

1. Overview: a sell-off in global bond markets

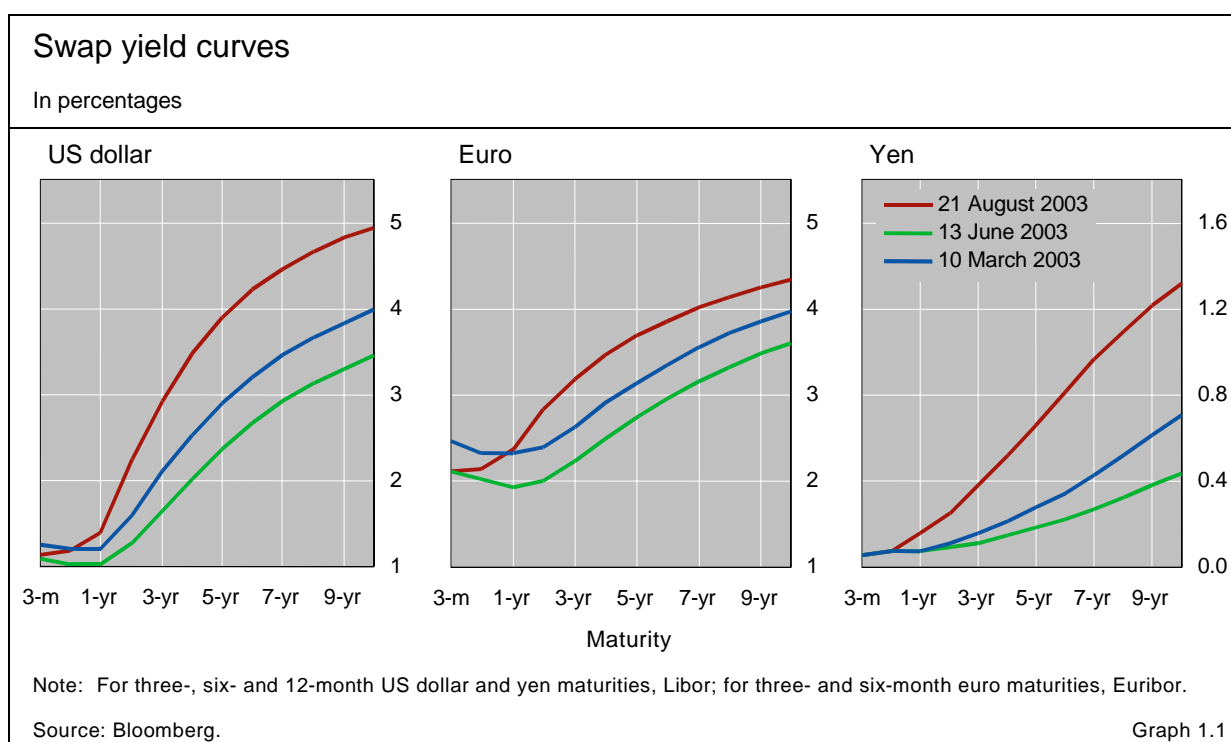
In late June and July, global bond markets suffered their largest sell-off since 1994. US dollar, yen and euro yields all increased sharply – dollar yields by as much as 140 basis points. The rise in part reflected upward revisions in bond investors' expectations about global growth prospects. An additional factor behind the rise appears to have been a change in bond investors' assessment of the likelihood of unconventional policy measures by the US Federal Reserve.

In the US dollar market, the backup in yields was exacerbated by the hedging activities of holders of mortgage-backed securities (MBSs). As yields rose, the flow of mortgage refinancing started to dry up, and investors found themselves holding MBS portfolios with durations exceeding their targets. To return to their duration targets, many investors turned to the interest rate swap market, where their demand for the fixed payment side of the contracts contributed to a doubling of swap spreads.

Spillovers to credit and equity markets were for the most part limited. Although high-yield and emerging market spreads widened as the search for yield abated, volatility in government bond and swap markets did not trigger a general sell-off in credit markets. The picture was similar in equity markets. In fact, the Tokyo equity market rallied as bond yields rose. Valuations for banks and most other financial institutions kept pace with changes in broad market indices, suggesting that equity investors were not concerned about the impact of higher yields on these institutions' balance sheets.

Unusual dynamics behind the rise in yields

While investors' increased optimism about global economic growth played an important role in recent increases in yields, unusual factors also contributed at various stages. These factors included auction results, risk management mechanisms, hedging of mortgage positions and views about "unconventional measures" of monetary policy. As a result, from a low of 3.11% on 13 June, 10-year US Treasury yields jumped above 4.40% by the end of July. Over the same period, 10-year Japanese government bond (JGB) yields rose by 50 basis points to 0.93%, and German bund yields by 70 basis points to 4.19%.



The rise was most pronounced at longer maturities, leading to a sharp steepening of yield curves (Graph 1.1).

Long-term yields had not risen so sharply in such a short period since 1994. Then, over the eight weeks beginning in early February 1994, 10-year US Treasury yields surged by approximately 130 basis points, bund yields by 80 basis points and JGB yields by 35 basis points. The move was precipitated by a shift in the stance of US monetary policy, with the Federal Reserve raising its target rate by 25 basis points after a long period of low or declining rates. Although for the most part the global financial system adjusted smoothly to higher yields in 1994, some strains did emerge. The Orange County municipal investment pool, with \$7 billion in investments, failed in December 1994, and the Mexican crisis broke out later that month. In contrast to 1994, the most recent upturn in yields was not accompanied by a shift towards a more restrictive policy stance. The central banks of all the major economies continued to pursue an accommodative monetary policy.

The most recent rise in yields occurred over at least four distinct phases. During the first phase, from 13 to 24 June, the Japanese market sold off most sharply. The second phase lasted from 25 June to 14 July and saw all of the major markets sell off. The third phase, from 15 July to early August, saw dollar yields continue to rise. In the final phase, from early August to the end of the month, Japanese yields again moved up.

In the first phase, a mix of technical factors and macroeconomic news triggered a substantial rise in yen yields beginning in mid-June. A poorly received auction of 20-year JGBs on 17 June reportedly led to profit-taking by Japanese banks and selling by hedge funds. The sell-off during this first phase culminated in a 16 basis point rise in the yield on 10-year JGBs on 19 June to 0.69% (Graph 1.2). The resulting higher volatility caused those investors

The bond market
sell-off ...

... is not triggered
by tighter monetary
policy

Yen yields are the
first to bottom

relying heavily on quantitative risk management techniques, such as value-at-risk models, to breach limits and unwind their positions. This unwinding exacerbated price dynamics in the JGB market. Such volatility was expected to persist; the implied volatility of JGB futures increased by a factor of one half in the first phase, while it rose much more gently in the euro and dollar markets.

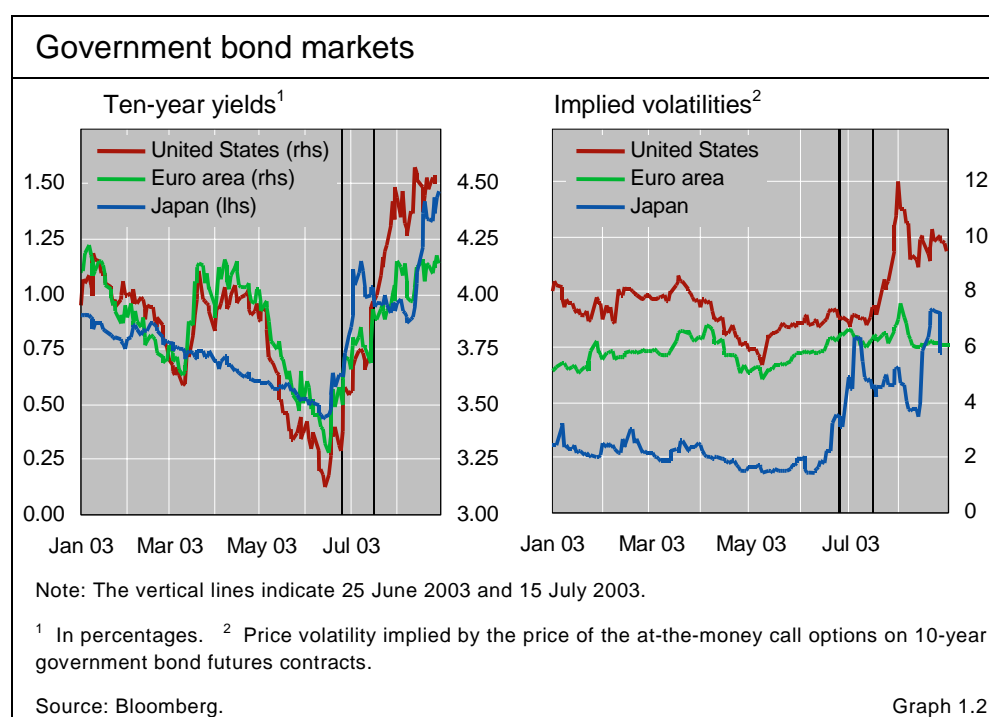
Interestingly, foreign rather than domestic macroeconomic news appears to have influenced the moves in JGB yields during this phase. Better than expected US macroeconomic data during the week of 16–20 June, in particular the Empire State Manufacturing Survey and the consumer inflation report, were cited as factors contributing to the rise in Japanese yields. US data also put upward pressure on dollar yields during this period.

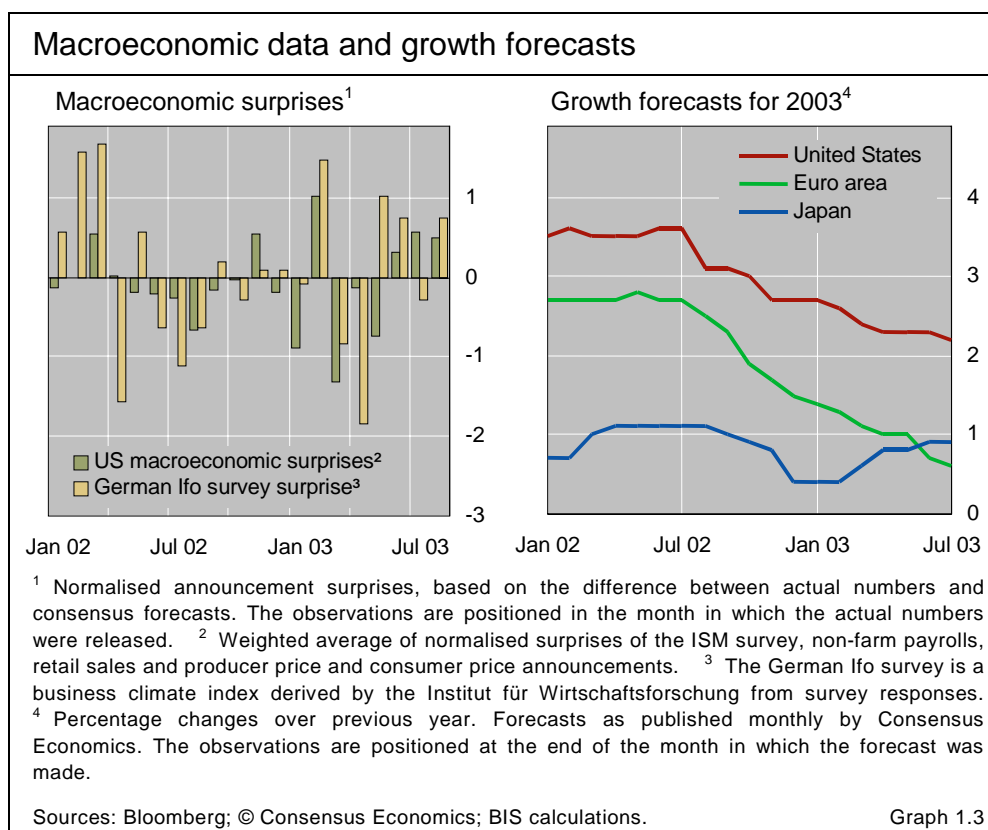
In the second phase, the US Federal Reserve's decision on 25 June to cut its target rate by 25 basis points rather than the anticipated 50 basis points triggered a further increase in yields. The decision was interpreted by market participants as signalling that the Fed was unlikely to implement unconventional policy measures in the near future. In particular, it changed perceptions about the likelihood of Fed purchases of US Treasury securities to hold long-term rates down, the possibility of which had buoyed the US Treasury market after the Fed's policy meeting in May. Yields on 10-year Treasury securities rose by 30 basis points over the two days following the rate cut. Euro and yen yields followed with a few days' lag.

Market participants' response to the Fed's decision was amplified by developments in Japan. Sales of US Treasuries and other foreign securities by Japanese banks exceeded purchases by an outsized \$25 billion in July. In addition, the size and suddenness of the rise in yields and volatility in the yen market are likely to have sensitised investors to the possibility of such a move in other major markets.

"Unconventional measures" appear less likely

Feedback from the yen market





Though better than expected growth was frequently cited as a reason for the upturn in global yields, macroeconomic releases were not unambiguously positive for either the United States or Europe. Indeed, economists' growth forecasts for 2003 were not revised upwards during June and July (Graph 1.3). The mixed economic data suggest that the fixed income markets in the United States responded asymmetrically to US economic news, shrugging off negative reports. For instance, on 29 July yields rose despite much weaker than expected consumer confidence numbers. In any event, the economic readings seemed to exert less influence on yields than concerns about Federal Reserve actions and mortgage hedging (see below).

Only in Japan were the economic indicators clearly bullish. The climb in yen yields gained considerable momentum after the announcement of a better than expected *Tankan* survey on 1 July. They rose again following a poorly subscribed 10-year bond auction on 3 July. Intraday volatility was most extreme in the JGB market on 4 July, when the 10-year yield hit 1.4% during the day before falling back to close at 1.05%.

Policy changes by the Japanese authorities appear to have played a major role in restoring stability to the yen market in the second phase. In the days following 4 July, the Ministry of Finance announced a series of measures intended to reduce volatility in the JGB market, including the introduction of pre-auction trading and repurchases of five-year JGBs. In addition, observers highlighted the decision by the Bank of Japan in May to switch from mark to market to amortised cost in accounting for its own holdings of JGBs, which was viewed as a signal of the Bank's willingness to increase the pace of its outright purchases of JGBs if necessary. This contributed to the stabilisation of the yen

Economic data not a major surprise ...

... with the exception of Japan

Temporary stabilisation of the yen market

Renewed selling of
Treasuries in mid-
July ...

market, and the correlation between daily percentage changes in JGB yields and bund and Treasury yields weakened considerably after 15 July.

Bond markets entered a third phase of selling following the Federal Reserve Chairman's semiannual monetary policy report to Congress on 15 July. The report and subsequent testimony were interpreted by market participants as confirmation that the Fed was less likely to implement unconventional policy actions than they had previously thought. The report judged that situations requiring unconventional actions were unlikely to arise, noting both that monetary policy could be eased further through conventional tools if necessary, and that signs of a recovery were emerging. Dollar yields rose immediately following this report, with 10-year US Treasury yields moving up by 20 basis points on 15 July and by a further 55 basis points by the end of month. Moreover, the implied volatility of Treasury futures soared during the last two weeks of July. Market factors unique to the United States, in particular mortgage hedging activity, contributed importantly to this phase of the sell-off (see below).

Euro yields continued to track US yields during this third phase, although not as closely as during the second phase. Bund yields rose by 30 basis points during the last two weeks of July, to 3.97%. The implied volatility of bund futures also increased, albeit by much less than that of Treasury futures.

... and a mid-
August surge in
JGB yields

The yen market was seemingly unaffected by events in the dollar market during the third phase. However, the sell-off in Japan resumed in August. In this fourth phase of the sell-off, 10-year JGB yields surged by more than 55 basis points in the three weeks to the end of August, to 1.47%. This followed better than expected economic data, in particular a robust GDP growth figure for the second quarter and a strong machinery orders report. Another factor was the widely observed reallocation of funds by overseas hedge funds and other investors from bonds into stocks on the back of renewed gains in Japanese shares. Policymakers appeared to acquiesce to the rise in rates that resulted from an improving economic outlook.

Mortgage hedging unsettles the swap market

The feedback
effects of mortgage
hedging ...

The size and structure of the mortgage securities market distinguish fixed income markets in the United States from markets elsewhere. While volatility in US fixed income markets remained more or less stable following the initial jump in yields, mortgage hedging contributed to a change in market dynamics following the renewed rise on 15 July. The surge in long-term yields abruptly lengthened the duration of US mortgage-backed securities (MBSs), which in turn intensified efforts by holders of such securities to adjust their interest rate hedges (see the box on page 6). The duration of Lehman's mortgage index lengthened from 0.5 years in mid-June to 1.8 years in mid-July and to over three years by early August. It added 0.4 years on 15 July alone. Efforts to hedge this duration extension appear to have had broader and deeper feedback effects on US financial markets than during past episodes of rising yields. This is probably due to the increase in size, both in absolute and relative terms, of the market for MBSs.

Impact of mortgage securities hedging on US financial markets

One of the characteristics of contemporary financial markets is that risk management systems aimed at reducing the volatility of the earnings or capital of individual institutions can at times increase the volatility of financial markets overall. An example prominent in the recent fixed income market sell-off was hedging related to mortgage-backed securities (MBSs). Although also a factor during the sell-off in 1994,¹ such hedging activity appears to have had a deeper and broader impact in 2003 than during past periods of volatility.

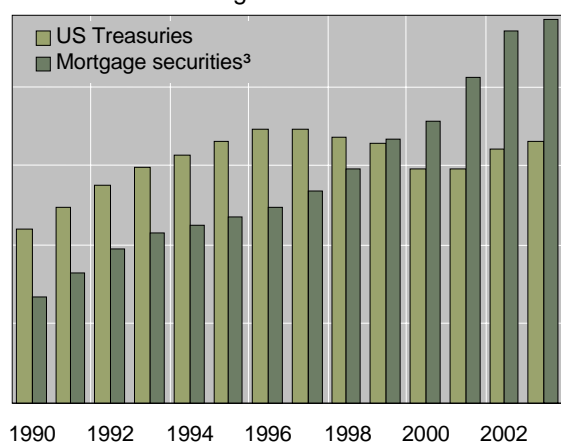
How can securitised mortgage markets increase market volatility? Owing to the prepayment risk embedded in MBSs originated in the United States – the risk that homeowners will refinance their mortgages before the stated maturity – movements in interest rates often result in significant changes in the average life, or more precisely the option-adjusted duration, of an MBS. For example, when interest rates rise, fewer homeowners will opt to refinance their mortgages, leading to an increase in the duration of MBSs. MBS investors typically manage their exposure to interest rate moves by hedging their holdings with Treasury securities, swaps or related derivatives. Continuing with the previous example, investors might hedge against an increase in interest rates by shorting Treasuries in the cash market, selling Treasury bond futures, contracting to pay the fixed leg of a swap, or buying an option granting the right to pay fixed in a swap. Changes in the duration of MBSs, therefore, can exacerbate price movements in these other markets.

The potential impact of hedging activity by MBS holders on other segments of fixed income markets has increased in recent years because of changes in the structure of mortgage and related markets. First, the sheer size of mortgage markets is a source of vulnerability. The US MBS market has doubled in size since 1995 and is now the largest fixed income market in the world: at end-March 2003, the outstanding stock of MBSs totalled \$4.9 trillion, compared to \$3.3 trillion in outstanding Treasury securities (see graph below). A sudden rebalancing by MBS holders could strain the capacity of dealers to make markets.

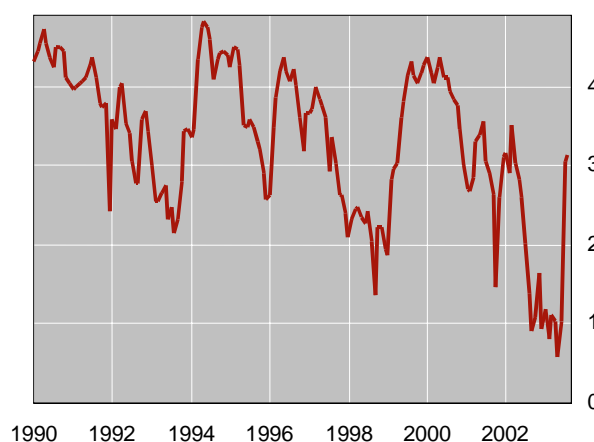
Second, the large number of refinancings since 2000 has concentrated holdings in MBSs paying similar coupons. Among the MBSs included in Lehman Brothers' US fixed rate MBS index, 70% have a coupon of between 5.5 and 6.5%. Such concentration has meant that the sensitivity of MBSs to changes in market interest rates has been similar across a large number of MBS portfolios, thereby increasing the likelihood of a sudden and common rebalancing in the event of a change in interest rates.

Third, in some ancillary markets, such as the swap market, the concentration of OTC hedging activity in a small number of dealers seems to have made these markets more vulnerable to a loss of liquidity. At times of high volatility, it is enough for one or two of these dealers to breach their risk limits and cut back on their market-making activity for the whole market to lose liquidity. Indeed, this is apparently what happened on 1 August, when the lack of liquidity caused US dollar swap spreads to spike.

Amounts outstanding¹



Duration²



¹ In trillions of US dollars. ² Modified adjusted duration of Lehman Brothers' US fixed-rate MBS index; end-month.

³ Agency and private-label MBS, plus collateralised mortgage obligations.

Sources: Bond Market Association; Lehman Brothers.

¹ See, for example, J Fernald, F Keane and P Mosser, "Mortgage security hedging and the yield curve", *Federal Reserve Bank of New York Quarterly Review*, Summer-Fall 1994.

... contribute to a spike in dollar swap spreads

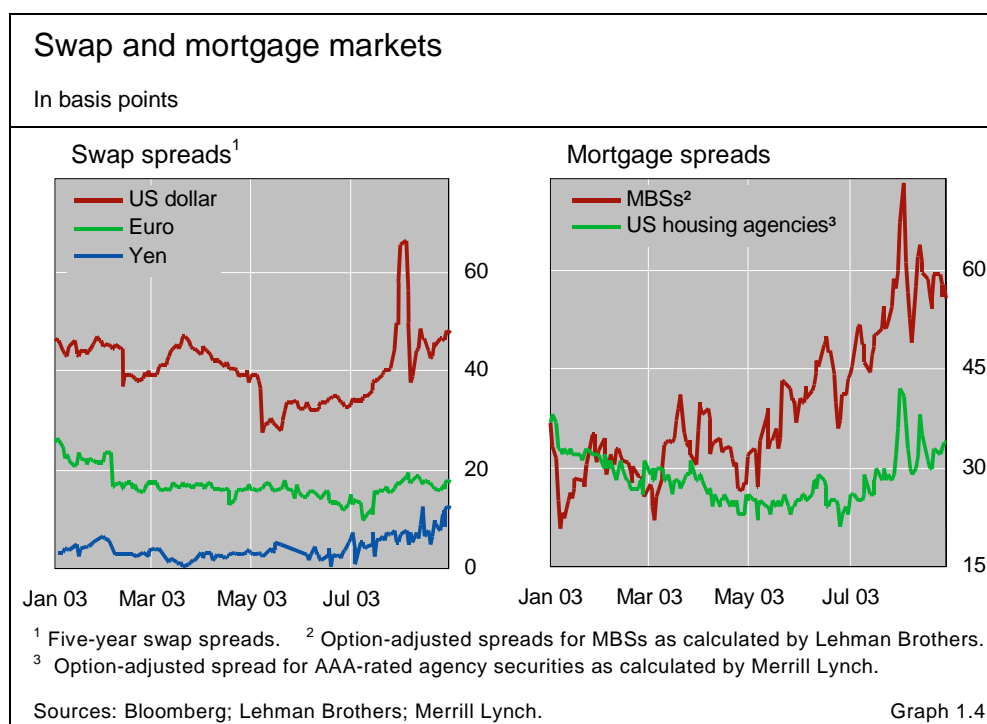
As a result of this hedging activity, spreads widened and volatility increased. The 10-year US Treasury yield jumped from 3.72% in mid-July to 4.41% at the end of July, owing in part to short sales of Treasuries by holders of MBSs seeking to reduce the duration of their portfolios. Similar trades caused dollar swap spreads to double in the last half of July, to 65 basis points (Graph 1.4). Indeed, swap markets tended to become one-sided: sell orders elicited lower prices, and lower prices in turn elicited more sell orders. Selling pressure also led to a 30 basis point increase in MBS spreads during July, to a peak of 74 basis points on 4 August.

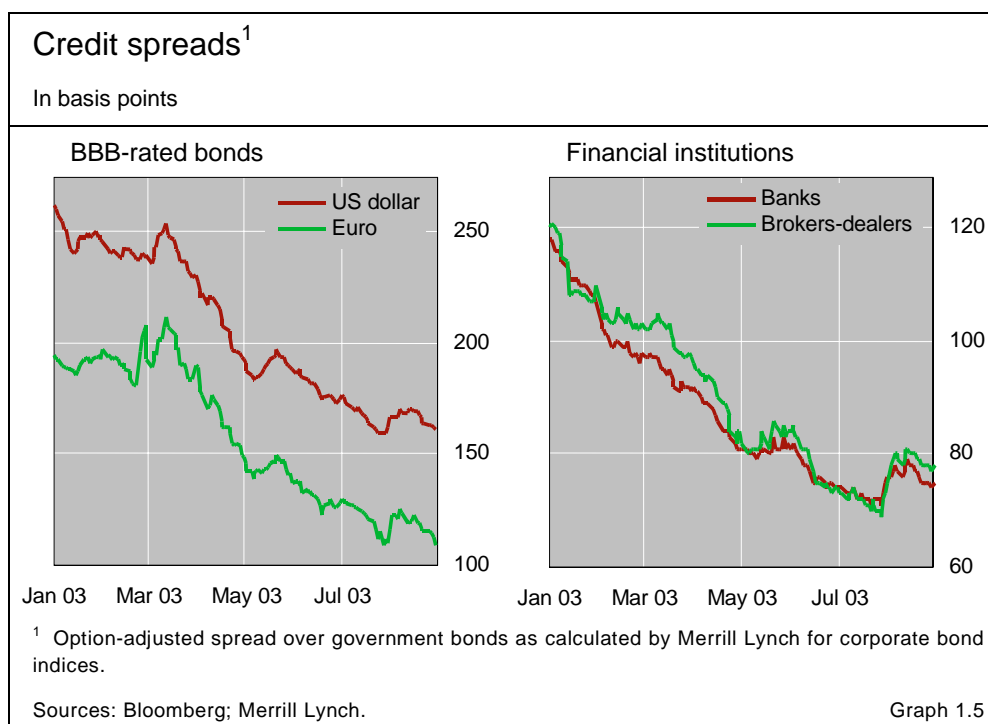
Mortgage-related markets were especially volatile in the last few days of July and the first few days of August. The widening of swap spreads had caused a number of swap dealers to breach their market risk limits, and they subsequently scaled back their activities. Given the dominance of the swap market by a few dealers, this quickly caused liquidity conditions to deteriorate. The loss of liquidity in the swap market made it more difficult to hedge MBSs, leading holders to sell, and as a result MBS spreads widened still further.

Unusually, auctions of US Treasury securities also added to volatility in early August. Announcements of auction results typically do not greatly affect yields in the Treasury market. Yet on 5 August 10-year Treasury yields rose by 10 basis points following a poorly subscribed three-year note auction. Subsequent auctions were better subscribed, pushing yields down again.

Another notable development was that credit spreads were only modestly affected by developments in the swap and mortgage markets. On some past occasions of extreme market volatility, in particular the LTCM crisis of 1998, credit spreads against Treasuries had tended to widen by at least as much as swap spreads. Spreads between corporate bonds and Treasury yields

Modest impact on credit spreads





did widen towards the end of July, indicative of some adjustment of corporate spreads to swap spreads, but the movement was limited (Graph 1.5). When measured against swaps, credit spreads actually narrowed. Credit default swaps remained more or less unchanged.

Investment grade spreads were supported by signs of an improvement in credit quality. In the second quarter of 2003, corporate earnings continued to recover, defaults declined and the ratio of credit rating upgrades to downgrades rose to its highest level since 1999. As a result, the long rally in credit markets that had begun in October 2002 continued through to the end of July. Having already fallen by 110 basis points between mid-October and early May, spreads between BBB-rated US corporate debt and US Treasuries fell by a further 25 basis points between early May and late July, to 160 basis points.

The relative lack of movement in the credit markets testifies to the technical nature of the widening of swap spreads in late July. Corporate bond investors appear to have recognised that the phenomenon was driven largely by mortgage hedging and did not reflect an increase in overall credit risk. Whereas past episodes of swap widening, such as the LTCM crisis, were accompanied by a change in perceptions of risk, spreads on default swaps on large financial institutions were virtually unchanged this time around.

One exception was the US housing agencies, Fannie Mae and Freddie Mac, which saw borrowing costs increase sharply in June and July. The housing agencies are by far the largest players in the US mortgage securities market. The revelation of accounting irregularities and assumed weaknesses in corporate governance at Freddie Mac had earlier sensitised investors and dealers to possible shortcomings in risk management at the two agencies. The suddenness and magnitude of the duration extension heightened these concerns. In late July, spreads between AAA-rated agency securities and US Treasuries jumped by 10 basis points to 40 basis points.

Swap and mortgage markets stabilise in August

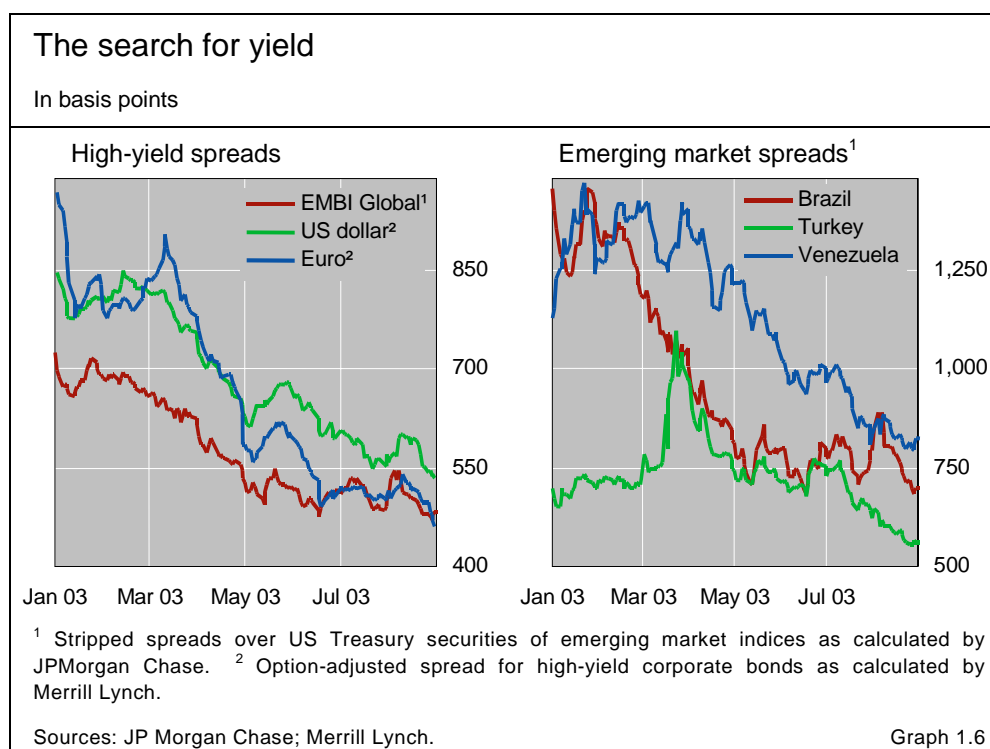
The relative calm of credit markets helped swap and mortgage markets settle down in early August. Credit derivatives traders in particular took advantage of arbitrage opportunities created by the widening of spreads on interest rate swaps. A popular strategy in the credit derivatives market is to buy a bond and buy protection on the same name, earning the difference between the bond spread and the default swap spread (which is frequently narrower than the bond spread). Some participants hedge the interest rate risk associated with the bond purchase by paying fixed on an interest rate swap. When the spread between corporate bonds and interest rate swaps narrowed in late July, traders following this strategy took profits, selling bonds and unwinding swaps. This helped to re-establish a two-way interest rate swap market. In early August, swap, MBS and agency spreads all fell from their peaks, albeit to levels that were higher than a month earlier. The implied volatility of Treasury securities also fell.

The search for yield abates

Although there was no general sell-off in credit markets, investors' earlier search for yield abated. After nine months of inflows, investors withdrew money from US high-yield mutual funds in late July and early August. Indeed, according to AMG Data Services, the first week of August saw the largest ever outflow from high-yield mutual funds.

High-yield debt spreads widen ...

At the same time, a surge in issuance helped dampen the expectations of corporate deleveraging that had underpinned the narrowing of credit spreads in earlier months. Issuance by lower-rated corporations increased, as they sought to take advantage of low borrowing rates. The result was upward pressure on



high-yield debt spreads (Graph 1.6). In addition, announcements of investment grade bond issues also rose markedly during the period. One major instance in late June was a large package of issues by General Motors and its financing subsidiaries, reportedly to fill a pension plan shortfall (see “The international debt securities market” on page 27).

Investors also shifted out of emerging market debt. In fact, financing conditions for emerging market borrowers began to deteriorate around mid-June, more than one month before those in the high-yield corporate market. The EMBI Global index reached a record low of 476 basis points on 17 June and subsequently sold off as Treasury yields rose. Brazil was the most adversely affected. The country’s sovereign spread widened by approximately 200 basis points between mid-June and early August, and the real depreciated by 6% against the US dollar to BRL 3.07. Even investment grade emerging markets, such as Mexico and South Africa, experienced wider spreads.

... as do emerging market debt spreads ...

Positive economic and political news helped to narrow emerging market spreads somewhat in early August. In late July, Standard & Poor’s had upgraded the credit ratings of Turkey and Venezuela by one notch, to B and B– respectively. The Brazilian government secured legislative approval in early August for reforms to the public sector employees’ pension plan. In the Philippines, which had seen spreads jump by 50 basis points in late July following a revolt by some members of the armed forces, spreads also recovered as the government moved quickly to maintain order.

The rise in borrowing costs – through both wider spreads and higher yields – is not expected to create serious difficulties for emerging markets. Many borrowers had prefunded earlier in the year in expectation of a rise in yields. Net issuance of international debt securities by emerging market borrowers over the first six months of 2003 was almost 30% higher than during the same period a year ago (see “The international debt securities market” on page 27). Furthermore, emerging market borrowers are increasingly turning to local bond markets to meet their financing requirements (see the special feature “Changing links between mature and emerging financial markets” on page 45).

... though serious funding difficulties are unlikely

Indeed, the abatement of the search for yield might not be an unwelcome development in some countries. Inflows of short-term capital had put upward pressure on a number of emerging market currencies, which in turn threatened to weaken export growth. Some emerging markets responded by expanding capital controls on inflows, or removing them on outflows. In particular, Argentina imposed controls on short-term capital inflows in May. China relaxed controls on outflows in June, followed by Thailand in July.

Bank stocks keep pace with equity markets

The sell-off in bond markets had little direct impact on equity markets. Equity markets in the United States and Europe had rallied in April and May on expectations of a recovery in economic growth. To the extent that the rise in yields reflected similar expectations, bond investors seemed only to be catching up with the optimism of equity investors.

Equity markets retain earlier gains ...

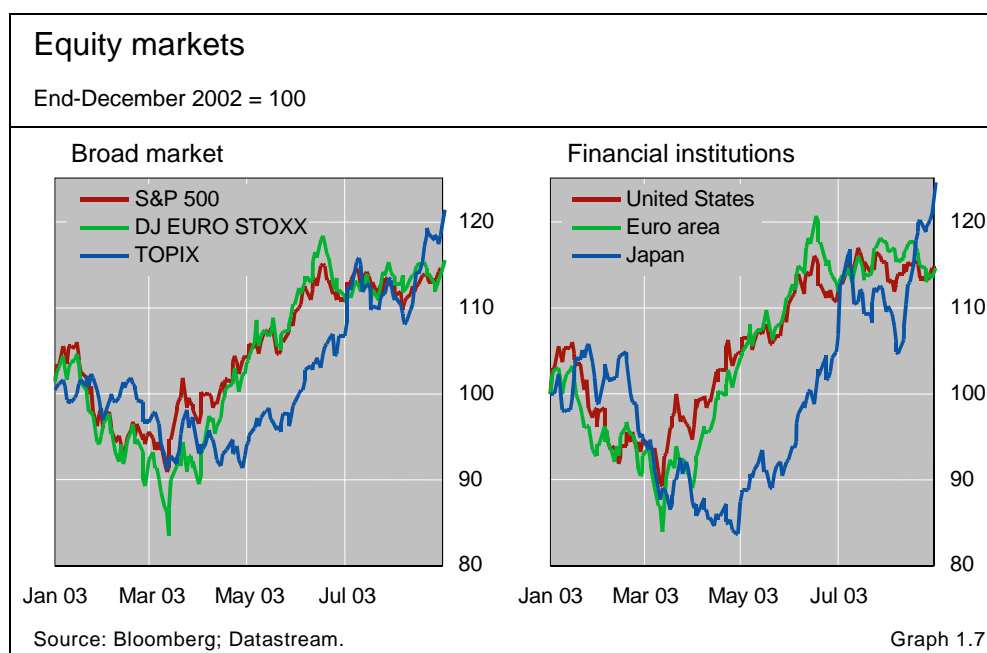
... as financial
sector shares shrug
off the backup in
rates

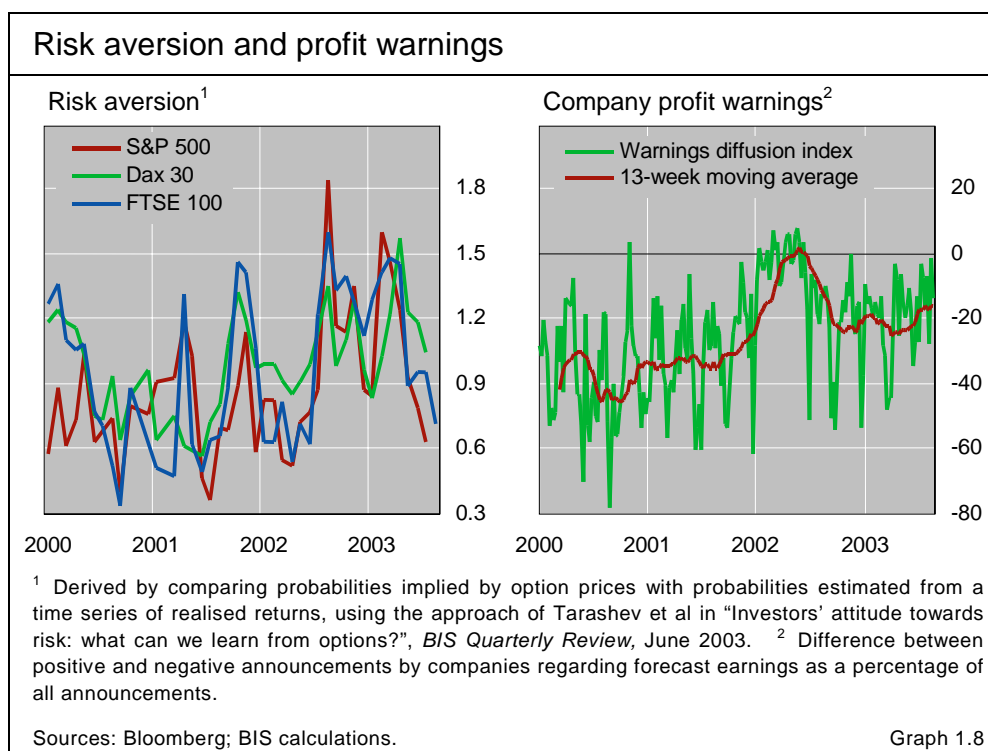
It was notable that the financial sector kept pace with the overall equity market despite the backup in long-term interest rates. Valuations for Fannie Mae and Freddie Mac were marked down in early June, following the revelation of corporate governance improprieties, and again in the second half of July, owing to the volatility in mortgage markets. However, share prices for most other US and European financial institutions were largely unchanged, suggesting that market participants were not concerned about the vulnerability of the balance sheets of these institutions.

The rally in US and European equity markets stalled in July even as estimates of the effective risk aversion of investors continued to decline (Graph 1.7). Such risk aversion seemed to lag rather than lead significant market movements. Earnings that generally came in better than expected also failed to sustain the market rally. Investors increasingly appeared to discount analysts' forecasts of a further acceleration in earnings growth in the latter half of the year and to give greater credence to firms' warnings about future profits (Graph 1.8). One such announcement was US retailer Costco's forecast on 5 August of a drop in earnings, which drove the market down in consequence.

Asian markets
outperform ...

Most Asian markets outperformed US and European markets between May and August. In Japan, surprisingly positive economic news contributed to a nearly 20% increase in the TOPIX between the end of May and the end of August. Large upward moves followed the release of the *Tankan* on 4 July and of the GDP report for the second quarter on 12 August. Investment in the Japanese equity market came to be viewed as a global reflation play, and as such attracted significant foreign inflows. Marked downward moves in Japanese indices during the period tended to be associated with weak earnings announcements by technology firms in the United States, a testament to the fact that Japan's market ultimately remained dependent on the strength of the prospective US recovery.





Japanese banks outperformed the market over this period. Investors apparently perceived that any losses on banks' bond holdings arising from the backup in yields would be more than offset by gains on their equity holdings and a decline in loan delinquencies. Companies in financial difficulty also outperformed the market. The public recapitalisation announced in May for Japan's fifth largest banking group, Resona, under relatively lenient terms for existing shareholders was viewed as a signal that weaker borrowers would be protected from bankruptcy by government support for the banking system.

... as do Japanese banks

Other Asian markets, which had significantly underperformed US and European markets earlier in the year, made up for lost ground starting in May. The Thai, Indian and Taiwanese stock exchanges all rose by more than 30% in local currency terms between early May and late August. Fears about SARS, which had weighed heavily on sentiment earlier in the year, receded as the number of reported cases fell. Markets were also supported by the continued strength of exports from the region.