Ingo Fender
+41 61 280 8415
ingo.fender@bis.org

Peter Hördahl
+41 61 280 8434
peter.hoerdahl@bis.org

Overview: credit retrenchment triggers liquidity squeeze

Concerns about exposures to US mortgages cast a dark shadow over global financial markets during the period from end-May to 24 August 2007, with deepening losses on mortgage-related products spilling over to markets for other risky assets. As uncertainty about the extent and distribution of these losses spread through the financial system, investors fled to safe havens and liquidity demand surged. This caused a pronounced squeeze across major financial markets, prompting central banks around the globe to inject large amounts of liquidity.

Triggered by declining confidence in the valuation of mortgage-related and structured credit products, spreads rose sharply across the credit universe, increasingly affecting higher-rated products and assets other than credit. The price of credit risk, a measure of investor appetite for credit market exposures, jumped upwards, suggesting that a large part of the ongoing repricing was due to changes in investor sentiment towards risk.

Government bond yields plunged as investors fled risky assets and turned to the relative safety of government securities. The downward pressure on bond yields also seemed to partially reflect a reassessment of risks to the growth outlook in the light of the deteriorating situation in the US housing market, and heightened fears of a credit crunch in the wake of the turmoil in credit markets. Apart from the impact on bond yields, the combination of the flight to safety and surging liquidity demand was evident from a sizeable drop in Treasury bill rates that occurred while interbank money market rates rose considerably.

Equity markets sold off under the weight of mounting losses from the repricing of credit risk, with housing-related and financial sector stocks underperforming the wider market. In line with sharply reduced appetite for risk, estimates of implied equity market risk tolerance dropped significantly. Foreign exchange markets also saw substantial increases in volatility, as carry trades were rapidly unwound. Emerging market equities and bonds, however, proved relatively resilient, reflecting broadly favourable economic conditions.

Credit markets sell off as mortgage exposures are reassessed

Global credit markets experienced considerable volatility and saw spreads rise sharply across the board, as uncertainties about the size and distribution of losses from US subprime mortgage exposures caused investors to adjust their positions. Between end-May and late July 2007, the US five-year CDX high-yield index rose by 270 basis points to around 525, while the corresponding US investment grade index widened by some 45 basis points to a high of 81 in early August. In Europe, the five-year iTraxx Crossover CDS index climbed by 280 basis points to 471 in late July, while the headline iTraxx Europe investment grade index increased by 48 basis points to a high of 68. In the process, all four indices surpassed the levels realised during the spring 2005 sell-off. By 24 August, credit spreads were somewhat off their peaks, but still more than 70% above the lows seen in early June (Graph 1, left-hand and centre panels).

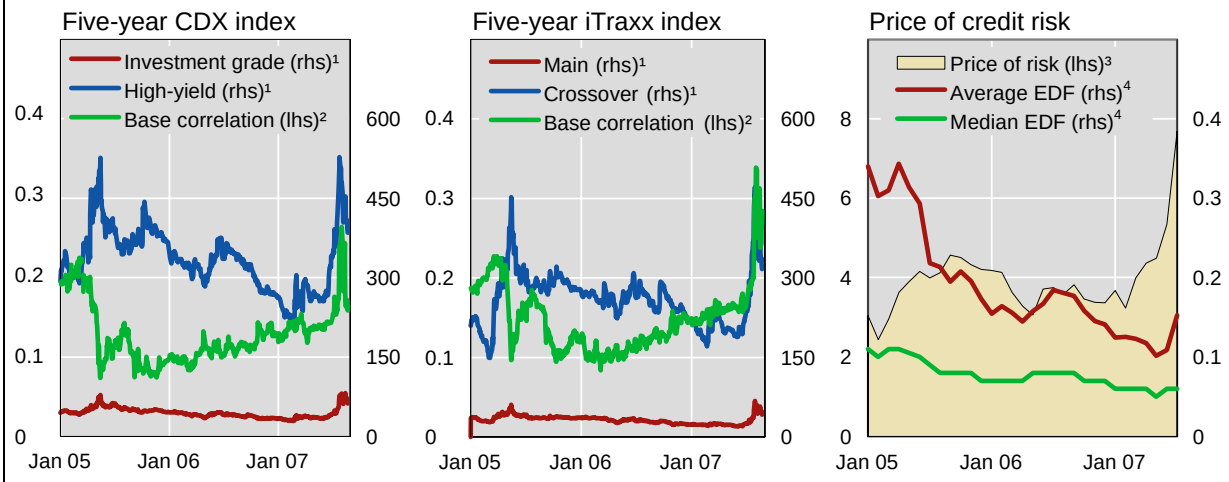
Signs of stress in subprime mortgage markets …

These increases in credit spreads coincided with a significant reduction in investor risk tolerance. The price of credit risk, as extracted from risk neutral and empirical default probabilities of non-investment grade companies, increased markedly (Graph 1, right-hand panel). At the same time, default correlations implied by tranched index products surpassed the peaks they had reached in February. To the extent that this reflected an increase in the weight investors attached to systematic as opposed to credit-specific risk factors, it suggested higher expectations of a turn in the credit cycle.

… trigger sharp repricing of mortgage-backed securities

The general repricing of credit risk developed in three stages, with the first starting in mid-June. The immediate triggers of this early stage were renewed signs of stress in the US subprime mortgage market. On 15 June, Moody's cut the ratings of 131 securities backed by subprime home loans, because of rising delinquency levels on the underlying mortgages (Graph 2, left-hand panel).

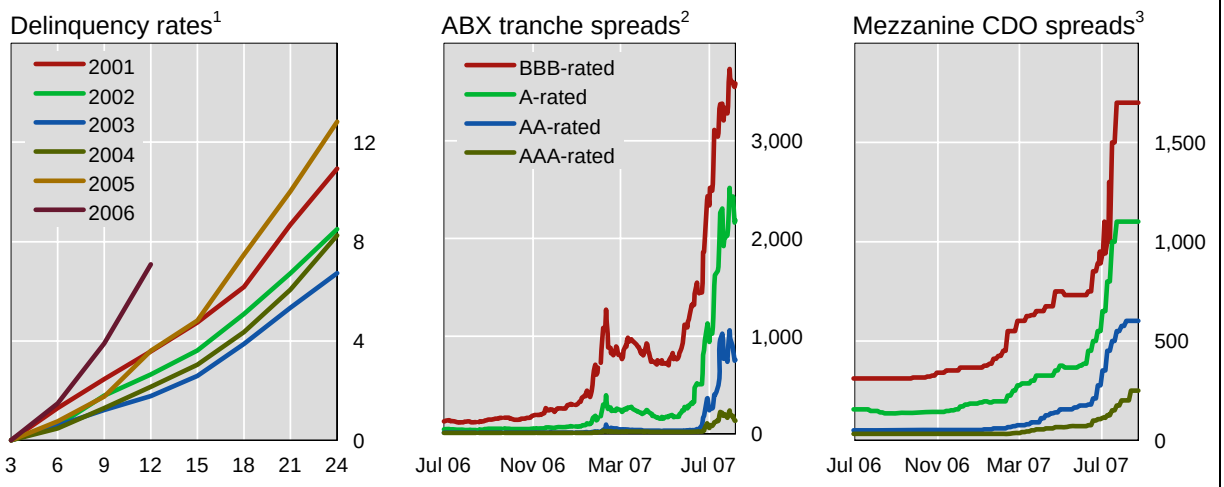
Credit spreads and price of risk



[1] On-the-run CDS mid-spread, in basis points. [2] Implied default correlation based on prices for on-the-run 0–3% loss tranches; 20-day moving averages. [3] Ratio of risk neutral to empirical probabilities of default. Empirical probabilities are based on Moody's-KMV EDF data. Estimates of risk neutral probabilities are derived from US dollar CDS spreads (document clause MR) and estimates of the recovery rate. The reported ratio is the value for the median name in a large sample of BBB-rated and non-investment grade entities. [4] In per cent.

Sources: Markit; Merrill Lynch; Moody's KMV; BIS calculations. Graph 1

US subprime mortgage market



[1] Subprime mortgage delinquency rates (60+ days) by cohort year, in per cent. Number of months of seasoning plotted on the horizontal axis. [2] JPMorgan Chase home equity (ABX.HE 2006-2) floating closing on-the-run spreads, in basis points. [3] Spreads over Libor of tranches of CDOs backed by mezzanine tranches of ABSs, in basis points. Stale quotes reflect limited market liquidity.

Sources: JPMorgan Chase; LoanPerformance. Graph 2

Moody's also announced that the ratings of about 250 mortgage-backed securities (MBSs) were to be reviewed for downgrade. This was followed, on 20 June, by news that two large hedge funds managed by Bear Stearns were close to being shut down as a result of gross exposures of some $20 billion to securities backed by subprime mortgage loans. The combination of these events and concerns about distressed sales of asset-backed securities (ABSs) based on mortgage loans, including collateralised debt obligations (CDOs) containing tranches of subprime mortgage-backed ABSs, caused credit spreads for these products to widen (Graph 2, centre and right-hand panels). Increases in corporate spreads, however, were much more contained.

As mortgage-related losses worsen …

Losses on mortgage exposures worsened from mid-July, when a succession of negative news releases related to the US housing market led to a second stage of more widespread and pronounced adjustments across credit markets. On 10 July, S&P put $7 billion worth of 2006 vintage ABSs backed by residential mortgage loans on negative ratings watch. This was followed on the same day by news that Moody's was lowering the ratings on $5 billion worth of subprime mortgage bonds and reviewing those on 184 CDO tranches. One day later, the number of US foreclosures nationwide for June was reported to be 87% above its level the previous year. As a result, spreads on high-yield credit default swaps (CDSs) in the United States and the crossover index in Europe widened by 44 and 49 basis points, respectively, on 10 and 11 July alone. Later in the month, on 26 July, the release of the National Association of Home Builders (NAHB) index for June indicated that new home sales had slid by 6.6%, and the largest US homebuilder reported a quarterly loss. Once again, a two-day span (26–27 July) saw outsized movements in major credit indices, with increases of 59 and 71 basis points in the high-yield US and European crossover indices, respectively. Further reports of troubles at mortgage lenders, rising dealer haircuts on collateral posted by hedge funds, and related fears of imminent margin calls added to the negative sentiment (Table 1).

Timeline: Key events over the period	
Date	Event
15 June	Moody's downgrades the ratings of 131 ABSs backed by subprime home loans and places about 250 bonds on review for downgrade.
20 June	News reports suggest that two Bear Stearns-managed hedge funds invested in securities backed by subprime mortgage loans are close to being shut down.
22 June	One of the troubled hedge funds is bailed out through an injection of $3.2 billion in loans.
10 July	S&P places $7.3 billion worth of 2006 vintage ABSs backed by residential mortgage loans on negative ratings watch and announces a review of CDO deals exposed to such collateral; Moody's downgrades $5 billion worth of subprime mortgage bonds.
11 July	Moody's places 184 mortgage-backed CDO tranches on downgrade review; further reviews and downgrades are announced by all major rating agencies in the following days.
24 July	US home loan lender Countrywide Financial Corp reports a drop in earnings and warns of difficult conditions ahead.
26 July	The NAHB index indicates that new home sales slid by 6.6% year on year in June; DR Horton, the largest homebuilder in the United States, reports an April–June quarter loss.
30 July	Germany's IKB warns of losses related to the fallout in the US subprime mortgage market and reveals that its main shareholder, Kreditanstalt für Wiederaufbau (KfW), has assumed its financial obligations from liquidity facilities provided to an asset-backed commercial paper (ABCP) conduit exposed to subprime loans.
31 July	American Home Mortgage Investment Corp announces its inability to fund lending obligations; Moody's reports that the loss expectations feeding into the ratings for securitisations backed by Alt-A loans will be adjusted.
1 August	Further losses exposed at IKB lead to a €3.5 billion rescue fund being put together by KfW and a group of public and private sector banks.
6 August	American Home Mortgage Investment Corp files for Chapter 11 bankruptcy, leading to a term extension on outstanding ABCP by one of its funding conduits.
9 August	BNP Paribas freezes redemptions for three investment funds, citing an inability to appropriately value them in the current market environment; the ECB injects €95 billion of liquidity into the interbank market; other central banks take similar steps.
17 August	The Federal Reserve's Open Market Committee issues a statement observing that the downside risks to growth have increased appreciably; the Federal Reserve Board approves a 50 basis point reduction in the discount rate and announces that term financing will be provided for up to 30 days.

Sources: Bloomberg; *Financial Times*; *The Wall Street Journal*; company press releases. Table 1

… price effects spill over into other markets …

In the wake of the negative news flow, market liquidity for mortgage-related securities and structured credit products rapidly disappeared, casting doubts on the assumptions underpinning their model-based valuations. Amid concerns about forced sales of better-quality assets, mark to market losses mounted, increasingly including on assets at the more senior levels of the capital structure and those outside the residential mortgage sector. Signs of spillovers into commercial real estate markets were particularly pronounced, possibly reflecting concerns about the extent to which the phenomenon of weakening loan covenants might have spread from the residential to the commercial side of the mortgage business. The CMBX family of indices, which provides a measure of the cost of insuring against defaults in securities backed by commercial mortgage loans, has seen its BBB spreads widening by more than 200 basis points from their lows in June (Graph 3, centre panel).

… including commercial mortgage-backed securities …

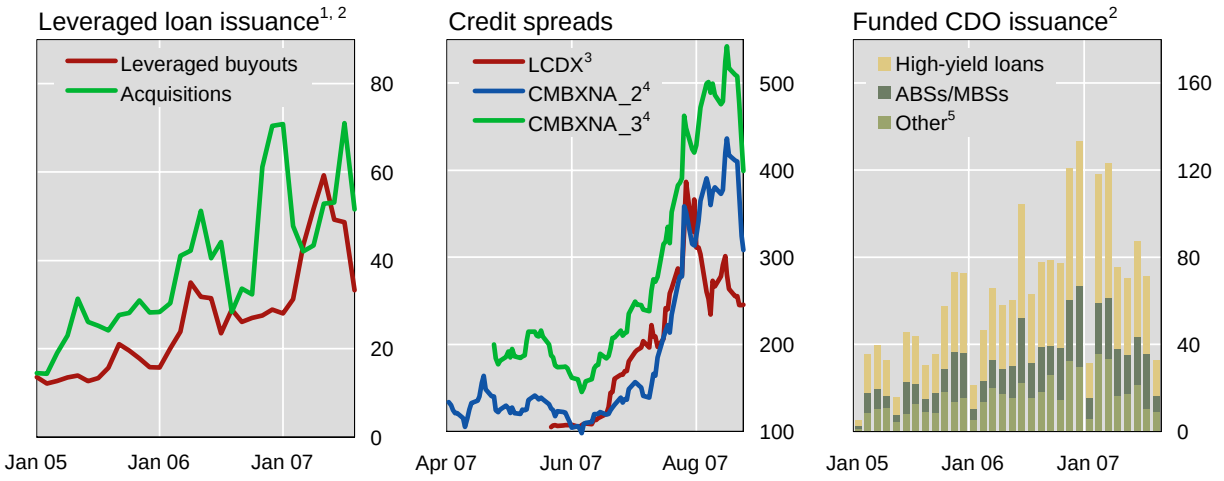
Reflecting this more difficult environment, issuance volumes collapsed across credit markets. In the LBO market, which helps to finance the leveraged

... and leveraged buyouts

buyouts of listed companies, the value of announced takeovers had reached new highs in the first half of 2007 (Graph 3, left-hand panel). According to S&P, this activity had left banks needing to arrange funding for some $230 billion of announced purchases, and therefore vulnerable to the sharply reduced appetite for credit risk. As the deal pipeline for collateralised loan obligations, the main vehicle for institutional demand in US and European loan markets, and similar products dried up, the LBO market came under strain. In the process, the newly formed LCDX index, referencing five-year credit default swaps on 100 equally weighted syndicated US loans, jumped from around 120 basis points in May to more than 350 basis points in late July, before dropping back to around 250 basis points by late August (Graph 3, centre panel).[1] As a result, a number of ongoing deals were reportedly delayed, restructured or pulled from the market, as in the case of Alliance Boots. Primary bond market and ABS issuance came under similar pressures.

The ensuing sell-off during June and July had some similarities with developments in 2002, the most recent major sell-off in corporate credit markets. Back then, following high-profile reports of accounting irregularities, BBB and high-yield US corporate bond spreads increased by more than 50%, with bonds issued by like-rated European borrowers performing in a similar fashion. However, in contrast to the events in 2002, the current sell-off was characterised by a larger and more rapid relative spread increase in the high-yield segment (Graph 4, left- and right-hand panels). While part of this difference is explained by different spread levels, part may have been due to more widespread use of leveraged trades and CDS short positioning in recent times, as compared to the earlier period (Graph 4, centre panel).

Credit spreads and issuance data

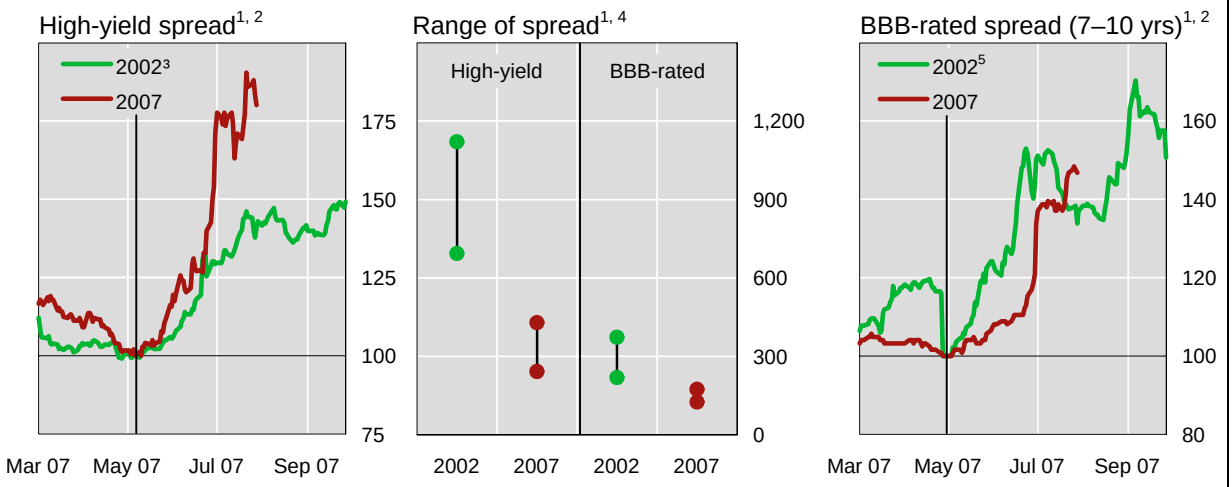


[1] Three-month moving averages, in US dollars. [2] Data corresponding to August 2007 are partial. [3] Index spreads for five-year CDSs on syndicated US loans. [4] Index spreads for BBB tranches of commercial mortgage-backed securities (index series 2 and 3). [5] Emerging market debt, high-yield bonds, investment grade debt, private equity, hedge funds and trust-preferred securities.

Sources: Bloomberg; International Index Company; JPMorgan Chase; Loanware; Markit. Graph 3

[1] Spreads on its European counterpart LevX, which has been trading since October 2006, also increased; both indices trade at narrower spreads than corresponding CDX and iTraxx high-yield indices, given the secured nature of their underlying loan portfolios.

Credit spread adjustments: 2002 vs 2007



[1] Merrill Lynch corporate bond indices; options-adjusted spreads over US Treasuries. [2] Vertical lines indicate relative low points in spreads, indexed at 100. [3] 6 March–2 October. [4] Indicates the highest and lowest spread levels realised during the current and 2002 episodes, in basis points. [5] 4 April–31 October.

Sources: Merrill Lynch; BIS calculations. Graph 4

Uncertainties about credit-related losses ...

The ongoing repricing entered a third stage at the end of July, when attention turned to uncertainty over financial system exposures outside the United States. While the flow of negative news from the US mortgage market seemed to abate, uncertainties persisted about the size and distribution of credit risk exposures and related losses from the ongoing adjustment in credit spreads. Moreover, whereas earlier concerns had focused on hedge funds and US financial institutions with direct involvement in mortgage origination and distribution, by late July news about losses had increasingly spread internationally. Related concerns crystallised on 30 July, when Germany's IKB revealed that its main shareholder had assumed its financial obligations from liquidity facilities provided to an ABCP conduit exposed to subprime loans. This came as a surprise, just 10 days after the announcement of a preliminary operating result of €63 million for the April–June quarter. Further losses at IKB and other financial institutions were exposed in early August. These were followed by announcements on 9 August that illiquid markets had forced a number of investment funds to stop redemptions, while a number of ABCP issuers had drawn options to extend the maturity of outstanding securities earlier in the same week. In the wake of these events, activity in the ABCP markets almost ground to a halt, while concerns about banks being forced to take ABCP exposures onto their balance sheets added to fears about an impending credit crunch (see box).

... feed concerns about counterparty risks ...

... which cause liquidity demand to surge

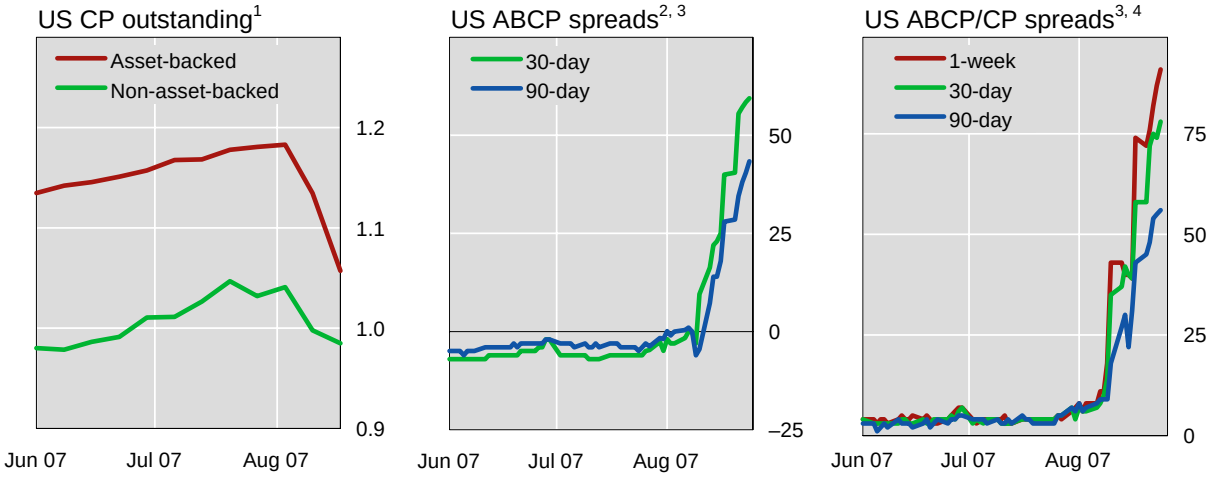
As nervousness about funding needs and banks' conditional liabilities intensified, surging liquidity demand started to spill over into short-term money markets, causing overnight interest rates to soar. In this environment, on 9 August the ECB injected €94.8 billion of liquidity into the interbank market. This followed the announcement that an extraordinary fine-tuning operation would take place in which funds would be provided on demand at the prevailing

Liquidity risk and ABCP mechanics

One of the markets that saw spillovers from the ongoing repricing of credit risk was the market for collateralised short-term financing. As uncertainty about credit losses related to subprime exposure surged, investors began to shun any instrument for which such losses were deemed possible. This included asset-backed commercial papers (ABCPs), which are collateralised short-term instruments that are continuously rolled over to provide financing to an issuing programme. ABCP exposure to mortgage-related assets had grown to an estimated $300 billion, about a third of this in programmes based on structured investment vehicles (SIVs),[①] and investors had become increasingly unsure about the exact nature and quality of these assets.[②] With major banks providing liquidity backstops to ABCP programmes, resulting rollover risks quickly translated into concerns about banks' contingent liabilities. These, in combination with uncertainties about banks' exposures to the general repricing of risky assets, contributed to surging liquidity demand in the interbank market. Consequently, on 9 August the ensuing environment of heightened counterparty risk and liquidity hoarding led to a sharp rise in short-term interbank rates, which was countered by large-scale central bank liquidity injections.

ABCPs, just like other securitisations, pool large quantities of homogeneous assets with predictable cash flows or marketable securities into a special purpose vehicle that issues short-term securities against this collateral.[③] The pools are tranched into securities with different levels of seniority and with maturities typically ranging from one day to nine months. ABCP collateral includes assets such as automobile loans, credit card receivables and mortgage loans as well as senior CDO tranches. According to market estimates, the total amount of outstanding ABCPs topped $1.5 trillion at end-March 2007. US ABCP programmes accounted for some 75% of this amount, while the $260 billion European market made up much of the rest. The US ABCP market, in turn, represents around 55% of the total US CP market (Graph A, left-hand panel).

ABCP markets



[1] In trillions of US dollars. [2] ABCP yield minus the corresponding Libor rate, in basis points. [3] ABCP and CP yields for A1+ rated issues. [4] ABCP yield minus the corresponding CP yield, in basis points.

Sources: Federal Reserve Bank of New York; Bloomberg; BIS calculations. Graph A

The bulk of ABCP tranches receive prime credit ratings (A1 or P1), the highest short-term ratings assigned by credit rating agencies. To achieve these, the credit risk borne by ABCP investors is reduced by way of various structural and third-party credit enhancements, including overcollateralisation (the issuance of securities of lower aggregate value than the underlying collateral), subordination (the inclusion of tranches that absorb the first default losses) and letters of credit. In addition, because collateral assets tend to be less liquid and of longer maturity than the securities issued against them, liquidity backstops are required to protect ABCPs against timing mismatches and rollover risk.[④] These tend to be provided by highly rated financial institutions and take the form of loan or asset purchase agreements providing full coverage of maturing debt obligations. Alternatively, ABCP programmes may give the sponsor the option of extending the term

of the issued securities up to some maximum period. Such extendable notes, in exchange for compensation in terms of additional yield, thus pass part of the liquidity risk on to investors. By end-March, extendable notes constituted about $147 billion (13%) of outstanding US ABCPs. Of these, some $60 billion were mortgage-backed and an estimated $58 billion had external support of less than 100%, relying chiefly on the sale of underlying collateral assets for their repayments.

Strains in the ABCP market began in late July in the form of rising spreads relative to Libor (Graph A, centre panel). One of the first concrete signs that credit market woes were spilling over into ABCPs came on 30 July. Rhineland Funding, a conduit managed by German bank IKB and exposed to MBSs, had failed to find investors that would allow it to roll over maturing paper, causing IKB's main shareholder to step in with an emergency liquidity line. In the wake of this event, rising uncertainty about the credit quality of underlying asset pools meant that some conduits, particularly so-called single seller programmes purchasing mortgage assets from only one originator, experienced increasing problems rolling over maturing funds.

These problems came into focus on 6 August, following the news that a conduit called Broadhollow Funding had exercised an option to extend the term on $1.6 billion worth of outstanding paper financing warehouse pools of mortgage loans. Other conduits with total outstandings of about $5 billion of ABCP followed with term extensions during the same week. These events raised concerns about the effects of liquidation in an already weak market, and about contingent liabilities for liquidity providers, which would have to cover any shortfalls resulting from valuation losses on liquidated assets and the corresponding par values. In the wake of the above-mentioned extensions, ABCP spreads thus widened across the maturity spectrum, outstanding volumes fell and maturities shortened for those issues that were successfully rolled over.

Problems quickly spread to outside the core US and European markets. Coventree, a Canadian ABCP sponsor, ran into rollover problems that led to the extension of some $238 million worth of outstanding paper and the triggering of liquidity backup lines on another $660 million. Further extensions and emergency funding requests followed over the next few days, as Coventree and other sponsors sought recourse to liquidity support on the basis of "market disruption event" clauses. While these were initially contested by some of the liquidity providers, a group of banks later agreed to help roll over maturing paper through conversions into floating rate notes to ease liquidity pressures in the market. Similarly, Australian issuer RAMS Home Loans Group extended $4.9 billion worth of outstanding US ABCPs.

In comparison to the upheaval in the ABCP market, particularly among programmes backed by mortgage collateral or the issuance of extendable notes, the broader CP market performed somewhat more positively. Despite substantial spillovers from the ABCP market, spreads between non-asset-backed CP and Libor widened much less than those for ABCP, with large parts of the observed volatility due to the sharp swings in Libor rates resulting from broad liquidity concerns (Graph A, right-hand panel). This was consistent with relatively positive assessments of the credit quality of corporate issuers, as opposed to concerns about losses on ABCP collateral pools. It also contrasted with market developments in 2001–02, when problems facing CP issuers had been related to concerns about corporate risk in the wake of ratings downgrades and the WorldCom scandal, whereas ABCP markets had continued to provide reliable short-term funding.

---

[1] While traditional ABCP conduits fund themselves exclusively through commercial paper (CP) issuance, SIV-based programmes tend to rely on a mixture of ABCP issuance and medium-term financing. SIVs and similar structures are estimated to have grown to an overall portfolio size of about $395 billion and tend to invest in tradable securities with investment grade ratings, such as senior tranches of CDOs. In contrast to traditional conduits, SIVs are marked to market. [2] On similar cases of bank run-type effects in securities markets, see BIS, "A depositor run in securities markets: the Korean experience", *BIS Quarterly Review*, June 2003, and Borio, "Market distress and vanishing liquidity: anatomy and policy options", *BIS Working Papers*, no 158, July 2004. [3] ABCP pools are often sourced in primary or secondary markets or obtain their assets from multiple originators. This is in contrast to traditional types of CP, which are backed by a single corporate issuer. [4] Liquidity backup lines developed in the early 1970s, after the default of Penn Central caused a drying-up of the CP market, and give issuers recourse to short-term bank loans in case of market disruptions or failure to roll over maturing paper.

4% refinancing rate and against the usual collateral. Later that day, the US Federal Reserve added $24 billion in open market operations, and other central banks took similar steps. Further central bank actions, including a 50 basis point reduction in the US discount rate, were undertaken through the following

weeks, which helped to alleviate immediate pressures in overnight markets. However, as concerns about term liquidity persisted, money market rates remained unusually volatile into late August.

Bond yields plunge as investors flee risky assets

Bond yields fall …

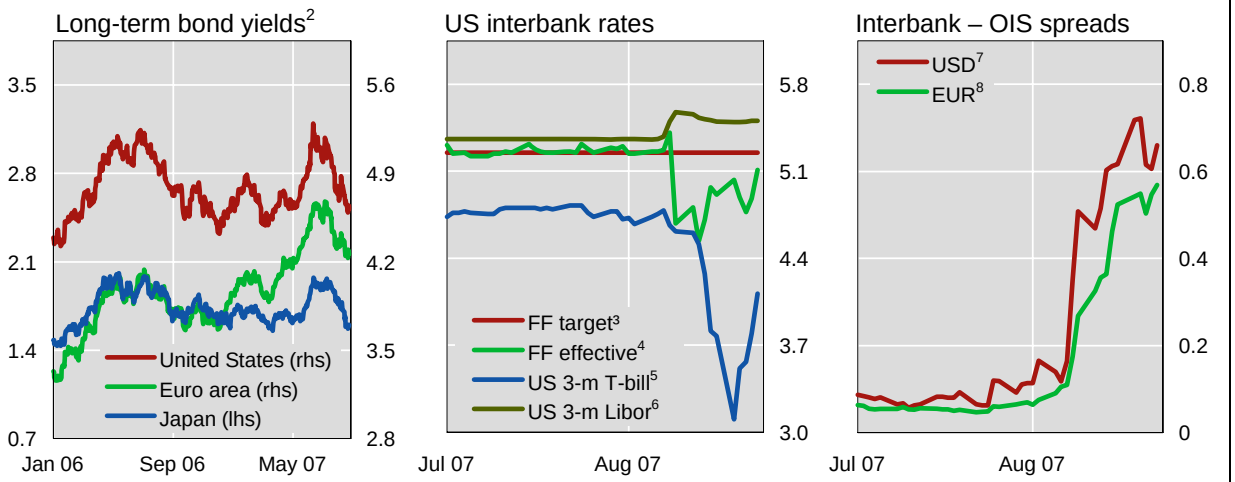
The period under review saw government bond yields in industrialised countries fall sharply as markets sold off and investors retreated from risky assets (Graph 5, left-hand panel). This drop more than offset a pronounced upward move in bond yields that had taken place in the first two weeks of June. Hence, while the yield on 10-year US bonds had risen by some 40 basis points in the first half of June, by late August it had dropped back by around 65 basis points. Similar swings, albeit a bit less pronounced, took place elsewhere. From their local peaks around mid-June, 10-year government bond yields in the euro area and Japan declined by around 40 basis points, bringing them to levels somewhat below those seen at the end of May.

The sharp rise in bond yields that occurred in early June, adding to increases that had taken place in May, was largely the result of perceptions among investors that the growth outlook had improved, in particular in the United States. This had also led to a scaling-back of investors' expectations of Federal Reserve rate cuts, which, in combination with rising term premia, placed significant upward pressure on yields.

… as investors flee risky assets …

As credit markets started to sell off in the second half of June, bond yields began to fall for two reasons. First, the turbulence in credit markets, which soon spread to other markets, prompted a flight to the relative safety of government bonds, as investors scaled back their holdings of risky assets. This manifested itself in a reversal of the rise in estimated term premia that had taken place in May and early June. The flight to safety was particularly evident

Interest rates[1]



[1] End-of-day data, in per cent. [2] Ten-year government bond yields; for the euro area, German bund. [3] Federal funds target rate. [4] Federal funds effective rate. [5] US three-month Treasury bill rate. [6] US three-month Libor rate. [7] Spread between three-month eurodollar rate and three-month overnight index swap rate. [8] Spread between three-month Euribor and three-month EONIA swap rate.

Sources: Bloomberg; BIS calculations. Graph 5

in the US Treasury bill market, where rates plunged in August (Graph 5, centre panel). Second, news of the deteriorating situation in the US housing market brought about a reassessment among investors of risks to the economy as a whole. This was compounded by the intensity of the credit market sell-off beyond the subprime sector, which led to fears of an impending credit crunch. In this environment, investors seemed to take comparably little comfort from any benign macroeconomic news, such as the second quarter US GDP release on 27 July, which reported a better than expected annual growth rate of 3.4%.

… and liquidity demand surges

While the market turbulence started off as a credit-related sell-off, it subsequently evolved into a severe liquidity squeeze across various markets. The ABCP market was among the first to display clear signs of liquidity disruptions (see box), which soon spread to the interbank money market. As a result of this squeeze, money market rates spiked in early August (Graph 5, centre panel). While central bank liquidity injections alleviated some of the pressure in this market, notably for very short maturities, considerable liquidity shortages remained elsewhere. One sign of strain in money markets was the persistent widening of spreads between interbank rates and overnight index swap rates, reflecting perceptions of higher counterparty risk and increased preference for liquidity at maturities longer than overnight (Graph 5, right-hand panel). Such strains added to investors' worries about the fallout from the financial turbulence for the growth outlook. The surging liquidity preference, in combination with intensifying flight to safety, was also evident from a significant rise in inflows into money market funds that invest only in short-term government securities, which in turn increased the severe downward pressure on Treasury bill rates. On 20 August, the three-month T-bill rate fell to almost 3%, which, at more than 200 basis points below the Federal funds target rate, represented the lowest level relative to the policy target rate since 1982.

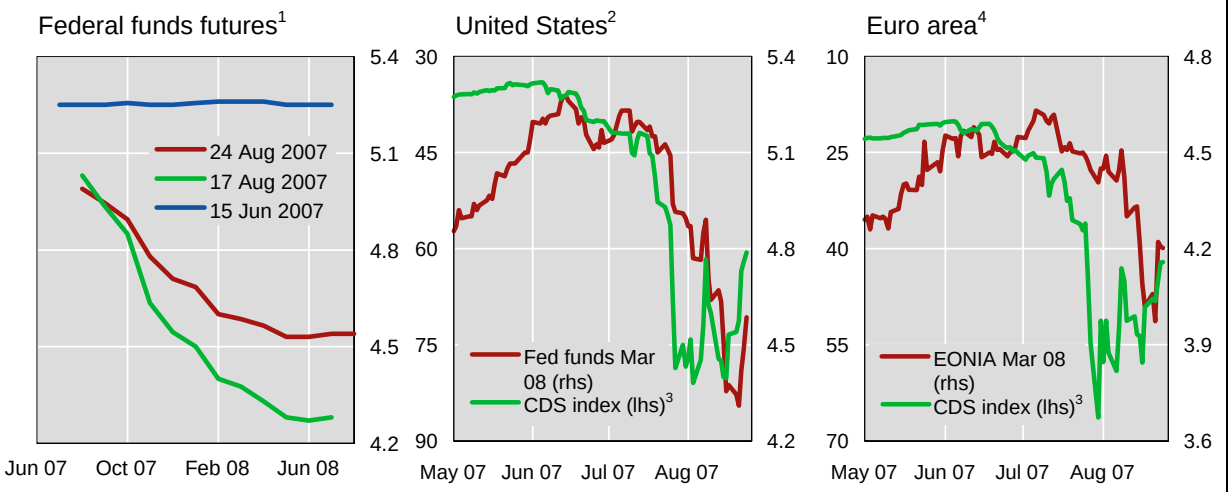
Investors expect Fed rate cuts …

In line with rising concerns about the risks to the US economy and growing fears of widespread market disruptions, expectations among market participants that the Federal Reserve would ease monetary policy gathered momentum (Graph 6, left-hand panel). While the pricing of federal funds futures contracts in mid-June had suggested that the Federal Reserve would remain on hold for the foreseeable future, investors began increasingly to price in easier monetary policy as risky asset markets sold off (Graph 6, centre panel). Although part of the observed downward shift in the federal funds futures curve reflected the fact that the effective federal funds rate was trading considerably below target in the second half of August (Graph 5, centre panel), futures prices seemed to also suggest that expectations of rate cuts intensified as the liquidity squeeze in money markets deepened. The decisions on 17 August by the Federal Reserve Board to lower the discount rate, and by the FOMC to release a statement noting an appreciable increase in downside risks to growth, were widely seen as confirmation by investors that the federal funds target rate was likely to be lowered sooner rather than later.

… while ECB hike expectations are scaled back

With investors viewing the European economy as less vulnerable than that of the United States, much of the decline in euro bond yields seemed initially to reflect a general flight to safety, rather than any significant reassessment of the macroeconomy. However, as the market turmoil deepened, investors gradually

Monetary policy expectations and credit spreads



[1] In per cent. [2] Federal funds futures rate for March 2008 and US investment grade CDS index (CDX.NA.IG.8). Left-hand scale in basis points, right-hand scale in per cent. [3] Inverted scale. [4] Approximate implied EONIA forward rate for March 2008, based on EONIA swap prices, and European investment grade CDS index (iTraxx Europe Series 7). Left-hand scale in basis points, right-hand scale in per cent.

Sources: Bloomberg; BIS calculations. Graph 6

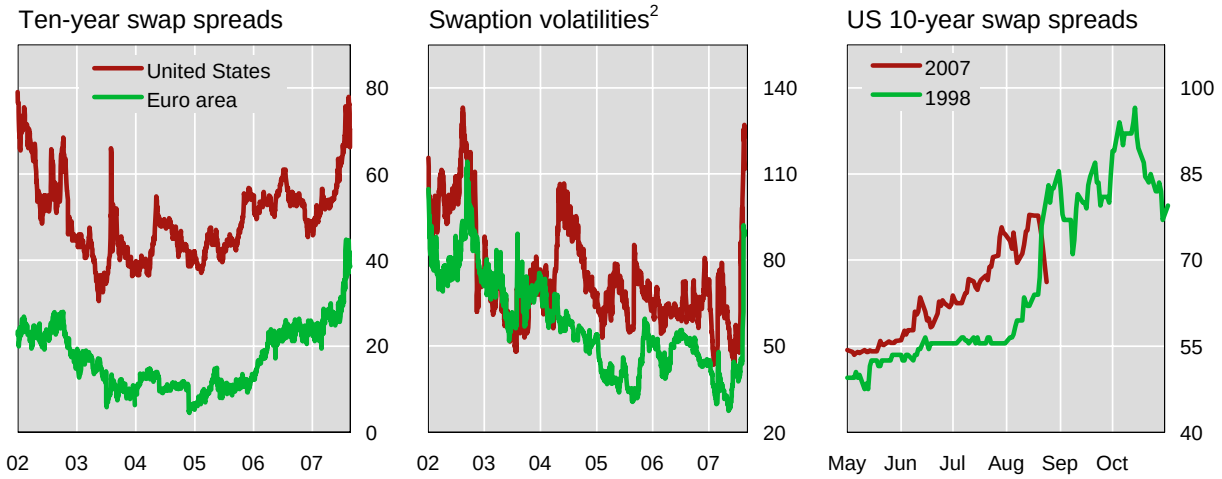
became concerned also about risks to the European banking sector and the outlook for economic growth. Accordingly, expectations of further ECB rate hikes began to dissipate as the sell-off gathered pace and liquidity concerns in markets became more acute (Graph 6, right-hand panel).

In Japan, as in other markets, bond yields were subject to downward pressure in July and August as investors sought safer havens. The volatile situation in markets also contributed to some moderation in the pace of monetary policy tightening expected by market participants. At the same time, a number of macroeconomic data announcements were seen as indicating a softer economic outlook than had been anticipated. In this environment, investors' concerns about the fallout from the market turbulence, in combination with a sizeable appreciation of the yen, may have added to the decline in Japanese bond yields.

Swap spreads rise ...

The flight of investors away from risky assets into government bonds led to a substantial increase in swap spreads (Graph 7, left-hand panel). Between end-May and mid-August, the US 10-year swap spread rose by about 20 basis points to close to 80 basis points, levels not seen in over five years. Similar developments were observed in swap markets denominated in other currencies. Apart from the impact of the flight to safety, increased hedging activity in an environment of reduced market liquidity also contributed to the upward pressure on swap spreads. Moreover, comments by market participants suggested that part of the widening of spreads might have been due to heightened concerns among investors about systemic risks. Some began to draw parallels with the autumn of 1998, when the collapse of LTCM had triggered fears of instability in the banking system as a whole. However, the recent rise in US 10-year swap spreads was less sharp than at the time of the LTCM crisis (Graph 7, right-hand panel). In the second half of August, swap spreads narrowed to some extent as markets recovered somewhat.

Swap spreads and swaption volatilities[1]



[1] In basis points. [2] Implied volatilities, three-month swaptions on one-year swap rates.

Sources: Bloomberg; BIS calculations. Graph 7

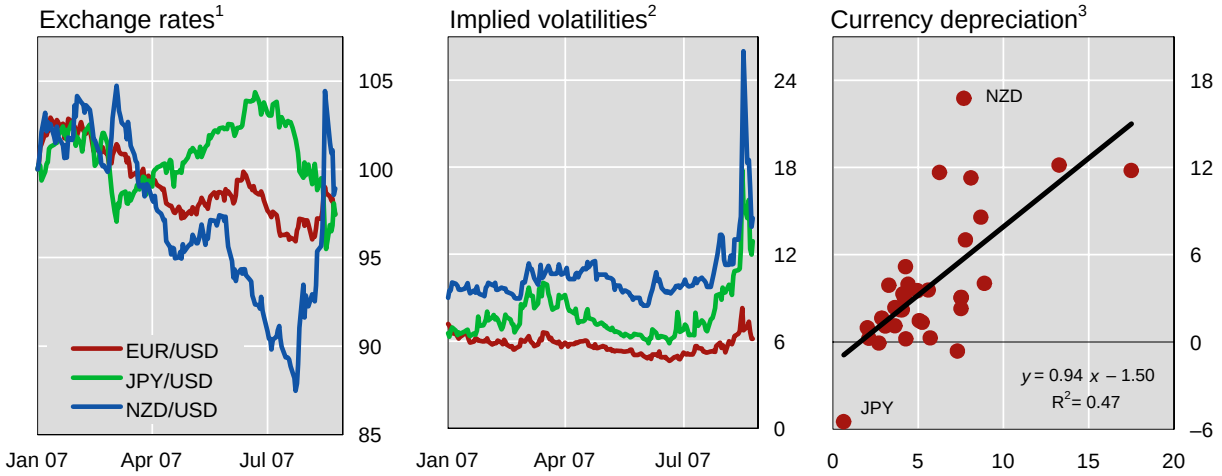
... swaption volatilities surge ...

After having reached historical lows earlier in the year, implied swaption volatilities in the United States and the euro area rose significantly as the credit sell-off progressed (Graph 7, centre panel). While implied volatilities rose across the maturity spectrum, the most pronounced increases were seen for short-term rates, suggesting that uncertainty about the monetary policy outlook had intensified. In addition to greater uncertainty, an increase in the required compensation for exposure to interest rate volatility risk may also have contributed to the general rise in swaption volatilities.

... and carry trades are unwound

In parallel with rising volatility across markets, foreign exchange markets saw extraordinary swings in exchange rates as investors began unwinding carry trades. Low-yielding currencies such as the Japanese yen appreciated

Exchange rates and implied volatilities



[1] 1 January 2007 = 100. [2] One-month at-the-money implied volatilities. [3] Depreciation of various currencies vs the US dollar (in per cent), in the period 25 July to 16 August 2007 (when the VIX rose from 17% to 31%), plotted against the average short-term interest rate for the previous six months. For details, see J Cairns, C Ho and R McCauley, "Exchange rates and global volatility: implications for Asia-Pacific currencies", *BIS Quarterly Review*, March 2007.

Sources: IMF, *International Financial Statistics*; Bloomberg; Datastream; BIS calculations. Graph 8

considerably, while high-yielding ones, notably the New Zealand dollar, fell sharply (Graph 8, left-hand panel). Other currencies that felt the impact of unwinding carry trades included the Australian dollar. In mid-August, the Reserve Bank of Australia intervened in currency markets after the Australian dollar had fallen by 11% against the US dollar and 18% against the yen, compared to July peak levels. Implied volatilities on foreign exchange rate options rose across the board, with particularly sharp increases seen for carry trade currencies (Graph 8, centre panel). Because traders rely on calm conditions in currency markets to generate a steady cash flow from carry trades, the surge in volatility added to incentives to unwind such trades. The exchange rate movements seen in July and August were therefore fully consistent with historical experience during high-volatility episodes, when high-yielding currencies tend to depreciate while low-yielding ones tend to serve as safe havens (Graph 8, right-hand panel). In line with this, exchange rate movements in late August suggested that some carry trade positions were re-established as markets entered a period characterised by lower volatility.

Credit turmoil spreads to equity markets

Equities are hit by market turbulence …

As the turbulence in the credit markets gathered momentum, the retreat from risky assets spread to other asset classes – including equity markets, which saw broad-based declines in stock prices in the second half of July and in August. Compared to the level seen at the end of May, the S&P 500 Index had by mid-August lost 8%, before recovering in subsequent days to end 3.3% lower on 24 August (Graph 9, left-hand panel). Equities outside the United States retreated even more, with the Dow Jones EURO STOXX index falling by around 7% and the TOPIX by almost 10% between end-May and 24 August. These losses wiped out much of the gains that had accumulated in US and European equity markets since the beginning of the year, while bringing Japanese equities considerably below their end-2006 levels.

… as premia rise and risks are reassessed

The declines in equity prices were due in part to rising risk premia, although fundamentals played a role too, as investors reassessed the risks of the deteriorating housing market for US profits and the economy as a whole. The significance of adverse news related to the housing market was apparent in the week of 23–27 July, in which the S&P 500 Index fell by 4.9% – its largest weekly decline since 2002. This plunge took place as a number of homebuilding companies posted losses for the second quarter. At the same time, one of the largest US home loan lenders, Countrywide Financial Corp, reported lower than expected earnings and warned that difficult conditions were likely to persist. On top of this, concerns grew among investors that the boom in global mergers and acquisitions (M&As), which had been fuelling rising equity prices for some time, might be coming to an end.

Bank equities suffer …

Equities in the construction and banking sectors suffered particularly from the negative housing news and the resulting credit market turmoil. The worst performer in the S&P 500 Index from end-May was the Homebuilding Sub-index, which by 24 August had fallen by more than 33%. The S&P Bank Index also fared worse than the index as a whole, declining by almost 7% between

end-May and 24 August, while the Investment Banking Sub-index fell by 17% during this period, after having lost more than 25% at one point in mid-August. Share prices of banks in Europe and Japan performed similarly, declining by some 11% and 18% between end-May and late August, respectively (Graph 9, centre panel). This largely reflected investors' anticipation of losses related to speculation in the subprime market and other credit products, as well as expected declines in bank profits due to lower M&A-generated fees. Despite such losses, the overall decline among US banks had not, by late August, been as severe as in 1998, when the financial sector had suffered a major blow following the LTCM/Russian default crises (Graph 9, right-hand panel).

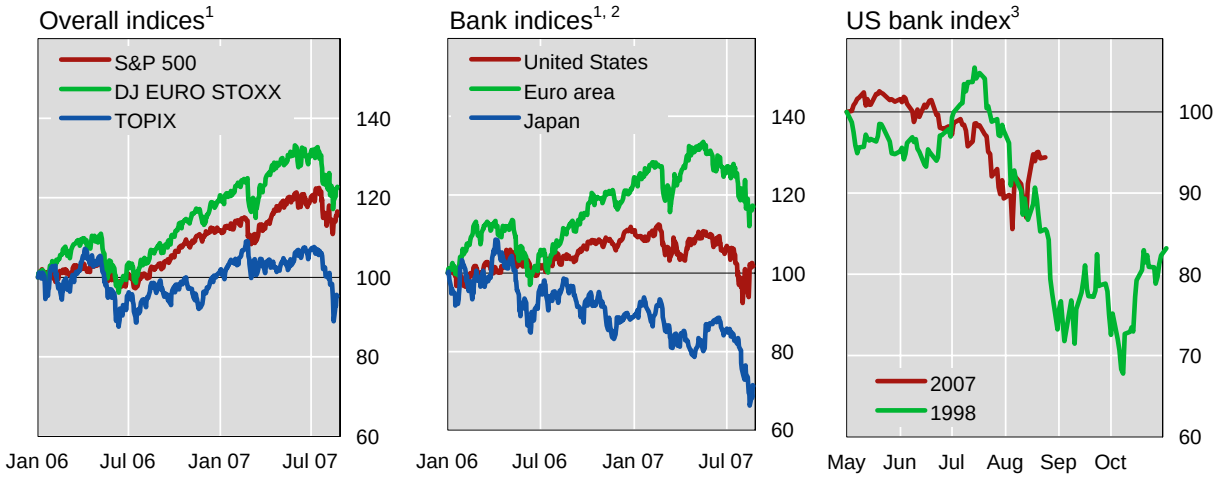
… on concerns about future profits

The equity sell-off occurred in an environment of solid corporate earnings and with macroeconomic conditions that still appeared relatively favourable. In the United States, two thirds of reporting S&P 500 companies exceeded second quarter earnings expectations, while just over 20% reported lower earnings than expected. These proportions were close to recent historical experience. The average year-on-year profit growth was almost 11% (on a share-weighted basis), which seemed to indicate robust profitability in the corporate sector. Second quarter profit growth among S&P 500 banks was even more brisk, at an annual rate of almost 16%. However, markets focused less on backward-looking data, such as profits, and more on risks to future economic growth and earnings resulting from the turmoil in credit markets and beyond.

Implied volatilities surge …

As in previous sell-offs, implied equity index volatilities rose sharply, as the market retreat gathered pace. The S&P 500 VIX implied volatility index, which had settled at around 13% after the February–March sell-off, rose steadily in July and August, reaching an intraday peak of 37.5% on 16 August (Graph 10, left-hand panel). Similar developments were apparent in Europe, where one-month implied volatility on the DJ EURO STOXX 50 Index exceeded 30% in mid-August. Implied volatilities subsequently fell back in late August as

Equity markets

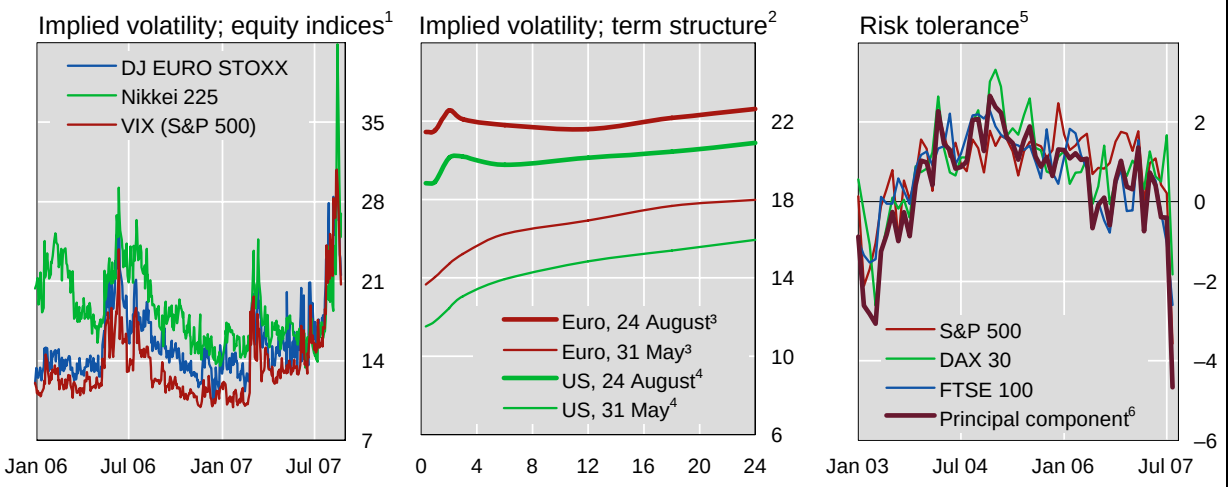


[1] In local currency; 3 January 2006 = 100. [2] For the United States, S&P Bank Index; for the euro area, DJ EURO STOXX Bank Index; for Japan, TOPIX Banks Index. [3] 1 May 1998 and 2007 = 100.

Source: Bloomberg.

Graph 9

Equity market volatility and risk tolerance



[1] Volatility implied by the price of at-the-money call option contracts on stock market indices; in per cent. [2] Volatility implied by the price of at-the-money call and put option contracts on stock market indices (on 31 May 2007 and 24 August 2007), in per cent. The horizontal axis refers to the maturity of the options in months. [3] DJ EURO STOXX 50. [4] S&P 500. [5] Derived from the differences between two distributions of returns, one implied by option prices, the other based on actual returns estimated from historical data. [6] First principal component of risk tolerance indicators estimated for the S&P 500, DAX 30 and FTSE 100.

Sources: Bloomberg; Chicago Mercantile Exchange; Eurex; London International Financial Futures and Options Exchange; BIS calculations. Graph 10

some of the turbulence in markets faded. Nonetheless, by 24 August implied volatility term structures remained substantially above the levels seen at the end of May (Graph 10, centre panel). The fact that the term structures had flattened considerably seemed to indicate that markets did not expect volatility to return any time soon to the low levels seen in early 2007. Higher volatility risk premia resulting from a reduced appetite for risk probably also contributed to the increase in implied volatilities. A clear sign of such a reduction in investor risk appetite was a sharp drop in the estimated risk tolerance implied by equity option prices and returns (Graph 10, right-hand panel).

... while risk appetite plummets

Emerging markets show relative resilience

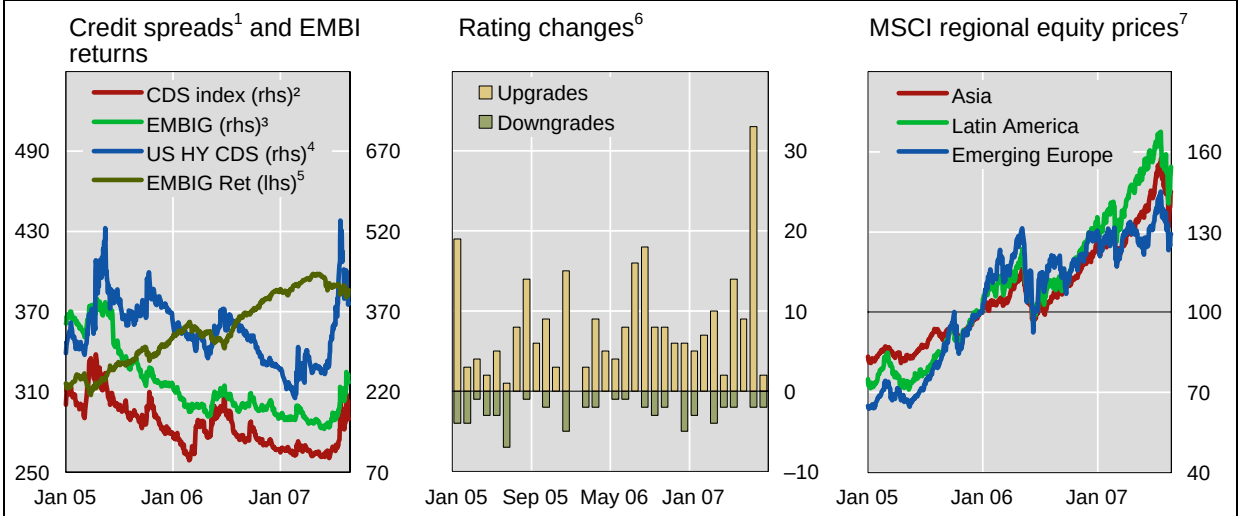
Emerging market bonds show initial resilience ...

In line with the general repricing of risk, emerging market spreads rose significantly from late June to late August. Nonetheless, the rise was not as sharp as in industrialised country credit markets, and emerging market spreads also showed some initial resistance to the widening of spreads seen in other markets. The EMBI Global spread index increased from an all-time low at 151 basis points in early June to a peak near 260 in mid-August, its highest point in eight months. By end-August, spreads had tightened back to 238 basis points. While losing some 2.5% in return terms, the index outperformed most measures of similarly rated corporate credit. Over the same period, the five-year emerging market CDX index widened by about 70 basis points to around 170, after reaching a peak near 230 basis points in early August. This was, however, still lower than the levels seen during the 2005 sell-off (Graph 11, left-hand panel).

... but spreads increase in the wake of general risk repricing

It was only during the second stage of the credit market correction that reduced risk appetite spilled over into emerging market debt, following renewed

Emerging market credit spreads and equity prices



[1] In basis points. [2] CDX five-year on-the-run CDS mid-spread for 14 emerging market issuers. [3] EMBI Global index; sovereign spread over government bond yields. [4] CDX five-year on-the-run CDS mid-spread for 100 high-yield corporate names. [5] EMBI Global index; cumulative total return index as calculated by JPMorgan Chase. [6] Monthly long-term foreign and local currency sovereign rating changes from Fitch, Moody's and Standard & Poor's; August 2007 data are partial. [7] In local currency; 31 December 2005 = 100.

Sources: Bloomberg; JPMorgan Chase. Graph 11

subprime-related jitters starting in mid-July. With spread correlations of emerging market debt and ABX BBB tranches returning to the elevated levels last seen in February, the EMBI Global saw spreads increase by about 50 basis points in the five-day period up to 26 July. Spreads experienced a further, similar increase in mid-August, when concerns about liquidity demand began to permeate across global financial markets, before recovering somewhat late in the month. At the individual country level, spread movements seemed to largely reflect established patterns, with higher risk credits, such as Argentina and Ecuador, tending to lead the market in either direction. Despite increased market volatility, positive rating changes continued to outnumber negative ones by a wide margin, thus providing relative support (Graph 11, centre panel). Market commentary also pointed to positive technical factors, with large coupon and amortisation payments, expected buybacks and a low level of sovereign issuance all contributing to favourable supply side effects.

Emerging market equities also correct

Emerging market equities also proved relatively resilient to the market turbulence, while being drawn into the ongoing repricing of risky assets from late July. In the wake of the ensuing correction, the MSCI index lost about 15% of the value it had reached at its high on 23 July, before recovering in late August. Overall, the index still gained 3.5% in local currency terms (2.5% in US dollar terms) between end-May and 24 August (Graph 11, right-hand panel). At the regional level, Asian markets outperformed other emerging equity markets. For instance, investors in the Shanghai stock market pushed valuations to successive all-time highs, before seeing the index temporarily retreat. In part, this resilience may have reflected continuing expectations of strong macroeconomic performance, with data pointing to solid economic and corporate earnings growth in emerging Asia.