant relationship for Europe by aggregating the data for five European countries. They judged the robustness of their estimated relationships to be more satisfactory than analyses performed at the national level. Also Lindé (2001) found that larger budget deficits induce higher (short- and long-term) interest rates in Sweden. This latter result is particularly significant given the unusually high sample variability in the Swedish data.[52] As mentioned above, low sample variability can

47. Although Table 4 reports a larger estimated impact from Chinn and Frankel (2003), differences in specification make their results difficult to compare. By very roughly translating their results to a form more comparable with those of Laubach (2003), Chinn & Frankel suggest that their results for the US are actually very close to those of Laubach (around 5 to 6 basis points) and their results for other countries slightly lower (4 to 5 basis points).

48. Conway and Orr (2002) and O'Donovan *et al.* (1996).

49. As discussed by Laubach (2003).

50. Chinn and Frankel (2003) found a perverse relationship between G7 debt and European long-term interest rates, suggesting (as they recognise themselves) a problem with their specification.

51. Contrast Laubach (2003) with Orr *et al.* (1995): 25 bps (on US real long-term interest rate) versus 15 bps (global panel). Similarly contrast Canzoneri *et al.* (2002) with Reinhart and Sack (2000): 40–60 bps (on the US yield curve slope) versus 10 bps (global panel). Also, using debt data contrast Laubach (2003) with Conway and Orr (2002): 4 bps (on US real long-term forward bond yield) versus less than 2 bps (global panel).

52. For example, Lindé reports that the variance of Swedish fiscal deficits is significantly higher than the variance of government spending or money growth, as compared with the other way around in the data set used by Plosser (1987).

exacerbate the problem of precisely estimating coefficients, making it difficult to distinguish the null and alternative hypotheses. On the other hand, there is some evidence that higher budget deficits do not Granger cause higher long-term interest rates in Japan (Cheng, 1998).

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Table 1. **Magnitude of rebound in real long-term interest rates following troughs**

	Percentage point increase[a]				Duration[b]			
	Cycle 1 (late 1980s)	Cycle 2 (1994)	Cycle 3 (1999)	Average increase	Cycle 1	Cycle 2	Cycle 3	Average duration
Canada	2.6	3.2	1.4	**2.4**	6	6	12	**8**
France	3.5	3.0	1.9	**2.8**	14	12	12	**13**
Germany	1.1	3.1	2.0	**2.1**	5	15	12	**11**
Italy	2.4	5.0	2.0	**3.1**	9	14	12	**12**
Japan	3.3	1.8	2.9	**2.4**	4	11	23	**13**
United Kingdom	2.6	2.8	1.9	**2.4**	8	8	9	**8**
United States	2.3	2.9	2.0	**2.4**	10	13	15	**13**
Average	**2.5**	**3.1**	**1.9**		**8**	**11**	**14**	

a) The percentage point rebound in interest rates is taken from the trough (as indicated by the vertical lines in Figure 2) to the highest point reached within two years of the trough. In most cases, the local maximum is also the absolute peak of the interest rate cycle, but there are a number of exceptions, most notably the first cycle rebound in Italy where this table shows a 2.4 percentage point rise over nine months, whereas long rates actually went on to rise another 3½ percentage points over the following five years.

b) Number of months.

Source: OECD.

Table 2. **Extent of share-market losses regained**

	Change since peak[a] (to 20 Aug. 2003) (A)	Date of peak	Change from peak to trough[a] (B)	Date of trough	Rise since trough[a] (to 20 Aug. 2003) (C)	Percentage of loss regained since the rebound (D)
Canada – *Composite*	-34.2	1 September, 2000	-50.0	9 October, 2002	31.5	31.5
France – *CAC 40*	-52.6	4 September, 2000	-65.3	12 March, 2003	36.5	19.4
Germany – *DAX*	-56.6	7 March, 2000	-72.7	12 March, 2003	58.9	22.1
Italy – *MIBTEL*	-45.6	6 March, 2000	-56.6	12 March, 2003	25.3	19.4
Euro area- *FTSE Eurotop 100*	-49.6	4 September, 2000	-61.8	12 March, 2003	32.0	19.8
Japan – *Nikkei 225*	-73.6	29 December 1989	-80.5	28 April, 2003	35.3	8.6
United Kingdom –*FTSE 100*	-39.1	3 January, 2000	-52.6	12 March, 2003	28.3	25.5
United States						
Dow Jones	-19.8	14 January, 2000	-37.8	9 October, 2002	29.0	47.6
S&P500	-34.5	24 March, 2000	-49.1	9 October, 2002	28.8	29.8
Wilshire 5000	-34.4	24 March, 2000	-50.2	9 October, 2002	31.7	31.4

a) Percentage change.

Source : Datastream, OECD.

Table 3. **Correlation between average projected balance** (as percentage of GDP) **and interest rate variable**

	Correlation between average MTB fiscal projection and:	
	Real bond yield[a]	Interest rate spread (10-year minus 3 month)
Canada	-0.74** (-5.70)	0.03 (0.14)
France	0.06 (-0.34)	-0.09 (-0.49)
Germany	0.18 (0.97)	-0.19 (-1.04)
Italy	-0.63** (-4.34)	0.37* (2.17)
Japan	0.74** (5.90)	-0.50** (-3.14)
United Kingdom	-0.50** (-3.09)	-0.67** (-4.89)
United States	-0.23 (-1.28)	-0.63** (-4.34)

a) Real 10-year bond yield less core inflation HP filtered.

Note: t- statistics in parentheses; * denotes significance at 5 per cent level; ** denotes significance at 1 per cent level.

Source : OECD.

Table 4. **Estimated impact of fiscal variables on interest rates**
Summary of some key findings in the literature

Part A: Fiscal *flows*

Interest rate variable	Author(s)	Country/Data period/ Data frequency	Fiscal explanatory variables (as percentage of GDP)	Estimation method/ Additional explanatory variables	Effect on interest rate variable of 1 percentage point decrease in fiscal position
Expected future nominal and real 10-year bond yields	Laubach (2003)	United States: CBO: 1976-2003 annual 1985-2003 semi-annual OMB: 1985-2003 annual	Projected fiscal balance over long horizon (CBO and OMB 5-year projections)	OLS Trend growth and equity premium	Typical estimate: +25 bps on nominal rates after 5 years (range: 20-40 bps). Similar effect on real rates.
Nominal interest rate spreads (10-year or 5-year minus 3-month)	Canzoneri, Cumby and Diba (2002)	United States: Semi-annual: 1984-2002, and 1992-2002	Projected fiscal balance over long horizon (CBO projections: 5 and 10 years ahead)	OLS No other explanatory variables	+41-60 bps. +20-70 bps from regressions using actual fiscal data (higher estimates when data in first differences).
Domestic minus foreign interest rate differential for both 3-month and 5-10 year yields	Lindé (2001)	Sweden: 1982/84 - 1996 monthly and quarterly	Fiscal balance	OLS Real government expenditure, money supply, foreign price level	+20 bps (short-term i-differential) after 2 years +25 bps (long-term i-differential) after 2 years
(1) Nominal interest rate spreads (10-yr minus 3-month) (2) Realised change in real short-term yield over next 5 years	Reinhart and Sack (2000)	19 OECD countries and G7 alone 1981-2000 annual	Projected fiscal balance over short horizon (OECD projections for current and next fiscal years)	Panel regression OECD projections of inflation, unemployment, & real GDP growth	1) +9 bps steepening of yield curve in OECD sample +12 bps in G7 sample. 2) +45 bps over next 5 years in G7 No impact in full OECD sample.
Ex post real 10-year yield	Cebula (1998)	United States: 1973-1995 annual	Structural fiscal balance	OLS Real GDP, real short-term interest rate, capital flows	+86 bps
Regional nominal long-term yield (aggregated using GDP weights)	Knot and de Haan (1995)	5 European countries (France, Germany, Italy, Netherlands, United Kingdom): 1960-1989 annual	Raw and cyclically adjusted budget balances	OLS expected inflation, money supply, government debt, world interest rate	+40-60 bps

Table 4. **Estimated impact of fiscal variables on interest rates** *(contd.)*

Part A: Fiscal *flows* *(cont'd)*					
Interest rate variable	Author(s)	Country/Data period/ Data frequency	Fiscal explanatory variables (as percentage of GDP)	Estimation method/ Additional explanatory variables	Effect on interest rate variable of 1 percentage point decrease in fiscal position
Real 10-year bond yields	Orr, Edey & Kennedy (1995)	17 OECD countries: 1981-1994 quarterly	Fiscal balance	Panel ECM Large number of other explanatory variables[a]	+15 bps in long-term
Change in nominal 6-month, 3-year, 5-year and 20-year yields	Elmendorf (1993)	United States: 1971-1987 quarterly	Revisions to projected fiscal balance over short horizon (DRI projections for current and next fiscal years)	OLS Federal spending, money growth, inflation and cyclical position of economy	+49 bps on 3-year yield +43 bps on 5-year yield Smaller and statistically insignificant effect on 6-month and 20-year interest rates.
Short-term real yield	Giannaros and Kolluri (1989)	5 countries (Canada, France, United Kingdom, United States, West Germany) 1965-1985 quarterly	Fiscal balance	OLS Expected inflation, budget deficit, real money supply, real government expenditure	No statistically significant effect
Nominal and real interest yields of varying maturities. Also Moody's Aaa bond yield	Evans (1987a)	United States: Monthly data: 1908 – 1984 plus 11 sub-samples	VAR innovations in fiscal balance as proxy for unexpected changes in fiscal policy	OLS Real government spending and real money supply	Insignificant or *negative* effect *E.g.* for 1953-1984 sample: approx -50 bps on nominal short-term i; -15 bps on Moody's bond rate; zero effect on real short-term rate.
Short-term nominal yields	Evans (1987b)	6 countries (G7 excluding Italy): 1974-1985 annual	Fiscal balance (differenced)	OLS Government spending and real money supply	Insignificant or (for the UK) *negative* effect.

a) Additional long-run determinants include: rate of return on capital, domestic portfolio risk of holding bonds, current account balance, past inflation, expected future inflation. In the case of the smaller countries, the real interest rate of an influential G3 country was also included. Additional short-run determinants include: real short-term interest rates, the structural budget deficit, quarterly changes in long-run determinants.

Table 4**. Estimated impact of fiscal variables on interest rates** *(contd.)*

Part B: Fiscal *stocks*

Interest rate variable	Author(s)	Country/Data period/ Data frequency	Fiscal explanatory variables (as percentage of GDP)	Estimation method/ Additional explanatory variables	Effect on interest rate variable of 1 percentage point increase in public debt
Real 10-year bond yields	Chinn and Frankel (2003)	France, Germany, Italy, Japan Spain, United Kingdom, United States 1988-2002 quarterly	Net public debt, actual and projected by OECD (2 years ahead); Net public debt for the G7.	Individual country and pooled euro-area OLS regressions; Inflation, actual domestic debt, projected domestic debt, output gap, foreign bond yield.	3-32 bps on individual country interest rate. 7-12 bps on European interest rate. Negative effect of G7 debt on European interest rate.
Real 5-year-ahead 10-year bond yield	Laubach (2003)	United States: 1976-2003 annual 1985-2003 semi-annual	Projected net public debt (5 years ahead)	As in Laubach listed in part A of this table.	4-5 bps
Real 10-year bond yields	Conway and Orr (2002)	7 countries (Australia, Canada, Germany, New Zealand, Sweden, United Kingdom, United States) 1985-2002, quarterly	Net public debt	Pooled ECM Framework similar to O'Donovan, Orr and Rae (see below)	<1 bp if starting from 0 per cent debt Approx 1.5 bps if starting from 100 per cent debt.
Real 10-year bond yields	O'Donovan, Orr and Rae (1996)	17 OECD countries 1985-1995 quarterly	Net public debt	Pooled ECM Framework Various explanatory variables:[c]	<1 bp if starting from 0 per cent debt Approx 2 bps if starting from 100 per cent debt
Real 1-year yield for each country Two measures of the *world* real interest rate	Ford and Laxton (1995)	9 countries[d] 1977-1993 annual (*i.e.* only 16 data obs!)	World net public debt (GDP-weighted average across OECD countries)	Individual country and pooled OLS regressions Various explanatory variables.[e]	15-27 bps on *world* real interest rate. 14-49 bps on individual country interest rates.
Global real short- and long-term yields for 8-country area and for G3[f]	Helbling and Wescott (1995)	8 countries (same as Ford & Laxton but excluding Denmark) 1960-1993 annual	World gross[g]ublic debt (GDP-weighted average across OECD countries)	DOLS ECM Return on capital	10-12 bps on long-term interest rates in pooled model 16-20 bps on short-term interest rates.
Innovations in nominal and *ex ante* real yields of varying maturities, up to 5 years	Plosser (1987)	United States: 1968-1985 monthly (and various sub-samples)	VAR innovations in private held public debt	OLS Innovations of output, inflation, real public debt, real military spending and real money	Negative effect on interest rates prior to late 1970s. Small *positive* effect thereafter. Less negative (or more positive) effect as instrument maturity increases.

b) Euro area countries only include France, Germany, Italy and Spain.

c) Long-term explanatory variables include: historical inflation less current inflation; current account balance; domestic portfolio risk of holding bonds; riskiness of bonds relative to equities. Debt enters non-linearly.

d) Belgium, Canada, Denmark, Germany, Japan, Netherlands, Switzerland, United Kingdom and United States

e) Explanatory variables include: income share of capital; inflation rate; unemployment rate; growth in real GDP; labour productivity; employment. Model assumes that an extra dollar of public debt has the same effect on real interest rates regardless of which country issues it.

f) Global real interest rates are calculated as the weighted average of national interest rates (weighted by nominal GDP).

g) Helbling and Westcott also experimented with net public debt data which produced larger effects on interest rates, but with unexpected signs on other variables. The results using gross public debt were thus considered to be more robust.

Table 5. **Predicted impact of fiscal deterioration on interest rates**

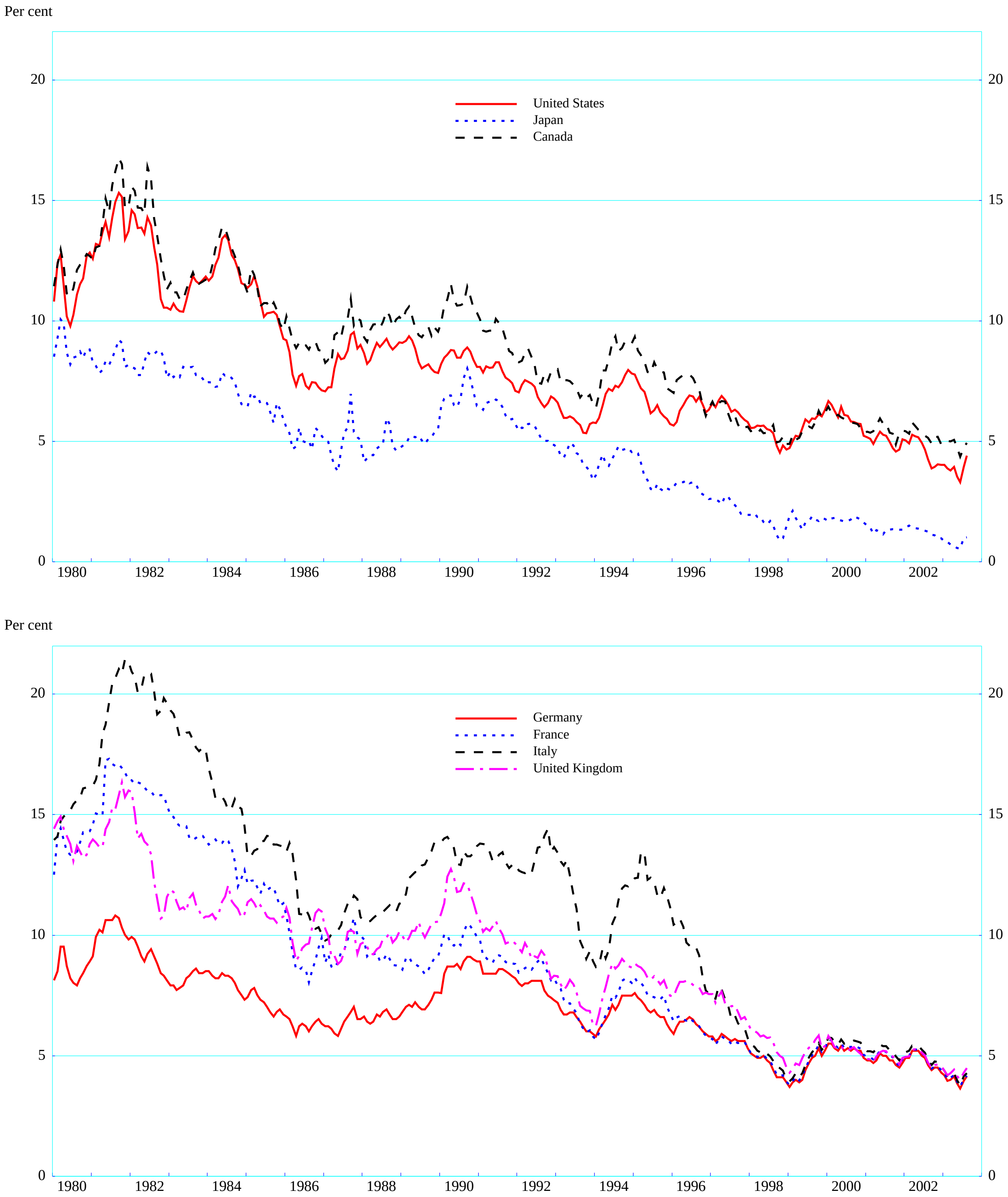
Based on some empirical estimates from the literature

Fiscal variable **(A)**	Effect of 1 percentage point increase in fiscal deficit/debt on long-term interest rate[a] **(B)**	Assumed deterioration in fiscal variable **(C)**	Predicted rise in trend interest rate **(= B x C)**
United States: CBO/OMB projected fiscal deficit as percentage of GDP	25 (based on Laubach, 2003)	United States: 4.4 per cent (= the deterioration in OMB projections between Feb 2000 and Jul 2003).	110 bps (US 10-year interest rate)
United States: projected net public debt as percentage of GDP	4-5 (based on Laubach, 2003)	(1) United States: 5 per cent (= OECD projected deterioration in US debt/GDP between 2000 and 2003). (2) United States: 42 per cent (based on assumption of a 2 per cent *permanent* deterioration in the cyclically-adjusted fiscal balance).[b]	(1) 20-25 bps (2) 170-210 bps (US 10-year interest rate)
OECD area projected fiscal deficit as percentage of GDP	15 (based on Orr, Edey & Kennedy, 1995)	2 per cent (= the deterioration in OECD-area fiscal projections between 2000 and 2003).	30 bps (OECD country 10-year interest rates)
World (OECD area) gross debt as percentage of GDP	10-12 (based on Helbling & Westcott, 1995)	5 per cent (= OECD projected deterioration in OECD-area gross debt between 2000 and 2003)	50–60 bps (world long-term interest rate)

a) In basis points.
b) Steady-state Debt/GDP = Δ Deficit*(1+g)/g, where g = nominal GDP growth, and Δ Deficit is the permanent change in the deficit to GDP ratio. Here it is assumed that g = 0.05, so for a permanent 2 per cent deterioration in the fiscal balance, debt in the steady-state will rise by 42 per cent of GDP.

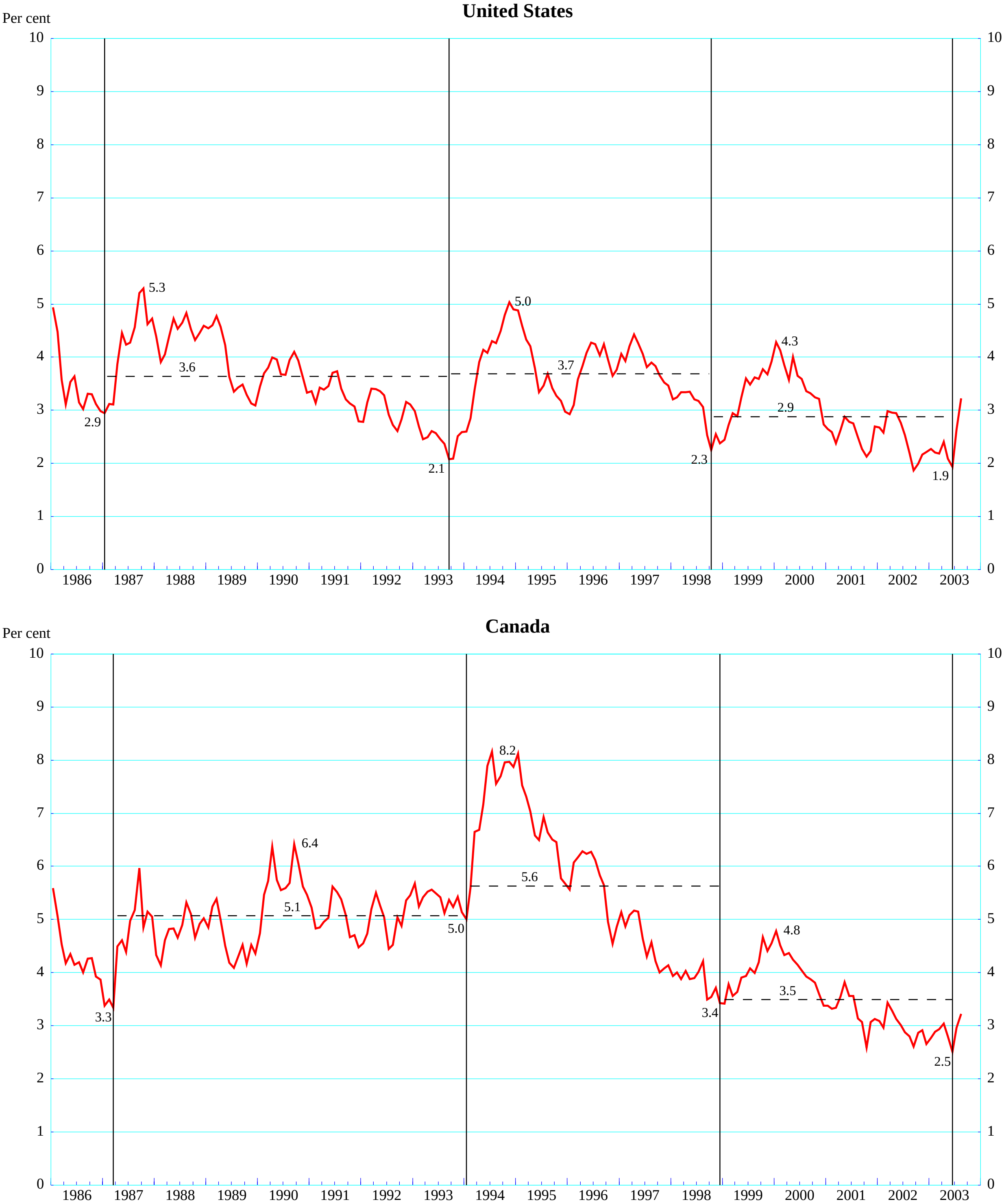
Source: OECD.

Figure 1. Nominal long-term interest rates



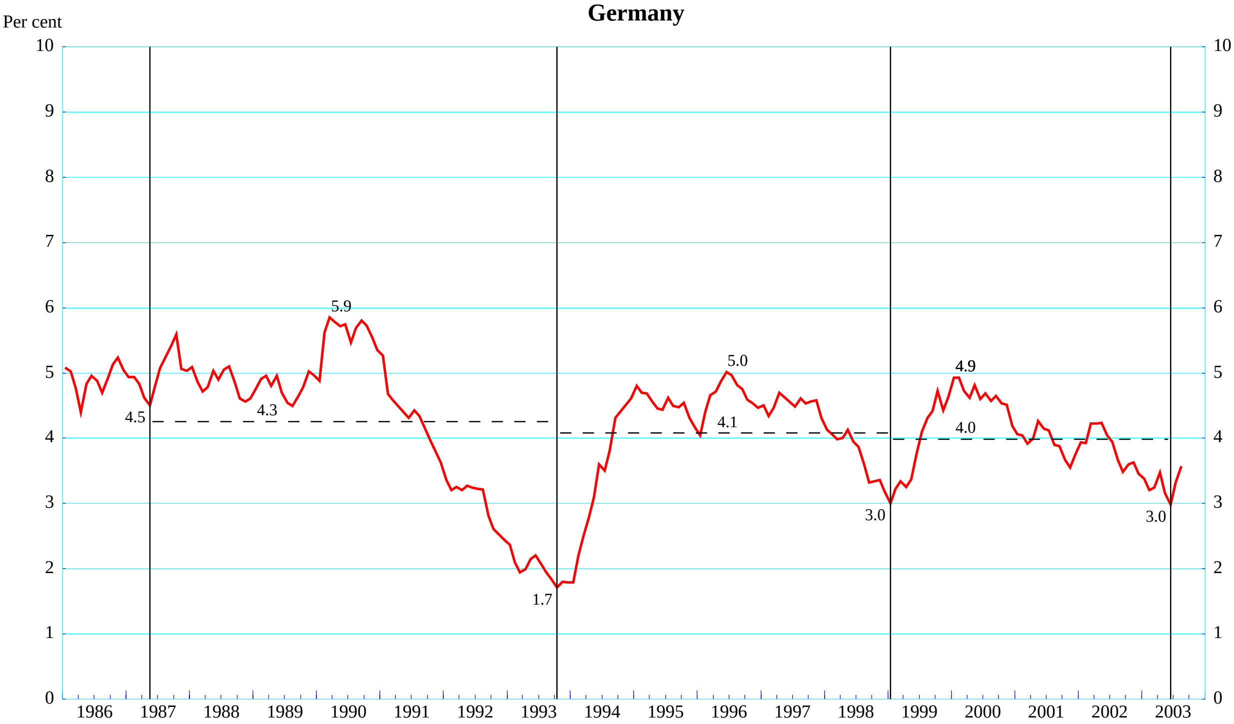
Note: Monthly data, August monthly data are calculated as an average of daily data up to 20 August.
Source: Datastream, OECD.

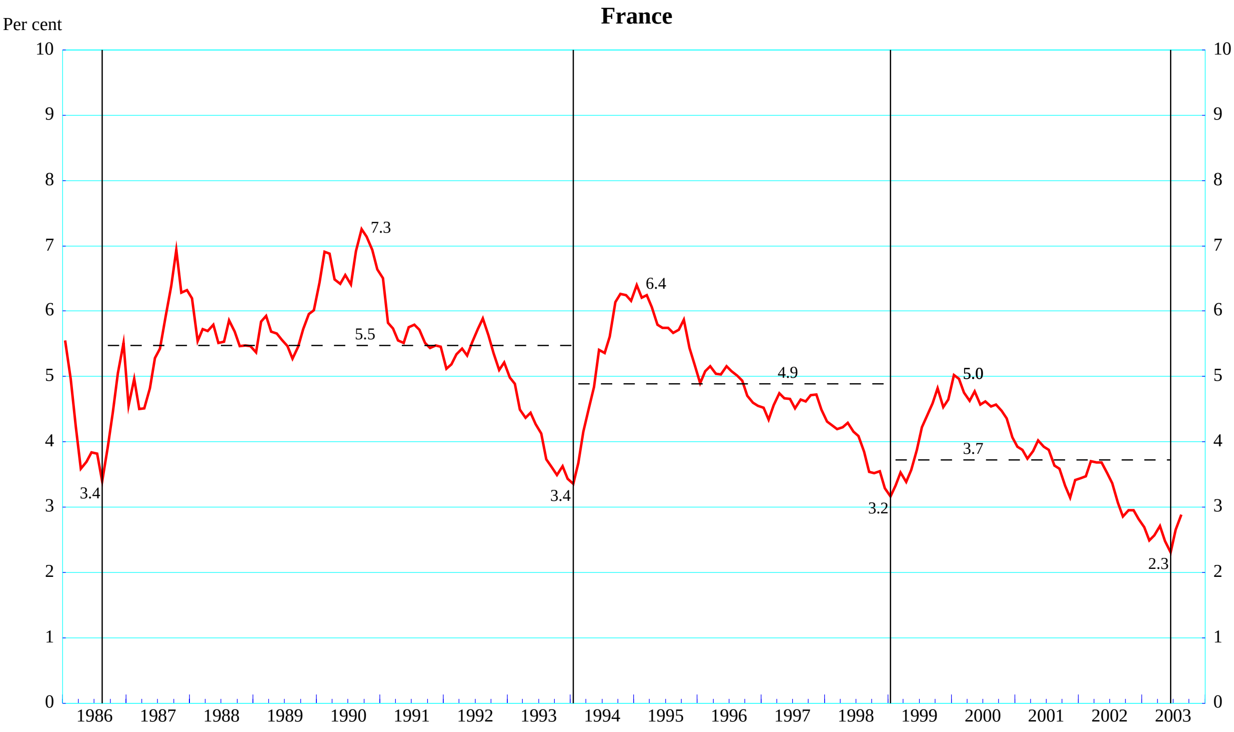
Figure 2. Real long-term interest rates [1]



1. Real rate equals nominal rate less HP-filtered core inflation (non-food, non-energy). Core inflation data series includes Economic Outlook 73 forecasts of core inflation.
Source: Datastream,OECD.

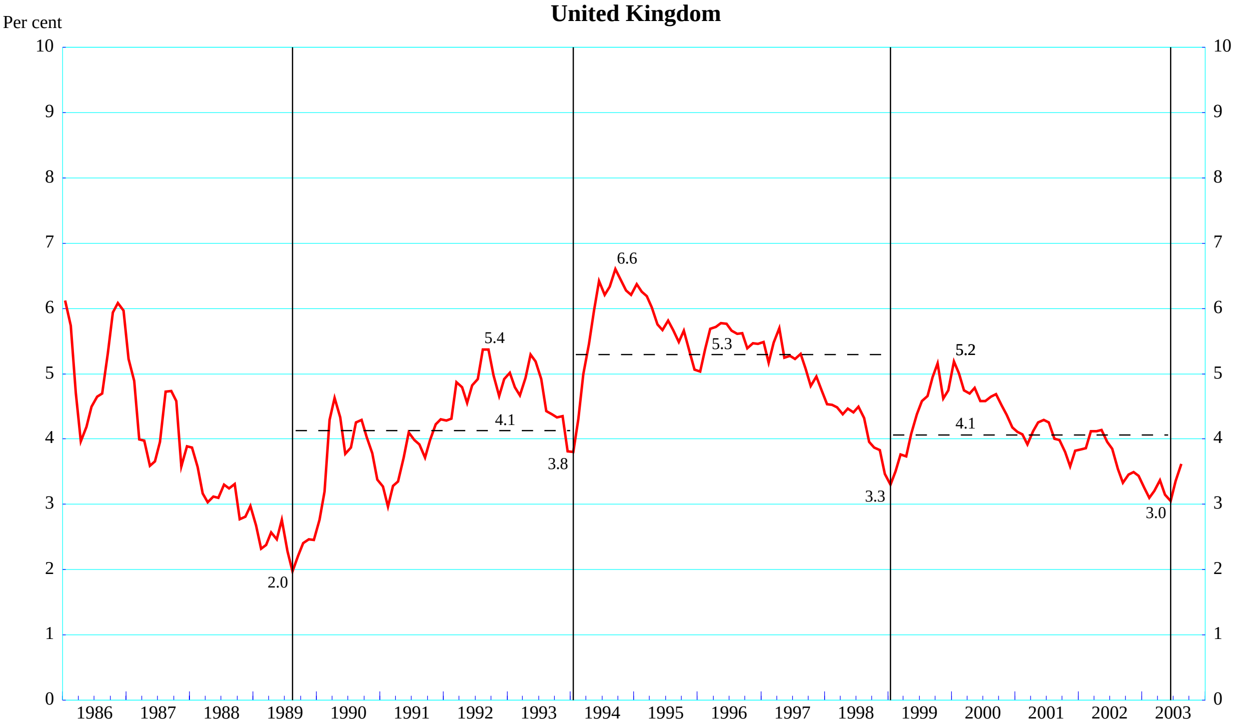
Figure 2 (Cont.) Real long-term interest rates [1]

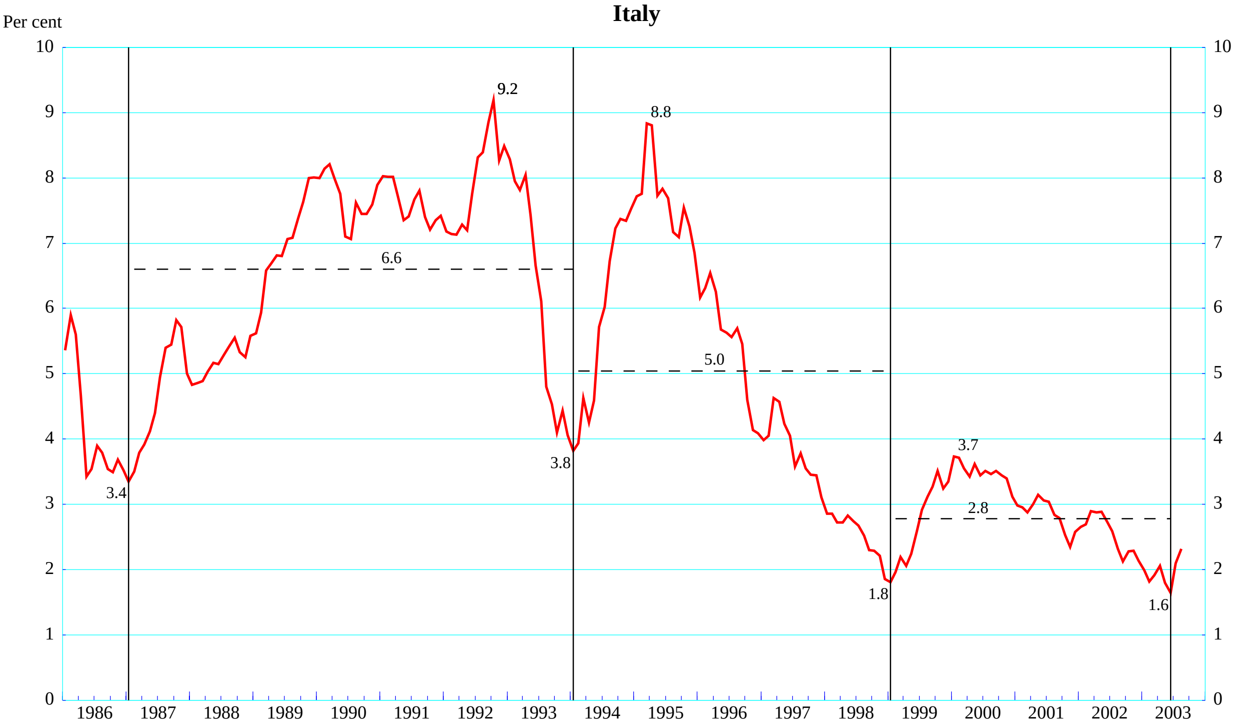




1. Real rate equals nominal rate less HP-filtered core inflation (non-food, non-energy). Core inflation data series includes Economic Outlook 73 forecasts of core inflation.
Source: Datastream,OECD.

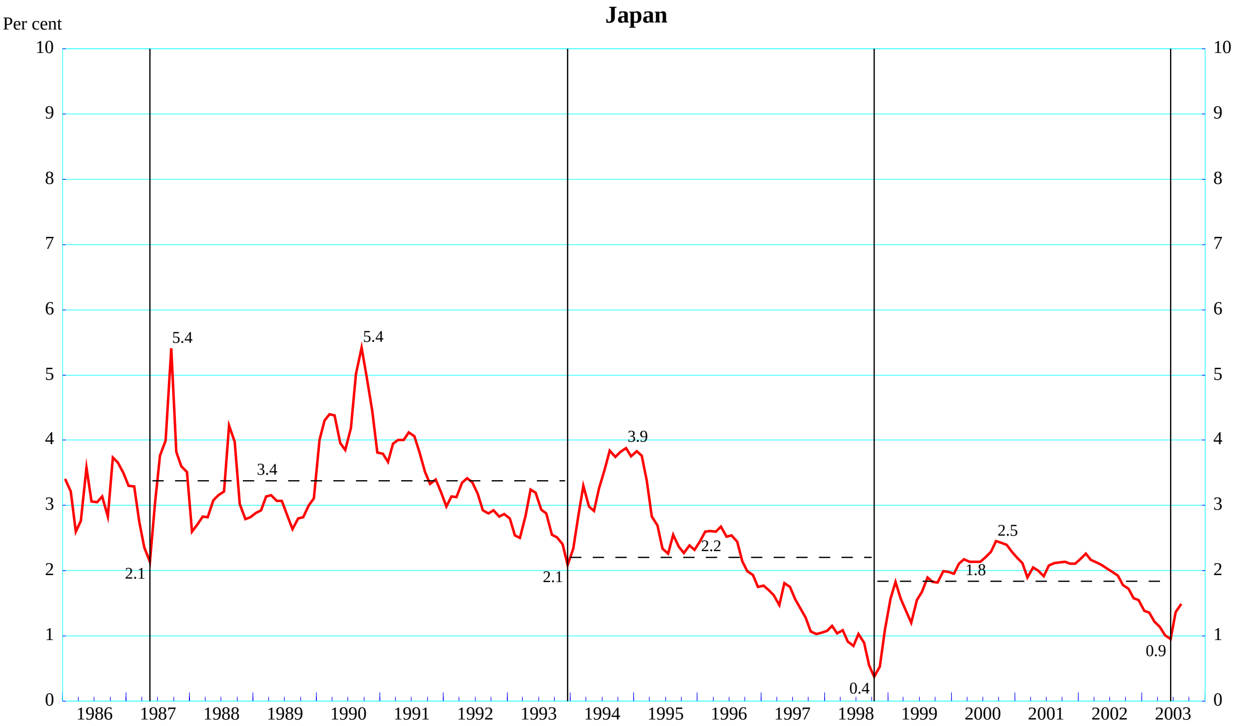
Figure 2 (Cont.) Real long-term interest rates[1]





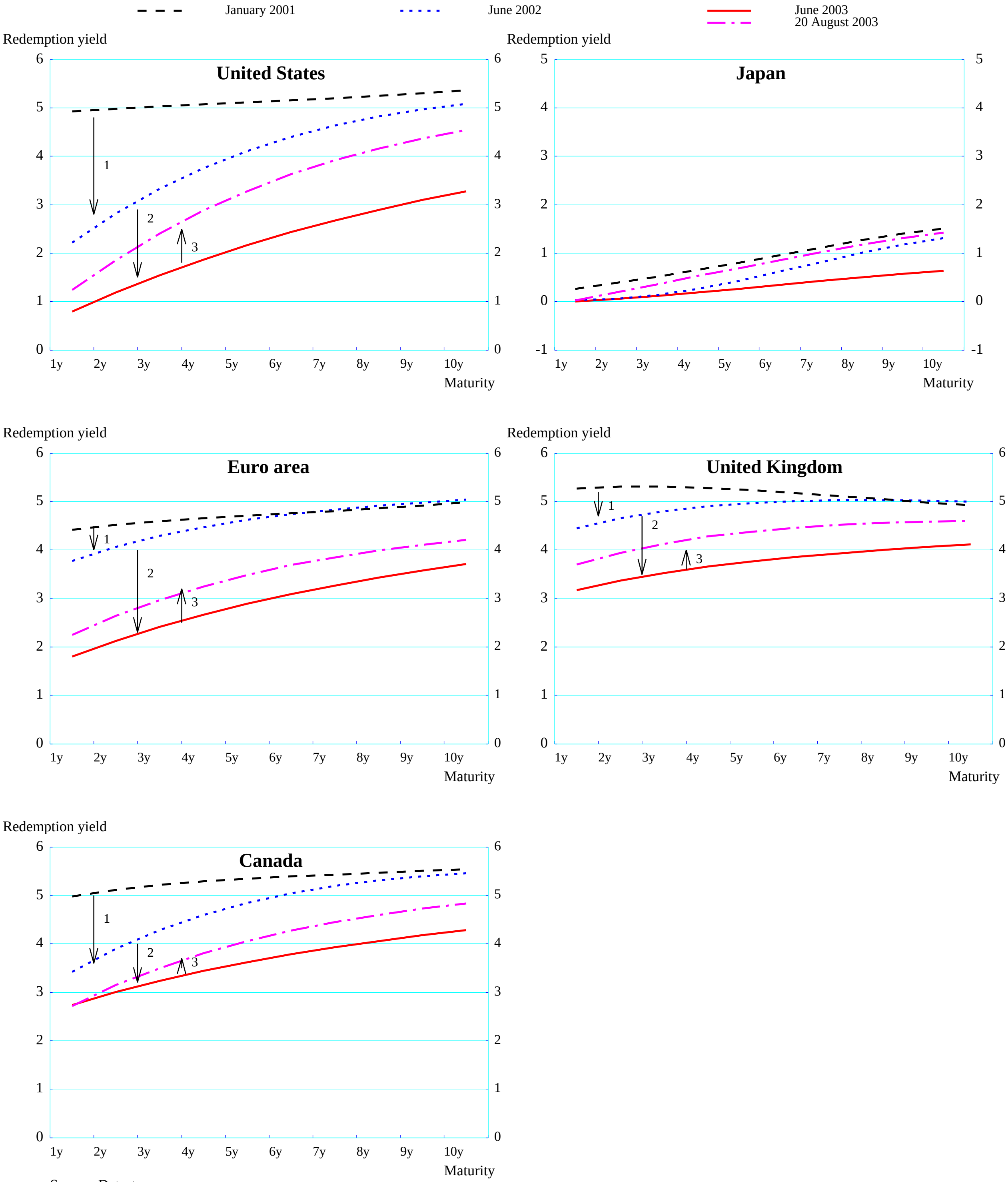
1. Real rate equals nominal rate less HP-filtered core inflation (non-food, non-energy). Core inflation data series includes Economic Outlook 73 forecasts of core inflation.
Source: Datastream,OECD.

Figure 2 (Cont.) Real long-term interest rates [1]



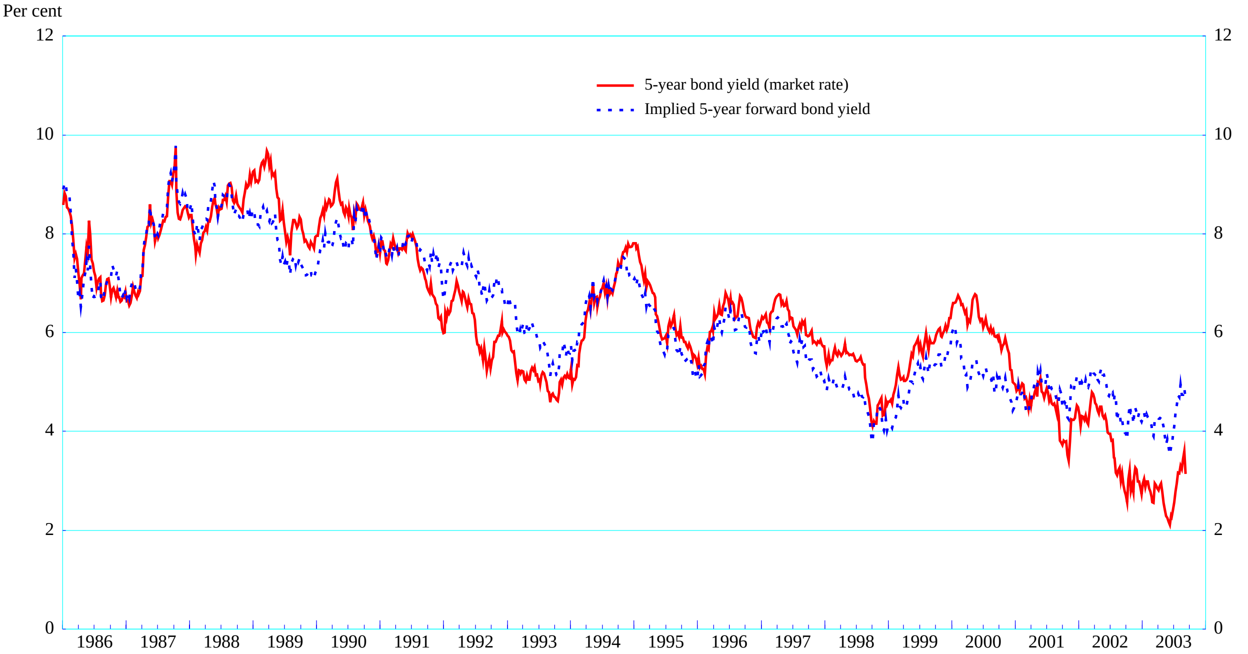
1. Real rate equals nominal rate less HP-filtered core inflation (non-food, non-energy). Core inflation data series includes Economic Outlook 73 forecasts of core inflation.
Source: Datastream,OECD.

Figure 3. Yield curves in the major economies

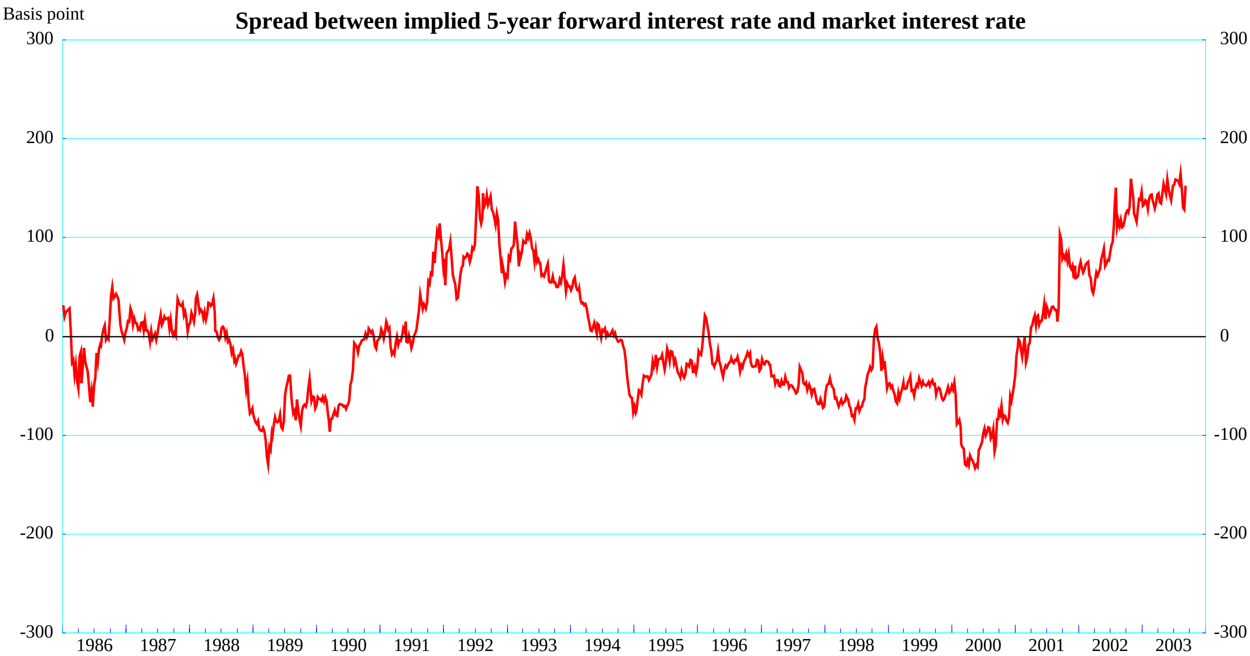


Source: Datastream.

Figure 4. Implied forward rate [1]
United States

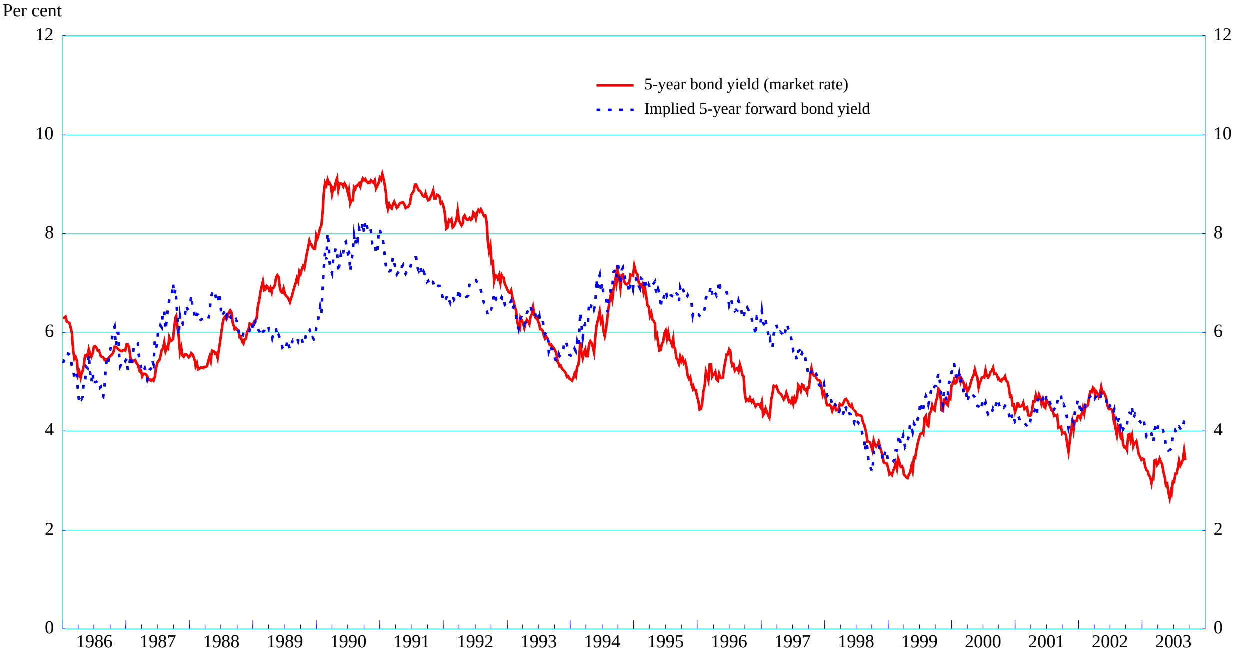


Spread between implied 5-year forward interest rate and market interest rate

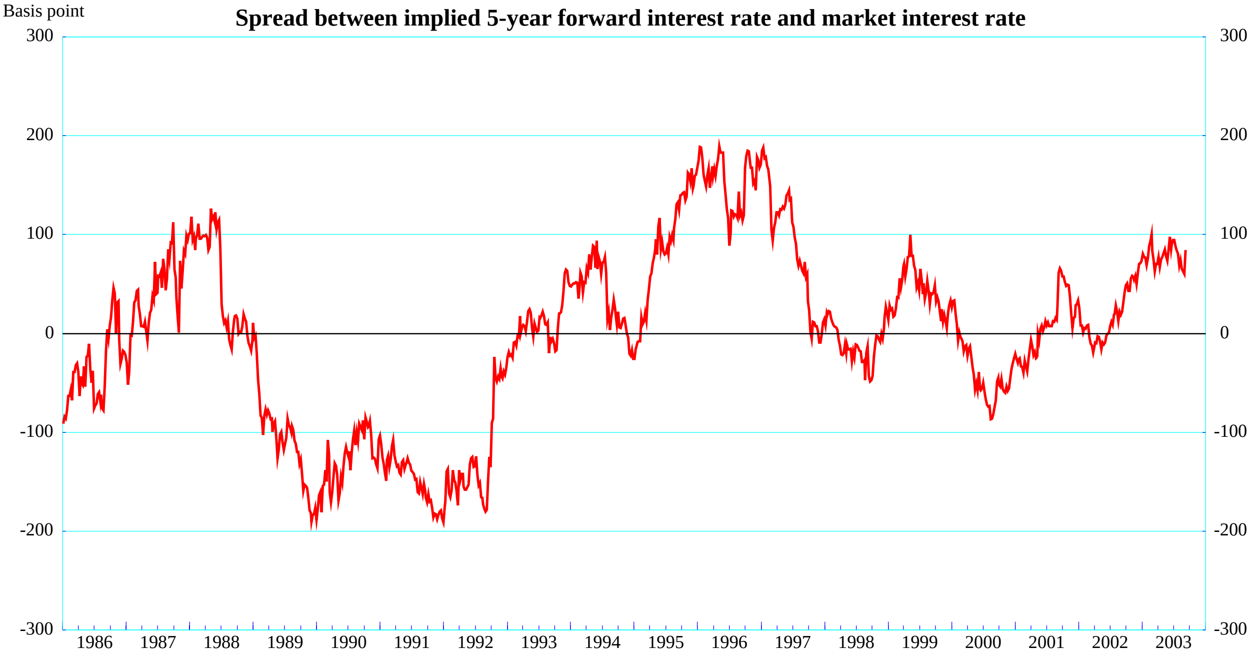


1. The implied 5-year bond yield 5-years forward is approximated as 2 times the government benchmark 10-year yield minus the government benchmark 5-year yield and adjusted for the average term premia since 1986. This gives a relatively close approximation to the semi-annually compounded forward rate (at the current low level of yields the compounding effects are small). Note also that this is an approximation of forward rates calculated from the zero coupon curve.
Source: Datastream, OECD calculations.

Figure 4 (cont.) Implied forward rate [1]
Germany

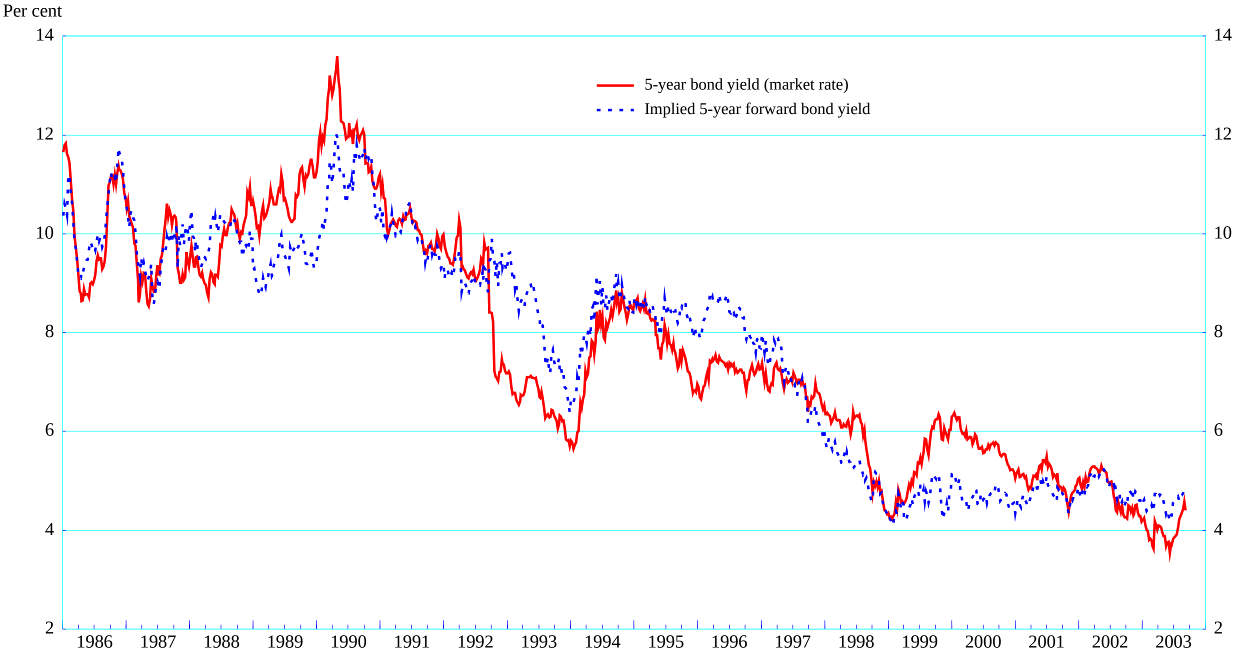


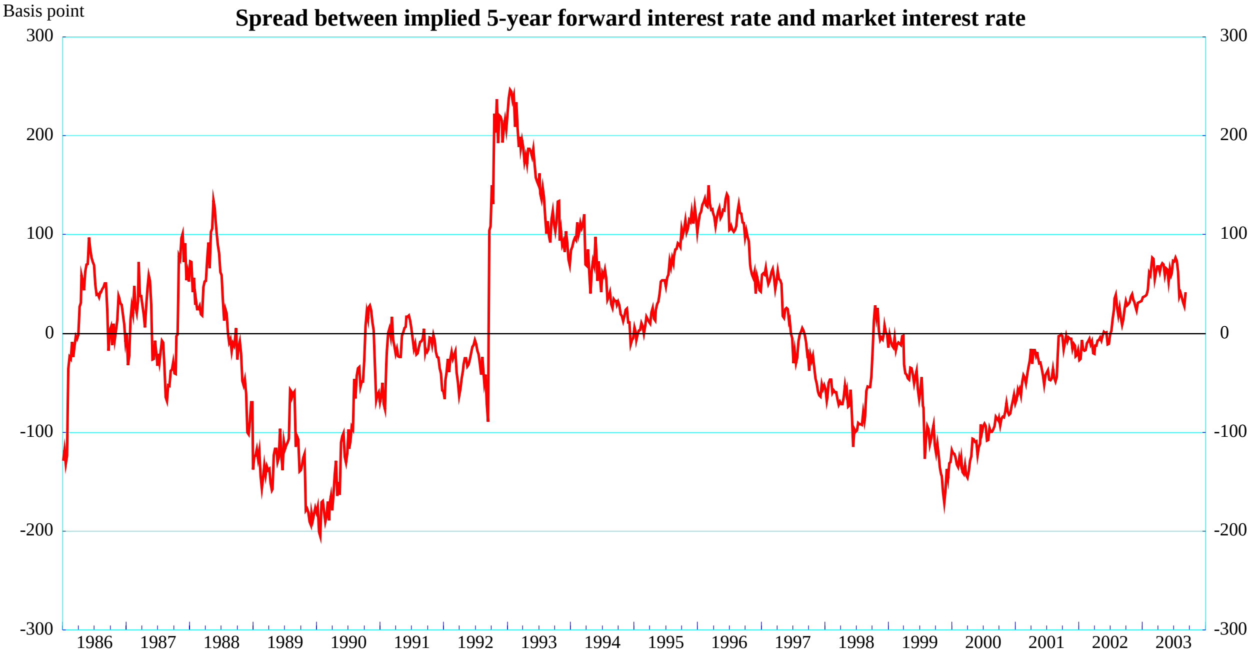
Spread between implied 5-year forward interest rate and market interest rate



1. The implied 5-year bond yield 5-year forward is approximated as 2 times the government benchmark 10-year yield minus the government benchmark 5-year yield and adjusted for the average term premia since 1986. This gives a relatively close approximation to the semi-annually compounded forward rate (at the current low level of yields the compounding effects are small). Note also that this is an approximation of forward rates calculated from the zero coupon curve.
Source: Datastream, OECD calculations.

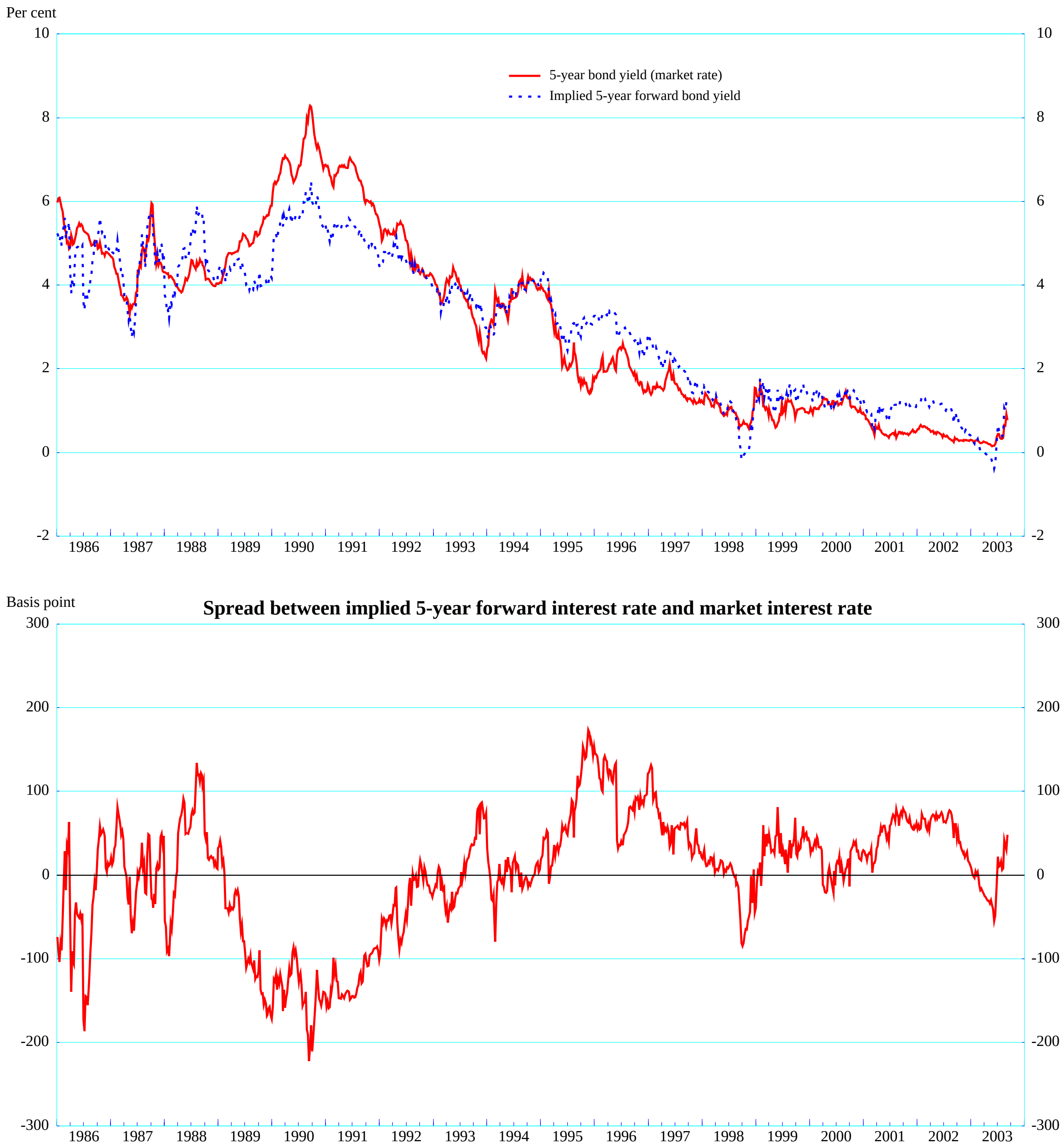
Figure 4 (cont.) Implied forward rate[1]
United Kingdom





1. The implied 5-year bond yield 5-year forward is approximated as 2 times the government benchmark 10-year yield minus the government benchmark 5-year yield and adjusted for the average term premia since 1986. This gives a relatively close approximation to the semi-annually compounded forward rate (at the current low level of yields the compounding effects are small). Note also that this is an approximation of forward rates calculated from the zero coupon curve.
Source: Datastream, OECD calculations.

Figure 4 (cont.) Implied forward rate[1]
Japan



1. The implied 5-year bond yield 5-year forward is approximated as 2 times the government benchmark 10-year yield minus the government benchmark 5-year yield and adjusted for the average term premia since 1986. This gives a relatively close approximation to the semi-annually compounded forward rate (at the current low level of yields the compounding effects are small). Note also that this is an approximation of forward rates calculated from the zero coupon curve.
Source: Datastream, OECD calculations.

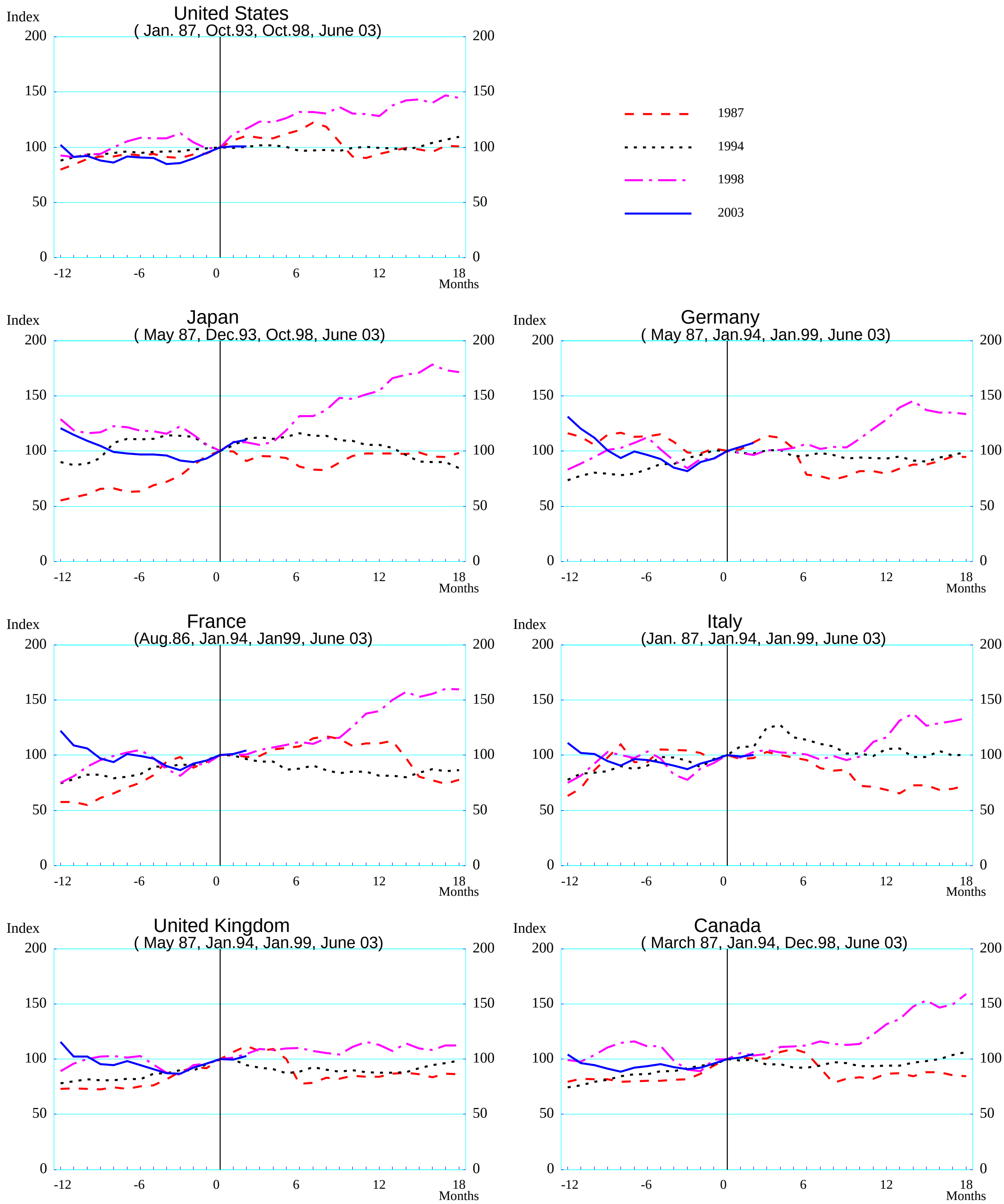
Figure 5. Bond markets compared

Nominal ten-year bond yields

Note: Dates in parentheses correspond to the months in which 10-year bond yields reached their lowest points.
Sources: OECD, Datastream.

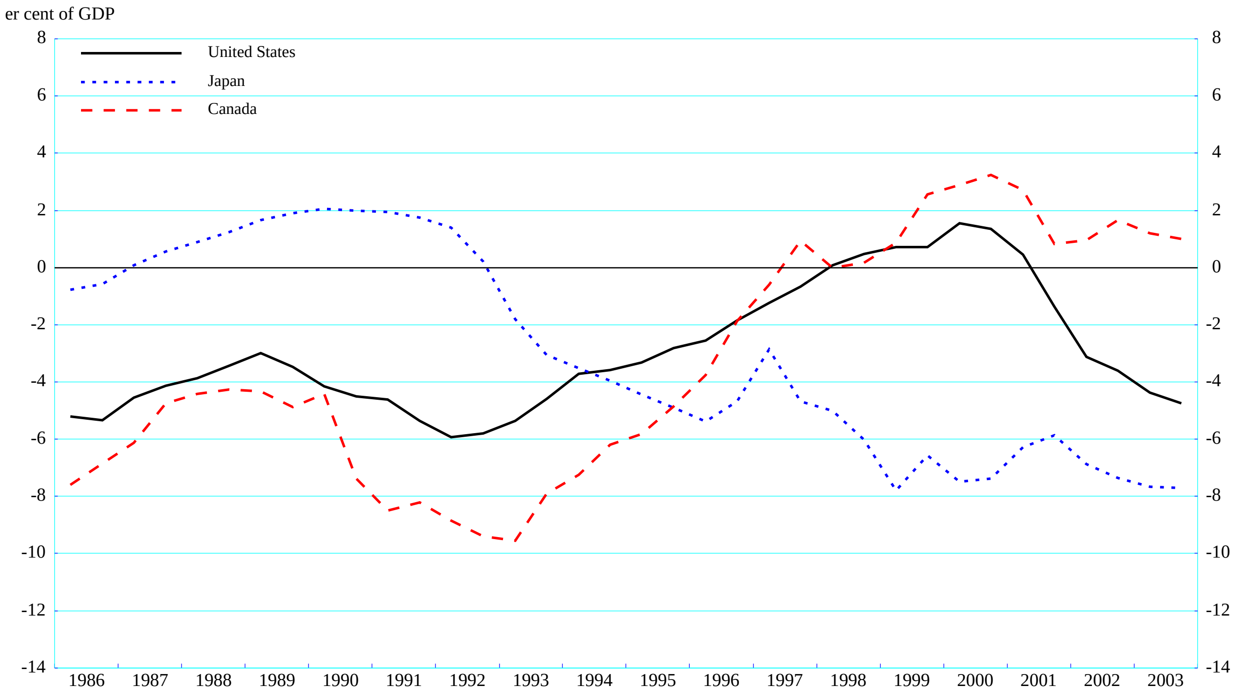
Figure 6. Share indices compared

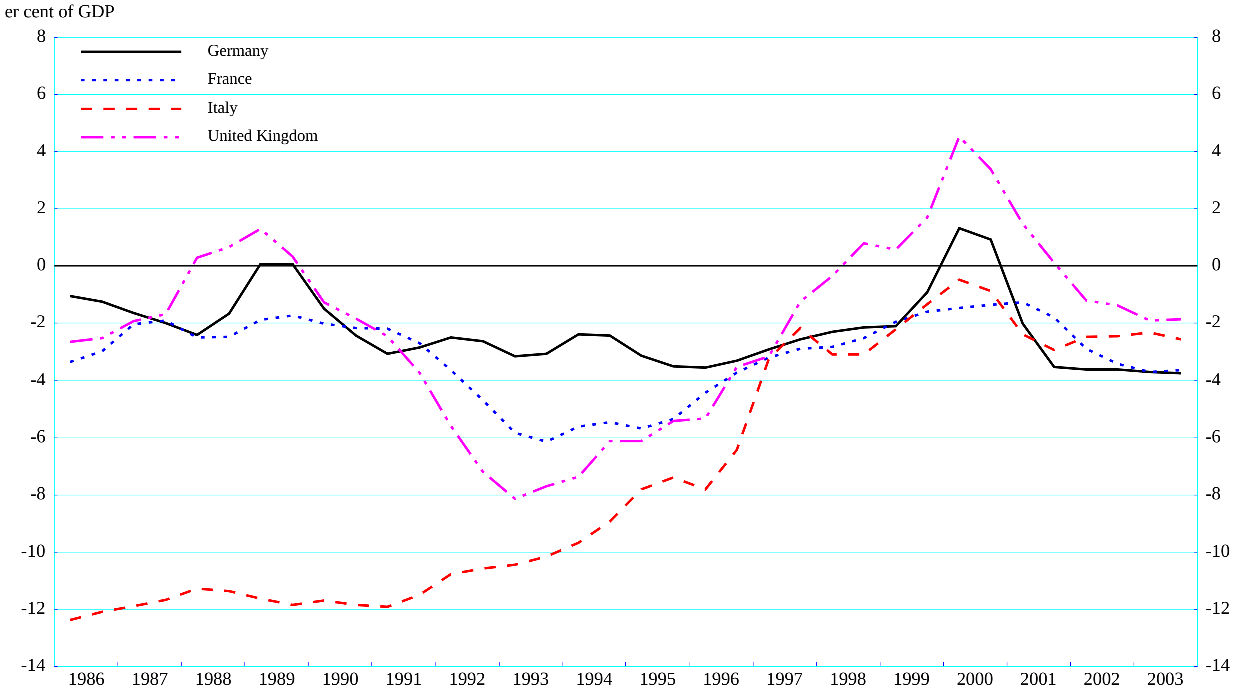
Total market: indices rebased to 100 at month zero



Note: Dates in parentheses correspond to the months in which 10-year bond yields reached their lowest points.
Sources: OECD, Datastream.

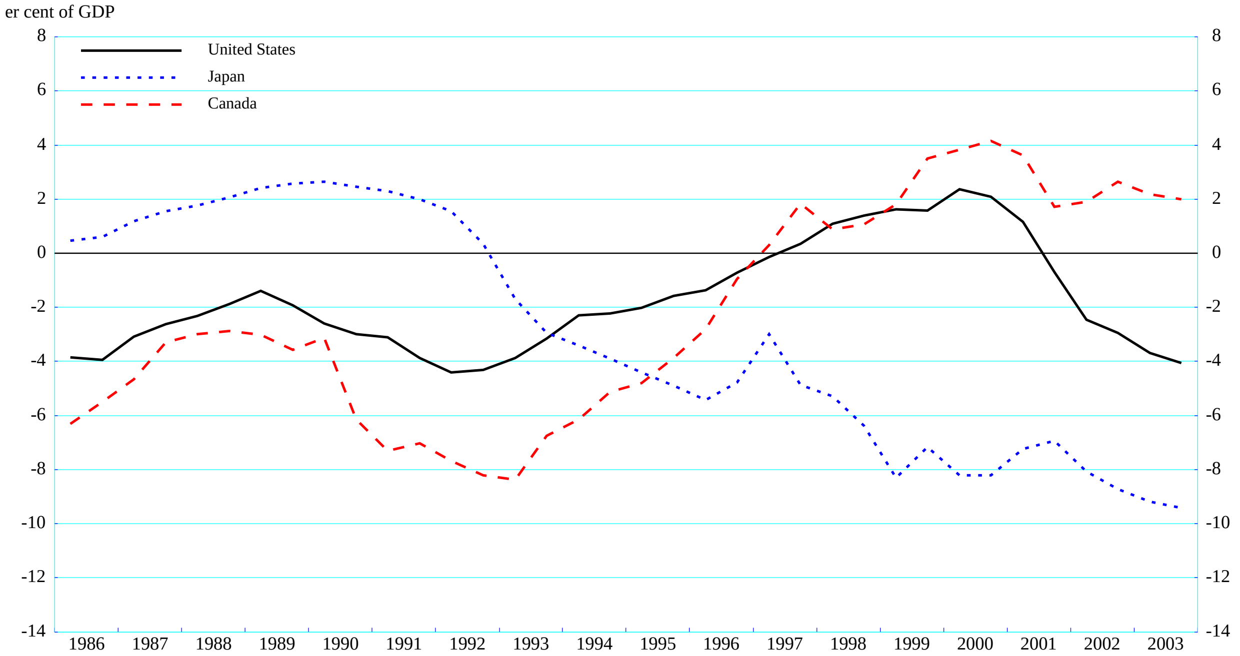
Figure 7a. Fiscal positions

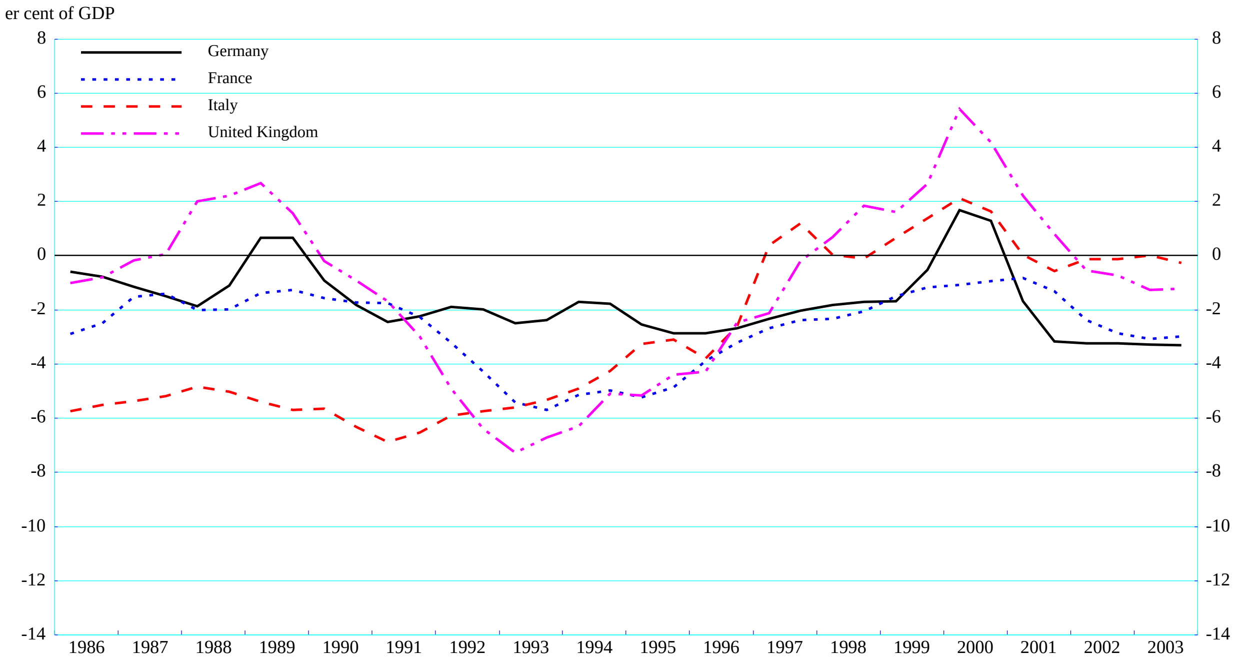




Note : Projections are from Economic Outlook 73 (June 2003).
Source: OECD.

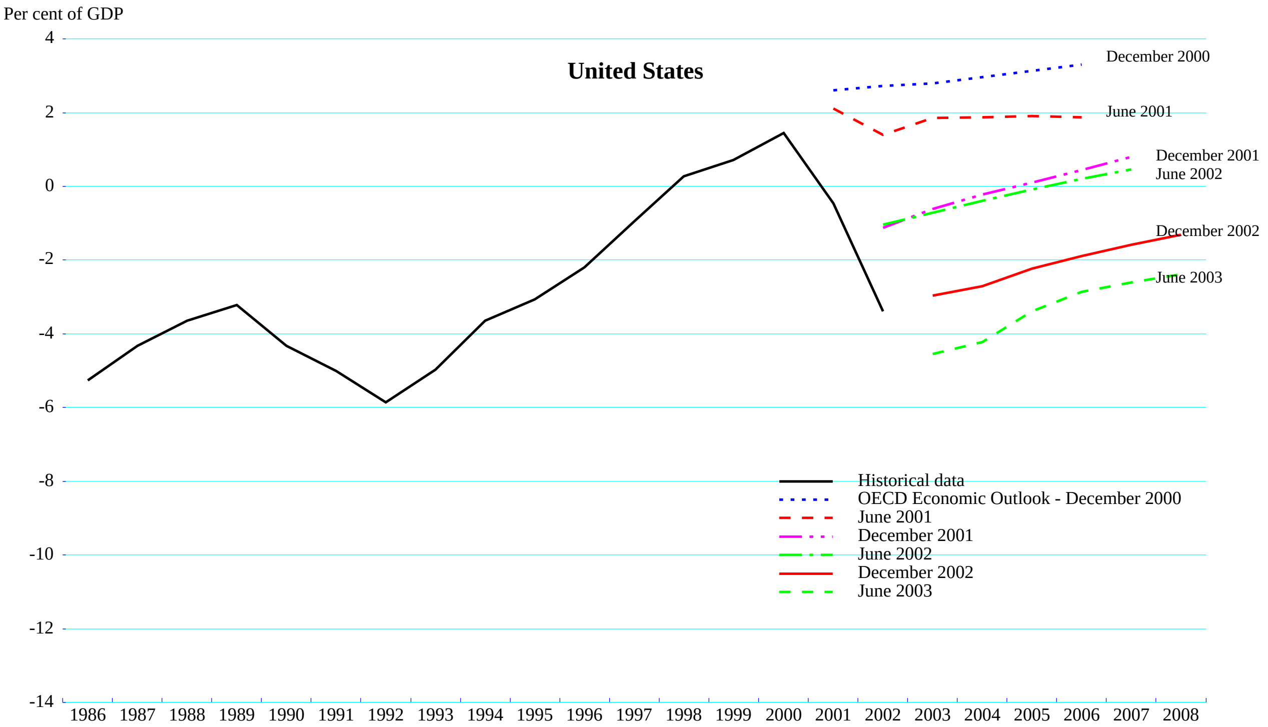
Figure 7b. Fiscal positions
(adjusted for inflation)





Note: The adjusted fiscal balance-to-GDP ratio is equal to the raw ratio plus HP-filtered inflation (based on GDP deflator) times net public debt in the previous period. This adjustment roughly converts debt-servicing expenditure from nominal to real, thus effectively including the so-called 'inflation tax' in budget revenues. Since inflation has the effect of biasing the fiscal balance-to-GDP ratio downwards (i.e. higher deficits), the adjustment has the effect of reducing the size of fiscal deficits (or increasing surpluses) for all countries except Japan in recent years (where deflation has increased the real value of public debt, thus producing a more negative adjusted fiscal balance). Note that to the extent that governments do not receive a market return on their assets, the use of net debt rather than gross debt implies that these adjustments are conservative.
Source: OECD.

Figure 8. Government fiscal positions



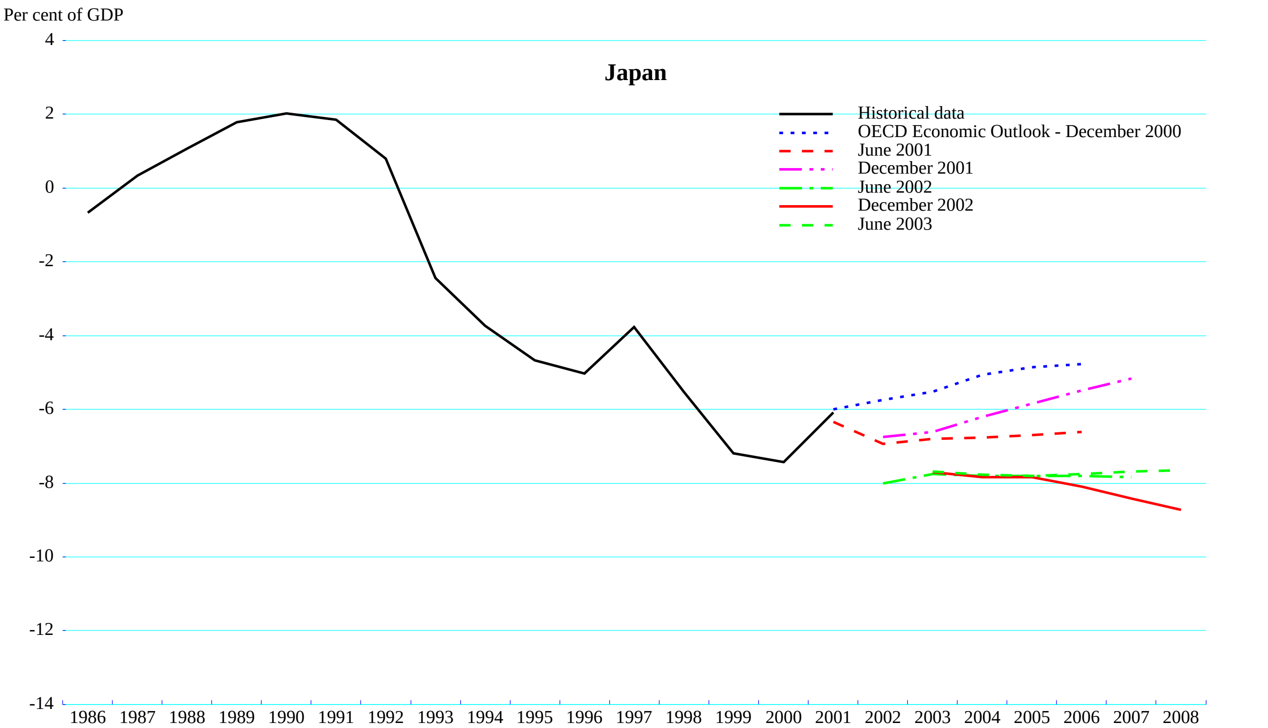
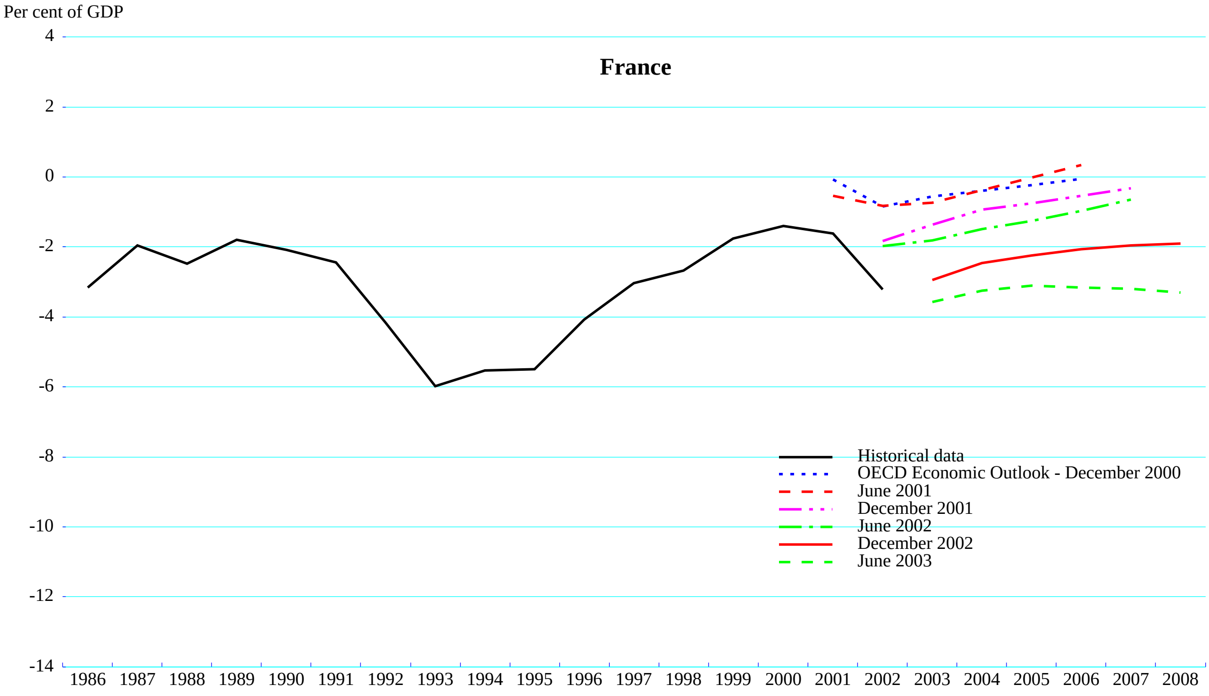
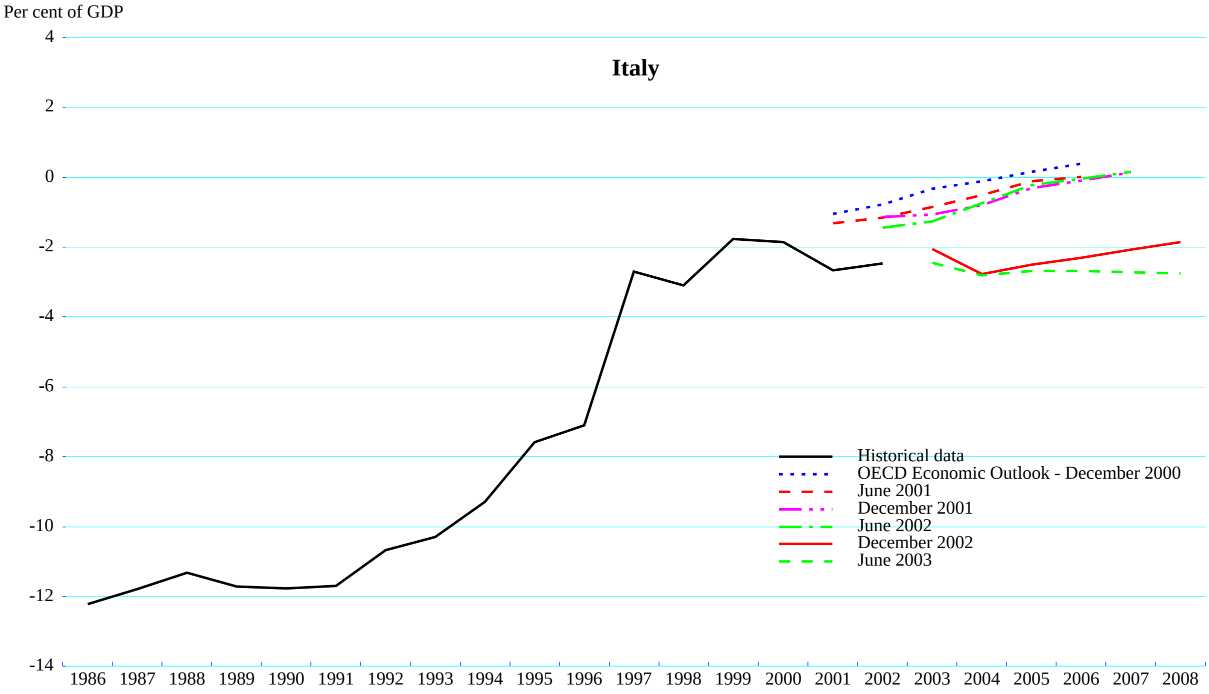


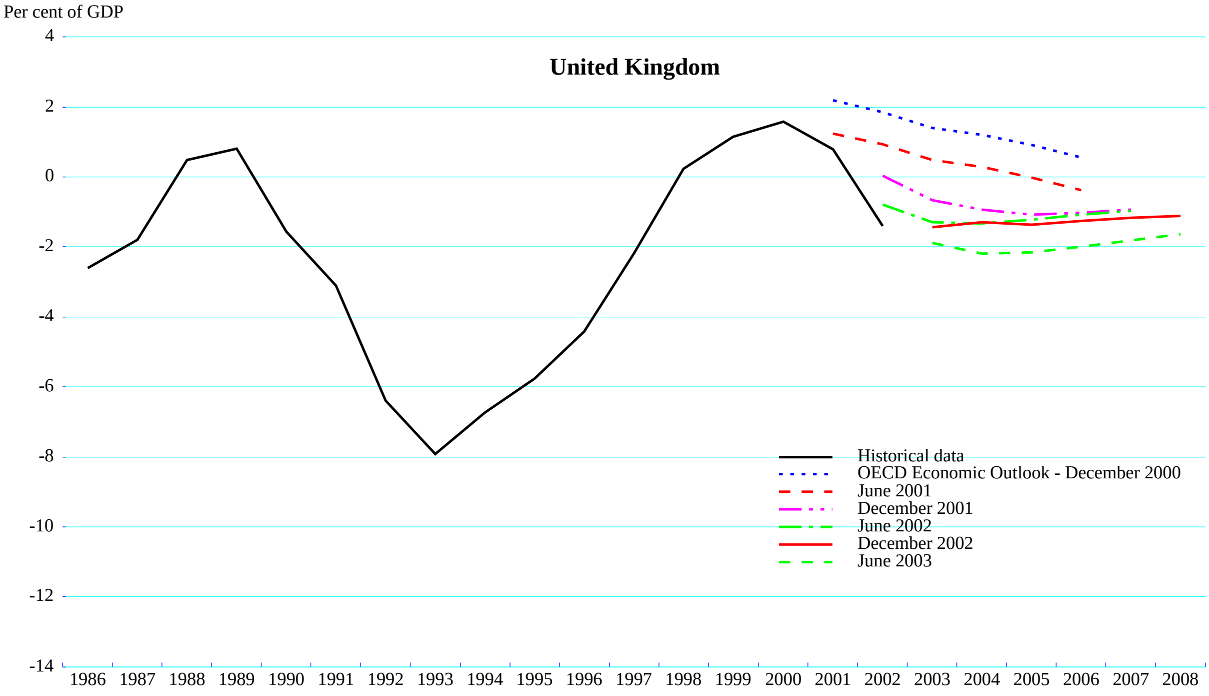
Figure 8(cont.) Government fiscal positions

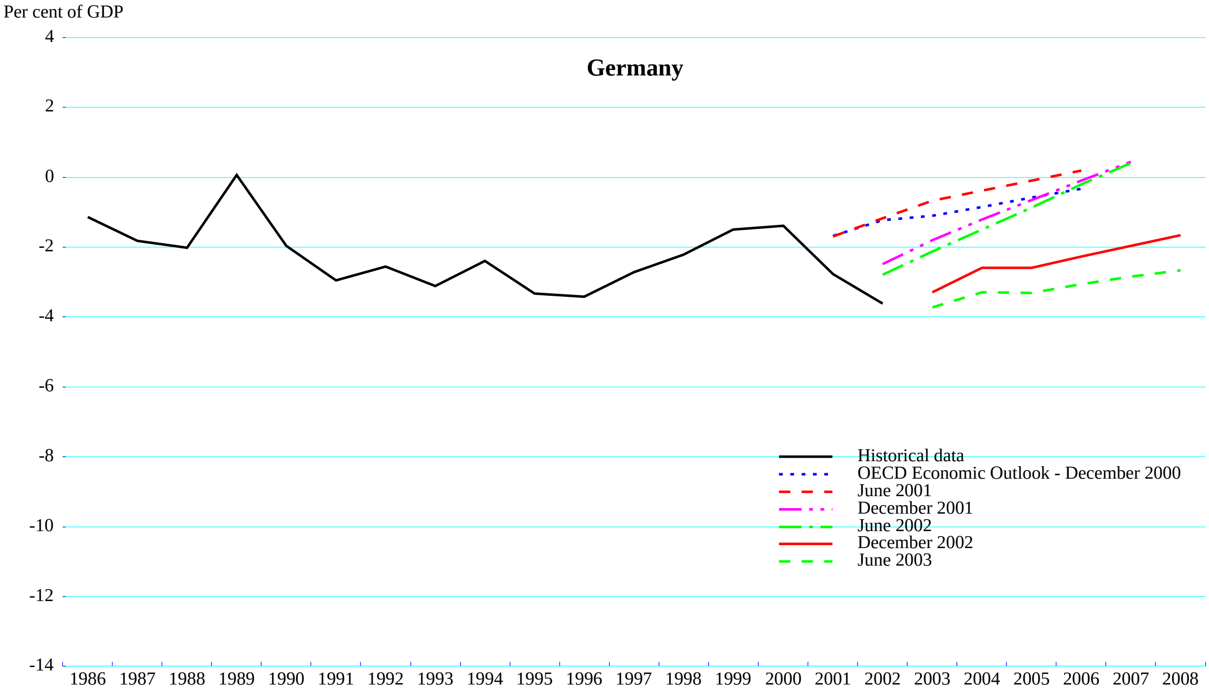




Note : Fiscal balance excludes one-off revenue from the sale of third generation mobile phone licences: for France it concerns the years 2001 and 2002; for Italy 2000.
Source: OECD.

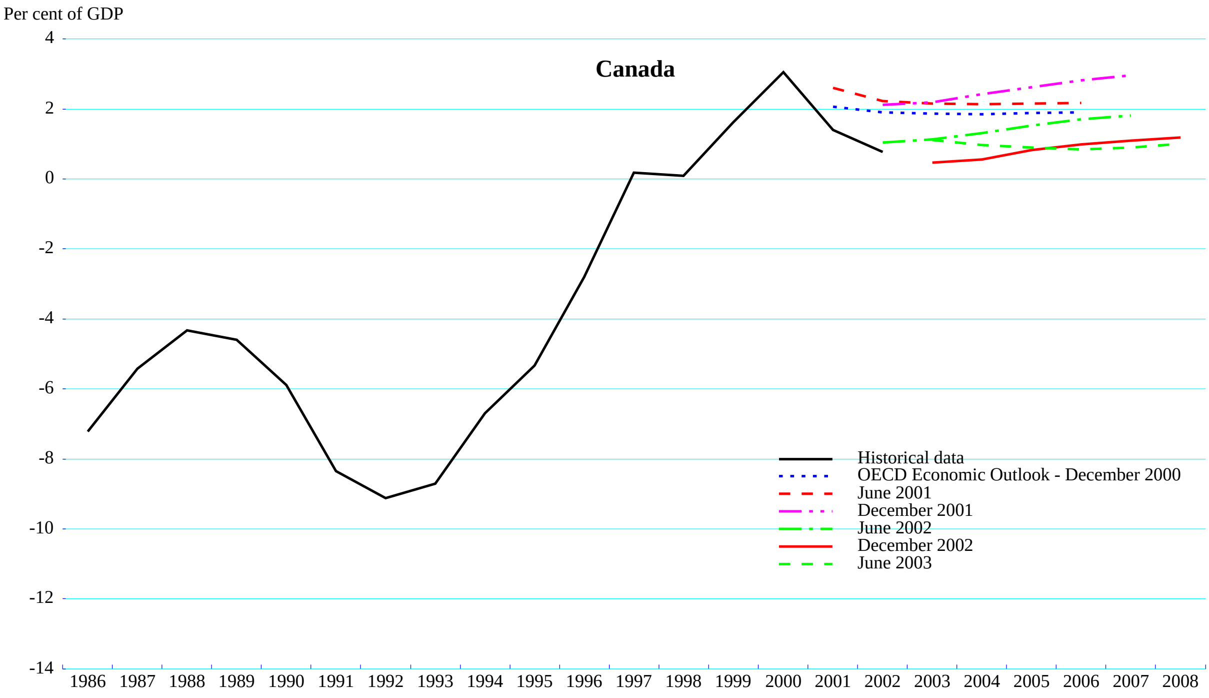
Figure 8(cont.) Government fiscal positions





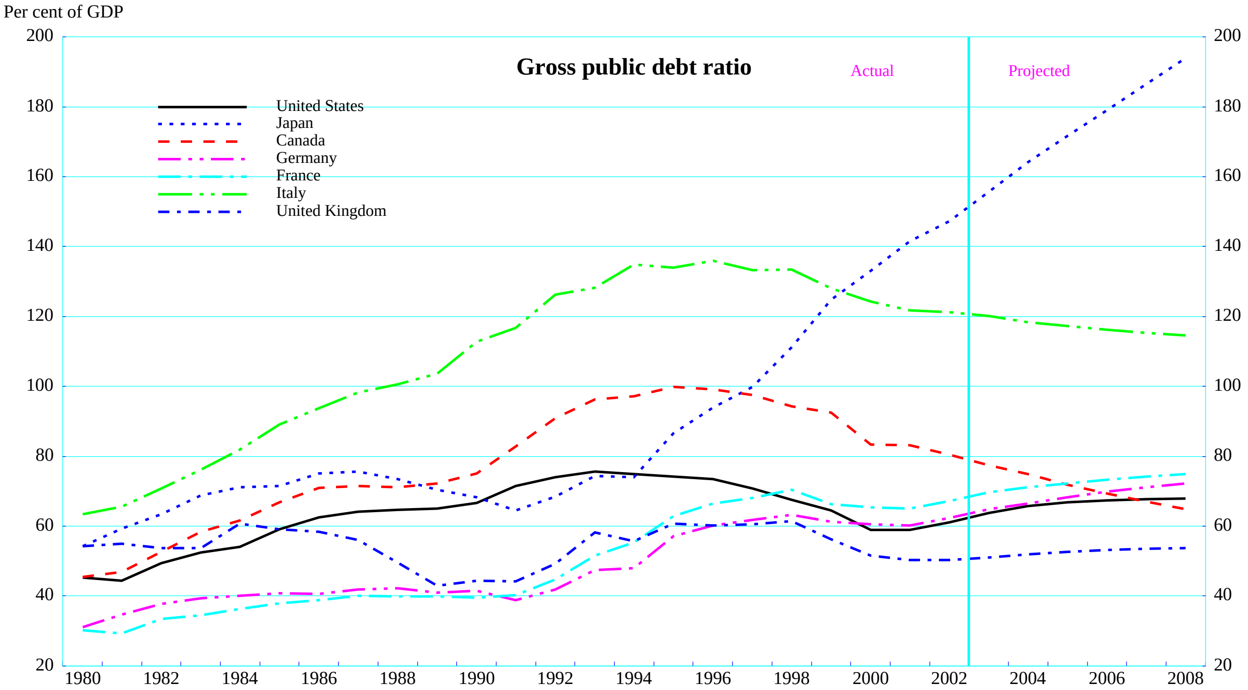
Note : Fiscal balance excludes one-off revenue from the sale of third generation mobile phone licences: for the United Kingdom and Germany it concerns the year 2000.
Source: OECD.

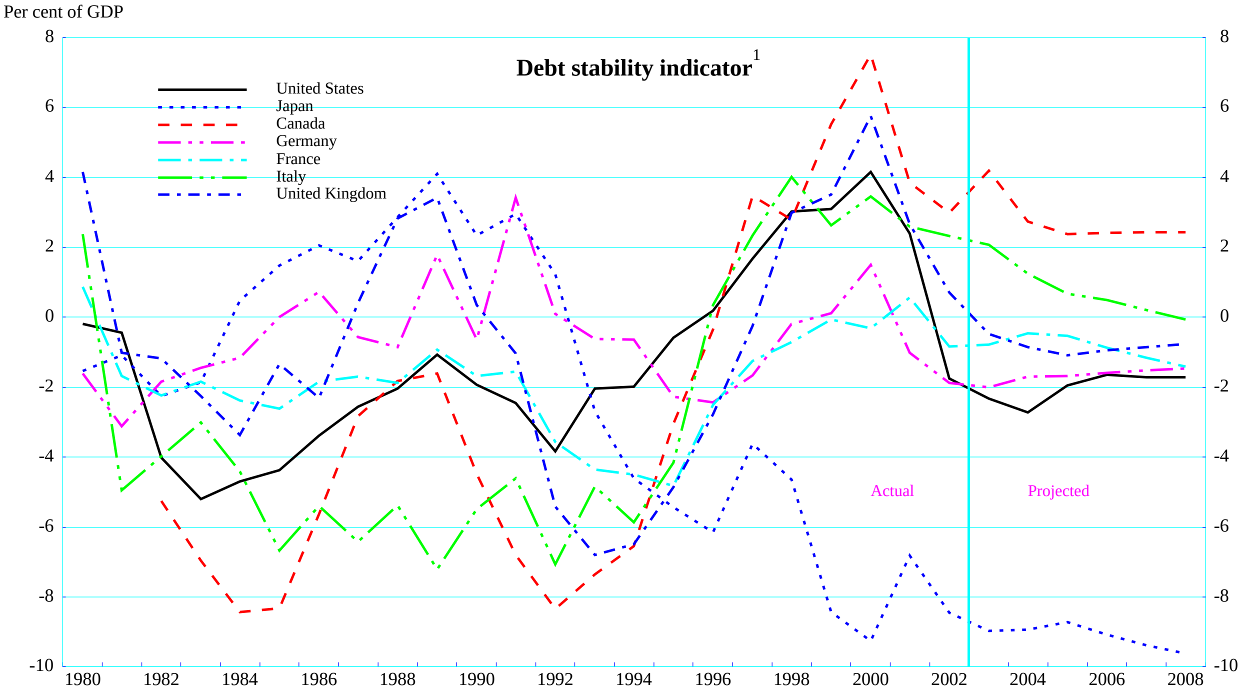
Figure 8(cont.) Government fiscal positions



Source: OECD.

Figure 9. Measures of fiscal sustainability



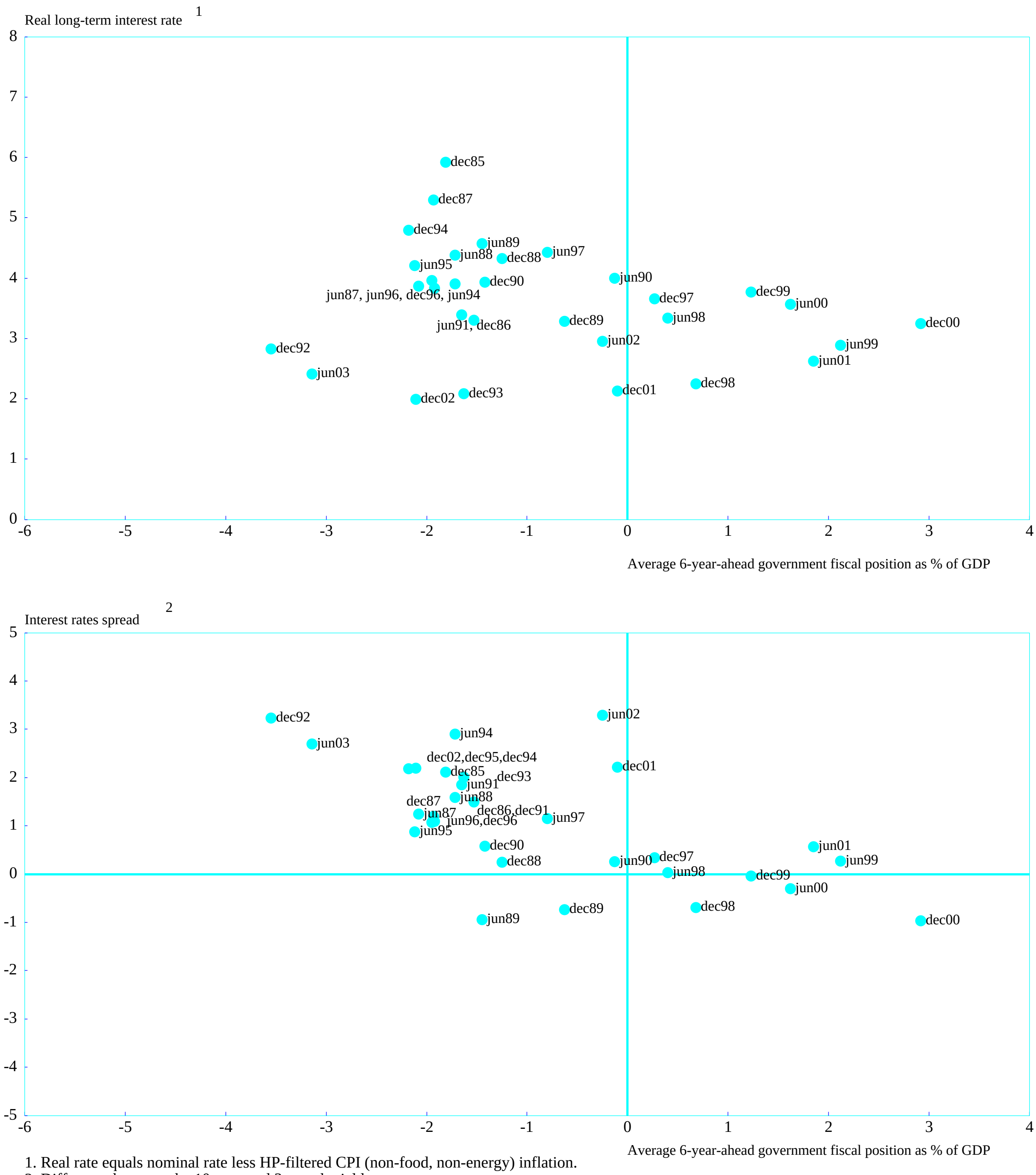


1. The debt stability indicator represents the difference between the actual primary balance and the primary balance needed to stabilise the debt ratio. Projections are based on OECD Economic Outlook no.73 (June 2003).

Source : OECD.

Figure 10. Projected fiscal position and interest rates spread

United States



1. Real rate equals nominal rate less HP-filtered CPI (non-food, non-energy) inflation.
2. Difference between the 10-year and 3-month yield.
Source : OECD.

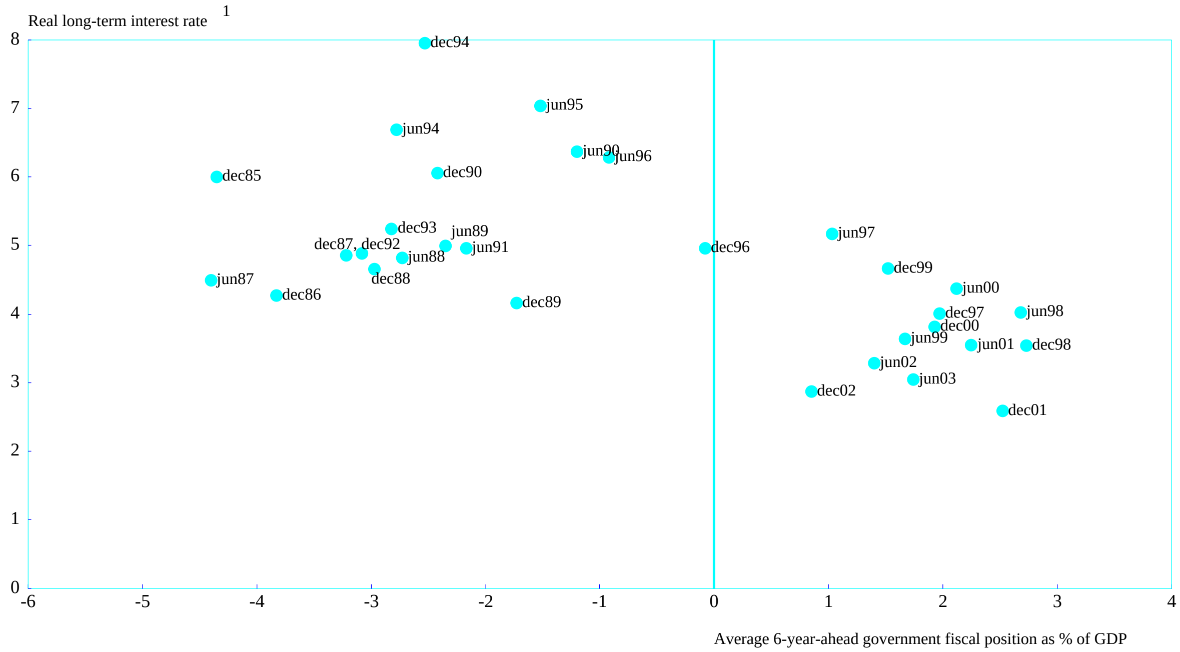
Figure 10 (cont.) Projected fiscal position and interest rates spread

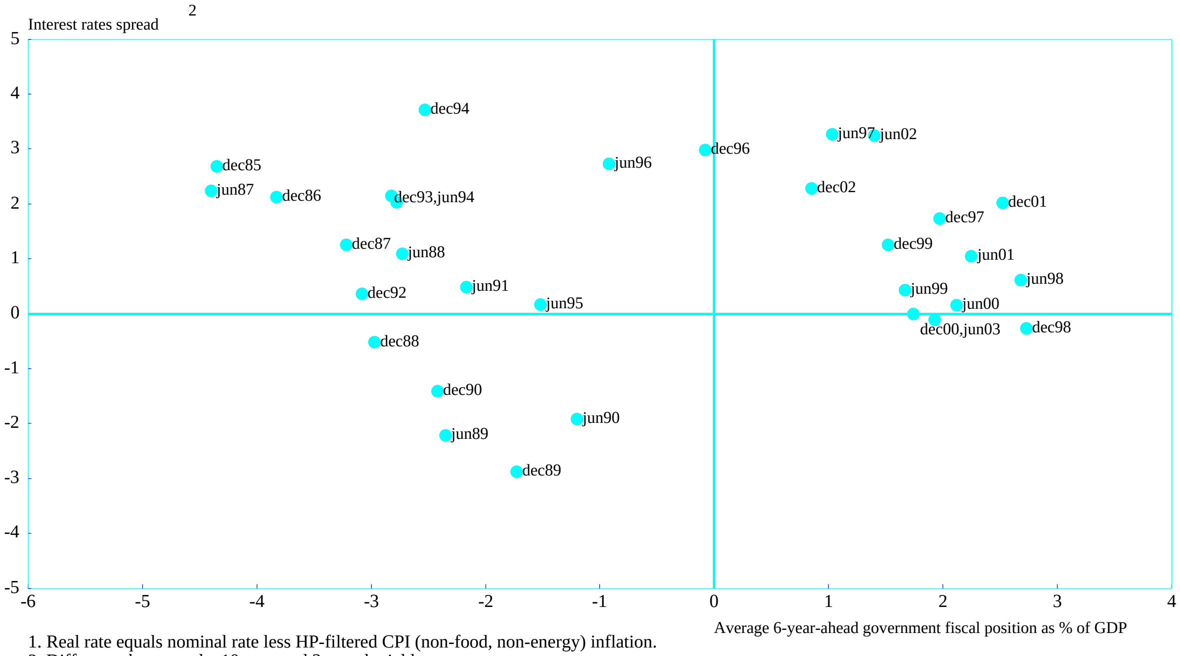
United Kingdom

1. Real rate equals nominal rate less HP-filtered CPI (non-food, non-energy) inflation.
2. Difference between the 10-year and 3-month yield.
Source : OECD.

Figure 10 (cont.) Projected fiscal position and interest rates spread

Canada

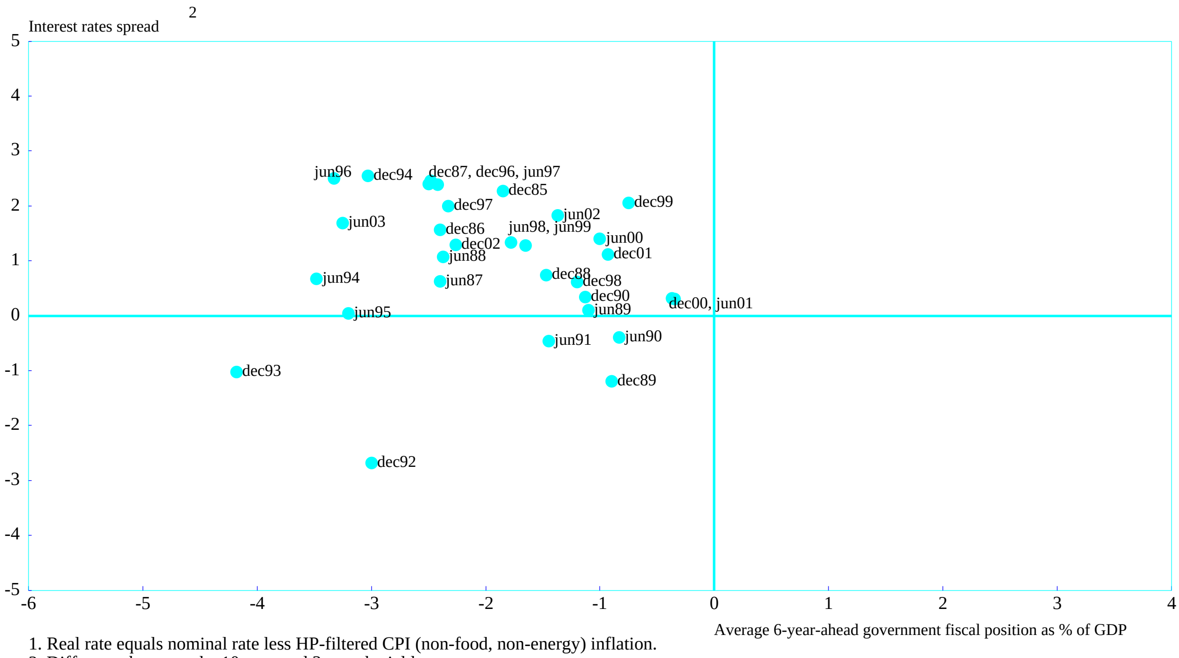




1. Real rate equals nominal rate less HP-filtered CPI (non-food, non-energy) inflation.
2. Difference between the 10-year and 3-month yield.
Source : OECD.

Figure 10 (cont.) Projected fiscal position and interest rates spread

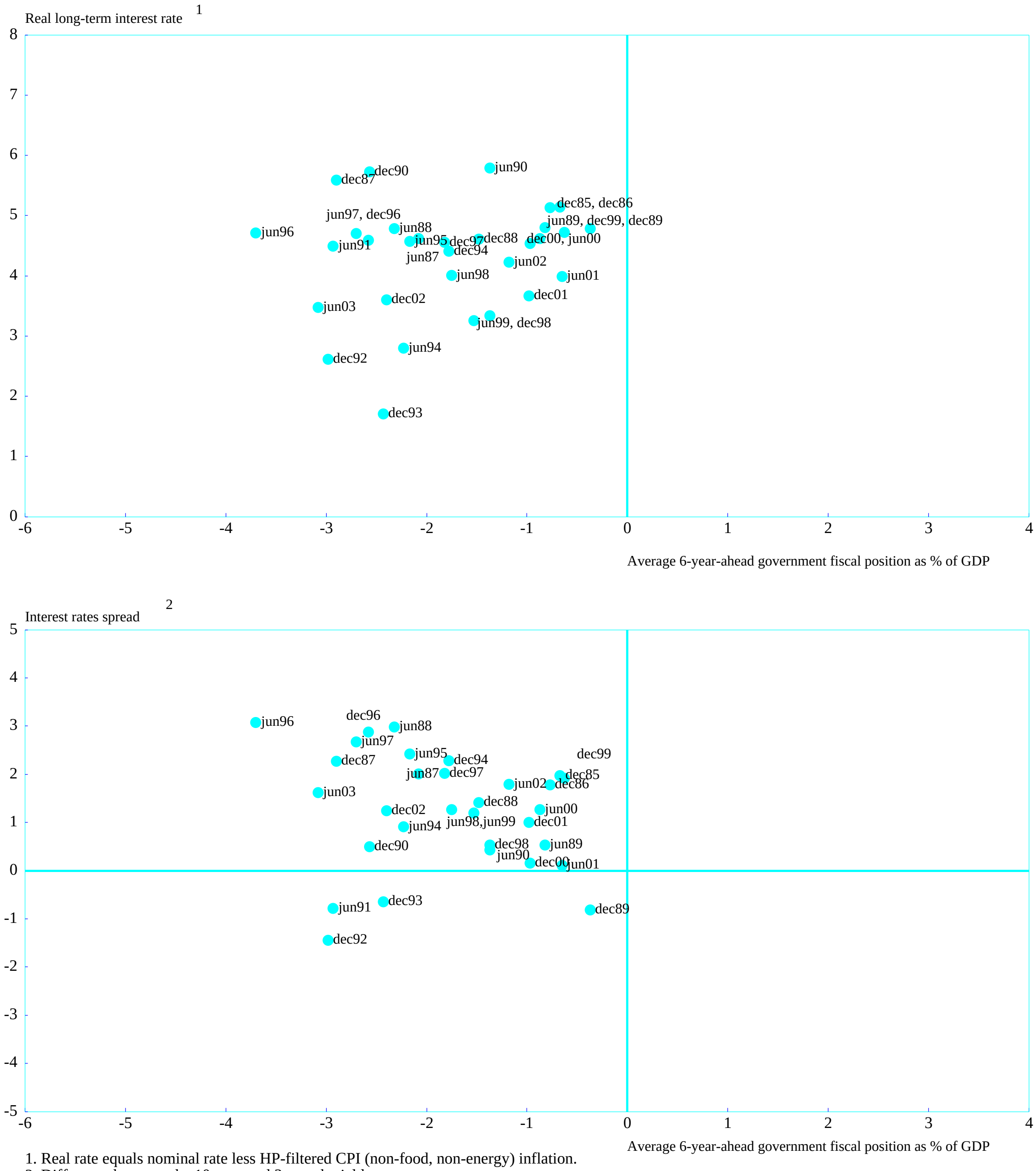
France



1. Real rate equals nominal rate less HP-filtered CPI (non-food, non-energy) inflation.
2. Difference between the 10-year and 3-month yield.
Source : OECD.

Figure 10 (cont.) Projected fiscal position and interest rates spread

Germany



1. Real rate equals nominal rate less HP-filtered CPI (non-food, non-energy) inflation.
2. Difference between the 10-year and 3-month yield.
Source : OECD.

Figure 10 (cont.) Projected fiscal position and interest rates spread

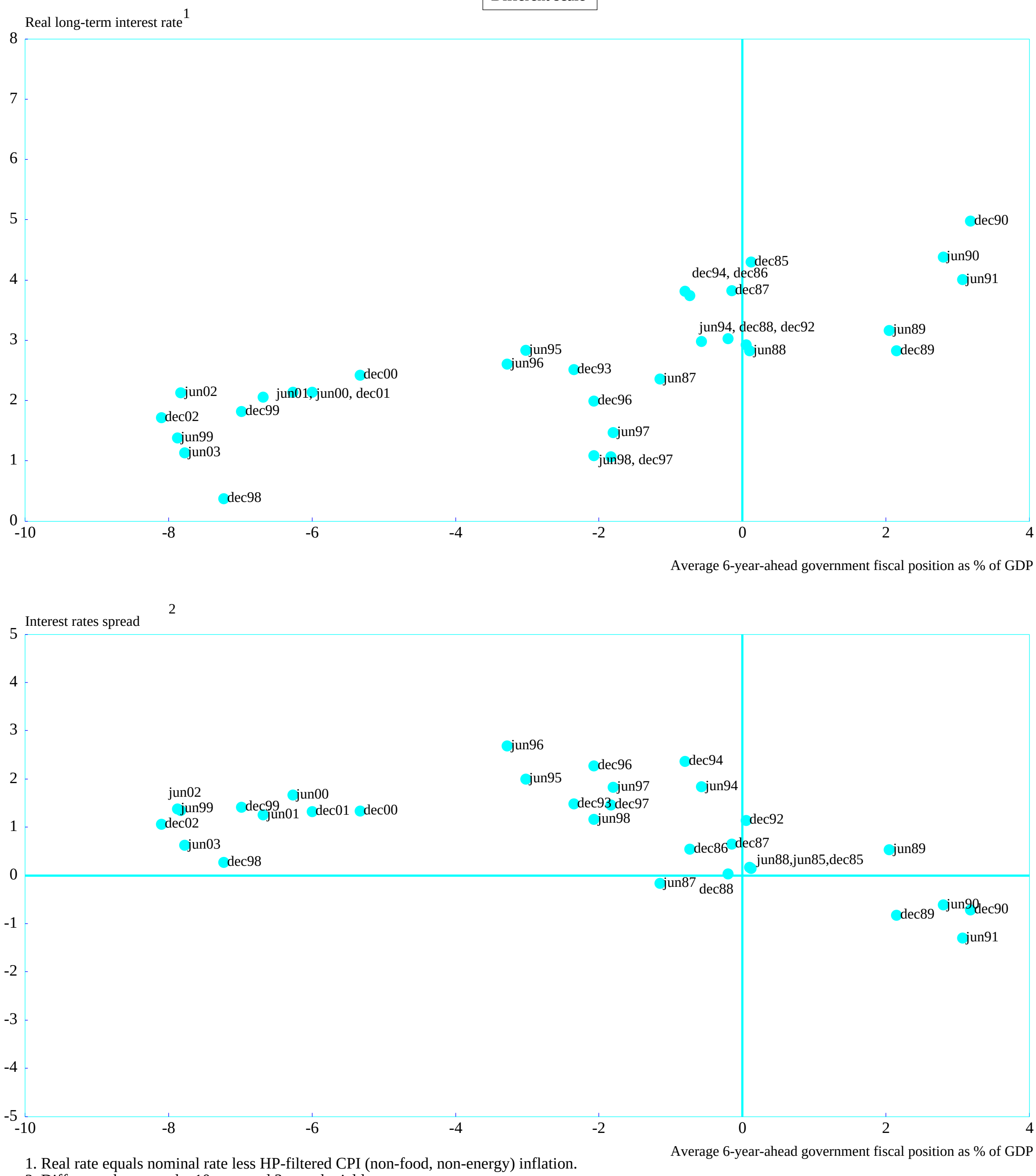
Italy

1. Real rate equals nominal rate less HP-filtered CPI (non-food, non-energy) inflation.
2. Difference between the 10-year and 3-month yield.
Source : OECD.

Figure 10 (cont.) Projected fiscal position and interest rates spread

Japan

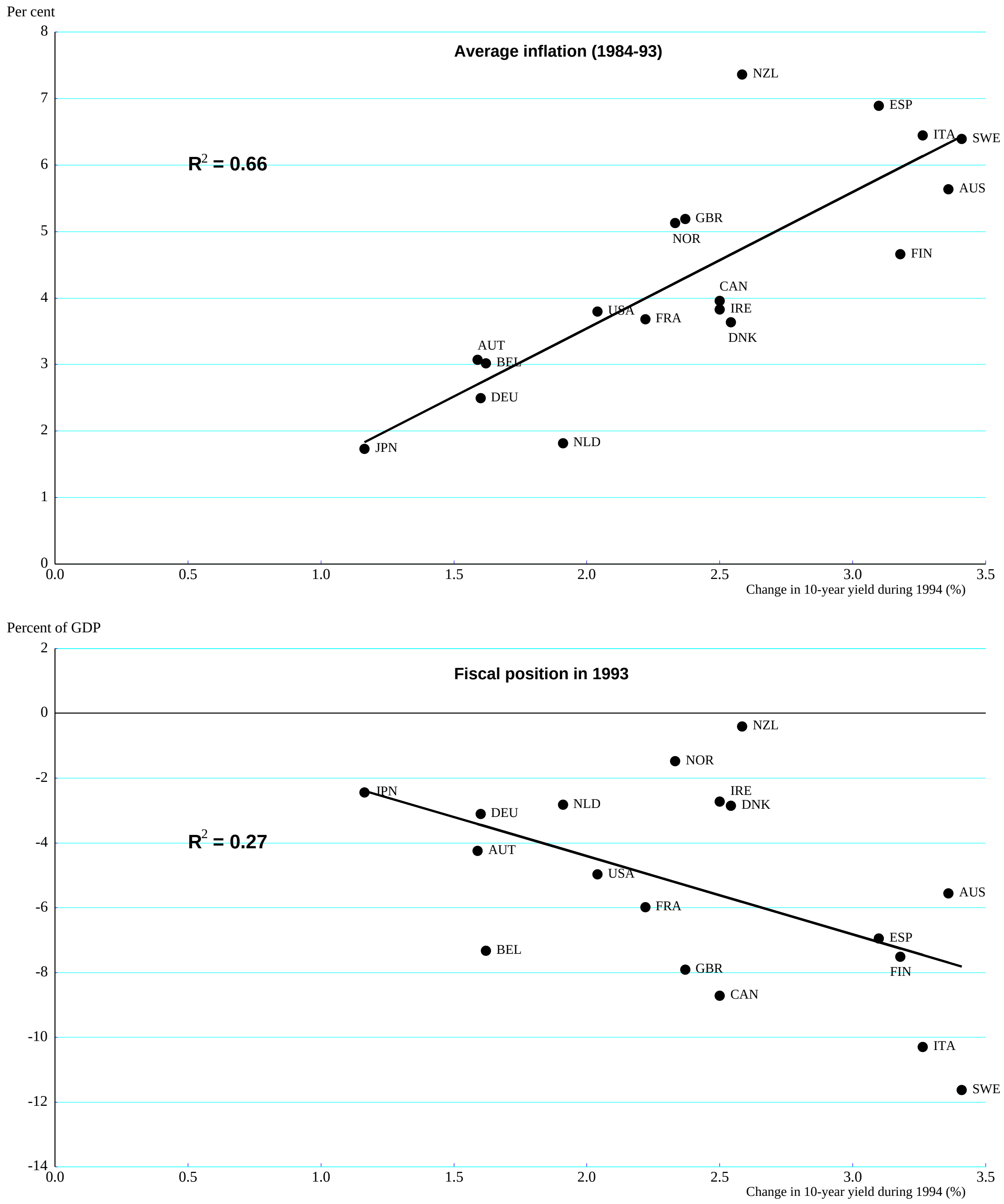
Different scale



1. Real rate equals nominal rate less HP-filtered CPI (non-food, non-energy) inflation.
2. Difference between the 10-year and 3-month yield.
Source : OECD.

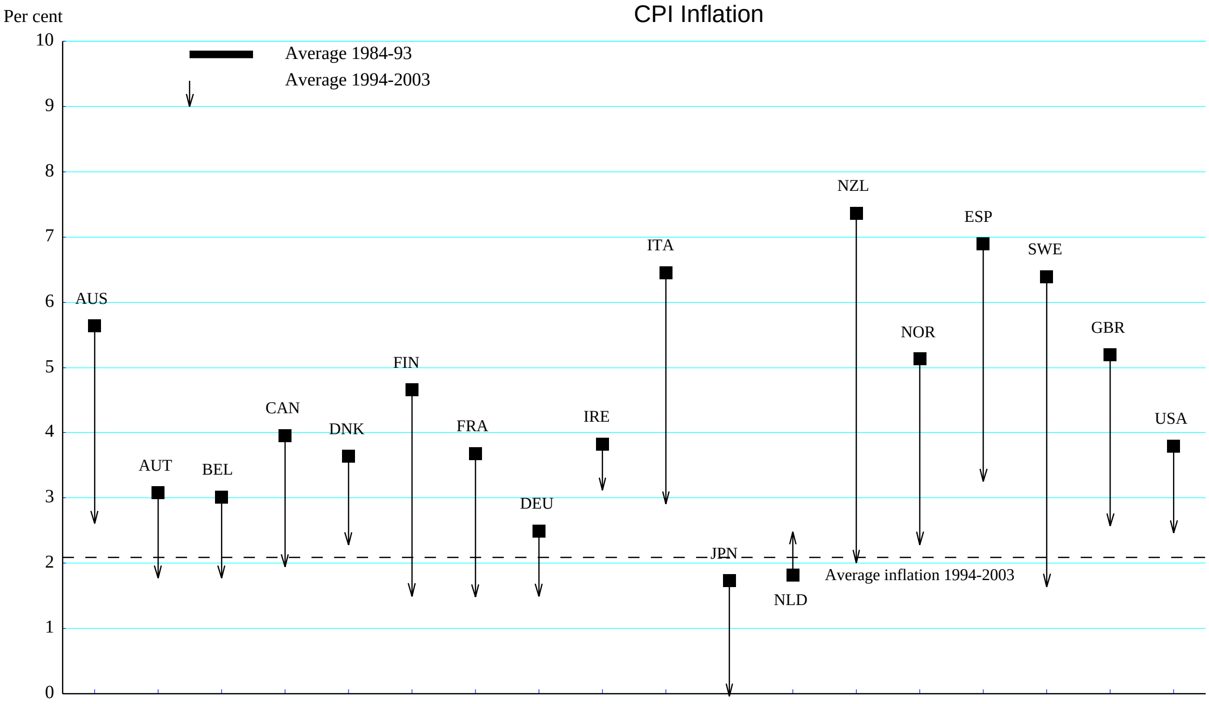
Figure 11. Bond yield increase (during 1994) vs possible determinants

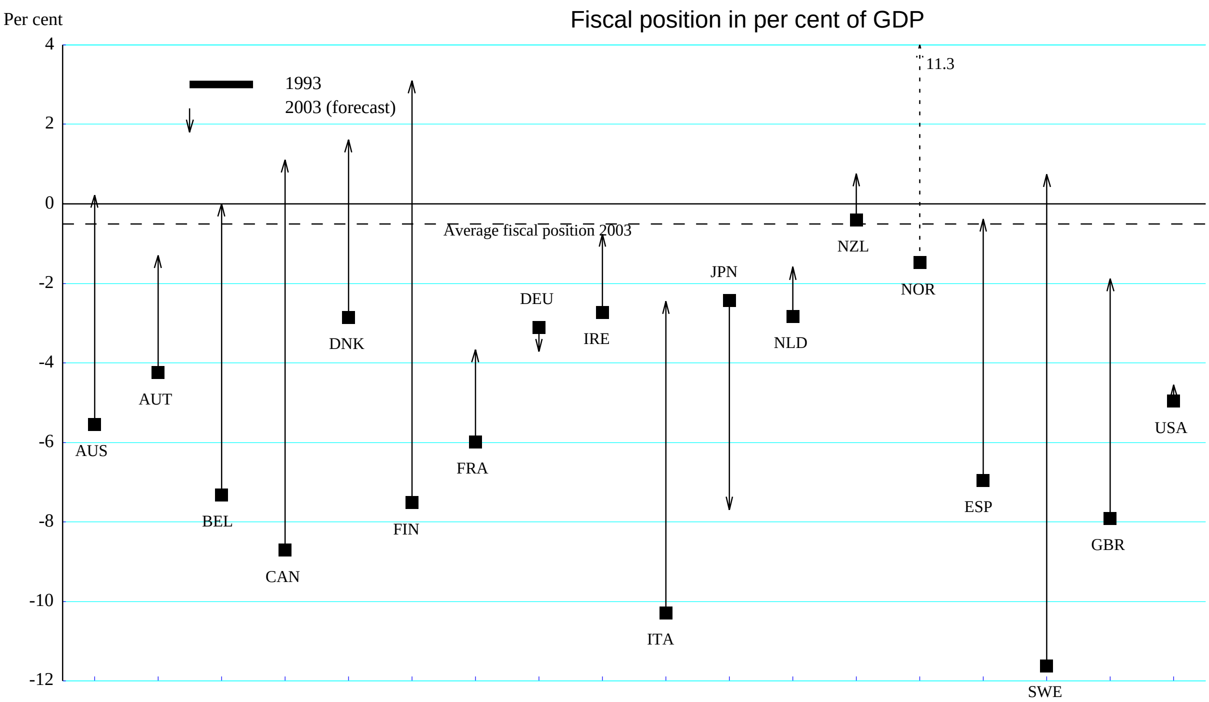
(Historical inflation and budget deficit)



Source: OECD.

Figure 12. Different starting position

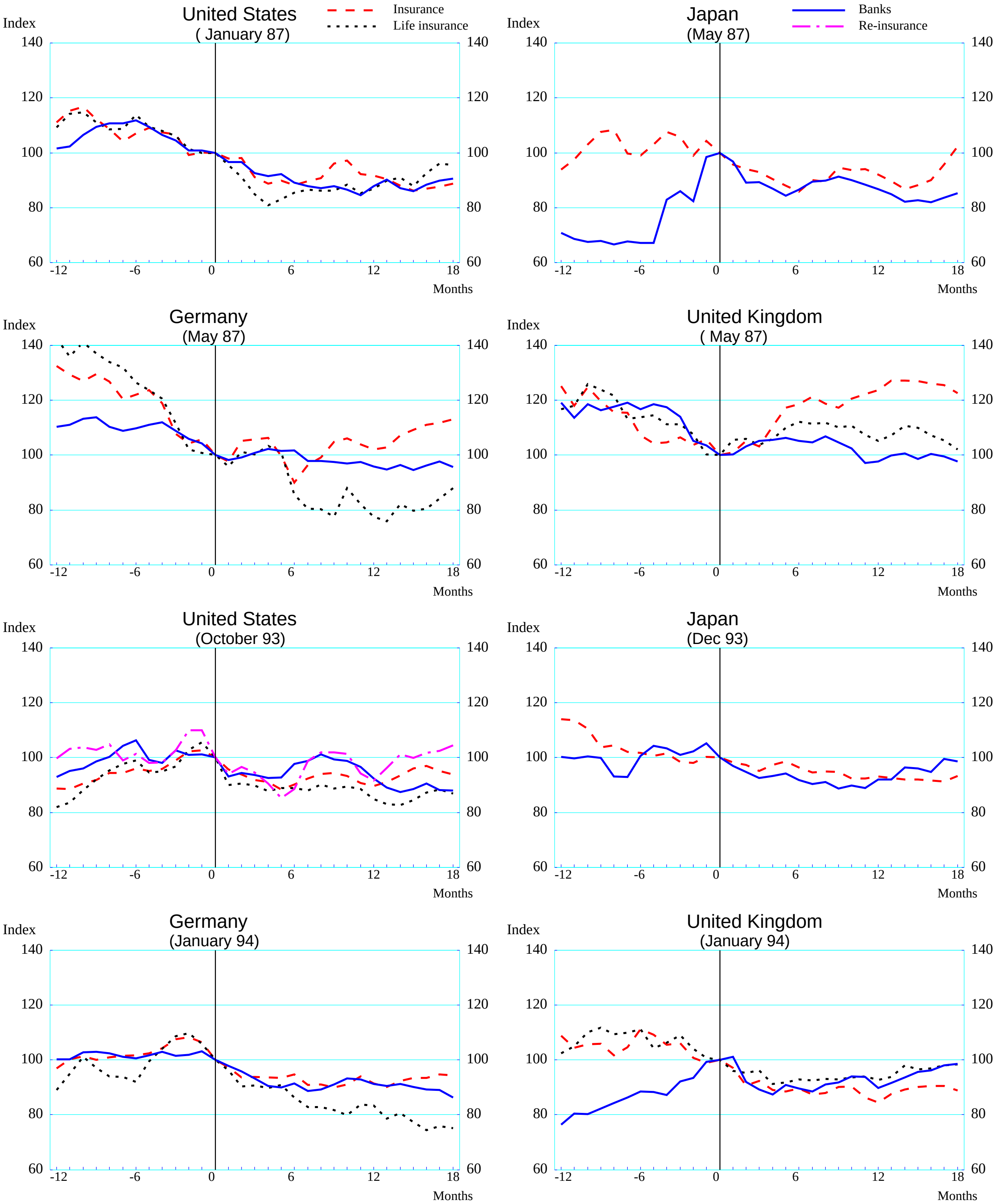




Source: OECD.

Figure 13. Share subsectors indices relative to total market compared

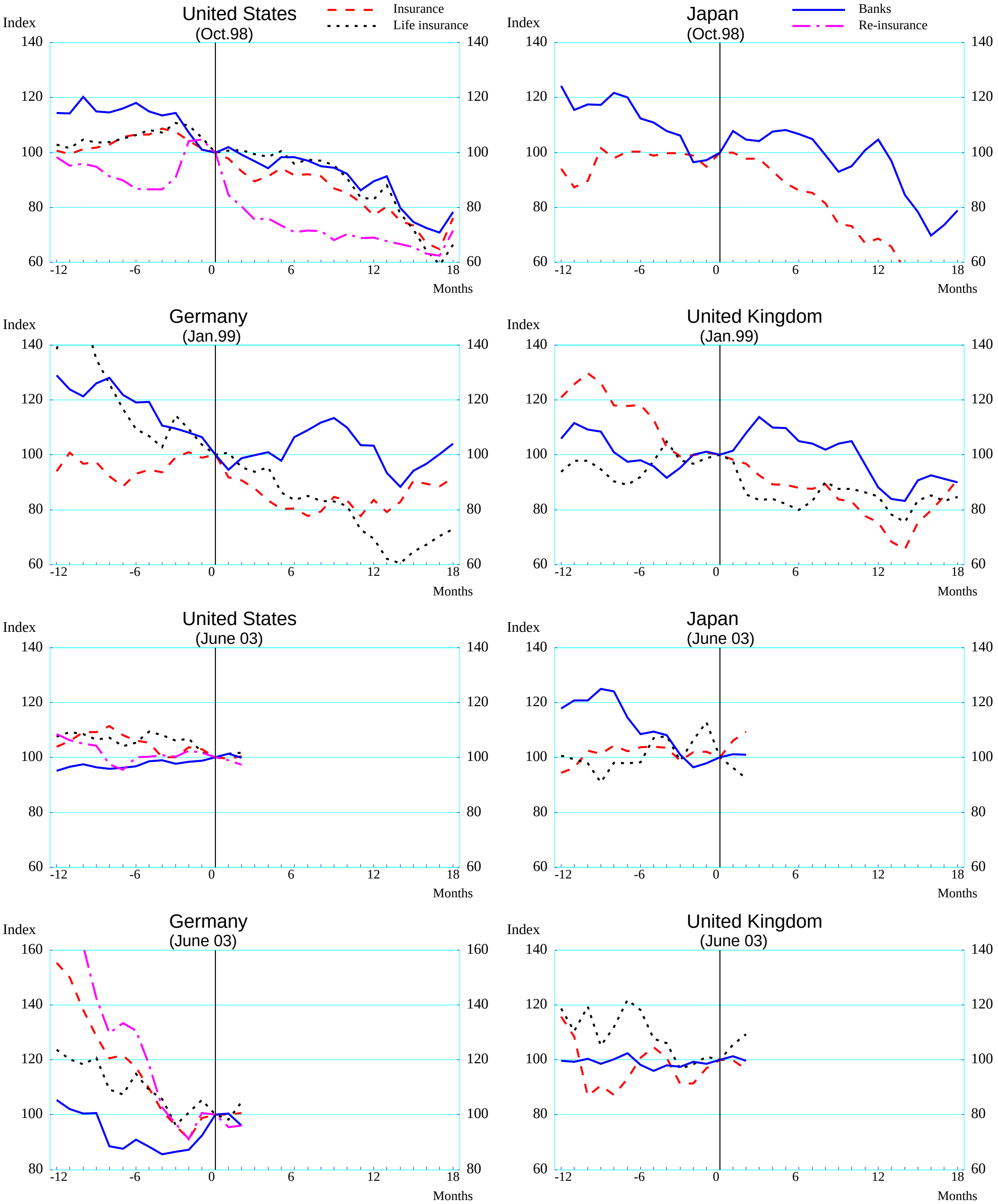
Indices rebased to 100 at month zero



Note: Dates in parentheses correspond to the months in which 10-year bond yields reached their lowest points.
Sources: OECD, Datastream.

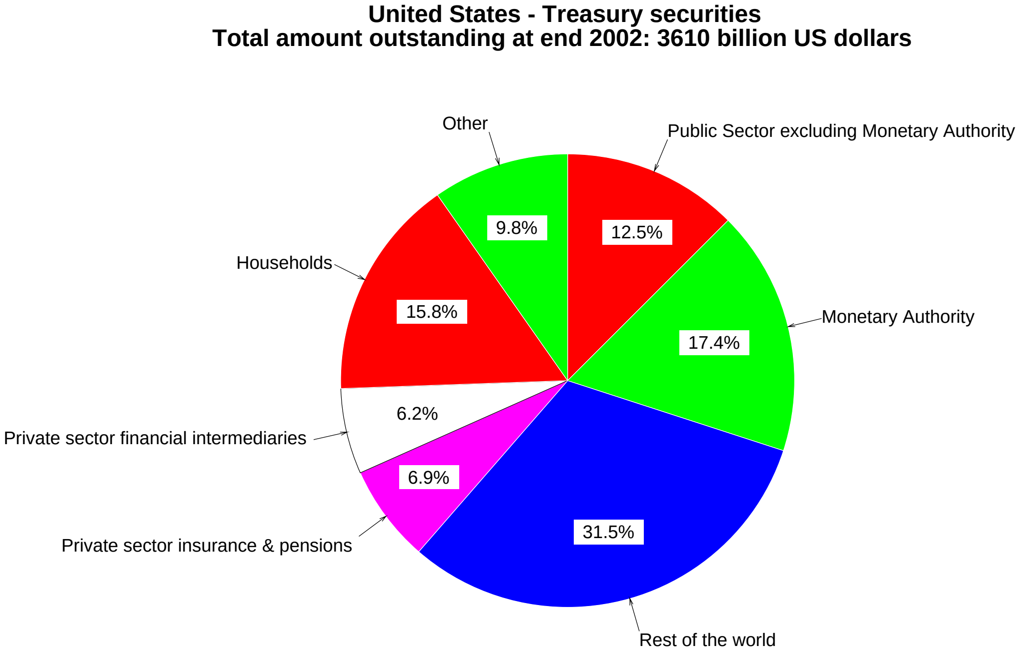
Figure 13 (cont.) Share subsectors indices relative to total market compared

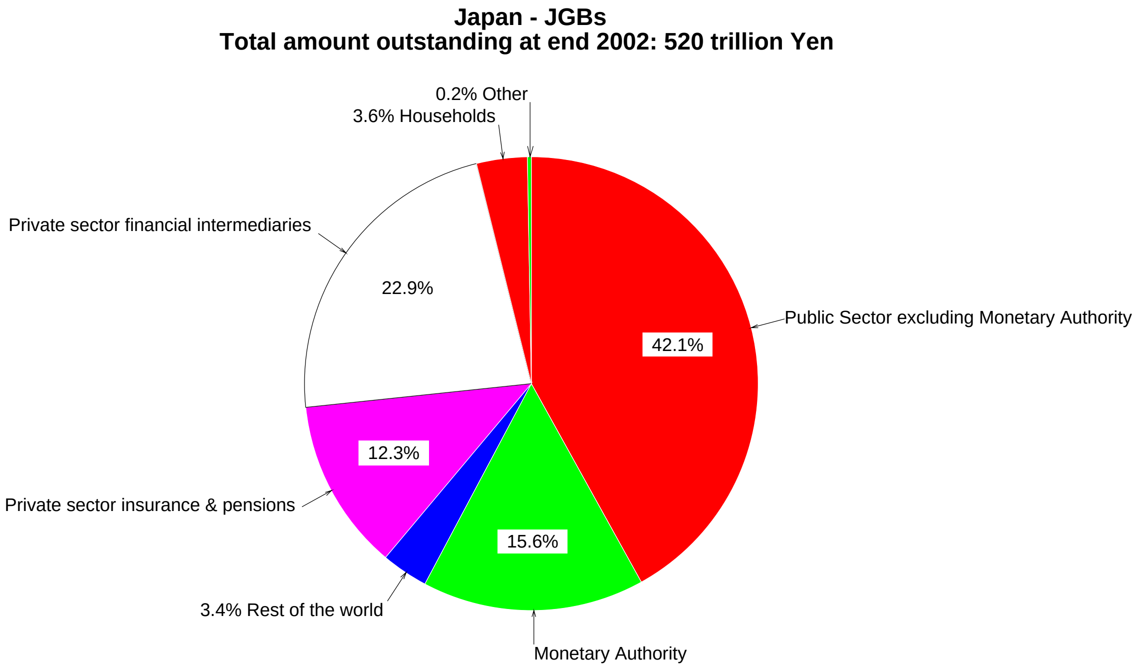
Indices rebased to 100 at month zero



Note: Dates in parentheses correspond to the months in which 10-year bond yields reached their lowest points.
Sources: OECD, Datastream.

Figure 14. Holdings of domestically-issued government bonds

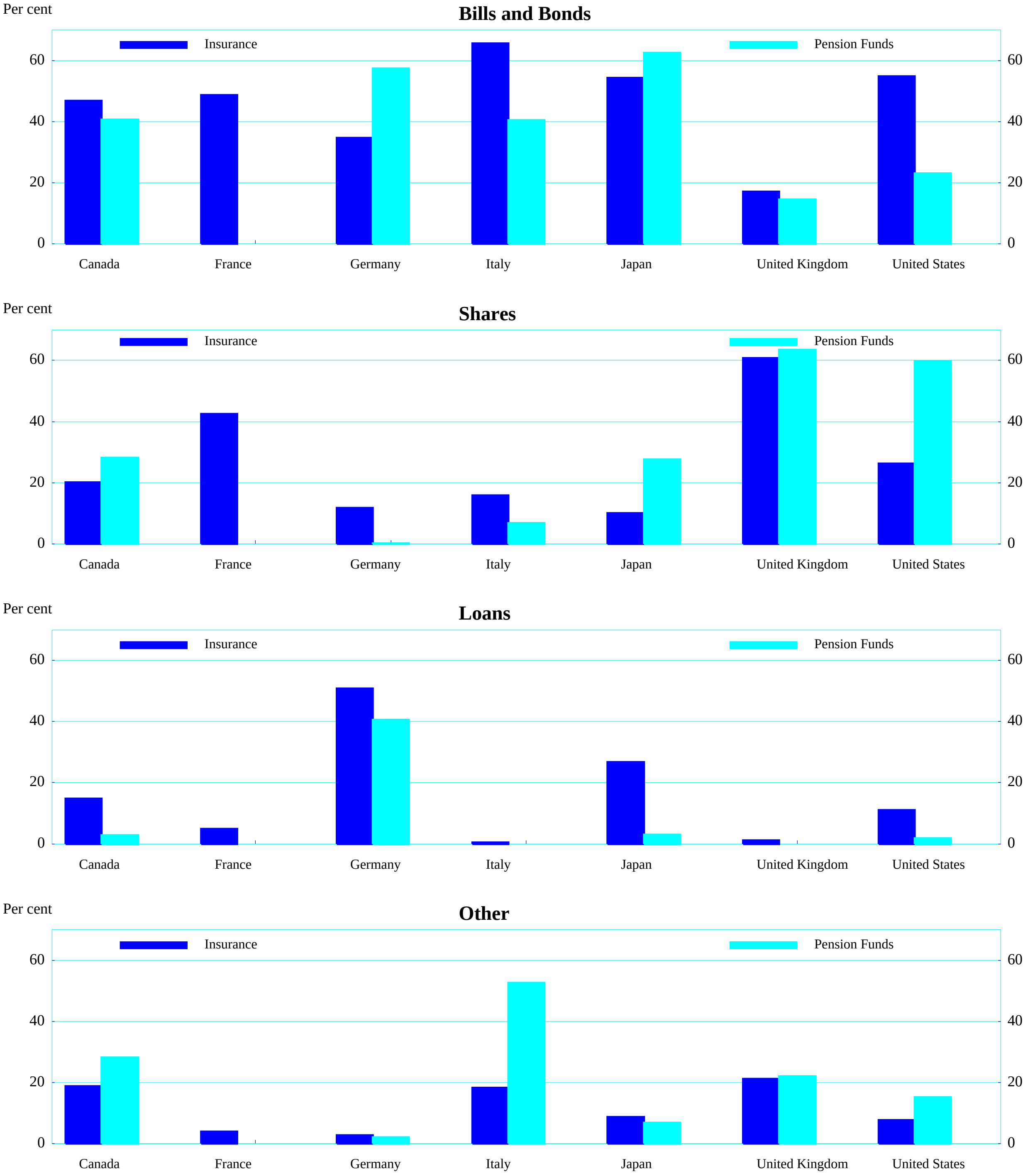




Notes:
For the US, the public sector comprises 7.6% state and local governments and 4.9% state and local government retirement funds.
For Japan, the public sector can be further subdivided into: 12.7% Fiscal Loan Fund; 12.9% postal savings; 9.0% postal insurance; 7.1% social security fund; 0.3% government financial institutions.
For Japan the household sector includes private not-for-profit institutions
For the US, the 'other' category includes mutual funds (7.6%)
Sources: Flow of Funds, Federal Reserve and Flow of Funds, BoJ.

Figure 15. Composition of financial assets in the insurance and pension fund sectors

Cross country comparison



Notes: All amounts outstanding at end of 2001 (provisional data).
Numbers are as a percentage of total financial assets. For most countries for which the data are available, non-financial assets are relatively small. (Other than in Italy, where around 36% of total assets are non-financial.)
For Italy most of the 'other' category comprises cash and deposits. For France, no data are available on the composition of pension fund assets.
Source: Preliminary data from draft 2003 OECD Institutional Investors Statistical Yearbook (forthcoming).

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